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Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting

Endorsed by the Communicable Diseases Network Australia, the National Public Health Partnership and the Australian Health Ministers’ Advisory Council

January 2004
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This document is also included in Paradigm’s annotated index of healthcare epidemiology and infection control literature at:

http://bookstore.phf.org/prod125.htm

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How to use this document

IMPORTANT NOTE

Part 1 of this document (Principles of Infection Control) provides recommendations that form the foundation for all work practices and procedures detailed in the remainder of the document. Reading and applying these principles is the key to understanding the issues that affect infection control. Please read Part 1 first, then the table of contents where all the information is listed in a logical sequence.

These guidelines should be considered in association with the State or Territory legislative requirements that affect work practices of the health care establishment and/or health care worker. If the recommendations in this document conflict with State or Territory guidelines, the statutory requirements of the State or Territory should take precedence.

This document outlines the principles involved in, and the procedures necessary for, the prevention of transmission of infectious diseases in the health care setting, hereafter in this document referred to as infection control or infection control procedures.

Successful infection control is based on good hygiene around a range of practices that arise from identifying hazards and implementing risk management for the hazards.

This involves understanding:

• the infectious agents;

• the work practices that prevent the transmission of infection in different settings; and

• management systems that support effective work practices.

To address these issues, this document has been prepared in five main parts.

Part 1 (Principles of infection control) provides the foundation for all work practices and procedures detailed in the remainder of the document. Reading and applying these principles is the key to understanding the issues involved.

Parts 2 to 5 may be read in their entirety or used as a ready reference to obtain specific information about the many different aspects of an effective infection control program. For example, to find information on a specific disease, refer to Part 4 (Managing infectious diseases in the health care setting).

An additional part, Part 6, includes appendixes and other endmatter and can be consulted as required.
There is an overall table of contents for the guidelines following this section. Each part of the document also has its own contents page, which provides a detailed breakdown of all the sections, subsections, tables and figures in that part of the guidelines. A subject index is also included at the end of the guidelines for easy reference to particular subject areas.

Many sections of the document refer to Australian Standards (AS) or Australian and New Zealand Standards (AS/NZS). A full list of all the standards referred to in this document is given in Appendix 3. Other publications cited in the ICG are listed in the References section.
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Preface

The intention of this document — Infection Control Guidelines for the Prevention of Transmission of Infectious Diseases in the Health Care Setting (ICG) — is to provide national best practice guidelines for infection control procedures in Australian health care settings. The scope of ICG is broad and applies to a wide range of health care establishments, including hospitals, office practices (medical and dental), long-term residential care establishments, community nursing, emergency and first aid services. This document is also intended to be used as a resource to guide or implement infection control policy for health care establishments and individual health care workers (HCWs).

These guidelines have been prepared under the auspices of the Communicable Diseases Network Australia (CDNA). CDNA is a subcommittee of the National Public Health Partnership (NPHP), which is a subcommittee of the Australian Health Ministers’ Advisory Council (AHMAC). CDNA comprises public health experts drawn from Commonwealth, State and Territory public health departments and agencies. The guidelines have also been endorsed by the Australian Health Ministers’ Advisory Council.

The aim of CDNA has been to:

• develop infection control guidelines that are substantiated by advice from experts and evidence from published scientific and medical literature;
• provide accurate and up-to-date technical information or ‘best practice guidelines’ for infection control management; and
• address ethical issues pertaining to infection control where a national approach is appropriate.

CDNA recognises that the information needs to be reviewed continuously because of technical developments, new instrumentation, regulatory changes and microbial evolution. Regular updates will be made to this document in the light of these developments. Amendments to the text will be posted on the Australian Government Department of Health and Ageing website:

http://www.icg.health.gov.au

An Infection Control Guidelines Steering Committee (ICGSC) was formed to oversee the project and to provide expert medical and scientific advice. The ICGSC was supported by a project team drawn from the Communicable Diseases Branch of the Department of Health and Ageing. The department’s project team provided scientific advice, and administrative and secretariat support.
Recognised experts and organisations drafted various sections of the document to reflect current scientific evidence and best practice. The draft was posted on the department’s website in July 2000 and public comment invited. All submissions were considered by ICGSC, and in August 2001 further public comment was sought on the revised draft. The draft was further amended by the ICGSC in the light of the public consultation, before consideration and endorsement by the CDNA. The NPHP and AHMAC subsequently endorsed the guidelines.

Special thanks and acknowledgment to the Infection Control Guidelines Steering Committee (honorary) members for their generous donation of time, their technical advice and cheerful cooperation, which contributed to the success of the project.
The terms of reference for the Infection Control Guidelines Steering Committee were as follows.

1. Review the documents:
   
   
   B. *Creutzfeldt–Jakob Disease and Other Human Transmissible Spongiform Encephalopathies: Guidelines on Patient Management and Infection Control* (NHMRC 1995); and

   Provide a revised document on infection control in health care settings, by March 2000, to the Communicable Diseases Network Australia (CDNA; formerly the Communicable Diseases Network Australia New Zealand) for endorsement.

2. As part of the review process:
   
   • consult with key stakeholders;
   
   • consider the available scientific evidence and current best practice methods, both in Australia and internationally, that may impact on the ICG revision; and
   
   • take legal advice about current and emerging trends, both ethical and practical, influencing infection control practice in the health care setting.

3. Incorporate appropriate recommendations based on current scientific, medical and legal advice into a revised document for publication and distribution to health care providers.

4. Advise the CDNA on mechanisms for the ongoing:
   
   • review of infection control issues;
   
   • implementation of the guidelines into infection control practice;
   
   • evaluation of the guidelines; and
   
   • incorporation of new or emerging issues into future revisions of ICG.

5. Report progress of the review to the CDNA, through the National Centre for Disease Control (NCDC), at least once every six months during the current revision process.
Committee membership

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The officers listed above were involved in the review and production of these guidelines over a period of some years.
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1 Infection control strategy

**Key points**

- Because many infectious agents are present in health care settings, patients may be infected while receiving health care, health care workers may be infected during the course of their duties and other people may be infected when working or interacting with patients in a health care establishment.

- Health care associated infections could occur in any health care setting — for example, hospitals, general practice, day surgery centres, domiciliary nursing services, residential aged care, community services or office practices (dentistry, podiatry and so on).

- Adopting quality control measures (based on identifying hazards and assessing risks) may minimise health care associated infections.

- Successful infection control involves five elements, which form the basis for Parts 1–5 of these guidelines:
  - applying basic infection control strategies (Part 1);
  - adopting quality management practices (Part 2);
  - developing effective work practices that prevent the transmission of infectious agents (Part 3);
  - managing specific infectious agents (Part 4); and
  - identifying infection control strategies in specialised health care settings (such as operating rooms, dentistry rooms, residential aged care facilities) (Part 5).

1.1 Introduction

Continually improving the quality of care and providing a safe working environment are fundamental activities for Australian health care establishments. An effective infection control strategy for preventing the transmission of infections from person to person within health care establishments is central to these activities.

Infectious agents evolve and constantly present new challenges in the health care setting. Continually modifying and improving procedures is important in meeting these challenges.
Many infectious agents are present in health care settings. Patients may become infected while they are receiving health care and health care workers (HCWs) are at risk while they are doing their work. Other people visiting and working in the health care establishment may also be at risk. In some cases, health care associated infections are extremely serious or even life threatening. HCWs should adopt the guidelines in this document to minimise infections.

1.1.1 Scope

This document has a broad scope and aims to establish a nationally accepted minimum standard for infection control. The guidelines provide a basis for HCWs and health care establishments to develop detailed protocols and systems for infection control that apply to their specific health care setting.

The guidelines apply to a wide range of health care establishments, including hospitals, office practices (medical and dental), nursing homes, extended care establishments, community nursing, emergency services and first aid services.

The following general definitions are used throughout these guidelines.

Health care associated infections — infections acquired in health care establishments (‘nosocomial’ infections) and infections that occur as a result of health care interventions (‘iatrogenic’ infections), and which may manifest after people leave the health care establishment.

Health care establishment — any facility that delivers health care services. Health care establishments could be hospitals, general practice surgeries, dentistry practices, other community-based office practices, day surgery centres, domiciliary nursing services, residential aged care facilities, alternative health provider facilities and other community service facilities, such as needle exchanges.

Health care workers (HCWs) — all people delivering health care services, including students, trainees and mortuary attendants, who have contact with patients or with blood or body substances.

1.2 Successful infection control

Maintaining a safe environment for people, patients and HCWs in a health care setting is a complex matter. Identifying hazards and classifying the associated risks is the key to successful infection control management. This task requires unselfish cooperation between management, HCWs and support staff.

Health care establishments should develop detailed protocols and policies that cover the five elements of successful infection control listed in the key points box at the beginning of this section. These elements are addressed in five main parts of these guidelines.
Part 1 Principles of infection control:

- overall strategy;
- basic measures for infection control (standard and additional precautions);
- identifying hazards and minimising risks;
- identifying who is at risk and from what;
- responsibilities of health care establishments, HCWs, patients, carers and other people; and
- routine practices essential for effective infection control, such as aseptic technique, handling of sharps, use of single-use equipment, reprocessing of instruments, antibiotic use and the appropriate use of antiseptics and disinfectants.

Part 2 Quality management:

- administrative arrangements for effective infection control, including
  - implementing an infection control program,
  - appointing an infection control committee and infection control practitioner,
  - compliance and accreditation standards,
  - quality improvement program maintenance,
  - continuum of care responsibilities, and
  - employee health policies;
- educating and training HCWs to improve their awareness and to encourage their compliance with national infection control standards; and
- ethical and legal issues that affect health care service delivery.

Part 3 Effective work practices and procedures:

- design and maintenance of premises;
- handwashing and personal hygiene;
- use of personal protective equipment;
- handling and disposal of sharps;
- management of clinical and related wastes;
- reprocessing of instruments and equipment (including instruments requiring special reprocessing);
- environmental cleaning and spills management;
- health care establishment support services (linen, laundry and food services);
- use of therapeutic devices;
- surveillance and outbreak investigations;
• protection for HCWs, including health status records, immunisation and testing of immune status;
• management of incidents involving blood or body fluid exposure;
• management of infections among HCWs;
• handling and use of blood and blood products; and
• organ and tissue transplants.

Part 4 Managing infectious diseases in the health care setting:
• identification of major risk factors;
• recommendations for management procedures for patients, HCWs, instruments and the health care environment; and
• short descriptions of the viral, bacterial, antibiotic-resistant and other diseases that are important in the health care setting.

Part 5 Infection control in specific health care settings:
• identification of the major risk factors and management procedures for specialised health care settings:
  – operating rooms;
  – office practice (general);
  – dental practice;
  – midwifery and obstetrics;
  – home and community; and
• long-term care.

HCWs should recognise that, although specific settings may have their own requirements, the principles outlined in these guidelines form the basis for infection control procedures in all health care settings.

Overall, successful infection control depends on:
• each health care establishment ensuring that policies and practices are guided by an infection control professional;
• provision of adequate resources (people, equipment and space) to do the work of infection control, consistent with both the establishment’s infection control strategic plan and its business plan;
• application of the infection control program across all components in the organisation, including support services as well as direct clinical care;
• integration of a system of quality management into the infection control program;
• appropriate training and management of all staff, fostering commitment to the infection control program;
• ongoing assessment of the infection control program, including incident monitoring, that encourages adjustment to work practices when required; and

• regular evaluation of the infection control program, with feedback to management and HCWs on the program’s effectiveness and provision for adjustment as required.
2 Basic infection control measures

Key points

- **Standard precautions** are standard operating procedures that apply to the care and treatment of all patients, regardless of their perceived infectious risk. These precautions include aseptic technique, handwashing, use of personal protective equipment, appropriate reprocessing of instruments and equipment and implementation of environmental controls. Standard precautions should incorporate safe systems for handling blood (including dried blood), other body fluids, secretions and excretions (excluding sweat), nonintact skin and mucous membranes.

- **Additional precautions** are required when standard precautions may not be sufficient to prevent the transmission of infectious agents (e.g., tuberculosis, measles, Creutzfeldt–Jakob disease). Additional precautions are tailored to the specific infectious agent concerned and may include measures to prevent airborne, droplet or contact transmission and health care associated transmission agents.

2.1 Background

The strategies for infection control described in these guidelines are based on current understanding of the aetiology of the infections involved and the most effective ways to control them. Before the advent of human immunodeficiency virus (HIV) in the early 1980s, and the increase in high-throughput, short-stay surgical and medical treatments, the majority of recognised health care associated infections occurred in hospitals.

Before the 1980s, infection control systems were based on identifying at-risk patients in hospitals and applying isolation systems or special treatments. The isolation approach failed to take account of the possibility of transmitting infection from asymptomatic individuals, particularly those with bloodborne viruses or antibiotic-resistant bacteria.

By the mid-1980s, the acquired immune deficiency syndrome (AIDS) epidemic created an urgent need for new strategies to protect health care workers (HCWs) from bloodborne infections in their working environment. In 1985, universal blood and body fluid precautions (universal precautions) were proposed by the United States Centers for Disease Control and Prevention (CDC 1987). This new approach emphasised the universal use of blood and body fluid precautions regardless of a patient’s presumed infectious status.
As initially defined by the CDC, the term ‘universal precautions’ applied to blood and body fluids that were implicated in transmitting bloodborne infections. CDC universal precautions do not apply to faeces, nasal secretions, sputum, sweat, tears, urine or vomit, unless they contain visible blood (CDC 1994a).

State/Territory health departments in Australia adopted a broader approach to universal precautions. They agreed that all blood and body substances should be considered potentially infectious and introduced the principle of ‘standard precautions’. This level of care was applied to all people, regardless of their perceived or confirmed infectious status, as a strategy for minimising health care associated infections from both asymptomatic and symptomatic people. In 1996, the National Health and Medical Research Council (NHMRC)/Australian National Council on AIDS (ANCA) Infection Control Working Party broadened the scope of this approach and adopted the terms ‘standard precautions’ and ‘additional precautions’ (based on modes of transmission of infectious agents), to define appropriate work practices.

- **Standard precautions** are work practices required to achieve a basic level of infection control and are recommended for the treatment and care of all patients (see Section 2.2).

- **Additional precautions** are recommended for patients known or suspected to be infected or colonised with disease agents that cause infections in health care settings and that may not be contained by standard precautions alone (see Section 2.3).

This two-tiered approach should provide high-level protection to patients, HCWs and other people in health care establishments.

### 2.2 Standard precautions

Standard precautions are work practices required to achieve a basic level of infection control. **Table 2.1** provides a directory of these work practices, which are pivotal to infection control in the health care environment.
Basic infection control measures

2-3

INFECTION CONTROL IN THE HEALTH CARE SETTING

Standard precautions are recommended for the care and treatment of all patients, regardless of their perceived or confirmed infectious status, and in the handling of:

- blood (including dried blood);
- all other body fluids, secretions and excretions (excluding sweat), regardless of whether they contain visible blood;
- nonintact skin; and
- mucous membranes.

The use of standard precautions is essential as the primary strategy for the successful minimisation of transmission of health care associated infection. This is because:

- infectious patients may not show any signs or symptoms of infection that may be detected in a routine history and medical assessment;
- a patient’s infectious status is often determined by laboratory tests that may not be completed in time to provide emergency care;
- patients may be infectious before laboratory tests are positive or symptoms of disease are recognised (the window period of disease); or
- people may be placed at risk of infection from those who are asymptomatic but infectious.

The work practices listed in Table 2.1 should be considered minimum requirements for infection control. Implementing standard precautions minimises the risk of transmission of infection from person to person even in high-risk situations. Standard precautions should be implemented at all times,
particularly when patients are undergoing invasive procedures, including catheterisation, cannulation or intubation. Health care establishments that offer these procedures should provide detailed protocols for patient management in their infection control procedures manuals.

DISCUSSION POINT

Over years, many routine practices intended to reduce infection risk have been adopted in the workplace. Examples include wearing masks in operating theatres by all personnel, the use of overshoes, being required to wear a fresh uniform every day, and excluding nasal staphylococcal carriers from designated duties.

There have been no scientific trials to provide evidence to support most of these practices. Nevertheless, some activities, such as washing hands between administering care to successive patients, have a credible history to support their routine application in preventing cross-infection. Other practices, 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.

Today, people are questioning routine practices such as wearing protective masks for routine procedures. This may be appropriate. However, the absence of evidence to support routine practices should not be considered to be a basis for abandoning them. Rather, routine practices should continue until there is sufficient evidence to support alternative procedures.

2.3 Additional precautions

Additional precautions should be applied in a health care setting for patients known or suspected to be infected or colonised with infectious agents that may not be contained with standard precautions alone and that could transmit infection by the following means:

- airborne transmission of respiratory secretions (eg pulmonary tuberculosis, chickenpox, measles);
- droplet transmission of respiratory secretions (eg rubella, pertussis, influenza);
- contact with patients who may be disseminators of infectious agents of special concern (eg faecal contamination from carriers of vancomycin-resistant enterococci); and
- inherent resistance to standard sterilisation procedures, or other disease-specific means of transmission where standard precautions are not sufficient (eg patients with known or suspected Creutzfeldt–Jakob disease — see Section 31).1

1 Unless otherwise specified, in this document, the term ‘Creutzfeldt–Jakob disease (CJD)’ is used as a general term to cover the classical forms of CJD (including related human transmissible spongiform encephalopathies) and variant CJD. For further details of this group of diseases, see Section 31.
Additional precautions should be tailored to the particular infectious agent involved and the mode of transmission, and may include one or any combination of the following:

- allocation of a single room with ensuite facilities;
- a dedicated toilet (to prevent transmission of infections that are transmitted primarily by contact with faecal material, such as for patients with infectious diarrhoea or gastroenteritis caused by enteric bacteria or viruses);
- cohorting (room sharing by people with the same infection) if single rooms are not available;
- special ventilation requirements (eg monitored negative air pressure in relation to surrounding areas);
- additional use of personal protective equipment (eg a well-fitting respiratory protection device for HCWs attending to patients in respiratory isolation; a 0.3-µm particulate filter respiratory protection device\(^2\) is recommended for tuberculosis);
- rostering of immune HCWs to care for certain classes of infectious patients (eg those with chickenpox);
- dedicated patient equipment; and
- restricted movement both of patients and HCWs.

**Table 2.2** shows an outline of the application of additional precautions for infections with respiratory (airborne or droplet) transmission or contact transmission.

Additional precautions are not required for patients with bloodborne viruses, such as HIV, hepatitis B virus or hepatitis C virus, unless there are complicating infections, such as pulmonary tuberculosis.

To minimise the exposure time of other people in office practices or hospital waiting rooms, people identified as at risk of transmitting droplet or airborne diseases (eg a child with suspected chickenpox) should be subject to additional precautions and also be attended to before other people waiting for treatment.

Further information about specific diseases is given in **Part 4** (Managing infectious diseases in the health care setting).

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\(^2\) See **Section 13.4** for definition and description of appropriate masks and personal respiratory protection.
### Table 2.2 Outline of requirements for specified categories of additional precautions

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Airborne transmission</th>
<th>Droplet transmission</th>
<th>Contact transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>None</td>
<td>None</td>
<td>For all manual contact with patient, associated devices and immediate environmental surfaces</td>
</tr>
<tr>
<td>Impermeable apron/gown</td>
<td>None</td>
<td>None</td>
<td>Use when HCWs’ clothing is in substantial contact with the patient (includes items in contact with the patient and their immediate environment)</td>
</tr>
<tr>
<td>Respirator or mask</td>
<td>Particulate filter personal respiratory device for tuberculosis only</td>
<td>Surgical mask&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Protect face if splash likely</td>
</tr>
<tr>
<td>Goggles/face-shields</td>
<td>Protect face if splash likely</td>
<td>Protect face if splash likely</td>
<td>Protect face if splash likely</td>
</tr>
<tr>
<td>Special handling of equipment</td>
<td>None</td>
<td>None</td>
<td>Single use or reprocess before reuse on next patient (includes all equipment in contact with patient)</td>
</tr>
<tr>
<td>Single room</td>
<td>Yes (or cohort patients with same infection)</td>
<td>Yes (or cohort patients with same infection)</td>
<td>If possible, or cohort with patient with the same infection (eg methicillin-resistant <em>Staphylococcus aureus</em>)</td>
</tr>
<tr>
<td>Negative pressure</td>
<td>Essential for pulmonary tuberculosis</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Transport of patients</td>
<td>Surgical mask&lt;sup&gt;a&lt;/sup&gt; for patient Notify area receiving patient</td>
<td>Surgical mask&lt;sup&gt;a&lt;/sup&gt; for patient Notify area receiving patient</td>
<td>Notify area receiving patient</td>
</tr>
<tr>
<td>Other</td>
<td>Encourage patients to cover nose and mouth when coughing or sneezing and to wash their hands after blowing nose Provide one metre of separation between patients in ward accommodation</td>
<td>Provide one metre of separation between patients in ward accommodation</td>
<td>Remove gloves and gown, and wash hands before leaving patient’s room</td>
</tr>
</tbody>
</table>

<sup>a</sup> Surgical mask refers to a fluid-repellent, paper filter mask used in surgical procedures (see Section 13.4 and AS 4381).

Recinded
2.4 Triage policy

Specific triage policies should be developed to minimise transmitting diseases to other patients in outpatient and emergency units or health care waiting rooms. This applies particularly where there is a high risk of transmission (eg respiratory viruses such as respiratory syncytial virus, influenza and chickenpox). Triage staff and clinicians have a pivotal role in instigating an outbreak management plan.

Before admission to hospital or on presentation at an emergency unit, a detailed medical history should be collected from individuals or their carers to identify conditions that may require additional precautions. Triage staff should use a checklist to assess patients for conditions that require additional precautions, as well as for prioritising those who may require urgent attention, isolation or immediate treatment.

When referring patients (for surgery, dental treatment or hospital admission) the treating doctor should advise the clinician in charge of admission of any known infectious conditions that are relevant to the purpose of the referral. The patient’s consent should be sought before the release of any sensitive information.

For further information see Section 10 (Ethical and legal issues).

2.5 Quarantine

The Australian Government has legislative responsibility for human quarantine. Under the Human Quarantine Program, it develops policy on diseases of quarantine importance and, in collaboration with the chief quarantine officers (CQOs) of each State/Territory health department, coordinates the national response to outbreaks of quarantinable diseases.

Certain diseases are listed as quarantinable under the Quarantine Act 1908 (Commonwealth) and its proclamations. These include yellow fever, cholera, plague, rabies, Japanese encephalitis and four viral haemorrhagic fevers (Crimean–Congo, Ebola, Lassa and Marburg). The CQO of the relevant State or Territory should be notified immediately, by phone or fax, of any suspected or confirmed case of a quarantinable disease as required by local legislation. Contact may be made through the State/Territory health department.

2.6 Handling and transport of deceased patients

All bodies of deceased patients should be handled using standard precautions, as bloodborne pathogens may remain infective for some time. Any exposures to blood or body fluids should be reported and managed as outlined in Section 23. If additional precautions were required before death, people who handle the body after death should continue these precautions.

Any exposures to blood or body fluids should be reported and managed as outlined in Section 23.
Viewing of the body by relatives should not be prohibited on infection control grounds. Unless there is likely to be contact with blood or other body fluids of the deceased, relatives should not be discouraged from superficial contact, such as touching or kissing.

When deceased patients need to be transported, appropriate arrangements should be made to contain any potential spillage of blood or body fluids. Generally, an impervious plastic wrap should be used to encase the deceased patient before transport. The Australian Funeral Directors Association (AFDA 1992) suggests the use of polyethylene sheeting of suitable strength and size folded into an ‘envelope’ and sealed with 40-mm wide waterproof adhesive tape.

HCWs involved in the transport and handling of deceased patients should be aware of the danger from sharps that are still with or in the body. Appropriate personal protective clothing should be worn when handling deceased patients.
3 Identifying hazards and minimising the risks of infection

Key points

+ To successfully control transmission of infectious agents in health care settings it is necessary to:
  - identify hazards;
  - assess, classify and manage risks; and
  - develop risk management protocols and communication strategies to effectively minimise the risks.

3.1 Identifying hazards

A hazard in a health care setting is defined as an agent (biological, chemical or physical) that has the potential to cause harm to people or the environment. In infection control, a hazard is either an infectious agent or a mechanism that allows the transmission of an infectious agent (eg invasive device).

Identifying a hazard involves:

• identifying and documenting the activities and tasks that put patients and health care workers (HCWs) at risk of infection (eg sharps injury);

• identifying and documenting the infectious agent involved;

• identifying and documenting the route of infection; and

• obtaining evidence to confirm that the infection may be spread using this route (observational or experimental studies plus expert knowledge).

3.2 Assessment of risks

Risk assessment for the transfer of infectious diseases includes:

• hazard identification — see Section 3.1;

• hazard characterisation, which involves evaluating the infective dose of the infectious agent and a relationship between the dose received and the frequency/severity of the infection (dose–response relationship), and
  – knowledge of infectious agents, epidemiology etc;
PART 1—PRINCIPLES OF INFECTION CONTROL

3.2 INFECTION CONTROL IN THE HEALTH CARE SETTING

- assessment of the health care establishment physical environment (layout, facilities and practices);
- assessment of current infection control procedures;
- analysis of records of infection; and
- level of knowledge and/or training of patients and HCWs;

- exposure assessment, which involves evaluating factors relating to hazard exposure to determine the dose of infectious agent received, which may be quantitative or qualitative (for example, for a sharps injury this would be the source of infection and the level of contamination); and assessing
  - patient categories;
  - HCW categories;
  - procedures (critical, semicritical, noncritical); and
  - frequency of exposure; and

- risk characterisation, which involves integrating hazard and exposure information to give a qualitative estimate of risk (eg low risk) or, if data are available, a quantitative population-based estimate (eg 1 in 1000).

3.3 Risk management

The purpose of risk management/control is to minimise people’s exposure to sources of infection, including blood or body fluids, in the health care setting. Depending on the nature of specific risks, risk management may be achieved by:

- eliminating the risk factors;
- modifying procedures, protocols and work practices;
- engineering controls;
- implementing safe work practices;
- monitoring HCW and patient compliance with infection control procedures;
- providing HCWs with information about personal health conditions that may place them or patients at risk;
- providing information/education and training to patients and HCWs; and
- using personal protective equipment appropriately.

In addition to AS/NZS 4360:1995, a framework for identifying hazards, assessing the risks and implementing risk management is provided by the ‘hazard analysis critical control points’ (HACCP) approach (ANZFA 1996, Mortimore and Wallace 1998), which is based on the following principles:

- determining critical control point plans required to control identified hazards;
• specifying critical limits that determine whether a procedure is under control at a particular control point;
• establishing a monitoring system for critical limits;
• implementing corrective action if critical limits are not met; and
• verifying that the system is operating according to specification.

These principles form a framework to link identifying specific hazards with critical control points. Implementing suitable procedures within this framework should provide effective control over the transmission of infectious agents in the health care setting.

For example, the critical points for ensuring that reprocessed instruments are sterile may include cleaning the instruments before sterilisation, packing the sterilised units and validating the steam sterilisation process. Routine procedures are then required to ensure that each of these identified critical control points is adequately monitored (for example, see AS/NZS 41851).

Using this approach, critical control pathways may be mapped for all activities where hazards have been identified. The higher the risk associated with the identified hazard, the more critical control points and/or the more rigorous the monitoring procedures that may be required.

Health care establishments have a legal and ethical responsibility to provide HCWs with:
• risk assessment guidelines;
• a safe working environment;
• effective workplace instruction and ongoing education about infection control procedures;
• appropriate facilities and equipment, including occupational health services; and
• health screening programs.

Ongoing monitoring and evaluation of infection control procedures is also required.

### 3.4 Risk communication

Risk communication is the process of interactive exchange of information and opinion among risk assessors, risk managers and other interested parties. For this to occur, infection control objectives should be established and evaluated regularly. Feedback on the effectiveness of infection control programs should be provided to all the stakeholders of the establishment.

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3.4.1 Health care establishment communication strategies

An empowering infrastructure and environment are important factors for increasing the level of compliance with infection control programs. Hence, management should:

- provide direction (e.g., nominate issues for attention that are relevant to the establishment, such as rotavirus in pediatrics or urinary catheter sepsis in paraplegic care);
- establish goals (i.e., nominate benchmark rates for performance improvement);
- provide resources; and
- provide information to individuals, self-directed work groups, patients and other stakeholders, with an emphasis on continually improving performance.

Health care establishments should incorporate a communication plan and process that:

- provide timely information necessary to accomplish their objectives;
- facilitate feedback; and
- increase awareness of the infection control program.

3.4.2 Health care worker communication strategies

Strategies for communicating infection control issues among HCWs include:

- developing a set of shared values, behavioural guidelines and quality principles in support of the establishment’s infection control strategy that are reflected in job descriptions and duty statements;
- communicating annual infection control objectives to HCWs in simple and measurable terms to form the basis for HCW work plans;
- ensuring that HCWs understand the establishment’s infection control objectives and can articulate their contribution as part of regular HCW performance reviews;
- ensuring that all HCWs understand the link between the establishment’s infection control program objectives and their personal work objectives;
- undertaking regular reviews to ensure that HCW objectives are translated into work plans that act as
  - a mechanism for ongoing formal feedback on individual and collective behaviours, and
  - a system to build feedback into the process of continuous personal improvement; and
- holding multidisciplinary workshops to
  - devise individual infection control codes of conduct,
  - communicate the interdependent mechanisms of infection control, and
  - build infection control codes into career development.
3.4.3 Patient communication strategies

Health care establishments are responsible for communicating to patients their reasons for infection control policies and procedures. This should encourage the patient cooperation required to minimise cross-infection.

Education

Patient cooperation is vital for effective infection control. Health care establishments should inform patients about the risks associated with medical and surgical treatment.

Educational material should be provided in all health care settings, including the home/community setting, using a variety of media, including posters, printed material and educational videos. Patients should be familiarised with the infection control strategies that are employed in health care establishments to protect them, the people caring for them and the health care environment. They should also be provided with information about procedures for dealing with infection control breaches.

Risk disclosure

Health care establishments should inform patients about the risks associated with their medical care and the protocols for protecting their privacy and confidentiality. Patients should be encouraged to disclose their health or risk status, and any lifestyle choices that make them a potential risk or source of infection to HCWs or others within the health care establishment. Informing the patient of the protocols for protecting their privacy and confidentiality should form part of this discussion.

Patients should be informed about, and encouraged to use, feedback procedures to staff/management for any concerns they have about infection control procedures.

3.4.4 Communication with the health care industry

HCWs should liaise with the health care industry and interest groups to improve infection control procedures by providing feedback about equipment design. Risk prevention and optimal maintenance and cleaning by health care establishments should be considered, in conjunction with evidence-based infection control data, to ensure that high standards of design are achieved.

3.5 Tracking and traceability

For surveillance purposes, and in the event of a lookback investigation, health care establishments should implement an effective system to track and trace surgical instruments and devices that have been associated with health care associated infections.
3.5.1 Devices and instruments

Health care establishments should have systems in place that allow key items (for high-risk procedures, see Table 4.1) of equipment to be tracked. Those hard-to-clean instruments classified as semicritical items (see Table 4.2) that have been known to transmit infectious agents (eg flexible endoscopes) should also be tracked. The system should show individual devices and instruments, details of patient use, details of reprocessing steps, and process validation proof (see Section 17.1.2 for further information).

Health care establishments should be able to identify the patients on whom individual instruments have been used so that these patients may be traced if potential exposures have occurred (eg after use on patients with Creutzfeldt–Jakob disease or pulmonary tuberculosis).

3.5.2 Prostheses

Due to the potential dangers in the use of prostheses, health care establishments that are involved in the implantation or insertion of prostheses must maintain adequate records. These records must cross-reference patients with the batch and manufacturer code details of all implanted prostheses to allow identification of individual patients in the event of a recall or other event (eg health risk).

3.5.3 Contact tracing

When there are cases of specific infectious diseases (eg tuberculosis, measles), the health care establishment involved may be required to provide details of patients, HCWs and others who may have been exposed to the disease to public health officials responsible for tracing and informing potentially exposed persons. Health care establishments should maintain appropriate systems to enable such tracing.
4 Who is at risk and from what?

Key points

Risk of contracting a health care associated infection

- Patients may contract infections from themselves (endogenous infection) or from other patients, health care workers (HCWs), instruments and equipment, or the environment (exogenous infection). The level of risk relates to the health care setting (specifically, the presence or absence of infectious agents), the type of health care procedures performed and the susceptibility of the patient to infection.

- HCWs may contract infections from infected patients, instruments and equipment, or the environment. The level of risk relates to the type of clinical contact HCWs have with potentially infected patient groups, instruments or environments, and the health status of the HCW (eg immunised or previously exposed).

Risk of transmitting a health care associated infection

- Patients may transmit infections to other patients, HCWs, instruments and equipment, or the environment. The level of risk relates to the transmissibility of the infectious agent, the availability of a route of transmission, the susceptibility of exposed persons, and the success of applied control measures (ie standard and additional precautions).

- HCWs may transmit infections to patients during clinical contact, or to other HCWs, instruments and equipment, or the environment. The level of risk relates to the procedures undertaken (interviews and noninvasive procedures being the lowest risk and exposure-prone invasive procedures the highest risk) and the efficacy of the aseptic techniques used.

- Instruments and equipment may transmit infections to patients during clinical procedures. The level of risk relates to the site where the instrument is used — instruments that contact sterile tissue (critical sites) have the highest risk; instruments that contact only intact skin (noncritical sites) have the lowest risk.

- Infections may be transmitted from the environment when infectious agents are provided with a route of entry into susceptible patients or HCWs (eg airborne bacterial contamination of open wounds). The level of risk relates to the susceptibility of the patient or HCW, the availability of a route of entry from the environment and the level of contamination of the environment.
4.1 Spreading infection

The spread of infection requires three elements:

- a source of infecting microorganisms or other infectious agents (at a sufficient level to cause infection);
- a susceptible host; and
- a path for transmission of the infectious agent to the susceptible host.

In hospitals or other health care establishments, patients and health care workers (HCWs) are both potential sources and potential hosts for infectious agents. Human hosts may be people who are acutely ill, people who have no symptoms but who are in the incubation or window period of a disease (ie the time after infection has occurred but before a diagnosis is possible), or people who are chronic carriers of an infectious agent. Other sources of infectious agents are the normal endogenous microbial flora of patients or HCWs, or environmental sources, such as air, water, medications or medical equipment and devices that have become contaminated.

People have variable resistance to infection, depending on their age, underlying disease and other factors that may compromise their immune status, such as medical treatment with immunosuppressive drugs or irradiation. The risk of transmission of infection is higher for patients undergoing invasive procedures, and for patients who stay in hospital for a long time. ‘Indwelling’ devices (eg catheters) may increase the risk of infection, particularly when used over long periods. These risk factors are discussed further in this section by considering four main elements:

- patients
- HCWs
- instruments and equipment
- the health care environment.

Infections may pass between any of these elements in either direction, as shown in Figure 4.1. The risks associated with specific routes of infection are described in more detail in Part 4 (Managing infectious diseases in the health care setting).
4.2 Patients

4.2.1 Risk of contracting a health care associated infection

Patients may contract infection from:

- their own (endogenous) flora;
- exogenous sources, including:
  - contact with other patients or with HCWs;
  - cross-contamination of equipment by either infected patients or HCWs;
  - procedures (e.g., inadequately reprocessed instruments); and/or
  - the health care environment (e.g., ventilation, food).

The most common source of health care associated infection is the patient’s own flora. Some infections of this type may even be considered ‘inevitable’ (e.g., fungal infections in immunocompromised patients). Infection control practices should minimise the risk from the patient’s own normal (endogenous) flora (e.g., the use of skin antisepsis before invasive procedures), as well as from exogenous sources (e.g., appropriate reprocessing of instruments).

The risk of a patient contracting a health care associated infection is related to:

- the presence or absence and the burden of infectious agents (either endogenous or exogenous);
- the susceptibility of the individual patient to infection; and
- the type and quantity of health care procedures performed on the patient.

The burden of infectious agents is related to:

- the number of infectious agents present (dose); and
- their virulence (the ability to cause disease).
Susceptibility to infection is related to:

- disease immunity and/or immunisation status;
- systemic immune deficiency (inherent or acquired, including treatment-mediated);
- physical breaches of body defence mechanisms (e.g., invasive devices, surgical wounds);
- skin/mucosal conditions (e.g., psoriasis, excoriation); and
- other physical/health factors (e.g., age, pregnancy).

Immunocompromised patients are generally at increased risk from both endogenous and exogenous sources of infection. They may vary in their susceptibility to health care-associated infections, depending on the severity and duration of immunosuppression. These patients may be particularly susceptible to environmental contaminants, such as *Legionella* spp. or *Aspergillus* spp.

Children and confused adults who have not learnt, or are unable, to control their personal hygiene pose an additional challenge to maintaining infection control standards in health care establishments because they may be incontinent and use their hands and mouths to explore the environment. Very young children or babies may also be at increased risk of health care-associated infection due to their general lack of exposure to common diseases in the community, and due to their current immunisation status.

The type and quantity of health care procedures relates to factors such as:

- whether the procedure is invasive or exposure prone;
- the duration of the procedure or use of the device;
- the number of procedures performed (e.g., multiple procedures on one patient); and
- whether the instruments have been appropriately reprocessed.

### 4.2.2 Risk of transmitting a health care associated infection

Patients may transmit infection to other patients, HCWs or visitors when:

- they have an active symptomatic infection;
- they are infectious with detectable markers for a particular disease but asymptomatic (i.e., asymptomatic carriers); and/or
- they are infectious but have no detectable markers (i.e., ‘window period’).
The risk of transmission of infection to others is also related to factors such as the susceptibility of others to infection and the availability of a route of transmission (see Section 4.2.1).

### 4.3 Health care workers

#### 4.3.1 Risk of contracting a health care associated infection

The main risk to HCWs is that they may contract an infection from contact with patients, instruments or the health care environment. The risk of an HCW contracting a health care associated infection is related to the presence or absence and the burden of infectious agents (number and virulence), the susceptibility of the individual HCW to infection and the type of infectious hazard encountered (see Section 4.2.1).

The infectious hazards encountered by particular types of workers vary between and within health care establishments. For example, clerical staff in a paediatric outpatient clinic may encounter viral infections more frequently than clerical staff in a pay office.

HCWs can be placed in three main categories in relation to infectious hazards:

- clinical contact
- nonclinical contact
- laboratory and mortuary staff.

The categories are useful for targeting education programs and establishing immunisation protocols. However, they are not comprehensive and do not necessarily represent the category that should be assigned to HCWs in similar positions in all health care establishments.
Clinical contact

This category includes all HCWs who have clinical contact with patients. Some clinical contact HCWs have physical contact with, or potential exposure to, blood and body substances. This group includes:

- dentists, medical practitioners, nurses, student HCWs and allied health practitioners;
- emergency HCWs (fire, police, ambulance and volunteer first aid workers);
- maintenance personnel who service clinical equipment;
- sterilisation services personnel;
- mortuary technicians; and
- cleaning staff and waste management personnel.

The clinical contact category also includes HCWs in patient areas who have less direct contact with patients or with blood or body substances. These HCWs may be exposed to droplet-spread infections, such as rubella, but are unlikely to be at risk from bloodborne diseases. Examples include:

- catering staff
- primary care reception staff and ward clerks
- maintenance personnel.

Nonclinical contact

In many health care establishments, clerical staff, gardening staff and many other occupational groups have no greater exposure to infectious diseases than does the general public. These employees do not need to be included in vaccination programs or other programs aimed at protecting clinical contact staff.

Laboratory and mortuary staff

Laboratories contain special risk factors because of the equipment used (eg centrifuges) and the possibility of exposure to high concentrations of infectious agents generated by culture procedures. The major risk to laboratory staff occurs in the handling of blood and blood products.

The strategies for controlling infectious hazards in laboratories to create a safe working environment should be covered in laboratory manuals prepared inhouse in individual establishments to address the specific disease agents likely to be encountered, based on AS/NZS 2243.3.1

Mortuary staff may be at risk of exposure to infectious agents through contact with body substances, or through procedures such as autopsies or embalming. These risks may be minimised by appropriate handling of deceased patients (see Section 2.6) and the use of standard precautions. Further information about safe work practices in mortuaries may be found in AFDA (1992, 1995).

4.3.2 Risk of transmitting a health care associated infection

The risk of an infected HCW transmitting an infection to patients is of particular concern. The possibility of this happening is related to the types of procedures the HCW is involved in, their infection status and the types of patients they provide care for. Table 4.1 shows the level of risk to patients from HCWs infected with bloodborne viruses associated with various clinical procedures, from low-risk procedures (such as an interview or noninvasive examination), to high-risk, exposure-prone procedures (see below).

**Invasive procedures** carry a risk of infection and include any situation where an HCW enters the tissue, body cavity or organs of a patient, or surgically repairs traumatic injury to a patient. Operator factors may also increase the likelihood of transmission. These include technical competency (which may relate to skills training and education) and infectious status (e.g. high hepatitis B virus DNA titre).

**Exposure-prone procedures** are invasive procedures where there is potential for direct contact between the skin (usually finger or thumb) of the HCW and sharp surgical instruments, needles or sharp tissues (spicules of bone or teeth) in body cavities or in poorly visualised or confined body sites, including the mouth (NSW Health 1995a) of a patient. An exposure-prone procedure is one in which there is potentially a high risk of transmitting a bloodborne disease between an HCW and a patient during a medical or dental procedure.
**Risk assessment for transmission from infected HCWs**

For HCWs who perform high-risk procedures (see Table 4.1), the rate of exposures is sufficiently high to recommend that they should ascertain their status with respect to bloodborne viral diseases. HCWs who are infected with a bloodborne viral disease should not perform high-risk procedures. In the case of hepatitis B virus (HBV), hepatitis C virus (HCV) and possibly HIV infection, treatments may alter the infectious status. Thus, the determination about whether or not to participate in high-risk exposure-prone procedures requires consultation with State/Territory and/or professional advisory boards.

Variable-risk procedures (see Table 4.1) are those in which there is usually a low incidence of exposure. It is likely that the infected HCW may safely perform such procedures, provided strategies are used to minimise risk (see below). However, if the HCW is more prone to exposures than others (eg an HCW in training, or HCWs with a previous history of exposures during procedures) or if the assessment of the infected HCW indicates a highly infectious status (eg high HBV DNA), the situation should be reviewed in consultation with State/Territory and/or professional advisory boards.

**Risk minimisation**

Risk minimisation strategies include altering clinical procedures (eg using staple devices instead of hand-held suture needles) or, if this is not possible, preventing the infected HCW from carrying out the procedure (see above). Where there is uncertainty about whether certain procedures are exposure prone or about the level of risk associated with those procedures, the matter should be referred to State/Territory and/or professional advisory boards for individual assessment.

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**Table 4.1 Level of risk to patients from HCWs infected with bloodborne viruses, associated with particular procedures**

<table>
<thead>
<tr>
<th>Risk category</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High risk</strong> (exposure-prone procedures; NSW Health 1995a)</td>
<td>Any submucosal invasion with sharp, hand-held instruments, or procedure dealing with sharp pathology/bone spicules, usually in a poorly visualised or confined space (eg orthopaedic surgery, trauma, internal cavity surgery, oral surgery)</td>
</tr>
<tr>
<td><strong>Variable risk</strong>a,b</td>
<td>Minor dental procedures (excluding examination), routine dental extractions&lt;br&gt;Internal/instrument examination/biopsy (eg endoscopy, vaginal examination, laparoscopy)&lt;br&gt;Minor skin surgery</td>
</tr>
<tr>
<td><strong>Low risk</strong></td>
<td>Interview consultation, dental examination&lt;br&gt;Noninvasive examinations or procedures (aural testing, electrocardiograph, abdominal ultrasound)&lt;br&gt;Intact skin palpation (gloves not required, no pathology)&lt;br&gt;Injections/venepuncture (gloves required)</td>
</tr>
</tbody>
</table>

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a "Variable risk" refers to procedures where the risk may depend on training, experience, competence or other operator-specific factors related to the status of infection (eg HBeAg, high levels of HBV DNA).

b Where the risk to patients from HCWs infected with bloodborne viruses during specific procedures is unclear, consult with State/Territory and/or professional advisory boards for further advice.
HCWs who engage in exposure-prone procedures and who have positive or indeterminate test results for potentially serious bloodborne viral infections, such as HBV, HCV or HIV, must be individually assessed by their State/Territory and/or professional advisory boards or in accordance with local legislation or regulations (see Section 24).

4.4 Instruments and equipment

The risk of transferring infections on instruments and equipment is related to the presence or absence and burden of infectious agents (number and virulence), the type of procedure (eg invasive versus noninvasive) and the body site where the instrument is used (eg submucosal invasion versus intact skin).

The risk of transmission of infection by instruments and equipment may be classified according to the site where they are to be used. The Spaulding classification system (Spaulding 1968) suggests that contact sites for instruments may be classified as critical, semicritical or noncritical as shown in Table 4.2, and that instruments should be processed accordingly (see Section 16).

Table 4.2 Spaulding classification system for possible contact sites of instruments

<table>
<thead>
<tr>
<th>Application</th>
<th>Classification</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry or penetration into sterile tissue cavity or bloodstream</td>
<td>Critical</td>
<td>Surgical procedure with entry into sterile tissue, intravascular cannulation</td>
</tr>
<tr>
<td>Contact with intact nonsterile mucosa (or nonintact skin)</td>
<td>Semicritical</td>
<td>Respiratory therapy, gastrointestinal endoscopy</td>
</tr>
<tr>
<td>Contact with intact skin</td>
<td>Noncritical</td>
<td>Noninvasive procedures (eg palpation, abdominal ultrasound)</td>
</tr>
</tbody>
</table>

All instruments and equipment contaminated with blood or body substances must be cleaned as soon as practicable. Instruments that come into contact with sterile tissue must be sterile (see Section 16.2.2).

Instruments and equipment should be designed to minimise the potential for injury in routine use. Wherever possible, instruments or equipment that incorporate sharps should be minimised or guarded to reduce the likelihood of sharps injury.

4.5 Environment

Most environmental microorganisms are nonpathogenic (ie they do not cause disease in humans) but a small number are capable of causing disease in certain situations (eg Legionella spp). Some infectious agents may be shed by patients and/or HCWs into the environment (eg Staphylococcus aureus).
The risk of contracting an infection via the environment is related to the presence or absence and the burden (number and virulence) of infectious agents in the environment and their ability to gain entry to a susceptible host.

Only a small proportion of all health care associated infections are transmitted from the environment. The environment is usually contaminated with bacteria, but they are not likely to cause infection unless there is an opportunity for them to access open wounds or other potential sites of entry in sufficient numbers.

Reducing the number of infectious agents in the environment — for instance by appropriate management of blood spills (see Section 18.2), use of aseptic technique (see Section 6.1) and effective engineering maintenance programs (see Section 11.8) — will minimise the likelihood of contracting an infection from the environment.

The major environmental infection risk occurs with invasive procedures and devices. HCWs must use procedures to reduce the likelihood of environmental contamination during invasive procedures or in the use of invasive devices. Such procedures may include use of aseptic technique (see Section 6.1), specific ventilation requirements (eg during orthopaedic implant procedures; see Section 11.5) or procedures for the handling and use of invasive devices (eg keeping drainage bags off the floor; see Section 20.1.3). Contaminated environmental surfaces may be a potential source of infection for more than one patient. Effective environmental cleaning is essential to minimise these risks.

There may also be a risk of infection from the environment to specific patient groups, such as the potential for fungal infections in immunocompromised patients. Environmental or engineering controls may be required to reduce these risks (eg minimising dust that may contain *Aspergillus* spores, controlling legionellae in water supplies).
5 Responsibilities

Key points

The management of each health care establishment has a number of responsibilities in relation to infection control. These include:

- use of appropriate measures to prevent transmission of infection between health care workers (HCWs) and patients;
- development and/or maintenance of surveillance procedures, equipment and facilities, and education and training programs;
- the provision of options for the protection of HCWs;
- communication and protection of patients’ rights; and
- prevention of unwarranted discrimination against patients or HCWs with infections.

HCWs who undertake exposure-prone procedures have a responsibility to know their infectious status with regard to bloodborne viruses. Infected HCWs should seek appropriate medical care and advice.

Patients have a responsibility to declare their infectious status to the health care establishment. Patients should be informed of their rights to privacy and records as well as their responsibilities. Health care establishments should encourage a spirit of cooperation.

5.1 Health care establishments

The management of each health care establishment has a responsibility to prevent transmission of infections in the clinical environment. This requires coordination of clinical and nonclinical services to identify the hazards and to minimise the risk of the spread of infection. Specific aspects of this general responsibility are as follows.

General

- Use recommended measures to prevent the transmission of infection between health care workers (HCWs) and patients.

- Maintain surveillance for infections that may spread amongst patients and HCWs.
Part 1—Principles of infection control

Establish and practise infection control procedures that take account of the relevant pathogens for the particular clinical situation and pay due regard to the psychosocial welfare of the patient, thus enlisting their support and cooperation.

Take good medical histories, which explore known risk factors for infectious diseases (eg tuberculosis, immunodeficiency), of all patients entering the establishment.

Equipment and facilities

Maintain adequate physical facilities to control the spread of infectious agents.

Ensure that all equipment is maintained in sound working order and is subject to regular quality checks.

Education and training

Provide education in hygiene, including specific advice about handwashing and special requirements for specific areas where HCWs are working.

Inform and educate HCWs about the infectious hazards they will face during their employment. This information should be provided when they are first appointed and before rostering to hazardous areas. If patients present special or unusual hazards (eg tuberculosis in a general medical ward), HCWs at risk in the area should be informed and appropriate control measures should be taken.

Protection of health care workers

Maintain awareness of new vaccines becoming available to protect HCWs and initiate procedures to ensure that those at risk are fully immunised. An appropriate immunisation strategy is one that identifies the infectious agents likely to be encountered by HCWs at risk and offers immunisation programs that encourage compliance by providing full information about the vaccines (see also Section 22).

Take positive measures (eg immunisation) to implement appropriate infection control. Health care establishments should advise HCWs of the potential consequences if they refuse reasonable requests for immunisation. Such advice and refusal to comply should be documented. Should such HCWs subsequently develop work-related infections, it is most likely that the health care establishment would not be found to be in breach of its duty of care. Nevertheless, HCWs may be entitled to workers compensation under present legislation.

Testing should be offered following occupational exposure to blood or body substances, for example by needlestick injury (see Section 23).

Ensure that there is access to appropriately experienced counselling services for HCWs who become anxious about their health as a result of exposure to a potential hazard, whether actual or perceived.
Awareness of patients’ rights

- Ensure that HCWs are adequately informed of the rights and responsibilities of patients.
- Maintain procedures to ensure that knowledge of patient risk status can be handled in a calm and confidential fashion.

5.2 Health care workers

HCWs have an obligation to follow specific establishment infection control policies as part of their contract of employment. This includes reporting any known potential exposures to blood and/or body substances. Failure to follow infection control policies and procedures may be grounds for disciplinary action. Some States/Territories have statutory infection control requirements for HCWs.

All HCWs should be aware of their requirements for immunisation against infectious diseases and maintain personal immunisation records.

HCWs who undertake exposure-prone procedures have a responsibility to know their infectious status with regard to bloodborne viruses such as hepatitis B virus, hepatitis C virus and human immunodeficiency virus, and should be given relevant information about the tests available and encouraged to have voluntary testing.

HCWs with infections should seek appropriate medical care from a doctor qualified to manage infectious diseases. Where there is a risk of an HCW transmitting infection to a patient or other HCW (i.e., if the HCW is infected with a bloodborne virus, other transmissible infection or predisposing skin condition), the HCW should be counselled about their work options and either rostered appropriately or provided with information and facilities to enable them to continue to provide safe care.

5.3 Patients

Although there is no legal requirement for people who know they are infectious to declare their infectious status to health care establishments, patients have an ethical responsibility to do so if there is a known risk to others associated with their treatment. In addition, as is the case with any other members of the community, patients who know or have reason to believe that they are infectious may be exposed to both civil and criminal liability if they knowingly transmit infections.

If a situation arises where there is a need to know the infectious status of a patient (such as a sharps/blood accident), the patient has a responsibility to provide information or consent for testing that enables the health care establishment or responsible health professional to ensure the safe
management of the injured HCW. When obtaining consent, the patient should be offered pre-test counselling to advise them of the types of tests that may be needed and to outline the consequences to the patient of doing such tests. Post-test counselling may also be required, particularly if the test is positive.

Patients should have their responsibility explained and be encouraged to acknowledge it. When a patient is admitted to hospital or arrives at an accident and emergency unit, they should be encouraged to provide all relevant information about their infectious status to assist in triage management (see Section 2.4). Admission forms should be designed to ensure that this information is collected.

Patients are more likely to provide the relevant information if the risk of transmission of infection is explained in simple terms. They are also more likely to provide information if confidentiality is assured and if they are informed about the establishment’s policy and procedures for maintaining confidentiality. Health care establishments should promote a spirit of cooperation and participation among affected communities and seek to identify procedures or practices that encourage this spirit of cooperation.

### 5.4 Responsibilities relating to specific diseases

Health care establishments should fulfil their legal responsibilities in relation to infection control by adopting standard and additional precautions for specific infections as directed in these guidelines.

Infections that require additional precautions (e.g., tuberculosis, Creutzfeldt–Jakob disease, antibiotic-resistant bacteria) and other infections requiring special consideration are described in their respective sections in Part 4 (Managing infectious diseases in the health care setting).
6 Other key issues for infection control

Key points

- All health care workers should be aware of the concepts of aseptic technique, the handling of sharps, the use of single-use equipment and reprocessing procedures.

- Restraint in prescribing and adherence to the principles of prudent antibiotic use are essential to avoid the danger of emerging antibiotic resistance.

6.1 Aseptic technique

Asepsis is defined as the absence of infectious agents that may produce disease. Aseptic technique refers to practices used by health care workers (HCWs) to:

- reduce the number of infectious agents;
- prevent or reduce the likelihood of transmission of infectious agents from one person or place to another; and
- render and maintain objects and areas as free as possible from infectious agents.

Techniques to maintain asepsis may be categorised into ‘clean’ and ‘sterile’ techniques.

6.1.1 Clean technique

Clean technique refers to routine work practices that reduce the numbers of infectious agents. Routine practices include:

- personal hygiene, particularly handwashing, to reduce the numbers of infectious agents on the skin;
- use of barriers to reduce transmission of infectious agents;
- use of environmental controls to reduce transmission of infectious agents; and
- reprocessing of instruments and equipment between patient use.

Asepsis is defined as the absence of infectious agents that may produce disease.
These practices include most of the same elements as standard precautions. Before the emergence of human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and other bloodborne diseases, clean technique was conventionally seen as primarily protecting patients from infections carried by HCWs or by the health care environment. This concept has now been expanded to include protection for HCWs and patients, mainly from bloodborne infections but also from other infections, through standard precautions (see Section 2.2).

6.1.2 Sterile technique

Sterile technique refers to practices designed to render and maintain objects and areas as free from microorganisms as possible.

The concept of the ‘sterile operating field’, which has been practised for many years by operating room personnel, should be adopted by all practitioners undertaking invasive medical procedures. Everything within a defined radius must be clean and sterile (or, as a minimum, subject to high-level chemical or thermal disinfection). HCWs who come into contact with the sterile operating field must be appropriately trained and prepared (see Section 33.2).

In dental practice, the operating field includes anywhere that the patient’s blood (or other body substances, including saliva) may transfer to during a procedure (see Section 35).

Building design must provide for a sterile operating field, particularly with regard to ventilation systems and working surfaces (see Section 11).

6.2 Handling of sharps

Sharps are a major cause of incidents involving potential exposure to bloodborne diseases, and must be handled with care at all times. People involved in medical or dental procedures should devise and discuss methods of handling sharps that will minimise the risk of injury.

**IMPORTANT NOTE**

**Handling of sharps**

Sharp instruments must not be passed by hand between HCWs. Specified puncture-resistant sharps trays should be used for transfer of all sharp items (RACS 1998). Where possible, alternatives should be considered, including needleless intravenous systems, the use of blunt needles for drawing up sterile solutions from ampoules, or the use of retractable needle and syringe systems.
6.3 Single-use medications, injectables and instruments

To avoid cross-contamination between patients, single-use equipment should be used wherever this is practical.

6.3.1 Medications, solutions and injectables

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.

Multidose vials and multiuse products

The Australian Drug Evaluation Committee (ADEC) has advised that injectable products packaged in multidose vials should not be used except where products such as insulin are intended solely for the exclusive use of an individual patient. In these particular cases, specific protocols should be in place to ensure that the products are used for those individuals only. Every precaution should be taken to ensure that the unused portion of the vial is not contaminated, including using a clean needle and syringe to draw up the remaining contents of the vial on every occasion.

Medical and dental practitioners and paramedical HCWs should be aware of situations where cross-contamination from products might occur during routine medical or dental procedures. Protocols to prevent multiple-patient use in these circumstances should be developed. Examples include the use of topical lubricants in proctoscopy and/or vaginal examination, and local anaesthetics in throat procedures. When single-dose vials or ampoules are not available, the risk of cross-contamination is high if injectable products are used on multiple patients. The risk may be controlled by:

• drawing up all the contents of the container into individual syringes before administering to patients;

• establishing a separate area designated for the placement of these medications away from any work area;

• covering the medications to prevent environmental contamination;

• having only the current patient’s medication in the immediate working environment;

• using a clean needle and syringe to draw up the remaining contents of the vial or ampoule on every occasion; and

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1 ADEC 1995 Resolution No 5914.
2 ADEC 2001 Resolution No 7813.
• discarding any open ampoule(s) at the end of each procedure.

6.3.2 Instruments and equipment

Instruments or equipment intended for single use and labelled ‘single-use’ by the manufacturer should be disposed of after use.

The Therapeutic Goods Administration (TGA) provides the following advice about reprocessing ‘single-use’ instruments:

Devices listed on the Australian Register of Therapeutic Goods (ARTG) as ‘single use’ should be used only once. In July 2001, the Australian Health Ministers Advisory Council (AHMAC) agreed that any reprocessing of single use devices for reuse is a manufacturing activity and this should be regulated by the TGA. AHMAC also agreed that the regulation of the re-manufacture of single use devices for reuse should meet the same regulatory requirements and standards as apply to the original manufacturer. Any reprocessing would therefore only occur in a Good Manufacturing Practices (GMP) licensed facility that includes a monitoring system to ensure microbiological safety and product integrity. The TGA is developing a regulatory proposal for reprocessing of single use devices, but is not in the position to license reprocessing facilities until this regulatory proposal has been fully considered by all relevant stakeholders and finalised.

This option only applies to instruments and equipment that are capable of withstanding reprocessing that involves additional heat or chemical sterilisation methods as detailed in Table 31.9, without compromising product safety and integrity.

6.3.3 Implantable items

Devices or items intended for implantation must not be reprocessed or reused after use. Implantables that have had their sterile packaging opened but have not had contact with human tissue may be reprocessed and repackaged according to methods outlined by the manufacturer and approved by the TGA.

6.4 Reprocessing procedures

Any infectious agents introduced into sterile body sites may establish infection or colonise mucosal surfaces. Infectious agents are always present on skin and are likely to be carried through the air on dust particles. Infectious agents may contaminate instruments, medications and solutions that are intended to be sterile. Instruments and equipment used in critical sites must be sterile; instruments and equipment used in semicritical sites should be sterile or have been subjected to a minimum of high-level disinfection.

In order to achieve sterile conditions during procedures, all potential sources of contamination should be identified and minimised.
Effective reprocessing involves:

- cleaning to remove organic residue and chemicals immediately after use;
- disinfection by
  - heat and water (thermal) or
  - chemical disinfectants; and/or
- sterilisation.

Reprocessing procedures are described in more detail in Section 16. Section 17 gives further information on reprocessing of special instruments and equipment. General information on chemical disinfectants is given in Section 7.

6.5 Antibiotic use

Adherence to the principles of prudent antibiotic use is essential to avoid the danger of emerging drug resistance and provide best practice and quality care for patients.

The acquisition and spread of resistance to antimicrobial agents is more common in hospitals than in the community. This is due to:

- the selective pressure exerted by high levels of drug use, which allows the amplification of resistant infectious agents; and
- increased opportunities for transfer of infectious agents between HCWs and patients.

However, the same principles apply for both hospital and community or office practice settings. In all settings, antibiotics should be used according to the principles outlined in the Australian Therapeutic Guidelines: Antibiotic (Therapeutic Guidelines Ltd 2000). In addition, all prescribers of antibiotics should adopt the 'prudent use principles' shown below.
Successful implementation of antibiotic policies requires that the clinical administrations of health care establishments:

- formulate prescribing strategies appropriate for their establishment or practice;
- audit antibiotic use;
- participate in appropriate educational measures; and
- recognise the forces influencing doctors’ prescribing habits and practices.

Particular attention should be given to effective prescribing of antibiotics that are considered critical to human medicine (ie where there are no or few alternative antibiotics available for treatment of infections); for example, third-generation cephalosporins (eg cefotaxime, ceftriaxone, ceftazidime, cefpirome and cefepime) and glycopeptides (eg teicoplanin and vancomycin).

Important antibiotic-resistant pathogens, including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), multiresistant gram-negative bacilli and multidrug-resistant tuberculosis (MDR-TB), are discussed further in Part 4 (Managing infectious diseases in the health care setting), Section 30.
7 Disinfectants and sterilants

Key points

Surface disinfectants/sterilants

+ Surface disinfectants and sterilants are regulated by the Therapeutic Goods Administration (TGA) under Therapeutic Goods Order No 54 (TGO 54) as sterilants, instrument-grade disinfectants, hospital-grade disinfectants or household/commercial-grade disinfectants.

+ Sterilants are chemical agents that may be used to sterilise instruments or devices for use in critical sites (entry or penetration into a sterile tissue cavity or the bloodstream).

+ Instrument-grade disinfectants are further classified as high, low or intermediate level, where the level of activity is defined by the risk associated with specific in-use situations (see Section 16.4.1).

+ High-level instrument-grade disinfectants provide the minimum level of processing for instruments used in semicritical sites (contact with nonsterile mucosa or nonintact skin).

+ The performance of chemical disinfectants and sterilants is affected by temperature, contact time, concentration, pH, presence of organic and inorganic material, and numbers and resistance of microorganisms present.

+ Chemical disinfectants and sterilants should always be used with care according to the manufacturer’s instructions and material safety data sheets.

Skin disinfectants (antiseptics)

+ Skin disinfectants, or antiseptics, are substances used for dermal or mucous membrane application to kill or prevent the growth of microorganisms. They are regulated by the TGA as either registered medicines (AUST R), or listable medicines or medical devices (AUST L). Label claims must be followed.

7.1 Introduction

Chemical disinfectants and sterilants act by damaging the structure or impairing the metabolism of infectious agents. The biocidal (inactivation) range of a disinfectant or sterilant varies according to its active chemical structure and the general properties of the group to which it belongs (see
Table 7.1). All solutions labelled as disinfectants inactivate a range of vegetative bacteria, such as gram-positive and gram-negative bacteria, but may not inactivate more resistant bacteria, bacterial endospores, viruses or other microorganisms such as fungi (eg *Candida* spp) or protozoa (eg *Giardia* spp).

Sterilants and higher-level disinfectants also inactivate bacterial endospores, mycobacteria, viruses (both the more sensitive lipid-coated viruses, such as human immunodeficiency virus, and relatively resistant viruses, such as polio virus) and other microorganisms (see Section 7.2.1). However, the sporicidal activity during the usual shorter exposure time for high-level disinfection may not be optimal.

Most chemical disinfectants and sterilants are only partially effective against the agents of Creutzfeldt–Jakob disease. See Table 7.1 and Section 31.14 for details of inactivation methods for these agents.

Chemical substances may be formulated for use on inanimate surfaces (ie surface disinfectants) or for use on skin (ie skin disinfectants, or antiseptics).

Table 7.1 identifies the categories of active chemical substances used to formulate disinfectants/sterilants and antiseptics, and their ranges of activity. Classification of a product using any of these active ingredients as household grade, hospital grade, instrument grade, sterilant or antiseptic depends on the formulation used.

### 7.2 Chemical disinfectants and sterilants

Disinfectants and sterilants intended for use in the health care setting are regulated by the Therapeutic Goods Administration (TGA) under Therapeutic Goods Order No 54 (TGO 54) and are classified in the following broad categories:

- **sterilants**
  - instrument-grade disinfectants (three subclasses)
    - low grade
    - intermediate grade
    - high grade
  - hospital-grade disinfectants (two subclasses)
    - dirty conditions
    - clean conditions
- **household/commercial-grade disinfectants.**

Critical factors that may affect the performance of disinfectants or sterilants include temperature, contact time, concentration, pH, presence of residual organic and inorganic material, and numbers and resistance of the initial bioburden on a surface.
It is essential that disinfectants and sterilants are always used in accordance with the manufacturer’s directions to ensure that the product meets its label claims for efficacy in accordance with the requirements of TGO 54.

Disinfectants and sterilants should not harm instruments or equipment and the compatibility of instruments and equipment should be a consideration when choosing products. Products should not be mixed and ‘use by’ dates should be checked for currency. Products should be used at the recommended strength for soaking or exposure times. The required amount of product should be decanted as required to avoid contamination of the stock solution. Unused product should be discarded after use.

7.2.1 Sterilants and instrument-grade disinfectants

The TGA assesses products as instrument-grade (high, intermediate or low level) disinfectants or sterilants on the basis of stringent conditions outlined in TGO 54. The manufacturer is required to provide data to the TGA that demonstrates in-use efficacy and compatibility with a range of instruments. Those chemical disinfectants intended for use in automated washer–disinfectors should perform effectively as claimed on the label. Any disinfectant or sterilant used to reprocess medical instruments must be registered on the Australian Register of Therapeutic Goods (ARTG).

Sterilants

A sterilant is a liquid chemical agent that may be used to sterilise critical medical devices that will not withstand steam sterilisation (see Section 16.5). Sterilants inactivate all microorganisms, giving a sterility assurance level of less than $10^{-6}$ (see Glossary), which is the sterility level required for medical equipment that will contact critical body sites.

All chemical sterilants should be used in accordance with the manufacturer’s approved label conditions for sterilisation. For products that may be classified as both a sterilant and a high-level disinfectant (multiuse), the sterilisation time is the longer of the two times that appear on the label.

Automated chemical processing systems based on peracetic acid or high-concentration hydrogen peroxide (plasma) sterilants achieve sterilisation within 30–80 minutes, depending on the model and the system.

There are TGA-approved sterilant products for both manual and automated systems. If users of sterilants and/or high-level disinfectants are unsure of the TGA-approved status of a product, they should ask the manufacturer to supply the product’s AUST R code number before they take any further action.
Part 1—Principles of infection control

Instrument-grade disinfectants

Instrument-grade disinfectants are classified as high, intermediate or low level. Careful selection of an appropriate level of disinfectant is required to achieve the desired level of disinfection. The definitions given in TGO 54 state that, when used as recommended by the manufacturer:

- high-level chemical disinfectants inactivate all microbial pathogens, except large numbers of bacterial endospores;
- intermediate-level disinfectants inactivate all microbial pathogens except bacterial endospores; they are bactericidal (including mycobactericidal), fungicidal against asexual spores (but not necessarily dried chlamydospores or sexual spores) and virucidal; and
- low-level disinfectants rapidly inactivate most vegetative bacteria as well as medium-sized lipid-containing viruses; they may not be relied upon to destroy, within a practical length of time, bacterial endospores, mycobacteria, fungi or any small nonlipid virus.

The level of activity (high, intermediate or low) is defined by the risk associated with a specific in-use situation (see Section 16.4.1). The minimum level of processing required for specific items in use is shown in Table 16.1.

Halogens (such as chlorine and iodine) may perform as high-level disinfectants at high concentrations, but none are currently registered in Australia. Quaternary ammonium compounds usually perform as low-level disinfectants, which are ineffective against many microorganisms (eg bacterial spores, mycobacteria and many viruses). However, when coformulated with other active chemical substances, the final formulation may deliver the increased activity required of an intermediate or high-level disinfectant. Depending on the formulation, alcohols may be good intermediate-level disinfectants (see Table 7.1).

7.2.2 Hospital-grade disinfectants

Hospital-grade disinfectants are regulated by the TGA. These disinfectants must not be used to disinfect medical instruments. This should be stated on the product label.

The use of hospital-grade disinfectants is not necessary in health care establishments. The recommended procedure is the manual removal of visible soil and dirt, followed by cleaning with water and detergent (see Section 18.1). However, hospital-grade disinfectants may be used on environmental surfaces such as walls, floors, furniture and equipment that do not come into direct contact with the patient.

The activity of hospital-grade disinfectants is usually restricted to a range of vegetative bacteria of the type usually encountered in a health care setting, unless the TGA approves additional specific label claims, such as tuberculocidal or virucidal activities.
### 7.2.3 Household/commercial-grade disinfectants

Household/commercial-grade disinfectants are also regulated by the TGA. These disinfectants have limited use, as their efficacy has not been tested under conditions likely to be encountered in health care settings.

### 7.3 Skin disinfectants (antiseptics)

An antiseptic is a substance that is recommended by its manufacturer for application to the skin or mucous membranes of a person or animal to deactivate microorganisms or to prevent the growth of microorganisms to a level that may cause clinical infection. An antiseptic is not represented to be suitable for internal use (TGO 54).

Skin disinfectants/antiseptics are regulated by the TGA. Most antiseptic products marketed in Australia are either registered medicines or listable medicines (e.g., tea tree oil) on the ARTG and therefore require an AUST R or AUST L number, respectively, on the label. Other products contained in sachets are currently classified as listable medical devices, for which the display of an AUST L number is optional. The label claims of such products are important and should be followed.

Skin disinfectants/antiseptics should always be used according to the manufacturer’s directions, which are designed to ensure that a product, when used as directed, meets its label claims for efficacy in accordance with TGA requirements.

Hygienic handwash/scrub products are formulated to reduce transient bacteria on the hands. Surgical scrubs reduce the level of both transient and resident bacterial flora. Handwashing disinfectants chosen for health care workers (HCWs) should demonstrate residual as well as immediate activity.
HCWs should use skin disinfectants on their hands before participating in any surgical procedures, including cannulation, catheterisation and intubation. Skin disinfection before surgery should reduce the number of resident bacteria and thus the infectivity of skin or mucosal tissue in the patient and on the hands of the HCW. Each skin disinfectant should be labelled with the date when first opened and discarded after its designated 'use by' date as indicated on the manufacturer's label.

Before use, sufficient skin disinfectant for an individual patient’s use should be decanted into a sterile container. Any fluid remaining in this container should be discarded at the end of each procedure (see Section 6.3).

HCWs should check the label for the specific contact time of each antiseptic used and should use the antiseptic strictly in accordance with the manufacturer’s instructions. There is a wide range of antiseptics available. The formulations and concentrations chosen should be appropriate to the tissues to which the antiseptic is applied. Particular note should be taken of the flammability of the product in relation to the setting in which it is to be used.

The following preparations may be used, but the choice should be appropriate for the nature and site of the procedure:

- 70–80% w/w ethanol;
- 60–70% v/v isopropanol;
- chlorhexidine in aqueous formulations (0.5–4% w/v) or in alcoholic formulations with chlorhexidine (0.5–1% w/v) in 60–70% isopropanol or ethanol;
- 10% w/v aqueous or alcoholic povidone–iodine (1% w/v available iodine);
- solutions containing 1% w/v diphenyl ether (triclosan) (Gardner and Peel 1998).

Note that particular preparations are contraindicated for use at particular sites. For example, 4% w/v chlorhexidine is widely used as a bacterial skin cleaner for hygienic and surgical handwashing. An aqueous solution of 0.5% w/v chlorhexidine is recommended for use on facial skin. Weaker solutions (0.02–0.05% w/v) may be used for application to mucous membranes — for example during bladder irrigation (Gardner and Peel 1998). Where disinfectant is used during dental procedures, oral membranes should be dried/isolated to prevent dilution of the disinfectant with saliva.

Studies have indicated that 2% aqueous chlorhexidine is more effective than 10% povidone–iodine or 70% alcohol for cutaneous disinfection before insertion of an intravascular device and for post-insertion care, and may substantially reduce the incidence of device-related transmission of infection (Maki et al 1991, cited in Gardner and Peel 1998). However, 2% aqueous chlorhexidine is not currently marketed in Australia.
Chlorhexidine should never be used in surgery on the middle ear because it may cause sensorineural deafness (Bicknell 1971). Corneal toxicity — including transient epithelial defects, chronic corneal ulceration and corneal oedema — has been observed following ocular exposure to a proprietary product in which chlorhexidine was the active ingredient (Tabor et al 1989, Varley et al 1990).

An alcohol wipe (70% w/w ethanol or 60% v/v isopropanol) may be used before venous blood collection, injection, or insertion of acupuncture needles to reduce the bacterial load on the skin and thus lessen the risk of infection. Currently, there is no evidence to suggest a minimum drying time to effect skin disinfection before venous blood collection, injection or acupuncture. However, to reduce discomfort in the patient, the alcohol should be allowed to dry before proceeding. Alcohols are flammable and should be used with caution. Therefore, they should not be used for skin disinfection before electric cautery or laser treatment. Alcoholic solutions are inappropriate for use on mucous membranes.

7.4 Occupational health and safety issues for using chemical disinfectants

Chemical disinfectants should be used with caution and in accordance with the manufacturer’s directions. Information on the safe handling of chemicals in laboratories is given in AS/NZS 2243.1\(^1\) and AS/NZS 2243.2.\(^2\) Health care establishments should provide comprehensive induction and training programs for HCWs about the safe handling of chemicals.

Material safety data sheets for disinfectants should be consulted before use. Personal protective equipment must be worn when working with disinfectant/sterilant solutions. Ventilation should be adequate when using concentrated or volatile chemicals as defined by the National Occupational Health and Safety Commission (NOHSC 1994). Fume extraction systems should comply with AS 1668.2.\(^3\)

The use of hazardous substances is regulated under workplace health and safety legislation in each State/Territory. All chemical disinfectants should be discarded in accordance with State/Territory and local government regulations (see AS/ANZ 3816\(^4\)).

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**IMPORTANT NOTE**

**Using chemical disinfectants and sterilants**

Use chemical disinfectants with caution and follow the manufacturer’s directions. Consult material safety data sheets for disinfectants before use. Wear personal protective equipment and ensure adequate ventilation.

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**Table 7.1 Categories and ranges of activity of the active chemical substances used to formulate disinfectants and antiseptics**

<table>
<thead>
<tr>
<th>Activity range</th>
<th>Other properties/comments$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alcohols</strong></td>
<td>Ethanol:</td>
</tr>
<tr>
<td>• Effective:</td>
<td>• 70% w/w ethanol acts rapidly and dries quickly</td>
</tr>
<tr>
<td>bactericidal</td>
<td>• 90% w/w ethanol is useful as a virucide</td>
</tr>
<tr>
<td>fungicidal</td>
<td>• 100% ethanol is not an effective disinfectant</td>
</tr>
<tr>
<td>mycobactericidal</td>
<td>• Less effective against nonenveloped viruses (e.g., HAV) than against enveloped viruses (e.g., HIV)</td>
</tr>
<tr>
<td>• Variable:</td>
<td>Isopropanol:</td>
</tr>
<tr>
<td>virucidal</td>
<td>• Most effective at 60–70% v/v</td>
</tr>
<tr>
<td>• Poor:</td>
<td>• Variable mycobactericidal activity</td>
</tr>
<tr>
<td>not sporidical</td>
<td>• Not an effective virucide</td>
</tr>
<tr>
<td>• Ineffective:</td>
<td>General properties of alcohols:</td>
</tr>
<tr>
<td>CJD</td>
<td>• Do not penetrate organic matter well, so prior cleaning is required as alcohol acts as fixative</td>
</tr>
<tr>
<td></td>
<td>• Flammable</td>
</tr>
<tr>
<td></td>
<td>• May be combined with other bactericidal compounds for skin disinfection</td>
</tr>
<tr>
<td></td>
<td>May only be used as an instrument-grade disinfectant if labelled accordingly by manufacturer</td>
</tr>
<tr>
<td><strong>Aldehydes</strong></td>
<td>Highly irritant:</td>
</tr>
<tr>
<td>• Effective:</td>
<td>Act as fixatives; prior cleaning required</td>
</tr>
<tr>
<td>bactericidal</td>
<td>Penetrate organic material slowly and usually not inactivated by inorganic materials</td>
</tr>
<tr>
<td>fungicidal</td>
<td>Usually noncorrosive to metals</td>
</tr>
<tr>
<td>virucidal</td>
<td>Buffered alkaline solutions must be activated immediately before use and have a limited shelf life</td>
</tr>
<tr>
<td>sporidical (slow)</td>
<td>Acidic solutions are more stable but are slower acting; glycolated (mildly acidic) solutions have shorter inactivation times</td>
</tr>
<tr>
<td>• Variable:</td>
<td>Instrument-grade disinfectant when used for a short period (usually &lt;60 minutes) according to label: specific to each formulation</td>
</tr>
<tr>
<td>mycobactericidal</td>
<td>Instrument sterilant when used for a prolonged period (usually &gt;5 hours) depending on formulation/labelling</td>
</tr>
<tr>
<td>• Ineffective:</td>
<td>Slow acting against atypical mycobacteria</td>
</tr>
</tbody>
</table>
### Table 7.1 (cont'd) Categories and ranges of activity of the active chemical substances used to formulate disinfectants and antiseptics

<table>
<thead>
<tr>
<th>Activity range</th>
<th>Other properties/comments</th>
</tr>
</thead>
</table>
| **Chlorhexidine and biguanide polymers** | - Effective: gram-positive organisms less active against gram-negative organisms  
- Variable: virucidal fungicidal (subject to species variation)  
- Poor: not mycobactericidal not sporicidal  
- Ineffective: CJD  

| Hypochlorites | - Fast acting  
- Inactivated in presence of organic matter at low concentrations  
- Incompatible with cationic detergents  
- High concentrations corrosive to some metals (some compounds may contain corrosion inhibitors)  
- Diluted form unstable with short shelf life  
- Decomposed by light, heat, heavy metals  
- Chlorine gas released when mixed with strong acids  
- Carcinogenic reaction product when mixed with formaldehyde  
- Useful in food preparation areas and virology laboratories  
- Activity may be increased by combining with methanol  
- May only be used on instruments if labelled as an instrument-grade disinfectant  
- There are available chlorine requirements for:  
  - Blood spills: 10,000 ppm (1%)  
  - Laboratory discard jars: 2500 ppm (0.25%)  
  - Clean environmental disinfection: 1000 ppm (0.1%) (ie environment that has been precleaned of all soil and other organic and inorganic material or has not been exposed to soiling with body fluids)  
  - Disinfection of clean compatible items: 500–1000 ppm (0.05–0.1%)  
- Higher-risk CJD spills/contamination: 20,000 ppm for 1 hour (see Table 31.9)  

| Iodine preparations | - May be inactivated by organic matter  
- May corrode metals (eg aluminium)  
- Useful as a skin disinfectant but some preparations may cause skin reactions (povidone–iodine is much less irritant than iodine itself)  
- Antiseptic-strength iodophores are not usually sporicidal  
- May be used on instruments only if labelled as an instrument-grade disinfectant |
### Table 7.1 (cont’d) Categories and ranges of activity of the active chemical substances used to formulate disinfectants and antiseptics

<table>
<thead>
<tr>
<th>Activity range</th>
<th>Other properties/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peracetic acid and other peroxide compounds</strong></td>
<td>• Peracetic acid is highly irritant</td>
</tr>
<tr>
<td>• Effective:</td>
<td>• Corrosive to some metals/instruments</td>
</tr>
<tr>
<td>bactericidal</td>
<td>• Reduced activity in presence of organic matter</td>
</tr>
<tr>
<td>fungicidal</td>
<td>• Usually contain detergent</td>
</tr>
<tr>
<td>virucidal</td>
<td>• Useful for small spills</td>
</tr>
<tr>
<td>sporidical</td>
<td>• May be used as an instrument-grade disinfectant or sterilant under specified conditions, if compatible</td>
</tr>
<tr>
<td>mycobactericidal</td>
<td>• Hydrogen peroxide and potassium monoperoxygen sulfates have low toxicity and irritancy</td>
</tr>
<tr>
<td>• Variable/poor:</td>
<td></td>
</tr>
<tr>
<td>mycobactericidal (peroxygen compounds)</td>
<td></td>
</tr>
<tr>
<td>• Ineffective:</td>
<td></td>
</tr>
<tr>
<td>sporidical (peroxygen compounds)</td>
<td></td>
</tr>
<tr>
<td>CJD</td>
<td></td>
</tr>
<tr>
<td><strong>Phenolics</strong></td>
<td>• Avoid contact with skin/mucous membranes</td>
</tr>
<tr>
<td>• Effective:</td>
<td>• Stable in presence of organic matter</td>
</tr>
<tr>
<td>bactericidal</td>
<td>• Incompatible with cationic detergents</td>
</tr>
<tr>
<td>mycobactericidal</td>
<td>• Not for use on food preparation surfaces/equipment</td>
</tr>
<tr>
<td>fungicidal</td>
<td>• Detergent usually included</td>
</tr>
<tr>
<td>variable</td>
<td>• Absorbed by rubber and plastics</td>
</tr>
<tr>
<td>virucidal</td>
<td>• Diluted form unstable</td>
</tr>
<tr>
<td>poor:</td>
<td>• Useful for mycobacteria on surfaces</td>
</tr>
<tr>
<td>nonenveloped viruses</td>
<td></td>
</tr>
<tr>
<td>• Ineffective:</td>
<td></td>
</tr>
<tr>
<td>CJD</td>
<td></td>
</tr>
<tr>
<td><strong>Sodium dichloroisocyanurate (SDIC) granules</strong></td>
<td>• Less corrosive than hypochlorite</td>
</tr>
<tr>
<td>Similar to hypochlorites</td>
<td>• More resistant to inactivation in presence of organic matter</td>
</tr>
<tr>
<td>• Ineffective:</td>
<td>• Stable in dried form; unstable in solution</td>
</tr>
<tr>
<td>CJD</td>
<td></td>
</tr>
<tr>
<td><strong>Acids (formic) and alkalis (sodium hydroxide)</strong></td>
<td>• Corrosive/caustic</td>
</tr>
<tr>
<td>• Restricted use for CJD</td>
<td>• Use only with special care</td>
</tr>
</tbody>
</table>

CJD = Creutzfeldt-Jakob disease; HAV = hepatitis A virus; HIV = human immunodeficiency virus

* Classification of a product using any of these active ingredients as household, hospital, instrument or sterilant grade or as an antiseptic depends on the formulation used.

Note: Instruments contaminated with the agent of CJD should either be destroyed or reprocessed according to the guidelines in Table 31.9.

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</tr>
</tbody>
</table>

*Recinded*
8 Quality administrative arrangements

Key points

- The details outlined in this section are written primarily for the hospital setting. However, the principles of quality management and infection control apply to all health care settings.

- In order to implement a coordinated approach to infection control, each public and licensed private health care establishment should have a strategic plan for infection control.

- Each health care establishment should develop a comprehensive infection control procedures manual that specifies performance standards for routine work practices and procedures.

- Policies and procedures for infection control should be consistent with national minimum standards and generally accepted infection control principles, as outlined in these and other relevant national and State/Territory guidelines.

- Each health care establishment should have a system of infection control management (such as a committee) with input from across the spectrum of clinical services and management. The committee should meet regularly to consider and resolve current infection control issues that affect the working environment.

- Each health care establishment should employ an infection control practitioner (ICP) with an appropriate education to practise in that setting. The ICP should be primarily responsible for implementing the establishment’s infection control policies, including compliance with the respective State/Territory and/or national accreditation, licensing, policy or regulatory requirements. In hospitals, the recommended staffing level is 1.5 ICPs to 200 acute care beds.

- Health care establishments have a legal responsibility to provide a safe work environment, safe systems of work and a safe environment for patients and visitors in their care.

8.1 Introduction

Some studies have shown that hospitals with effective infection control programs can effectively reduce infection rates by up to one-third compared to those with no infection control programs (Haley et al 1985).
In Australia, a recent survey found that most Australian hospitals have infection control programs in place (Murphy and McLaws 1999). However, all health care establishments should implement infection control programs to prevent the transmission of infectious diseases. An integral part of the program should be a system to monitor and document any incident of health care associated infection (iatrogenic or nosocomial).

8.2 Implementing an infection control program

To implement a coordinated approach to infection control, health care establishments should have an infection control program in place that includes:

- development of an annual strategic business plan for infection control;
- preparation of a comprehensive procedures manual that specifies performance standards for routine work practices and procedures as outlined in these guidelines (see Section 1.2), and including the following:
  - strategies to modify procedures and equipment associated with increased risk of occupational exposure to blood and/or body substances, and to ensure their appropriate management;
  - strategies to monitor the effectiveness of the infection control program and ongoing compliance with regulatory and licensing requirements;
  - strategies to monitor antibiotic resistance;
  - strategies to monitor and manage critical incidents;
  - contingency plans to manage outbreaks of health care associated infections and breakdowns in infection control practices; and
- coordination by a suitably qualified health care worker (HCW), for example a registered nurse, clinical/medical microbiologist or infectious diseases physician (in smaller establishments this function may be combined with other tasks).

Policies and procedures should be consistent with national minimum standards and infection control principles outlined in these and other relevant national and State/Territory guidelines.

To promote ownership and compliance, policies and procedures should be developed in collaboration with all clinicians involved. They should also be practical, workable, necessary and sufficiently flexible to ensure their implementation.
8.3 Infection control management

Each health care establishment or region/district should have a committee or system of management that is responsible for the development, oversight and evaluation of the infection control program. Infection control management should reflect the spectrum of clinical services and administrative arrangements of the health care establishment so that policy decisions take account of implementation issues. The spectrum of advice should include:

- executive management
- responsible clinical expertise (eg surgeons, physicians, nurses)
- microbiology
- infection control practitioners
- support services (eg catering, cleaning, sterilising services)
- occupational health and safety.

Infection control management should regularly evaluate:

- routine surveillance reports from the infection control practitioner (ICP) based on the strategic plan — for example, clinical indicators such as:
  - device-related infections (eg catheter infections),
  - procedure-related infections (eg surgical wound infections),
  - blood and body substance exposures;
- HCW vaccination and education;
- outbreaks of health care associated infection;
- purchasing and equipment issues;
- building and refurbishment issues;
- clinical practice standards/guidelines/policies;
- advice from the National Health and Medical Research Council, the Communicable Diseases Network Australia, Australian and State/Territory health departments, professional colleges and other advisory groups about infection control issues and their implications for the establishment; and
- issues referred by the clinical service units or individuals within the establishment.

Infection control management should have the capacity to initiate a rapid response when specific needs arise.

The evaluation of the surveillance data and a report of the activities of the infection control program should be made available to all relevant staff. Consideration should also be given to allowing access by patients and the public to these reports.
8.4 Infection control practitioner

A recent study of Australian ICPs has demonstrated that there is a clear move away from any single focus and towards more strategic management and clinical monitoring (Jones et al 2000). The role now comprises:

- management, including change management;
- clinical practice;
- consultancy;
- research;
- surveillance; and
- education.

Furthermore, each of these areas covers issues of:

- strategic planning;
- resource management, including staffing, and access to computers and appropriate software;
- staff health;
- policy development and implementation;
- risk management;
- data collection and analysis (epidemiology); and
- professional development.

The scope of the ICP’s role will be influenced by the context of practice (e.g., acute care, long-term care). The complexity and scope of the ICP’s role have made it necessary for ICPs to be formally qualified. Specialist courses are available in Australian tertiary institutions. These tertiary courses are encouraged to seek infection control credentialling by the Australian Infection Control Association (AICA) Credentialling Board (established in 2000). The ICP is most often a registered nurse (Murphy and McLaws 1999), although medical microbiologists or other HCWs with additional training in hospital epidemiology and surveillance have also been appointed.

Staffing for infection control remains a controversial topic. There are currently no methods to precisely determine the required level of infection control staffing in Australian health care establishments (Murphy and McLaws 1999). Research into this area should be encouraged.

The number of hours dedicated to infection control within any health care establishment should be commensurate with the size, acuity, and level of infectious risks encountered (Scheckler et al 1998, Friedman and Chenoweth 1998, Friedman et al 1999).
In the Australian setting, in recognition of the expanded role of the ICP as described by Jones et al (2000), the AICA and the Australian Council on Healthcare Standards have recommended a ratio of 1.5 ICPs to 200 acute health care beds (ACHS and AICA 2001).

8.5 Compliance standards and accreditation

This document contains minimum infection control standards for health care establishments. Demonstrated compliance with these infection control standards should be a minimum requirement for accreditation or licensing.

Professional organisations should be consulted on accreditation requirements relating to infection control.

8.6 Quality improvement program maintenance

To be effective, infection control should be a part of an establishment-wide quality improvement program. Continuous quality improvement involves an organised and methodical range of activities and processes to implement practice guidelines and/or standards of care. There should be key performance indicators to identify any breaches of practice guidelines, indicate when corrective interventions are required, and/or evaluate such interventions for effectiveness. Key performance indicators should be monitored and appropriately communicated.

8.7 Continuum of care responsibilities

To ensure a continuum of care across different health care settings, service agreements or contracts can be developed between providers (eg acute care hospitals, long-stay residential establishments, community health centres) outlining roles and responsibilities, including those for infection control. The aim should be to provide safe, effective care across the whole spectrum of health care delivery, with mechanisms in place to monitor outcomes appropriately, including infection control outcomes. Multidisciplinary pathways that include infection control principles, and process indicators/incident monitoring of health care associated infections across different health care settings, improve coordination.
8.8 Employee health policies

Both employers and employees have a responsibility in relation to occupational health and safety (see Section 5).

As part of its infection control program (see Section 8.2), each health care establishment should develop, implement and document effective policies and risk reduction procedures, including strategies to:

- minimise occupational exposure to infection hazards;
- minimise occupational risks from chemicals or processes used for recommended infection control activities; and
- implement HCW immunisation programs for infectious agents likely to be encountered by HCWs in the course of their duties (see Section 22.3.3).
9 Education and training

Key points

Universities and training institutions that offer courses in health-related areas should ensure that the curriculum includes current information on infection control policy, procedures, incident monitoring and quality assurance. This applies to courses in medicine, nursing, allied health care, health services management, public health and natural therapies.

Health care establishments should provide a program of education and training on infection control principles for all health care workers and students that emphasises the importance of ongoing education and training.

9.1 Universities and training colleges

Universities and training colleges that offer undergraduate and postgraduate courses in health-related areas should ensure that the curriculum includes up-to-date information on infection control policy, procedures, quality assurance and incident monitoring.

Tertiary institutions have an obligation to inform prospective students of 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 24.6). This information should include advice about specific measures, including immunisation, that reduce the risk of acquiring infection during a course of study.

9.2 Health care establishments

As part of their overall infection control program, health care establishments should provide a specific program of education and training for all health care workers (HCWs) and students about infection control principles, policies and procedures relevant to the establishment. Education and training programs should explain and emphasise the five basic areas of infection control, as outlined in these guidelines (see Section 1.2). Health care establishments should maintain records of HCW participation in education programs.

Health care establishments should provide a specific program of education and training in infection control for all health care workers.
Managers should also emphasise the importance of continuing education and training (internal and/or external) for all HCWs. Orientation programs should include comprehensive information about the establishment’s infection control policies and programs and the important role of the HCW. Education and training programs should be flexible in presentation and encourage participation by HCWs, including those from non-English speaking backgrounds or with disabilities.

Workplace education and training should use a variety of techniques, such as peer educators and group sessions, involving the active participation of employees. Organisations that provide support and care for people affected by diseases, such as human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), should be invited to speak to HCWs about the impact of these diseases. Professional organisations (see Appendix 7) may also provide educational aids (videos, publications etc).
10 Ethical and legal issues

Key points

+ Health care establishments have a duty of care to protect people working in, accommodated in or visiting the establishment from exposure to infectious agents, and also to protect the privacy and confidentiality of all people in the establishment.

+ Health care ethics can be summarised by three basic principles:
  - *respect for persons* (respect for the autonomy and right of self-determination of people capable of making choices and the protection of persons with impaired or diminished autonomy);
  - *beneficence* (the obligation to maximise possible benefits and minimise possible harms); and
  - *justice* (fair distribution of the benefits and burdens of society to ensure that neither patients nor HCWs are denied appropriate health care or are discriminated against).

+ These principles have important implications for procedures such as isolation of patients, provision of emergency care and referral to other practitioners.

+ To encourage informed patient decision making and consent, all the relevant information should be provided to the patient, carer or guardian in a manner that ensures it is clearly understood.

+ Commonwealth and State/Territory legislation prohibits discrimination on the grounds of physiological disability (which may include infectious disease). However, an individual’s right to no discrimination should be balanced by the public health responsibility to prevent transmission of infectious diseases to other people.

10.1 Introduction

Major ethical and legal considerations arise in the implementation of guidelines for the prevention of transmission of infectious disease in health care settings. Broadly, ethical issues relate to consideration of the rights of infected individuals and the responsibilities of health care workers (HCWs) to do no harm to their patients. Legal issues arise in relation to the duty of care of health care establishments to protect both patients and HCWs from infection and in relation to various State/Territory legislation concerning infectious diseases.
There is considerable overlap between the legal and ethical obligations of individual HCWs and establishments. Ethical imperatives are not always defined by law, and are not necessarily as precise. HCWs need to be conversant with professional ethical codes as well as with the relevant laws.

The consideration of ethics in the health care setting can be summarised in three basic principles: respect for persons, beneficence and justice. These principles are described in the National Statement on Ethical Conduct in Research Involving Humans (NHMRC 1999a).

Respect for persons has two fundamental aspects:

- respect for the autonomy of individuals who are capable of making informed choices and respect for their capacity for self-determination; and
- protection of persons with impaired or diminished autonomy, that is, individuals who are incompetent or whose voluntariness is compromised.

Beneficence is the obligation to maximise possible benefits and minimise possible harms. The obligation to do no harm is referred to separately as non-maleficence.

The application of justice requires a fair distribution of the benefits and burdens of society. Consideration of justice will ensure that infected patients and HCWs are not denied appropriate health care and are not discriminated against.

Due consideration should also be given to ethical decision making concerning work and career choices for HCWs who may be infected with a bloodborne virus, in order to minimise emotional, psychological and financial harm for the infected HCW.

10.2 Developing and implementing policy and procedures

Health care establishments should implement policies and procedures that take account of their specific ethical and legal requirements. This is because the prevalence of disease will vary according to population groups and regions, and also because the risk to HCWs or patients will vary according to the prevalence of disease, the nature of treatment provided, the skills and experience of HCWs and other factors. Health care establishments should consider the potential risk of spread of infectious diseases and formulate clear guidelines for patients and HCWs in their own particular circumstances.
In developing and implementing policies, health care establishments should recognise the rights of, and the need for, individual HCWs to make judgments within their professional competence and in accordance with clinical circumstances. It is important, however, that a professional making such decisions is aware of the health care establishment’s policies in relation to legal and ethical obligations and the relationship between the health care establishment and that professional.

HCWs should ensure that the standard of care they provide and the appropriate standards to minimise the risk of transmission they adopt are sufficient to prevent transmission of any health care associated infection or occupational acquisition of infection.

10.3 Isolation policies

Unnecessarily restrictive isolation procedures or screening programs may be unethical if they infringe individual rights and freedom. For example, the routine screening of patients for nasal carriage of methicillin-sensitive *Staphylococcus aureus* and the confinement of positive patients is unnecessary because implementation of standard and additional precautions will minimise the potential for transmission of infection. Effective antibiotics are available to treat the consequences of infection, although their use should be in accordance with antibiotic guidelines to minimise potential for drug resistance (see Section 6.5). In the case of human immunodeficiency virus (HIV) and hepatitis viruses, implementation of standard precautions is the most appropriate means of preventing infection.

10.4 Duty of care in emergency care

Health care establishments and their HCWs generally have an ethical and, in some cases, legal responsibility to provide care to all patients seeking emergency treatment. Failure to provide appropriate care in an emergency may constitute a breach of duty of care for patients. In addition, a health care professional who fails to provide care to a patient in an emergency may be exposed to professional and/or institutional disciplinary action. Health care establishments must provide HCWs with appropriate protective equipment and instructions for its use for safe emergency care. Failure to do so constitutes a breach of duty of care for HCWs.

Provision of emergency care can involve exposure to infectious risks that may not be identified accurately at the time care is provided. These infectious risks to HCWs should be minimised by using standard and additional precautions and by preventing direct contact with blood and body fluid secretions.
HCWs who think they are at risk and seek to withhold their services should be assessed by a medical practitioner with a sound knowledge of infection control to determine their actual level of risk. The results of the assessment should be explained to the HCW and they should be offered work in another area if necessary. It is important that HCWs are educated about the incidence of risk associated with the care of patients with particular infectious diseases.

10.5 Referral

Patients should be referred to another practitioner only with the patient’s knowledge and consent. Referring practitioners have an ethical duty to provide relevant clinical information to the new practitioner. Depending on the purpose of the referral, this may include information about the patient’s infectious status, as this may be relevant for the appropriate ongoing care of the patient and for minimising risk to other HCWs and other patients. If the infectious status of the patient needs to be revealed, the patient should be informed and consent obtained.

10.6 Patient decision making and consent

Important decisions that individuals make about their own lives, particularly medical decisions, should be both free (voluntary) and uncoerced. They should also be based on a sound understanding of what is at stake. Ensuring that this is so is part of what is implied in the fundamental principle of respect for the dignity of every human being and requires that great care be taken.

A voluntary decision is one made without undue pressure, without coercion, force or persuasion against one’s will. A person’s decision may not be voluntary if people who are powerful or influential have put too much pressure on him or her, or if he or she has not had the opportunity to consider all relevant aspects of the situation. An informed decision is one based on information relevant to making the decision. Any information is relevant if it is important to the particular person making the decision.

Both the information provided and the way it is communicated will be influenced by patient characteristics, cultural background and understanding of spoken and written English. Informed decision making should take into account language and jargon barriers to ensure that a patient understands the nature of any risk they may incur. Health care establishments should provide access to independent trained interpreters, ideally in person, or via a telephone interpreting service if this is not possible.
Whenever possible, the consent process should be planned ahead of time to ensure that the patient has enough time to absorb the information presented, to ask questions and to reflect on the decision to be made. Information provided orally should be backed up by written information in plain English or community languages to allow the patient an opportunity to go over the information several times.

Provision of information for the purpose of obtaining consent to testing should involve explanation of the reasons for the test and what the results may mean. It should also include pretest counselling, as is required by law in some States/Territories, and often post-test counselling, regardless of the test result.

Informed and voluntary consent must be obtained before taking a blood sample to test for any purpose. For example, antenatal HIV testing on blood collected for routine blood-grouping without the patient’s consent is unethical and unnecessary — specific consent should be obtained for each test. In addition, the patient must be provided with relevant information concerning the purpose of a blood test and any specific tests performed. Long- and short-term consequences of test results should be discussed with the patient. In some jurisdictions, there are legislative requirements for pretest and post-test counselling about the consequences of a positive result. The ethical indications for such counselling are likely to have broader applicability than existing legal requirements. This is especially so in the case of patients from non-English speaking backgrounds. It is not reasonable to assume a uniform level of comprehension when counselling patients about possible consequences of testing.

Individuals have a right to be informed when the results of tests have consequences beyond the particular disease being treated. Health care establishments and their HCWs have a duty to warn patients about foreseeable consequences. This applies especially to notifiable infectious diseases where one outcome of a test may be the compulsory notification of authorities, which could lead to subsequent restriction of the patient’s freedom or a change in the manner in which medical care is provided (that is, the patient may be subjected to isolation procedures).

Giving a patient all the relevant information about procedures involved in their care and treatment, including information about blood tests, may protect an HCW or health care establishment from liability for assault, or damages for breach of contract, breach of confidentiality, discrimination and negligence. A patient’s consent to a particular procedure authorises only action taken for the patient’s benefit and does not justify action for the benefit of the health care establishment or its HCWs. For example, if a patient consents to a sample of blood being taken to test for the presence of meningococcal infection to determine appropriate treatment, the consent does not allow the sample to be tested for HIV or hepatitis B virus antibodies.
Patient competency

In obtaining consent for testing, treatment or other procedures, other than in an emergency, the treating medical practitioner must assure himself or herself that the patient is an adult and has the cognitive capacity to understand what is being proposed. In general, the more complex or risky the procedure, the higher the level of understanding that will be required.

Thus, it may be difficult to obtain consent that is ethically acceptable and legally valid from a patient whose mental competence is fluctuating or deteriorating.

The commonly accepted ethical goal of a consent process is to reach a decision that expresses and implements the patient’s own choice, made for reasons that are most important for the patient. The term ‘authentic’ is sometimes used to describe a decision that so expresses an individual’s well-considered choice. It is implicit that the decision should not be influenced by other people’s preferences or wishes.

Legally speaking, while it is customary to converse with and obtain informal consent from relatives for very minor aspects of medical and nursing care, HCWs need to be aware that a relative cannot legally give consent on behalf of a patient unless he or she has been officially appointed as a decision maker (eg as guardian).

HCWs therefore need to be conversant with the relevant guardianship or health decision legislation in their State/Territory. If in doubt, they should not hesitate to contact the local guardianship board; in most jurisdictions, boards provide a 24-hour advice service.

Preoperative testing

Any preoperative testing of a patient for infectious agents should be part of clinical assessment and carried out with the patient’s full knowledge and decision to participate. However, medical practitioners should exercise their professional judgment in ordering any clinically relevant test.

Patients who are unable to make a decision or who refuse to undergo testing should be managed as if they are infectious, applying standard or additional precautions as required.

In both emergency and non-emergency situations, the emphasis at all times should be on maintaining high standards of infection control, regardless of whether or not a patient is known to be infectious. Standard and additional precautions should enable procedures to be performed on all patients with minimal risk of transmission of infection.
**Decision to undergo testing for non-urgent or elective hospital admissions**

Any decision by a patient to undergo testing before being admitted to hospital must be informed and voluntary and must not be subject to duress. For non-urgent admissions, and where testing is clinically relevant, patients should be considered infectious until the test results are known or if they refuse to be tested. If this is not practicable, and provided immediate care is not required, admission or treatment may be deferred until testing becomes practicable or consent is given.

**Decision to undergo testing for emergency or urgent hospital admissions**

Where testing is clinically relevant, an attempt should be made to help the patient (or a legal guardian in the case of a patient who is not competent) make a decision in relation to testing. If it is not possible to obtain such a decision, or if there is a refusal to be tested, the patient should be considered infectious and managed according to standard and additional precautions.

### 10.7 Health care worker screening and testing

In establishing health screening policies and procedures, the relevant Commonwealth and State/Territory antidiscrimination legislation should be consulted to ensure that no illegal discrimination occurs. However, it should not be assumed that compliance with the legislation replaces any need to consider the ethical aspects of further screening.

Employers have a responsibility to protect HCWs (see Section 5.1), and should consider the need to offer them appropriate health screening and testing, along with advice on immunisations, to minimise the risks from infectious diseases.

HCW health screening is recommended in only a few situations (see Section 22.3). In each of these situations, relevant information should be provided for specific screening activities; appropriate advice should be given and valid consent obtained. Education programs should emphasise the importance of regular routine screening for HCWs in high-risk situations, such as when caring for patients with infectious pulmonary tuberculosis.

Whenever screening or testing is offered to employees, it must be accompanied by appropriate information, including:

- why the screen or test is being requested;
- who has access to and is notified of the results; and
- what the consequences of positive results may be.

Whenever screening or testing is offered to employees, it must be accompanied by appropriate information.
HCWs who may present a specific risk to patients in the course of their duties should be offered voluntary screening and testing where applicable. An example may be HCWs who perform exposure-prone procedures (see Sections 24.2 and 24.3).

Health care students should be offered appropriate health screening before they have any clinical contact with patients and should be required to review their immune status and be immunised against diseases that are preventable by vaccination if they are not immune to them already (see Section 22.3).

10.8 Privacy and confidentiality

Privacy and confidentiality are important considerations in the relationship between a patient and the HCW. The Privacy Act 1988 regulates the way Australian Government agencies (including those in the Territories) and private sector organisations can collect, keep secure, use and disclose personal information. The Act obliges a private sector organisation to tell individuals why it is collecting their personal information, what information it holds about them, how it will use the information and who else will get the information. The Act gives individuals the right to access their own records, as well as the right to correct the information if it is wrong.

Where it is necessary for a patient’s personal information, including health information, to be used or disclosed for purposes other than purpose for which the information was originally collected, it will be necessary for establishments to take account of specific requirements under the Privacy Act and any other legislative or ethical guidelines.

Employers should provide induction and regular inservice training on confidentiality and privacy for all HCWs. Procedures for disciplinary action for breaches of confidentiality must be clearly formulated and adhered to.

HCWs involved in the treatment and care of patients for whom additional precautions are required should be informed of the infection control procedures needed. However, access to confidential medical information should be strictly limited to HCWs who need to access the information for better clinical treatment of the patient.

10.9 Antidiscrimination

Specific legislation at both Commonwealth and State/Territory levels prohibits discrimination on a number of grounds, including impairment (including physiological, psychological and intellectual disabilities). Precedents have been established that identify infectious diseases as a physiological disability. Although differential treatment of people with infectious disease or with particular susceptibility to infectious disease constitutes discrimination, the law recognises that discrimination may be necessary in some circumstances.
This is because, at some point, the individual’s right not to be discriminated against (because of their infectious status) must be overridden by the public health responsibility to prevent transmission to other parties. When developing protocols dealing with infectious diseases, relevant State/Territory and Commonwealth antidiscrimination legislation should be consulted to ensure that no illegal discrimination occurs.

HCWs can be either the victims or the perpetrators of discrimination. However, they should be aware that sanctions may be taken against individuals who act in a discriminatory manner to others. Health care establishments should take appropriate steps to allow all HCWs to work and to gain experience in the normal range of activities associated with the positions to which they have been appointed, without being subject to discrimination.

Any HCW who believes that they cannot act in a nondiscriminatory manner should report the situation to the health care establishment’s administration. Any patient management that could be construed as discriminatory should be properly documented. For example, the protocol for isolation of people suspected of having an infectious disease must be documented and the patient’s infectious classification recorded in the clinical notes.

The health care establishment should inform HCWs of its antidiscrimination policy and require that it be followed. A monitoring program and protocol for handling complaints should be established and advertised to both HCWs and patients. There are independent health complaints units in all States and Territories; these are either statutory bodies or, in the case of South Australia, the Ombudsman’s Office. There are also health complaints units at departmental level.

10.10 Liability

In the context of these guidelines, civil liability for damages to a patient or HCW may arise where insufficient care has been taken to prevent transmission of infection or breach of confidentiality.

Currently, there is legislation in each State/Territory about the spread of infectious diseases under which liability for damages may arise (see the report of the Intergovernmental Committee on AIDS Legal Working Party, April 1992; DHHCS 1992). Both the common law and legislation will respond to meet changing needs in a changing environment and both reflect the minimum boundaries of acceptable social interaction.

In the past, it has been uncommon for people who spread disease negligently to be charged with criminal offences; however, in most jurisdictions the present criminal law allows serious cases of the spread of infectious diseases to be brought to account. If a person — HCW, patient or otherwise — infects another person negligently and causes serious illness, he or she can be charged with causing grievous bodily harm by negligent act.
If someone dies as a result of a negligent act, the person responsible can be charged with manslaughter. If the act of spreading the infection is deliberate, the appropriate charge is assault or murder. Liability would depend on whether the conduct amounted to criminal negligence, as opposed to civil negligence. It is conceivable that medical administrators could be charged with such offences if they were to permit the spread of infectious diseases in the health care establishments under their authority, either deliberately or negligently. In addition, legislation in each jurisdiction specifies additional offences related to the specific transmission of disease. Such offences deal with individuals who infect another person with a notifiable disease or, in some jurisdictions, merely engage in conduct such as to be likely to risk spreading a disease.
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11 Design and maintenance of health care premises

Key points

+ New or renovated health care premises should be designed to minimise the risk of transmission of infection.
+ Shared patient accommodation should have no more than four beds per room and include conveniently located toilets, baths and showers that are easy to clean.
+ For acute care, there should be at least one single room for every five ward beds and one respiratory isolation room for every 100 beds.
+ In waiting rooms, patients with infectious conditions should be identified using a triage system and separated from other patients.
+ Dedicated work areas should be designed to minimise the transmission of infection. Procedural and cleaning areas should be separated.
+ Workflow should be from clean to contaminated areas.
+ Ventilation, airconditioning, cooling towers and water systems must meet Australian standards.
+ Handbasins with hot and cold water, nontouch taps, supplies of liquid handwash (preferably in nonrefillable disposable containers) and disposable paper towels or single-use, clean, cloth towels must be readily available in accordance with Australian standards.
+ All aspects of the physical environment must be monitored and maintained to ensure that the establishment meets current standards, codes and regulations.

11.1 Introduction

The way health care premises are designed is fundamental to infection control and to the implementation of both standard and additional precautions. The design and layout of all new or renovated health care premises should take account of the movement of people and incorporate all necessary physical requirements to minimise the transmission of infection.

Advice on infection control issues should be sought at any time when changes are made to the design of health care establishments.

Further details of design features for specific health care settings are given in Part 5 (Infection control in specific health care settings).
11.2 Surfaces

11.2.1 General

Functional design allows routine cleaning to be carried out efficiently. Unnecessary horizontal, textured and moisture-retaining surfaces, or inaccessible areas where moisture or soil can accumulate, should not be used. Where possible, all surfaces should be smooth and impervious. All floors should have non-slip coverings.

Where there is likely to be direct contact with patients, or with blood and body fluids, the surface of floors and walls should be made of smooth, impermeable, seamless materials, such as welded vinyl. In equipment processing areas, work surfaces should be non-porous, smooth and easily cleaned.

Flooring should be able to be easily cleaned and in good repair. Treatment areas in office practice should not be carpeted. If the premises are carpeted and the procedure being undertaken is likely to result in spillage of blood or body fluids, plastic or rubber overlays can be used to prevent any spills soaking into the carpet.

11.2.2 Fixtures and fittings

All fixtures and fittings should be designed to allow easy cleaning and to discourage the accumulation of dust. Blinds that are easy to keep clean and do not allow dust to accumulate are preferable to curtains.

11.3 Patient accommodation

11.3.1 General

To minimise the risk of transmission of infection, hospitals should, wherever possible, restrict room sizes and the number of beds per room (ideally not more than four beds per room). Shared patient accommodation should include facilities such as toilets, baths and showers that are easy to clean and conveniently located to the patient. Clinical handbasins should be located in patient areas as described in Section 11.6.

11.3.2 Acute care

In acute care situations (excluding psychiatry), it is essential to provide an adequate number of single rooms for infection control purposes (at least one single-patient room for every five ward beds). There should be at least one respiratory isolation room for every 100 beds.
A single room with self-contained toilet and washing facilities should be available for patients infected with pathogens that are of particular concern for transmission of infection — for example, methicillin-resistant *Staphylococcus aureus* (MRSA) or *Clostridium difficile* diarrhoea. Where this is not possible, and the likelihood of transmission of infection or reinfection is not significant, cohort placement may be considered, noting the difference between strains and origin (eg community, hospital) of infectious agents.

Emergency medicine departments should have provision for at least one respiratory isolation room.

### 11.3.3 Patient waiting areas

Patient waiting areas, both in hospital outpatient areas and in office practice waiting rooms, should be able to separate patients who may be highly infectious (eg patients diagnosed with or suspected of having measles or pulmonary tuberculosis). A triage system should be used to identify such patients (see Section 2.4).

### 11.4 Work and treatment areas

#### 11.4.1 General

Defined and dedicated work areas should be planned carefully. The areas should be well lit and well ventilated. Work areas should have sufficient bench space to accommodate the necessary equipment (including a steam steriliser where applicable) and to ensure the separation of sterile, clean and soiled instruments and equipment. Equipment should be positioned and stored safely to minimise the risk of injury. There should be free access to work areas at all times.

Work areas should also include provision for handling and storage of appropriate waste and should be designed to minimise the potential for injury or exposure of staff and others.

#### 11.4.2 Workflow

Workflow should be from clean to contaminated areas, with care taken to avoid contaminated equipment re-entering clean work areas. Further information about workflow is given in AS/NZS 4187\(^1\) and AS/NZS 4815\(^2\).

Staff eating and recreation areas must be separate from work areas and patient treatment areas.

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\(^{1}\) AS/NZS 4187 (2003) *Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities*.

Part 3—Effective work practices and procedures

11.5 Environmental considerations

11.5.1 General

Work areas and patient accommodation should be ventilated in accordance with AS 1668.2\(^5\) or State/Territory guidelines, whichever is most appropriate for the situation. The work area and patient accommodation should also have adequate lighting. Work areas should have easy access to equipment and safe storage for equipment not in use.

The inflow of fresh air and the temperature, humidity and air purity (to minimise dust, infectious agents and gases) should be maintained within prescribed limits by ventilation equipment (AS 1668.2).

11.5.2 Airconditioning

Airconditioning systems in health care establishments should be monitored regularly and serviced by accredited service technicians; maintenance schedules should be documented.

Airconditioning or ventilation systems in critical areas, such as operating rooms, delivery suites, respiratory isolation rooms, burns and intensive care units, emergency treatment rooms and special treatment or procedural areas, should be ventilated.

Operating rooms must have high-efficiency particle arrest filtration of the air supply, with airflow directed away from the operating room.

There is considerable debate about the use of laminar flow systems. However, there is some evidence that laminar flow systems could be useful in operating rooms where more than 100 arthroplasties are performed per year.

11.5.3 Cooling towers and water systems

Cooling towers and hot water systems are an important source of infection for *Legionella* spp (causing legionnaires disease) and should comply and be maintained in accordance with State/Territory guidelines on cooling towers and hot and cold water services, and with other relevant Australian standards (eg AS SET 3500,\(^4\) AS/NZS 3666 and Standards Australia Handbook HB32\(^5\) and AS 3896\(^6\)). Further details on transmission and management of *Legionella* spp are given in the National Environmental Health Forum Guidance for the Control of *Legionella* (NEHF 1996a) and in Section 29.2 of these guidelines.

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Cooling towers should be avoided, where possible, as they can be a source of legionellae. Health care establishments that care for patients at risk of legionella infection should consider alternatives to water-based cooling towers. Where this is not possible, outlets should be sited and directed as far as practicable from patient and public areas, particularly air inlets and openable windows. The Australian standards do not specify a minimum distance; they state that outbreaks have occurred with known transmission distances of 150 metres and suspected distances of up to 1.7 kilometres.

Spa pools, heated swimming pools and other water systems are potential sources of infection with organisms such as pseudomonads, legionellae and cryptosporidia. Individual health care establishments should develop guidelines for the use of spas and therapeutic pools, based on State/Territory guidelines and other relevant Australian standards (AS 2610.1,7 AS 2610.2,8 AS 39799). The risks and benefits of using these facilities should be assessed for individual patients (eg immunocompromised patients, patients with open wounds or diarrhoea).

Spa baths should be avoided in health care establishments because they are difficult to keep clean. Ordinary bathtubs achieve a similar therapeutic effect and are more easily cleaned and maintained. Patients with infectious diarrhoea should not use spas for up to two weeks after resolution of symptoms (Carpenter et al 1999). Further information on the care of spas is given in the National Environmental Health Forum Guidance on Water Quality for Heated Spas (NEHF 1996b).

11.5.4 Respiratory isolation rooms

Accommodation and treatment rooms for patients with tuberculosis, or where there is a risk of airborne transmission of other infectious agents, should include a sufficient number of negative pressure single rooms (1 per 100 beds) with anterooms. Fresh air at 100% (that is, no recirculating air) will achieve the most effective dilution of airborne microorganisms. If any recirculation is contemplated, it is necessary to consider whether available filters and controls will adequately deal with droplet nuclei, dust and odour.

11.5.5 Special purpose areas

Sterilising services

Where the sterilising services department is attached to operating rooms, ventilation should be provided by a treated air supply and airconditioning should comply with AS 1386.10 Airconditioning in separate sterilisation services units should comply with AS 1668.2 and with the National Co-ordinating Committee on Therapeutic Goods Standard for the Operation of Sterile Supply/Services in Health Care Facilities (NCCTG 1995).

Bronchoscopy and other aerosol-generating procedural and recovery rooms

The United States Centers for Disease Control and Prevention (CDC) recommends that bronchoscopy should not be performed on patients with active tuberculosis unless there is no alternative investigative approach (CDC 1994b). If bronchoscopy is necessary on a patient with known active pulmonary tuberculosis, procedural and recovery rooms where bronchoscopy is performed must have negative pressure ventilation with appropriate minimum air changes per hour. The area used for bronchoscope cleaning must conform to appropriate workplace health and safety legislation in each State/Territory, with particular regard to ventilation and the control of hazardous aerosols.

Other procedures that are likely to generate aerosols or induce coughing (eg lung function testing) should be performed on patients with active pulmonary tuberculosis only in an area with negative pressure or local exhaust ventilation.

Operating rooms

Provision needs to be made for a sterile operating field (see Sections 6.1 and 33).

11.6 Handwashing basins

11.6.1 General

Health care workers (HCWs) must wash their hands before and after every significant patient contact (see Section 12).

In all health care establishments, handbasins with hot and cold water supplies, nontouch taps, supplies of liquid handwash (preferably in nonrefillable disposable containers) and disposable paper towels or single-use, clean, cloth towels should be readily available. The importance of regular handwashing must be emphasised in all situations where there is significant patient contact.

Taps should be fitted with antisplash devices, and should ideally be nontouch, as should liquid handwash dispensers (ie operated by elbow, knee or foot), in order to further reduce possible cross-contamination. Where filters or antisplash devices are fitted to taps, they should be cleaned in accordance with the manufacturer’s recommendations, and with due regard to water quality.
11.6.2 Procedural areas

Each procedural room should contain at least one clinical handbasin, scrub sink or trough designated for handwashing only. Handbasins should comply with AS/NZS 1730.11

11.6.3 Hospitals

In hospitals, there should be one clinical handbasin within or in close proximity to each single-patient room. The nonclinical (vanity) handbasin inside the room is not appropriate for handwashing by HCWs. If two single rooms are adjacent, a single clinical handbasin near the entrances to the rooms may be sufficient. However, it is preferable to have one in each room. There should be at least one clinical handbasin for every four beds; these should be situated at the entrance to any shared area and be easily visible and accessible. If the shared ward area is smaller than four beds, this area will need its own easily visible and accessible clinical handbasin at or near the entrance to the room.

11.6.4 Medical, dental and other office-based practices

Clinical handbasins should be provided in all medical and dental practices in areas where patient treatments are performed, but at a safe distance from patients to avoid inconveniencing or splashing patients during procedures.

In practices where minimal invasive procedures occur (eg physiotherapy, acupuncture clinics), clinical handbasins may be either installed in or easily accessible from areas where patient treatments are performed.

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11.6.5 Long-term care establishments

In residential aged care and other long-term care establishments, clinical handbasins should be provided in all areas in which patient treatment may routinely occur. This will include each room for dependent patients and treatment areas for independent patients.

11.7 Cleaning and reprocessing areas

Health care establishments should have separate, dedicated procedural and reprocessing areas that should be cleaned and dried between patients. Both areas should have smooth impervious surfaces without crevices, adequate lighting, good ventilation (to reduce the risk of infection transmission from aerosols) and suitable receptacles for the disposal of clinical waste (AS 4031 and AS/NZS 4261).

Health care establishments should have dedicated, defined areas for contaminated items and clean items, with direct access for HCWs from the procedure room for cleaning and disinfection of endoscopic equipment (Cowen et al 1999).

All workflow should be from clean to contaminated areas (see Section 11.4.2).

11.7.1 Contaminated items

The area for decontaminating items should include:

• adequate bench space for dismantling and working on equipment;
• at least one stainless steel sink or trough deep enough to accommodate instruments and other equipment requiring cleaning (double sinks are preferred); and
• cleaning and reprocessing materials and equipment (including brushes and ultrasonic cleaners).

Cleaning sinks should be separate from clinical handbasins, to avoid risk of contamination, and should be used only for reprocessing equipment and instruments. Where filters or antisplash devices are fitted to taps, they should be cleaned regularly.

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12 AS 4031 (1992) and Amendment 1 (1996) Non-reusable containers for the collection of sharp medical items used in health care areas.
13 AS/NZS 4261 (1994) and Amendment 1 (1997) Reusable containers for the collection of sharp items used in human and animal medical applications.
11.7.2 Clean items

The section for storage of clean items should be carefully defined and protected from all vapours, splashing or aerosols produced during procedures, handwashing, equipment washing, ultrasonic cleaning and reprocessing. The area should have adequate storage space and be used only for the storage of effectively covered or packaged, cleaned, disinfected and/or sterilised instruments and equipment.

11.7.3 Special-purpose areas

Some areas dedicated to the cleaning of special-purpose equipment have special requirements.

Endoscopy cleaning areas

Endoscopy units should have a separate area dedicated to the reprocessing of endoscopic equipment. The area should contain at least two large sinks plus appropriate disinfecting equipment. Instruments require immediate cleaning following use to prevent biological material drying within small channels. Adequate workflow patterns must ensure that there is no cross-contamination between dirty and clean areas. The area must conform to appropriate workplace health and safety legislation, with particular regard to ventilation and the control of hazardous aerosols. Space for, and availability of, appropriate cleaning utensils and accessory reprocessing devices, such as ultrasonic cleaners, must be available (see Section 17.1 for further details).

11.8 Health care establishment building infrastructure maintenance and monitoring

11.8.1 General

The design, construction and renovation of health care establishments should take account of infection control and there should be a monitoring and maintenance program for the physical environment.

The importance of monitoring and maintaining the physical environment of a health care establishment should not be underestimated. It is the primary responsibility of the engineering and building services department to maintain the services, equipment and fabric of the establishment to a safe and usable standard. Equally important is the department’s role in ensuring that all facilities meet current standards, codes and regulations.

It is the responsibility of health care establishments to make equipment and systems (whether they are purchased, contracted, loaned or on trial) available, before they are used, to the engineering and building services department so that it may:

- undertake a safety and operational inspection;
• develop an appropriately scheduled preventive maintenance plan; and
• ensure that the equipment manufacturer’s instructions, where appropriate, are available to users.

11.8.2 Education and training for users of equipment and systems

The engineering and building services department has a role in the education and training of potential users to ensure safe and competent use of equipment and systems, and to provide ongoing support to all departments within the establishment.

The level of communication between the engineering and building department and the infection control team can be improved by:

• formal involvement of the infection control team in renovations and new building works;
• the involvement of engineering staff representatives on infection control committees; and
• making sure that infection control manuals are readily available.

11.9 Forensic and hospital mortuaries

Design of mortuaries within health care establishments should incorporate the principles contained in the Royal College of Pathologists of Australasia/Australian Forensic Mortuary Managers Association Guidelines for Australian Forensic and Hospital Mortuaries (RCPA 2001) and the Australian Funeral Directors Association Infection Control Guidelines for the Funeral Industry (AFDA 1992, 1995).

These include the following guidelines:

• Refrigerated body storage facilities should be maintained at an internal temperature of 4°C, and must not be used for any purpose other than the storage of bodies.
• Longer-term body storage (if necessary) should be in a freezer maintained at –20°C.
• All refrigerators/freezers should be monitored and fitted with alarms that operate 24 hours a day.
• Mortuary design should minimise manual handling of bodies.
• Where autopsies are performed, dedicated room(s) should be used with negative air pressure ventilation.
12 Handwashing and personal hygiene

**Key points**

- Handwashing is the most important hygiene measure in preventing the spread of infection.
- Gloves are not a substitute for handwashing.
- Hands should be washed before and after significant contact with any patient, after activities likely to cause contamination and after removing gloves.
- A mild liquid handwash should be used for routine handwashing. Skin disinfectants formulated for use without water may be used in certain limited circumstances.

12.1 Handwashing

Handwashing is generally considered to be the most important measure in preventing the spread of infection in health care establishments (Larson 1996).

Health care workers (HCWs) must wash their hands before and after significant contact with any patient and after activities likely to cause contamination. Significant patient contact may include:

- contact with, or physical examination of, a patient;
- emptying a drainage reservoir (catheter bag); and/or
- undertaking venepuncture or delivery of an injection.

Activities that can cause contamination include:

- handling equipment or instruments soiled with blood or other body substances;
- direct contact with body secretions or excretions; and/or
- going to the toilet.

Table 12.1 summarises handwashing techniques for routine, aseptic (nonsurgical) and surgical procedures and includes examples for each level of handwashing.

*Gloves are not a substitute for good handwashing (see Section 13.2).*
A mild liquid handwash (with no added substances that may cause irritation or dryness) should be used for routine handwashing. Refillable containers are a potential source of contamination as bacteria can multiply within many products. Liquid handwash dispensers with disposable cartridges, including a disposable dispensing nozzle, are recommended. Special attention should be taken to clean pump mechanisms as these have been implicated as sources of infection (Barry et al 1984, Archibald et al 1997, Sartor et al 2000). Scrub brushes should not be used: they can cause abrasion of the skin, and may be a source of infection (Kikuchi-Numagami et al 1999).

12.2 Other methods of hand cleaning

HCWs may clean their hands with antiseptic products formulated for use without water in the following situations:

- emergency situations where there may be insufficient time and/or facilities;
- when handwashing facilities are inadequate; and
- in circumstances where an alcohol-based preparation provides a more effective option for individuals, such as those with a latex allergy.

Visible soil must be removed by some means (e.g. rinsing, mechanical rubbing or wipes) before use of antiseptic products formulated for use without water (see Section 7.3 on skin disinfectants). HCWs should wash their hands as soon as appropriate facilities become available.

DISCUSSION POINT

Is waterless hand cleaning with alcohol-based hand rinse preparations better than handwashing?

It has been suggested that waterless hand cleaning with alcohol-based preparations could be more effective in encouraging HCWs to ensure hands are clean between patient contacts (Voss and Widmer 1997). Although there is evidence to demonstrate that waterless hand cleaning may be less damaging to HCWs’ hands than traditional handwashing (Winnefeld et al 2000), there is not yet enough evidence available to support adopting waterless hand cleaning in place of traditional handwashing with running water (CDC 1998a).

Waterless hand cleaning may be used as an adjunct to traditional handwashing, for example during procedures where multiple handwashing episodes are usually required. Alcohol-based hand gels appear to be less microbiologically effective than alcohol-based liquid hand disinfectants. However, liquid alcohol preparations have a drying effect on the skin.
12.3 Hand care

Hand care is important because intact skin (with no cuts or abrasions) is a natural defence against infection. Any breaks or lesions of the skin are possible sources of entry for pathogens (Larson 1996).

Rings should not be worn, nails should be short and clean, and artificial nails should not be worn, as they contribute to increased bacterial counts (Larson 1996).
1996). Rings or artificial nails must not be worn when performing invasive procedures (i.e., where gloved hands are placed inside body cavities).

Repeated handwashing and wearing of gloves can cause irritation or sensitivity, leading to dermatitis or allergic reactions. This can be minimised by early intervention, including assessment of handwashing technique and the use of suitable individual-use hand creams.

To minimise chapping of hands, use warm water and pat hands dry rather than rubbing them. Cuts and abrasions should be covered by water-resistant occlusive dressings that should be changed as necessary. HCWs who have skin problems such as exudative lesions or weeping dermatitis must seek medical advice and must be removed from direct patient care until the condition resolves.

Hand care products marketed in Australia that claim a therapeutic use are generally either listed (AUST L) or registered (AUST R) on the Australian Register of Therapeutic Goods and must display the AUST L or AUST R number, respectively, on the label. Registered products are assessed for safety, quality, and efficacy. Listed products are reviewed for safety and quality. Labelling is part of this regulatory system, and should be checked to determine the product’s suitability, as some hand creams are not compatible with the use of chlorhexidine. Aqueous-based hand creams should be used before wearing gloves. Oil-based preparations should be avoided, as these may cause latex gloves to deteriorate.

**DISCUSSION POINT**

**Rings, jewellery and artificial (acrylic) nails**

Jewellery and artificial nails provoke debate and contention. There is little hard evidence that jewellery constitutes an infection risk to staff or patients. Nevertheless, it is likely that poorly maintained (uncleaned) rings, nails, and jewellery will harbour microorganisms that might contaminate operating fields and the like. Jewellery may also be a physical danger to either the patient or the HCW during direct patient care (e.g., necklaces may be caught in equipment or bracelets cause injury during patient handling).

When gloved hands are placed in sterile or critical sites, bacteria could be released into the sterile field or such items could attract patient bacteria if the glove is punctured during the procedure. Rings with sharp surfaces (e.g., gemstones) and sharp fingernails may themselves puncture gloves. Thus, rings should be removed from hands that are likely to enter sterile sites or contact internal mucous membranes (e.g., mouth, vagina) in the course of procedures.

Artificial nails have been implicated in a number of outbreaks of health care associated infection and should be avoided by all HCWs with direct patient contact, particularly those who perform or assist in invasive procedures (Hedderwick et al. 2000, Moolenaar et al. 2000).

Each health care establishment should develop policies about the wearing of jewellery (including ‘body piercings’), artificial nails or nail polish by HCWs. The policies should take into account the risks of transmission of infection to patients and HCWs, rather than cultural preferences.
## Personal protective equipment

### 13.1 Protective clothing and equipment

The use of protective clothing (gowns or plastic aprons), worn over uniforms, protects HCWs from exposure to blood or body substances. Protective clothing and equipment that complies with relevant Australian standards should be readily available and accessible in each health care establishment. It may include:

- examination gloves (AS/NZS 4011\(^1\)) and surgical gloves (AS/NZS 4179\(^2\));
- eye and/or facial protection (glasses, goggles or face-shields);
- surgical face masks (AS 4381\(^3\)) and respirators (AS/NZS 1716\(^4\)) designed for protection against respiratory pathogens (P2 particulate respirator; AS/NZS 1715\(^5\));

Key points

- All health care establishments should provide personal protective clothing and equipment that complies with relevant Australian standards and is appropriate for the intended use. All equipment should be readily available.
- Health care workers (HCWs) should wear gloves whenever there is a risk of exposure to blood or body substances. The type of gloves worn must be appropriate to the task. Wearing gloves must not replace handwashing. Gloves may have defects that are not immediately obvious or they may become damaged with use and become a hazard for HCWs.
- HCWs should wear protective eyewear or face-shields during procedures where there is potential for splashing, splattering or spraying of blood or body substances.
- HCWs should wear suitable masks during procedures where there is potential for splashing, splattering or spraying of blood or body substances, or where there is potential for airborne infection.
- HCWs should wear gowns and plastic aprons to protect their clothing and skin from contamination.

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3 AS 4381 (1996) and Amendment 1 (1997) *Surgical face masks.*
5 AS/NZS 1715 (1994) *Selection, use and maintenance of respiratory protective devices.*
Part 3—Effective work practices and procedures

13-2

INFECTION CONTROL IN THE HEALTH CARE SETTING

• gowns and aprons (AS 3789.2\(^6\) and AS 3789.3\(^7\)); and
• footwear to protect from dropped sharps and other contaminated items.

The particular type of protective clothing required varies according to the nature of the procedure, the equipment used and the skill of the operator, and is a matter for individual professional judgment or establishment policies based on local occupational health and safety (OHS) legislation. Professional organisations may also provide advice on the level of protection required (see Appendix 7).

In determining the type of personal protective equipment to use for a given procedure, HCWs should consider the following factors:

• probability of exposure to blood and body substances;
• amount likely to be encountered;
• type of body substance involved; and
• probable route of transmission of infectious agents.

Full protective wear, including double gloves, protective eye/face-shields, protective footwear and impermeable gowns or aprons, is recommended for operating room or mortuary procedures.

Appropriate respiratory protection should be worn by HCWs potentially exposed to *Mycobacterium tuberculosis*.

In order to ensure that effective personal hygiene and protection are practised, health care establishments must ensure that all the necessary materials and equipment are readily available (including appropriate size ranges of protective equipment), accessible and maintained in working order. Education/instructions about the correct use of personal protective clothing and equipment should also be provided to HCWs.

### 13.2 Gloves

HCWs should wear gloves when it is likely that their hands will be contaminated with blood or body fluid, or come into contact with mucous membranes. HCWs should change their gloves and wash their hands after each patient procedure and also during multiple procedures on the same patient if there is a risk of cross-contamination.

HCWs should wash their hands both before and after using gloves (see Table 12.1). Wearing gloves must not replace handwashing, as gloves may have defects that are not immediately obvious, or may become damaged during use.

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\(^6\) AS 3789.2 (1991) and Amendment 1 (1992) *Textiles for health care facilities and institutions — Theatre linen and pre-packs.*

\(^7\) AS 3789.3 (1994) *Textiles for health care facilities and institutions — Apparel for operating theatre staff.*
Gloves should comply with the standards for examination gloves (AS/NZS 4011) and surgical gloves (AS/NZS 4179). The type of gloves worn should be appropriate to the task:

- **sterile gloves** — for procedures requiring a sterile field, involving normally sterile areas of the body;
- **nonsterile gloves** — for procedures other than the above; and
- **general purpose utility gloves** — for housekeeping chores, including cleaning.

Single-use (sterile) surgical gloves must comply with AS/NZS 4179, while examination and procedural gloves for general medical and dental use must comply with AS/NZS 4011.

HCWs should change and discard single-use gloves as follows:

- after contact with each patient, and when performing separate procedures on the same patient if there is a risk of cross-contamination;
- as soon as gloves are damaged (torn or punctured);
- on completion of any task not involving patients but requiring the use of gloves; and
- before answering telephones or recording patient notes.

Sterile or procedural gloves should be removed carefully to avoid contamination of hands or other surfaces. They must not be washed or reused.

In operating rooms, surgeons should wear double sterile gloves (RACS 1994).

Some HCWs may develop allergy or sensitivity to latex gloves. This is likely to be due to contact with latex proteins that may not have been adequately removed during the manufacturing process. In the presence of sweat or moisture, these proteins may become adsorbed onto the lubricant powder used in the latex gloves (Swanson et al 1994, Heese et al 1997). Latex gloves that are powder-free or alternatives to latex (e.g. neoprene) can be used by HCWs who develop sensitivity or allergy to latex.

**DISCUSSION POINT**

Utility gloves may be reused but should be washed in detergent after use, stored dry, and replaced if torn, cracked, peeling or showing signs of deterioration.

Although it has been suggested that latex allergy in HCWs is directly linked to the use of powdered latex gloves, and in particular aerosolisation of latex proteins in glove powder (Swanson et al 1994), it has not yet been clearly demonstrated that changing to nonpowdered gloves throughout a health care establishment will reduce the development of latex allergy symptoms in HCWs (Trape et al 2000).
13.3 Protective eyewear and face-shields

HCWs must wear protective eyewear or face-shields during procedures where there is potential for splashing, splattering or spraying of blood or other body substances. This includes most dental procedures, most operating room procedures, dermabrasion and manual cleaning of instruments and equipment. Protective eyewear for HCWs should comply with AS/NZS 1336\(^8\) and 1337\(^9\), and must be optically clear, antifog, distortion free, close fitting and shielded at the side. Eyewear should be either reusable after cleaning or single-use. Dental patients should also be provided with protective eye equipment and a brief explanation about the potential for eye injury during some dental procedures.

13.4 Masks and personal respiratory protection devices

The body substances likely to be encountered and the nature of the activity determine the best choice of mask.

HCWs must wear masks whenever there is a possibility of splashing or splattering of blood or other body substances, or where airborne infection may occur. The type of mask best suited to a particular situation depends on the body substances likely to be encountered and the nature of the activity. There are two main types of masks used in health care:

- **Surgical masks** — fluid-repellent paper filter masks worn during surgical and dental procedures (see Sections 33 and 35).

- **Particulate filter personal respiratory protection devices (P2 respiratory protection devices)** — close fitting masks capable of filtering 0.3-µm particles and worn when attending patients with active pulmonary tuberculosis (see Section 29.8). Class P2 respiratory protection devices are regarded as being equivalent to US Standard N95 respiratory protection devices. In Australia, such devices used in health care are generally made of paper, but other respiratory protection devices (eg purified air powered respirators) that are regarded as equivalent to United States N95 standard are also suitable (see AS/NZS 1715 and 1716). These masks are also suitable for protection against laser plume.

Masks must:

- be fitted and worn according to the manufacturer’s instructions;
- not be touched by hand while being worn;
- cover both mouth and nose while worn;
- be removed as soon as practicable after they become moist or visibly soiled;
- be removed by touching the strings and loops only; and

Personal protective equipment

13.5 Gowns and plastic aprons

HCWs should wear impermeable gowns and plastic aprons or covers to protect their clothing and skin from contamination with blood and body substances. Where there is a risk of large amounts of blood or body substances splashing their clothing, HCWs should wear impermeable or fluid-resistant gowns. Sterile prepacked gowns must be used in all aseptic procedures requiring a sterile field. Operating room attire should not be worn outside the operating room environment.

HCWs should remove protective clothing contaminated with blood or body substances as soon as possible, and bag it for laundering or disposal (see Section 19.1). If their skin has been contaminated with blood or body substances, HCWs should remove their protective clothing and wash their skin as soon as practicable.

13.6 Footwear

HCWs should wear enclosed footwear that can protect them from injury or contact with sharp objects (eg if sharps are accidentally dropped).

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13.7 Uniforms

HCWs’ uniforms should be clean and in good condition. Long hair should be tied back or covered, and beards covered, when HCWs undertake aseptic or sterile procedures.

Uniforms should be comfortable to wear and suitable for the type of work undertaken. Facilities for changing and disposal of soiled uniforms should be provided. Protective clothing (impermeable gowns or plastic aprons) worn over uniforms will prevent undue contamination where HCWs are exposed to blood or body substances.
14 Handling and disposal of sharps

Key points

- Inappropriate handling of sharps represents the major cause of incidents involving potential exposure to bloodborne infections.
- Health care workers must at all times handle sharps with care in order to minimise injury.
- The person who has used the sharp must be responsible for its immediate safe disposal following use, preferably at the point of use.
- Needles should not be resheathed unless an approved recapping device is used. Needles should not be bent or broken by hand, removed from disposable syringes or otherwise manipulated by hand.

14.1 Handling of sharps

Inappropriate handling of sharps is the major cause of incidents involving potential exposure to bloodborne diseases. Sharps must be handled with care at all times. Methods of handling sharps during medical or dental procedures should be devised to minimise the risk of injury. These methods should be discussed between HCWs involved. Additional recommendations on the handling of sharps are to be found in AS/NZS 3825.1

Sharp instruments must not be passed by hand between HCWs. Specified puncture-resistant sharps trays should be used for transfer of all sharp items (RACS 1998). Where possible, alternatives should be considered, including needleless intravenous systems, use of blunt needles for drawing up sterile solutions from ampoules, or retractable needle and syringe systems.

14.2 Disposal of sharps

To prevent injury, needles should not be resheathed unless an approved recapping device is used. Needles should not be bent or broken by hand, removed from disposable syringes or otherwise manipulated by hand.

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The person who has used a sharp instrument must be responsible for its immediate safe disposal following its use. This must be at the point of use wherever possible. Disposable needle–syringe combinations, needles, scalpel blades, single-use razors and other sharp items must be discarded in a clearly labelled, puncture-proof container that conforms with AS 4031 or AS/NZS 4261, as appropriate.

Information on the management of sharps injuries is given in Section 23.

Health care establishments should provide written protocols for safe handling of sharps, and ensure that HCWs are fully trained in the recommended handling techniques.

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2 AS 4031 (1992) and Amendment 1 (1996) Non-reusable containers for the collection of sharp medical items used in health care areas.

3 AS/NZS 4261 (1994) and Amendment 1 (1997) Reusable containers for the collection of sharp medical items used in human and animal medical applications.
15 Management of clinical and related wastes

Key points


- Waste should be segregated at the point of generation, using appropriately colour-coded and labelled containers.

- Health care workers should wear gloves and protective clothing when handling clinical and related waste bags and containers. HCWs involved in the handling of such waste should be trained in the correct procedures.

15.1 Introduction

In 1999, the National Health and Medical Research Council (NHMRC) published the new National Guidelines for Waste Management in the Health Care Industry (NHMRC 1999b). The guidelines recommend that institutions generating such waste must ensure its safe identification, packaging, labelling, storage, transport, treatment and disposal, from the point of generation to the point of final disposal. Management of clinical and related wastes must also conform to relevant State or Territory legislation and regulations.

Health care establishments should also refer to AS/NZS 3816.1

15.2 Definition of health industry wastes

Providing a satisfactory and standard definition of clinical and related wastes has traditionally been a difficult issue for health care establishments. Terms such as hospital waste, clinical waste, infectious waste, medical or biomedical waste and biohazardous waste have been used synonymously, and often inappropriately, in many situations. In the waste management guidelines (NHMRC 1999b), health industry wastes are defined as all types of wastes (clinical, related and general) arising from medical, nursing, dental, veterinary, pharmaceutical or similar practices, and wastes produced in hospitals or other establishments during the investigation or treatment of patients in research projects.

Clinical waste includes the following categories:

- discarded sharps;
- laboratory and associated waste directly associated with specimen processing;
- human tissues, including material or solutions containing free-flowing blood; and
- animal tissue or carcases used in research.

Related waste includes:

- cytotoxic waste
- pharmaceutical waste
- chemical waste
- radioactive waste.

General waste includes other wastes that do not fall into the above categories. It forms the bulk of waste generated by health care establishments and is of no more public health risk or concern than household waste.

15.3 Segregation of waste

Waste should be effectively segregated according to its category, at the point of generation, using appropriately colour-coded and labelled containers according to AS/NZS 3816. The waste should be bagged, packaged or containerised and must be clearly marked with an adequate description of the contents. There are three main categories:

- Clinical waste must be placed in yellow containers bearing the international black biohazard symbol and clearly marked ‘clinical waste’.
- Cytotoxic waste must be placed in purple containers bearing the telophase symbol, and marked ‘cytotoxic waste’.
- Radioactive waste must be placed in red containers with the black international radiation symbol and marked ‘radioactive waste’.

Wastes that have not been segregated must be treated as that portion of the waste representing the highest risk. Clinical and related wastes should be segregated in line with the licence requirements of the final disposal facility. Most clinical and related wastes are nonhazardous and can be disposed of in the general waste stream. Waste segregation allows for supervised landfill for the bulk of clinical and related wastes.
15.4 Clinical waste

Any wastes can be classified as clinical by the relevant health care establishment or government authority. All clinical waste should be treated appropriately, contained and transported carefully.

Microbiological cultures should be rendered safe by a validated steam-sterilisation process, monitored in accordance with AS/NZS 4187, before they leave the control of laboratory HCWs. Clinical waste may be disposed of by incineration or landfill. Where landfill disposal of clinical and related wastes is intended, identifiable body parts, pharmaceuticals, cytotoxic and radioactive wastes should be excluded at source, and the landfill site must be confirmed as suitable.

Standard precautions should apply when handling clinical wastes. All waste should be handled with care to avoid injuries from concealed sharps (which may not have been placed in sharps containers). Gloves and protective clothing should be worn when handling clinical waste bags and containers. Staff involved in the handling of such waste should be properly trained, including in the management of clinical waste spills (see Section 18). Where possible, manual handling of waste should be avoided.

Clinical waste must be placed in appropriate leak-resistant bags or containers. These should not be overfilled, and must not be compacted by hand.

Trolleys used for transport of infectious or other hazardous waste should be clearly labelled as such, and used only for waste transport. They should be cleaned daily, never overfilled, and fitted with drip trays to contain leaks or spills.

15.5 Collection and disposal of waste

Arrangements for collection and disposal of solid clinical waste depend on the location, size and existing infrastructure of health care establishments. In health care establishments, there should be clear access to waste disposal facilities, including sluices for disposal of large volumes of liquids (eg 24-hour urine collections). In office-based practice, small volumes of blood, urine or faeces can be disposed of via the sewerage system, but disposal of a large volume of clinical liquid waste must follow local regulations (NHMRC 1999b).

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Protocols for waste disposal should follow national guidelines or codes of practice and must also comply with State/Territory and local regulations. Although current categories and terminology may vary among States and Territories, every effort should be made to comply with terminology and labelling of waste as specified in the NHMRC national guidelines for health industry waste management (NHMRC 1999b). AS/NZS 3816 should also be consulted.

Table 15.1 is a general guide only for recommended identification for containment and disposal of waste. Government authorities should be contacted for more detailed information.

### Table 15.1 Categories of waste and recommended containment and disposal

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Waste</th>
<th>Container colour</th>
<th>Disposal</th>
</tr>
</thead>
</table>
| None   | General | Black, buff, green, white | Landfill  
Consider recycling  
(Confidential waste to be shredded or incinerated) |
|        | Clinical waste | | License contractor (for disposal by approved technologies) |
|        | sharps   | Yellow, rigid container | Incineration                                      |
|        | nonsharps| Yellow bag        | Incineration or validated steam sterilisation, then supervised landfill |
|        | liquid   |                   | Sewer: local regulations must to be followed |
|        | Cytotoxic| Purple           | License contractor  
Incineration: 1100°C (NHMRC 1999b) |
|        | Radioactive | Red             | License contractor  
Monitor before disposal by incineration or supervised landfill  
Dilute isotopes may be disposed of via sewerage system in accordance with relevant guidelines |

Note: Any waste contaminated or stored with another waste requiring a higher level of destruction must be classified at the higher level.
16 Reprocessing of reusable instruments and equipment

Key points

+ Reprocessing of instruments and equipment refers to cleaning, disinfection (by heat and water, or chemical disinfectants) and/or sterilisation.
+ All the steps outlined in Australian standards AS/NZS 4187 and AS/NZS 4815, or an equivalent protocol, must be followed, including process validation.
+ The level of reprocessing required for instruments and equipment depends on the body sites where the instrument will be used (see Section 4.4).

**Critical site:** all items must be sterile

**Semicritical site:** items should be sterile (or must be a minimum of high-level disinfected if other methods are not suitable or available)

**Noncritical site:** items must be clean

+ Generally, cleaning can be manual or automated. Enzymatic cleaners should not be used routinely. The cleaning area should not be used for any other purpose.

+ Disinfection can be thermal or chemical. The level of chemical disinfection reached (high, intermediate or low) depends on the temperature, time and/or type of disinfectant used.

+ Sterilisation should preferably be by steam under pressure. For instruments that will not withstand heat, other methods include ethylene oxide and automated low-temperature chemical sterilants.

+ Single-use sterile instruments and equipment should be used whenever the clinical situation dictates. Items intended for single use should not be reused (see Section 17.13).

+ Special conditions apply for reprocessing instruments and equipment at risk of contamination with prions (Creutzfeldt–Jakob disease; see Section 31).
16.1 Introduction

Any infectious agents introduced into sterile body sites can establish infection. Infectious agents are always present on skin and are carried through the air on dust particles. They can therefore contaminate instruments, medications and solutions that are intended to be sterile. In order to achieve sterile conditions during procedures, attention must be given to all potential sources of contamination.

Effective reprocessing of reusable instruments involves cleaning immediately after use to remove organic residue and chemicals, and either:

- disinfection (by heat and water or chemical disinfectants); or
- sterilisation.

The procedures and process development necessary for the cleaning, disinfection and sterilisation of reusable medical and surgical instruments and equipment, and for the maintenance of associated environments in health care establishments, is given in AS/NZS 4187 and AS/NZS 4815. For safe and effective reprocessing of instruments and equipment, it is essential that all steps outlined in these standards (or an equivalent protocol), including process validation, are followed.

16.2 General principles

16.2.1 Training

Health care workers (HCWs) who clean instruments and equipment must be trained in all the necessary procedures. They should receive formal training in equipment cleaning and processing, disinfection and/or sterilisation at an appropriate level, as recommended by professional bodies.

The importance of thorough cleaning before any disinfection or sterilisation regimen should be emphasised in infection control education programs. Failure to adequately clean items after use may result in lack of disinfection or sterilisation of the instruments or equipment (Deva et al 1998).

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1 AS/NZS 4187 (2003) Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities.
16.2.2 Level of reprocessing required

Routine reprocessing

Instruments and equipment must be reprocessed to a level appropriate for their intended use. The appropriate level depends on the body sites where the instrument will be used and the risk associated with a particular procedure.

The minimum levels of processing and storage requirements for reusable instruments and equipment, based on three risk categories of use, are shown in Table 16.1. In brief, the minimum levels of reprocessing are as follows for different types of site:

- **Critical site** — instruments should be sterile at the time of use. This means instruments should be single use, should be steam sterilised (for instruments that are capable of withstandng heat), or should have undergone low-temperature chemical sterilisation (for heat-sensitive equipment).

- **Semicritical site** — instruments 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.

- **Noncritical site** — cleaning alone is generally sufficient for all noncritical items after every individual use, although either intermediate or low-level disinfection may be appropriate in specific circumstances.

These recommendations apply to office-based practices, as well as to larger health care establishments.

Steam sterilisation is the best method to achieve sterility. If steam sterilisation is not suitable (eg heat-labile instruments, fibreoptic scopes), other sterilisation systems, such as ethylene oxide (EO) or automated low-temperature chemical sterilant systems, may be used provided they are acceptable to the instrument manufacturer. Thermal disinfection does not kill all bacterial spores and therefore does not sterilise instruments but provides an acceptable level of disinfection when instruments are thermally treated under well-defined and controlled time and temperature parameters. Details of the procedures are given in Section 16.4.

Instruments used in operating rooms must be sterilised in accordance with AS/NZS 4187 and AS/NZS 4815 and with the National Co-ordinating Committee on Therapeutic Goods Standard for the Operation of Sterile Supply/Services in Health Care Facilities (NCCTG 1995).

Under a new harmonised system with the European Union, all reusable medical device manufacturers will be obliged to provide reprocessing instructions. Manufacturers of existing devices will have five years to comply.

Details are given in Section 31.12 for additional precautions that apply to instruments and surgical procedures for patients in risk categories for CJD.
**Items to be serviced**

Instruments and equipment should be reprocessed before being sent for servicing. If recommended reprocessing is not possible before repair, items should be sealed and labelled with the appropriate hazard warning before dispatch (See Tables 15.1 and 16.1).

**Loan sets**

Loan sets or instruments must be reprocessed on receipt at the health care establishment, before use. After use, loan sets and instruments must be reprocessed before being returned to the manufacturer or agent.

**Special reprocessing**

Information about instruments and equipment that need special reprocessing (e.g., endoscopes, respiratory and anaesthetic apparatus and diagnostic ultrasonic transducers) is provided in Section 17.

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**Levels of reprocessing**

According to the Spaulding classification system (see Section 4.4), it is not the item itself that defines the reprocessing required, but its intended use. Therefore, the level of reprocessing required should be determined by the future use of the item.

This means that an item that has been used on intact skin may require a higher level of reprocessing if it is to be used on sterile tissue in the future.

There are occasions when items cannot withstand the most suitable reprocessing requirements for the intended use. Some heat- and/or moisture-sensitive items cannot be steam sterilised (e.g., some fibreoptic endoscopic equipment and accessories) even though this is the recommended level of reprocessing for their intended use. This type of equipment should be reprocessed using a low-temperature chemical sterilisation system or high-level disinfection as the minimum level of reprocessing.

Health care establishments must also follow local State/Territory regulations that may mandate specific reprocessing requirements over and above those given in AS/NZS 4187 and AS/NZS 4815.
### Table 16.1 Minimum level of reprocessing required for specific items in use

<table>
<thead>
<tr>
<th>Level of risk</th>
<th>Application</th>
<th>Process</th>
<th>Storage</th>
<th>Example</th>
</tr>
</thead>
</table>
| Critical      | Entry or penetration into sterile tissue, cavity or bloodstream | Sterilisation by steam under pressure, or a minimum of an automated low-temperature chemical sterilant system, other liquid chemical sterilant or ethylene oxide sterilisation (ie must be sterilised) | Sterility must be maintained:  
- packaged items must be allowed to dry before removal from the steriliser  
- the integrity of the wrap must be maintained  
- wraps should act as an effective biobarrier during storage  
- store to protect from environmental contamination  
- unpackaged sterile items must be used immediately | Instruments, endoscopes and accessories used in invasive surgical and dental procedures, including:  
- hysteroscopes  
- arthroscopes  
- laparoscopes  
- oral surgical instruments  
- ERCP equipment and accessories  
- rigid bronchoscopes  
- flexible bronchoscopes  
- cystoscopes  
Podiatry instruments capable of penetrating or abrading the skin (scalpels, nail cutters, scalers, files), neurological testing sharps, forceps etc used on nonintact tissue  
Acupuncture needles (reusable) |
| Semicritical† | Contact with intact nonsterile mucosa (or nonintact skin) | Heat-tolerant items: Preferably steam sterilisation where possible, or a minimum of thermal disinfection (see Table 16.2) | Store to protect from environmental contamination | Breathing circuits  
Vaginal speculae  
Instruments for routine dental procedures  
Buffs used in dental laboratories |
|               | Heat-sensitive items | If equipment will not tolerate heat, use low-temperature automated chemical sterilant systems or a minimum of high-level chemical disinfection | Store to protect from environmental contamination | Flexible endoscopes:  
- fiberoptic scopes  
- sigmoidoscopes  
- gastrosopes  
- colonoscopes  
- bronchoscopes  
Invasive ultrasound probes |

**Special conditions apply to CJD (see Sections 17 and 31)**
16.2.3 Storage of equipment

All items must be stored in such a way that their level of processing is maintained (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 (see AS/NZS 4187 and AS/NZS 4815). This is essential for instruments and equipment that are intended for use on critical sites and that must be sterile.

16.2.4 Single-use instruments and equipment

Single-use sterile instruments and equipment should be used wherever the clinical situation dictates such practice. The following are some examples of single-use instruments and equipment for their use.

- Injecting apparatus (including hypodermic syringes, needles, dental local anaesthetic cartridges and dental needles, intravenous (IV) lines and giving sets) must be sterile and single use only. A new cannula must be used for each attempt at IV cannulation. Reusable syringe holders used for single-use anaesthetic cartridges must be steam sterilised between patients. Incompletely used anaesthetic cartridges, ampoules and vials must be discarded after each patient use.
- Dressings, suture materials, suture needles, scalpels, intracranial electrodes (or any probe used in intracranial examinations), pins or needles used for neurological sensory testing, spatulas and razors, including disposable razor blades on electric clippers, may be used for one patient and only once.
• Any single-use article or instrument that has penetrated the skin, mucous membrane or other tissue must be discarded immediately after use or at the end of the procedure, whichever is more appropriate.

Some single-use implantable items may have specific approval for reprocessing from the Therapeutic Goods Administration (TGA), as part of the device registration process, if they are opened but not used (i.e., have had no contact with tissue). In these instances, the manufacturer must provide appropriate instructions for reprocessing the devices, and these instructions must be followed explicitly. (See also Sections 6.3.3 and 17.12)

16.2.5 Patient care equipment

Patient care equipment, such as bedpans and urinals, is generally in contact with intact skin (noncritical sites). It should be cleaned, thermally disinfected (see Section 16.4.2), dried and stored appropriately. Alternatively, a bedpan washer–disinfector may be used (AS 24373).

16.3 Cleaning

16.3.1 General principles

Cleaning is an essential prerequisite for all effective disinfection and sterilisation processes, because organic residue may prevent the disinfectant or sterilant from contacting the item being processed and may also bind and inactivate chemical disinfectants (Muscarella 1998). It cannot be stressed too strongly that if the item cannot be cleaned, it cannot be disinfected or sterilised. Full details of cleaning are given in AS/NZS 4187 and AS/NZS 4815. Standard precautions must be followed during the cleaning procedure (see Section 2.2).

16.3.2 Cleaning area

The cleaning area must be dedicated for that purpose only. Consideration should be given to directed workflow (see AS/NZS 4187, AS/NZS 4815 and Section 11.4.2 of this document).

16.3.3 Initial cleaning

Gross soil must be removed from instruments and equipment immediately after use, and as close as possible to the point of use. Instruments and equipment should be cleaned as soon as possible after use. They should not be allowed to dry before cleaning. Detergent and water is generally sufficient for routine cleaning.

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For information on single-use medications and solutions see Section 6.3.1.

Establishments may wish to consider reprocessing for some expensive instruments labelled ‘single-use device’ (e.g., cardiac solid electrodes). Advice on this issue is given in Section 17.13.

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16.3.4 Manual cleaning procedures

Cleaning procedures and suitable cleaning agents are discussed in appendixes to AS/NZS 4187.

All channels or bores of instruments or equipment such as rigid or flexible endoscopes must be cleaned thoroughly (see Section 17).

Instruments that are washed manually should be rinsed and cleaned in a sink or bowl specifically designed for that purpose, using the following procedures:

- Wear a plastic apron, general purpose utility gloves and face protection (protective eyewear and mask or face-shield). Take care to prevent splashing of mucous membranes or penetration of the skin by sharp instruments.
- Remove gross soiling by carefully rinsing in warm (15–18°C) water.
- Fully disassemble instruments and immerse in warm water and a suitable detergent that is biodegradable, noncorrosive, nonabrasive, low foaming and free rinsing (or an enzymatic cleaner if indicated: see Section 16.3.5 below).
- Remove all visible soiling from the instrument or equipment using established methods and with reference to the manufacturer’s recommendations.
- Rinse instruments in hot water to assist drying, unless contraindicated.
- Dry mechanically in a drying cabinet or hand dry with a clean, lint-free cloth (note: items must not be left to dry in ambient air).
- Inspect instruments and equipment to establish that they are clean before further processing or storage.
- Cleaning brushes should be identified for cleaning only and should be washed, thermally disinfected, and stored dry.

Items should be thoroughly rinsed after cleaning with warm water and detergent, as detergent residue may reduce the effectiveness of the disinfectant. Items to be disinfected should be dried before immersion in disinfectant solution to avoid dilution of the disinfectant (which can make it less effective over the prescribed time for disinfection). Items must also be dried before inspection and packaging.
Reprocessing of reusable instruments and equipment

INFECTION CONTROL IN THE HEALTH CARE SETTING

**DISCUSSION POINT**

**16.3.5 Use of enzymatic cleaners**

Enzymatic cleaners are hazardous and should be used only for fibreoptic instruments and accessories and for other instruments where design characteristics make routine cleaning difficult. If enzymatic cleaners are used, HCWs should be made aware of associated hazards, and material safety data sheets should be displayed.

**16.3.6 Ultrasonic cleaners**

Ultrasonic cleaners and automated washing appliances reduce the handling of instruments and are recommended for cleaning basic instruments (eg artery forceps, scissors, needle holders) that can withstand the process. Ultrasonic cleaners must comply with AS 2773.14 or AS 2773.2.5

Further details on the use of ultrasonic cleaners and testing procedures are given in AS/NZS 4187. Where available, manufacturers’ instructions should be followed.

Studies on dental appliances indicate that presoaking, followed by cleaning in ultrasonic or automated washer-disinfectors with thorough rinse cycles, eliminates almost all traces of contamination on the equipment (Sanchez and Macdonald 1995).

Ultrasonic cleaners do not disinfect instruments. They work by subjecting instruments to high-frequency, high-energy sound waves, causing soil to be dislodged from the instruments and drop to the bottom of the tank, or to be sufficiently loosened to be removed during the rinsing process. They can be used to assist with cleaning of jointed and serrated stainless steel instruments. Internal surfaces of cannulated instruments, plastics and other similar materials cannot be successfully cleaned by this method. Cemented glass syringes and lenses will be damaged if repeatedly subjected to this process.

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5 AS 2773.2 Ultrasonic cleaners for health care facilities — non-portable — benchtop.
Dissimilar metals should not be processed together, as they are prone to electrolytic corrosion. The fine mechanical shaking can also blunt fine points by impaction. To minimise handling of sharp instruments, a cassette system, compatible with ultrasonic cleaning baths, may be used.

Ultrasonic cleaners should not be operated without a close-fitting lid in place, as the high sound frequency may cause damage to hearing (Pye 1984) and allow potentially infective aerosols to escape from the unit. Operators should not submerge any part of their body in the ultrasonic cleaning unit during its operation.

The efficiency of the ultrasonic cleaner should be tested daily, or when used, according to the manufacturer’s instructions (where available), and the results documented.

16.3.7 Automated washer–disinfectors

Some innovative automated washer–disinfectors that are now available in Australia include cleaning mechanisms in their cycles. Refer to the manufacturer’s technical manual for reprocessing directions specific to this type of equipment.

16.4 Disinfection

16.4.1 General principles

Disinfection is a process that inactivates nonsporing infectious agents, using either thermal (moist or dry heat) or chemical means. The level of chemical disinfection achieved depends on the temperature, exposure time and/or type of chemical disinfectant used. Thermal disinfection 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 of the required level, used alone or in conjunction with an automated chemical washer–disinfector.

- **High-level disinfection** — this is the minimum treatment recommended for reprocessing instruments and devices that cannot be sterilised for use in semicritical sites.
- **Intermediate-level disinfection** — this is the minimum treatment recommended for reprocessing instruments and devices for use in noncritical sites, or when there are specific concerns regarding contamination of surfaces with species of mycobacteria, for example *Mycobacterium tuberculosis*.
- **Low-level disinfection** — this is the alternative treatment to cleaning alone when devices for use in noncritical sites are reprocessed and when only vegetative bactericidal activity is needed. These disinfectants are not necessarily fungicidal for all forms of fungi or virucidal for all viruses.
Disinfection is not a sterilising process. Thermal disinfection and high-level chemical disinfection must not be carried out as convenient substitutes for sterilisation (see AS/NZS 4187 and AS/NZS 4815). If it is possible to sterilise items to be used in semicritical sites, or to use single-use items, this should be done.

Thermal disinfection is not suitable for instruments that are to be used in critical sites, as these instruments must be sterile. However, thermal disinfection should be used in preference to chemical disinfection whenever practicable (see Table 16.1).

### 16.4.2 Thermal disinfection

#### Principles

If items can withstand heat and moisture and do not require sterilisation, then thermal disinfection, or pasteurisation, using heat and water at temperatures and times that destroy pathogenic, vegetative agents, is the simplest, most efficient and most cost-effective method of disinfection.

Heat is readily conducted (by water and by most metals) and thus is able to penetrate and disinfect items more efficiently than chemicals. However, the microbicidal effect of heat can be compromised by inadequate cleaning.

Pasteurisation is a thermal disinfection process using hot water at a temperature of 75°C for a contact time of at least 30 minutes. These conditions, or the equivalent conditions shown in Table 16.2, are necessary for thermal disinfection of items to be used in semicritical sites.

#### Automated equipment

Automated equipment, such as washer–sanitisers, pasteurisation equipment, washer–decontaminators and washer–disinfactors, is recommended for use in thermal disinfection processes. The level of disinfection depends on the water temperature and the exposure time. Thermal washer–disinfectors can be programmed to deliver a range of disinfection levels, depending on the cycle selected (ie set temperature and exposure times). This type of equipment is regulated by the TGA, and users should follow the manufacturer’s directions to achieve the required level of disinfection.

Batch-type washer–disinfectors complying with AS 2945[^6] should be used. Such disinfectors require preventative maintenance programs, including monitoring of water quality (see AS/NZS 4187).

16.4.3 Chemical disinfection

The types of chemical disinfectants and their uses are described in detail in Section 7 and summarised in Table 7.1. Occupational health and safety considerations for the use of chemicals are described in Section 7.4.

The ability of chemical disinfectants to effectively inactivate contaminating infectious agents depends on a number of factors, including the initial number of agents present, temperature, pH and concentration (Chiba 1994).

Organic material that is not removed by cleaning before disinfection can bind and inactivate many chemical disinfectants (Cremieux 1986). Some disinfectants, such as glutaraldehyde, fix protein and thus may create a physical barrier of denatured protein that can protect infectious agents coated with organic material. A disinfectant cannot be effective against infectious agents it cannot reach, so thorough cleaning before disinfection is essential. All instruments and equipment must be cleaned and dried before chemical disinfection to prevent inactivation or dilution of the disinfectant (see Section 16.3).

Different grades of disinfectants are used for different purposes (see Section 7). Only instrument-grade disinfectants or sterilants are suitable for use with medical instruments. Hospital- or household/commercial-grade disinfectants must not be used on instruments; they are suitable only for use on environmental surfaces (eg walls, floors, cupboards). If users of high-level disinfectants are unsure of the TGA-approved status of a product, they should ask the manufacturer to supply the product’s AUST R code number (see Section 7.2).

Chemical disinfectants intended to cover a range of different levels of disinfection may specify different exposure and/or temperature combinations on the product label. Care should be taken to select the appropriate conditions for the desired level of disinfection. The active ingredients of the disinfectant

<table>
<thead>
<tr>
<th>Surface temperature (°C)</th>
<th>Minimum disinfection time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>75</td>
<td>30</td>
</tr>
<tr>
<td>70</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes: The temperatures and times given in this table are the minimum required to achieve an A₀ of 600. This concept is described in detail in AS/NZS 4815. The approach to thermal disinfection is currently under review by the International Organization for Standardization and the European Committee on Standardization.


Only instrument-grade disinfectants or sterilants are suitable for use with medical instruments.
in use must also be closely monitored on at least a daily basis. Monitoring is particularly important for multiple-use solutions. However, consideration should be given to more frequent monitoring when large volumes of items are being processed.

16.5 Sterilisation

16.5.1 General principles

Instruments and equipment will only be sterile if one of the following sterilisation processes is used:

• steam under pressure (moist heat);
• dry heat;
• ethylene oxide;
• automated environmentally sealed low-temperature peracetic acid, hydrogen peroxide plasma and other chemical sterilant systems or sterilants; and
• irradiation.

All of the above methods are designed to give a sterility assurance level (SAL) of at least $10^{-6}$ (see Glossary), provided the sterilisation process is validated by the user. AS/NZS 4187 and AS/NZS 4815 include detailed information on the sterilisation methods most commonly used in health care establishments and office-based practices, respectively.

The only suitable methods for inactivating CJD agents are described in Section 31.14 and Table 31.9.

Steam under pressure at the standard temperature and pressure settings used in health care establishments or the other methods listed above are not suitable for reprocessing items potentially contaminated with the infectious agents for CJD.

Ultraviolet light units, incubators, microwave ovens, domestic ovens and pressure cookers must not be used for sterilisation.

Before processing any item for steam sterilisation, ensure that it can withstand steam under pressure. Cleaning is the most important prerequisite for sterilisation. Items should therefore be cleaned thoroughly as soon as practicable after use, before sterilising (see Section 16.3).

In hospitals and larger health care establishments, sterilisation service/supply units (SSUs) are responsible for providing sterile items within the establishment. The National Co-ordinating Committee on Therapeutic Goods has developed guidelines for SSUs: Standard for the Operation of Sterile Supply/Services in Health Care Facilities (NCCTG 1995). It is possible that SSUs in larger establishments may also provide this service for smaller establishments, including office-based practices, on a contractual basis.
Records of sterilisation must be kept for the period of time specified in relevant Commonwealth and State/Territory legislation. These records enable items to be traced to an individual patient. Details of the documentation required for quality systems management are given in AS/NZS 4187 and AS/NZS 4815.

16.5.2 Steam-under-pressure (moist heat) sterilisation

**Principles**

The most efficient and reliable form of sterilisation of instruments and equipment is by steam under pressure, which dries packaged sterile items as part of the cycle before unloading. This is, therefore, the preferred and most widely used method of sterilisation for items used in critical and semicritical sites (as long as they can withstand heat and moisture). Steam under pressure is the preferred method of sterilisation in office-based practice.

The microbicidal effect of steam sterilisation is due to the latent heat of condensation being transferred to the load, causing it to heat rapidly. Steam under pressure causes coagulation of protein structures, thus inactivating infectious agents.

There are several types of steam-under-pressure sterilisers (formerly called autoclaves), including:

- downward (gravity) displacement (jacketed and nonjacketed);
- self-contained (‘benchtop’);
- prevacuum (porous load); and
- operator-convertible.

Downward displacement steam sterilisers are designed for general sterilisation of waste, solutions and instruments. They function by displacing air with steam, via a port in the bottom of the chamber. Prevacuum steam sterilisers, on the other hand, are not suited for liquid sterilisation but are optimised for sterilisation of clean instruments, gowns, drapes, towelling and other dry materials required for surgery. In prevacuum steam sterilisers, air is exhausted by a mechanical pump, which creates a vacuum that is replaced by steam.

AS/NZS 4187 and AS/NZS 4815 give further details of the different types of steam sterilisers. All steam sterilisers must meet the requirements of AS 2192, AS 1410 or AS 2182 and be operated according to AS/NZS 4187 and AS/NZS 4815. Details of different types of packaging material suitable for use in health care facilities are given in AS 1079.

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10 AS 1079 Packaging of items (sterile) for patient care (Parts 1–5; see Appendix 3).
Benchtop steam sterilisers

Benchtop (portable) steam sterilisers are regulated by the TGA. Models that comply with AS 2182 are the most efficient and reliable sterilising units for use in office-based practice. Benchtop sterilisers are suitable for sterilisation of small quantities of relatively simple items, both packaged and unpackaged. Items that are not packaged should be used immediately following sterilisation. Packaged items should be processed only in a steam steriliser that has a built-in drying cycle. Benchtop sterilisers that do not have a built-in drying cycle are appropriate only for the sterilisation of unwrapped items, which must be used immediately after removal from the steriliser using aseptic technique (see AS/NZS 4187 and AS/NZS 4815).

Some benchtop sterilisers, as well as most larger units, have a built-in drying cycle that dries packaged sterile items before unloading. The advantages of packaged and wrapped instruments are that they are easier to unload without contamination and do not have to be used immediately. Such sterilisers should have a drying stage complying with the requirements of AS 2182. Office-based practices intending to purchase new benchtop sterilisers for the sterilisation of wrapped instruments and porous loads should check that a built-in drying cycle is featured and that the sterilisers are listed by the TGA. If possible, older models should be modified to include a drying cycle.

Newer models of benchtop sterilisers also have printout facilities for monitoring temperature and pressure (as applicable) and holding time. Existing, older-style benchtop sterilisers should be fitted with a mechanism to allow the observation and immediate transfer of information (e.g., time at temperature, temperature, pressure) to an electronic data storage facility. Records produced must be kept for a period of time in accordance with Commonwealth and State/Territory regulations. In the event of printout or electronic data storage malfunction, manual monitoring of the steam sterilisation cycle must be performed, and a written log of cycles maintained.

When purchasing a steam steriliser for use in office-based practice, consideration must be given to HCW training and quality control (see AS/NZS 4187 and AS/NZS 4815) as well as running costs. Such ongoing expenditure may make the use of an external service (other office-based practice, hospital or commercial facility) or disposable single-use items more practical and cost-effective alternatives for smaller practices.

Sterilisers must be used in accordance with the manufacturer’s instructions. It may be necessary to contact relevant State/Territory occupational health and safety authorities regarding registration and inspection of steam sterilisers.
Users of benchtop sterilisers should be aware that the recycled water from previous cycles causes deterioration in the water quality for each successive cycle. Accumulated debris in recycled sterilising feed water may compromise the sterility of instruments. The water reservoir should be emptied, cleaned and flushed each week and filled with a fresh supply of water. The use of distilled or deionised water is recommended.

16.5.3 Dry heat sterilisation

Principles

Dry heat sterilisation by means of hot dry air destroys infectious agents by the process of oxidation. However, dry heat sterilisers (mechanical air convection and fan-assisted) have had limited application. It is difficult to maintain an even temperature throughout the load and the high temperatures and prolonged times required to achieve sterility make this method of sterilisation undesirable for office-based practices.

AS 2487\(^\text{11}\) specifies the requirements for dry heat sterilisers. The manufacturer’s instructions must be followed. The door of the steriliser must not be opened during the sterilising cycle.

Dry heat sterilisation is used for anhydrous items and items sealed within impermeable containers that cannot be sterilised by steam under pressure, but can withstand a temperature of 160°C for a minimum of 120 minutes plus penetration time. Dry heat sterilisers use mechanical convection, which provides forced air circulation with uniform temperature distribution throughout the chamber. Some materials and instruments, particularly those with moving parts, may suffer damage or loss of lubrication through dry heat sterilisation. Sterilising practitioners should check with the manufacturer about the suitability of dry heat sterilisation for specific items.

Dry heat sterilisation is not recommended for CJD-contaminated items (see Section 31.14).

16.5.4 Commercial irradiation sterilisation systems

Sterilisation by gamma radiation is available only from commercial gamma irradiation facilities. Other forms of radiation sterilisation (e.g., electron beam) are not currently available in Australia.

Radiation sterilisation is not recommended for CJD-contaminated items (see Section 31.14).

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\(^{11}\) AS 2487 (1981) *Dry heat sterilizers (hot air type).*
16.5.5 Ethylene oxide sterilisation systems

Ethylene oxide (EO) gas can be used for sterilisation of articles that are made partly or entirely from heat-labile materials or that contain electronic components. Sterilisation is achieved by alkylation of the protein in the microbial cell. Processing time depends on the temperature, relative humidity and gas concentration, and can be effective only if the gas can penetrate the packaging and reach all surfaces of the articles requiring sterilisation. The process generally takes from 12 hours to more than 24 hours, which includes the time needed for aeration to rid the articles of any residual EO gas. Due to its high toxicity, the use of EO in health care establishments is restricted. Special requirements in siting, monitoring and operation apply if EO sterilisation is used in health care facilities.

EO sterilisation is not recommended for CJD-contaminated items (see Section 31.14).

16.5.6 Low-temperature automated chemical sterilisation systems

Hydrogen peroxide plasma

Low-temperature hydrogen peroxide plasma (HPP) sterilisation works by alkylation of the protein in the microbial cell.

Low-temperature glow HPP sterilisers use HPP in a fully automated cycle to achieve low-temperature, low-moisture sterilisation within a 45–80-minute cycle, depending on the model of steriliser used. The system requires the use of nonwoven (noncellulose) polypropylene wraps/packaging.

HPP sterilisation is not recommended for CJD-contaminated items (see Section 31.14).

Peracetic acid

Low-temperature peracetic acid (PAA) sterilisation works by oxidation of microbial cell proteins.

Sterilisation is achieved with 0.2% PAA in an environmentally sealed chamber and a fully automated processing system. The process generally achieves moist, low-temperature sterilisation within 25–30 minutes, depending on conditions at the establishment where the equipment is installed. The items are not wrapped for this process; however, they are sterilised in special containers.

PAA sterilisation is not recommended for CJD-contaminated items (see Section 31.14).
16.5.7 Other chemical sterilants

Information on chemical sterilants is given in Section 7.2. To achieve sterilisation with aldehyde-based products, such as glutaraldehyde, at ambient temperature, a prolonged contact time is generally necessary, depending on the formulation and the TGA-approved labelling.

If users of sterilants are unsure of the TGA-approved status of a product, they should ask the manufacturer to supply the product’s AUST R code number (see Section 7.2).

**Important note**

Endoscopes and accessories that are soaked for the shorter of the two labelled exposure periods in a multiuse sterilant/high-level chemical disinfectant before use cannot be considered to be sterile (AS/NZS 4187).

Glutaraldehyde, other aldehydes, acetone and alcohols are not recommended for CJD-contaminated items (see Table 7.1 and Section 31.14).
17 Instruments and equipment requiring special processing

Key points

+ Specialised equipment, such as flexible fibreoptic scopes, respiratory apparatus and diagnostic ultrasound probes may not withstand steam sterilisation, thermal disinfection or some chemical agents. Such equipment can also be complex and delicate, making it difficult to reprocess and sample microbiologically.

+ Such equipment should only be used in health care establishments with proper reprocessing facilities, quality management systems to ensure full compliance with cleaning, disinfection and sterilisation protocols, and fully trained staff.

+ Records must be kept to allow retrospective identification of instrument use for specific patients.

+ Instruments that will be used in critical sites (penetration into sterile tissue) or semicritical sites (contact with mucosal or nonintact skin) should be sterilised with steam under pressure if they withstand heat.

+ For instruments that will not withstand steam sterilisation, a low-temperature sterilisation system should be used if it is available (or a minimum of high-level chemical disinfection). For invasive procedures, all accessories must also be sterilised.

+ Manufacturers’ instructions regarding sterilisation and disinfection should be taken into account. However, some manufacturers currently specify chemical agents that are not registered for use as instrument-grade disinfectants. Within the next few years, medical device manufacturers will be obliged to provide reprocessing instructions.

+ Flexible scopes should be reprocessed again on the day of use to kill environmental organisms that may have proliferated in any residual dampness (for duodenoscopes used for endoscopic retrograde cholangiopancreatography procedures, this reprocessing should be immediately before use).

+ It is preferable to use a disposable breathing circuit during anaesthesia. If this is not possible, either a single-use filter must be used, or the breathing circuit (including the carbon dioxide absorber) must be discarded after each procedure. These items and other respiratory equipment are semicritical and the minimum reprocessing required is therefore high-level chemical or thermal disinfection.

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17.1 Endoscopes (general)

Detailed information on processing of endoscopes and accessories is given in the following publications:

- *Infection Control in Endoscopy, 4th edition* (Cowen et al 1999), published jointly by the Gastroenterological Society of Australia (GESA) and the Gastroenterological Nurses College of Australia (GENCA). A copy of these guidelines can be obtained from the GESA office (see Appendix 7); and

- AS/NZS 4187 on the care and handling of flexible and rigid endoscopes and accessory equipment.

17.1.1 Types of scopes

Scopes can be classified as rigid or flexible according to their construction. Specialised endoscopes are named in relation to the sites in the body that they are intended to visualise — for example, cystoscope (bladder), nephroscope (kidney), ureterscope (ureter), urethroscope (urethra), bronchoscope (bronchi), laryngoscope (larynx), otoscope (ear), arthroscope (joint), laparoscope (abdomen) and gastrointestinal endoscope (gastrointestinal tract).

Depending upon the procedure, gastrointestinal endoscopes may be further categorised as colonoscopes, gastrosopes, duodenoscopes, sigmoidoscopes and so on.

Duodenoscopes are used for endoscopic retrograde cholangiopancreatography, or ERCP, which is a tool used to assist in the diagnosis of liver, bile duct, gallbladder and pancreatic diseases. The flexible side-viewing duodenoscope used for ERCP is inserted into the small intestine via the mouth, oesophagus and stomach. A catheter is passed through the endoscope and manipulated into the bile and pancreatic ducts. Dye is injected into the ducts to enable X-ray imaging.

Some endoscopes, such as bronchoscopes and sigmoidoscopes, are available in both flexible and rigid constructions.

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1 AS/NZS 4187 (2003) Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities.
Modern flexible fibreoptic scopes (including flexible bronchoscopes, colonoscopes, cystoscopes, duodenoscopes, gastroscopes and flexible sigmoidoscopes) are made from materials (eg plastics) that are unable to withstand temperatures above 60°C or many chemicals, which may lead to degradation of materials (eg lens cement). The endoscope is honeycombed with multiple small channels, some with blind endings, none of which can be adequately inspected following cleaning. The equipment is physically delicate, difficult to dry and difficult to sample microbiologically.

17.1.2 Quality control, traceability and surveillance

There is substantial evidence that endoscope and accessory reprocessing procedures are often not fully followed (Raymond et al 1990, Reynolds et al 1992, Collignon and Graham 1991, Bronowicki et al 1997). All centres that reprocess endoscopes and accessories should have clear and detailed quality management systems to ensure full compliance with all aspects of the cleaning and disinfection protocol. Clear, detailed and specific quality control processes for endoscope and accessory reprocessing are provided in *Infection Control in Endoscopy* (Cowen et al 1999). The reprocessing centre’s data may be critical in a retrospective investigation about the possible transmission of infectious agents by endoscopy and in the interpretation of cultures from endoscopes and automatic processors. In general, the purposes of the quality control system are:

- to ensure that HCWs responsible for reprocessing endoscopes and accessories have a clear understanding of the important principles involved and fully understand each of the steps necessary in reprocessing;
- to record measurable parameters, such as disinfectant immersion time and disinfectant concentration; and
- to maintain accurate records of each reprocessing operation, allowing an effective ‘lookback’ study.

Periodical bacteriological surveillance is required as follows:

- *recommended* for gastroscopes and colonoscopes following reprocessing, as part of a quality assurance program;
- *essential* for duodenoscopes and bronchoscopes; and
- *essential* for inner surfaces of automated endoscope reprocessors (washer–disinfectors).


Additional precautions are required for scopes that have been used on patients in the risk groups for CJD (Section 31.9). If a scope has been reused after use on a patient who is subsequently diagnosed with CJD, a lookback investigation may be necessary (see Section 31.16).
17.2 Endoscopes (gastrointestinal tract)

17.2.1 Risk factors

Clinical infections associated with the use of endoscopes may occur because infectious agents are transmitted from one patient to another during examination via the endoscope or its accessory equipment. Scopes can also be contaminated from the general hospital environment, from the water supply or from disinfecting machines (Axon 1991). Infectious agents introduced into sterile (critical) sites in the ducts in the organs under investigation during ERCP pose a higher risk of infection than endoscopic procedures that involve semicritical or noncritical sites.

The important risk factors are:

- the number and type of infectious agents present on or in the scope, its water-feed system and accessories;
- the particular type of procedure to be undertaken and whether tissue penetration or disruption occurs (for example, in procedures such as dilatation and polypectomy); and
- patient factors, including immune status, endovascular integrity, indwelling foreign material such as prostheses, and the presence of infective foci.

Flexible fibreoptic endoscopes are made from materials that cannot be steam sterilised or withstand many chemicals (see Section 17.1.1). However, there have not been many reported clinical infections due to endoscopic procedures, despite the difficulties associated with endoscopy. ERCP is the only endoscopic procedure that has been associated with a consistently significant rate of procedure-induced infection (Cowen et al 1999).

Infectious agents that can contaminate endoscopes

The following microorganisms can contaminate endoscopes:

- Bacteria that are resident in the gastrointestinal tract, such as salmonella, shigella, campylobacter and related species (O’Connor et al 1982, Dwyer et al 1987), *Serratia marcescens* (Webb and Vall-Spinosa 1975, Vandenbroucke-Grauls et al 1993), *Helicobacter pylori* (Gledhill et al 1985, Langenberg et al 1990) and *Clostridium difficile* (Patterson et al 1984, Hughes et al 1986).
- Other bacteria (usually derived from the environment), such as pseudomonas or similar bacteria, including *Proteus* spp. These bacteria, which are responsible for most reported endoscopy infections (Greene 1974, Bianco et al 1990) are resident hospital pathogens that colonise almost any damp surface, including channels within the endoscope itself, although in practice this has only been a problem for ERCP and endoscopy in severely immunocompromised patients where tissue disruption has occurred.
• Viruses such as human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV). When HIV is protected within a dried protein coagulum, some chemical disinfectants, such as glutaraldehyde, may fail to inactivate the virus (Hanson et al 1989a). This emphasises the need to ensure that all traces of blood and proteinaceous material are removed by scrupulous manual cleaning without delay after the procedure is completed (Hanson et al 1989b, 1990). Despite the high infectivity of HBV, there are few well-documented cases of transmission by endoscopy (Ferrari et al 1991). With HCV, however, there are now many documented cases (Crenn et al 1988, Kim et al 1996, Bronowicki et al 1997).

• Other infectious agents, such as fungi, protozoa and other bacteria and viruses, could potentially be transmitted by endoscopy. In practice, however, infectious agents such as cryptosporidia usually pose a significant threat only to immunocompromised patients.

• The infectious agent causing CJD presents a theoretical risk for all types of endoscopy (see Section 17.2.4).

Water-feed systems and rinse water

Hospital tap water may be contaminated with a variety of infectious agents, including pseudomonads and mycobacteria. This can pose a risk to patients if sterile cavities are entered, if there is extensive disruption of tissue or if the patient is immunocompromised. The following rinsing procedures are therefore recommended:

• After mechanical cleaning and disinfection, gastrointestinal endoscopes should be rinsed with filtered potable water of low mineral content.

• Duodenoscopes and endoscopes used in ERCP should be rinsed in water that is filtered through 0.2-µm filters, or with sterile bottled water. A coarse prefilter may be used to prolong the life of the 0.2-µm filter. (Note: bottled supermarket water is not sterile and is not suitable for this purpose.)

Patients with increased susceptibility to infection

A variety of clinical circumstances may increase the danger of infection associated with endoscopy, including:

• compromised immune status, such as HIV infection, neoplastic disease, cancer therapy, transplantation and advanced systemic disease (eg liver or renal failure);

• procedurally induced tissue damage such as oesophageal dilation, polypectomy and sphincterotomy at ERCP;

• intrinsic sources of infection such as diverticulitis or abscess, cholangitis or infected pancreatic pseudocyst; and

• increased risk of bacterial lodgment, such as cardiac valve prosthesis, rheumatic heart disease, or indwelling devices such as Hickman catheters; septic arthritis of prosthetic joints has been reported only rarely after endoscopic procedures.
17.2.2 Level of reprocessing required

The bile and pancreatic ducts are sterile (critical) sites and anything that enters these sites, such as accessories or catheters used within ERCP duodenoscopes, must be sterile.

As flexible fibreoptic duodenoscopes do not withstand steam sterilisation, low-temperature chemical sterilisation should be used, if available, to sterilise them. If this is not available, high-level disinfection is the minimum level of reprocessing required for the duodenoscope itself. Accessories and catheters must be sterile.

Other endoscopes are used in mucosal (semicritical) sites, and the minimum level of reprocessing for endoscopes that cannot withstand sterilisation is therefore high-level disinfection.

Endoscope accessories designed for reuse, and other items that penetrate tissue (e.g., biopsy forceps), or are associated with tissue disruption or introduction of devices into duct systems, must be sterile at the time of use. Where this process cannot be achieved, sterile single-use only accessories must be used. These single-use items cannot be reused.

IMPORTANT

17.2.3 Reprocessing methods

The reprocessing of flexible endoscopes is a difficult and complex task. Therefore:

• endoscopy should be undertaken only in centres that have adequate facilities for cleaning and disinfection; and

• only fully trained HCWs should perform the critical task of processing endoscopic equipment and accessories.

Full explanation and details of the cleaning and disinfecting processes can be found in the GESA/GENCA guidelines (Cowen et al 1999), AS/Nzs 4187 and on the Queensland Health internet site.2

IMPORTANT NOTE

Endoscopes and sheaths

Sheaths that cover endoscopes have recently become available to help reduce endoscope contamination. Use of these sheaths does not remove the necessity for correct cleaning and reprocessing of endoscopes between patient uses. Due to the potential for sheaths to be torn, to break or to have holes that are invisible to the naked eye, all endoscopes must be reprocessed according to the recommendations below regardless of whether sheaths are used.

Manual processing

Standard precautions should be used for the manual cleaning of endoscopes and accessories. Appropriate personal protective equipment (gloves, impervious gowns, plastic aprons, splash-resistant masks, safety eyewear and face protection) should be worn.

For duodenoscopes, inadequate cleaning and disinfection of the forceps-raising channel, and contamination of the water-feed system, has been linked to infection in ERCP procedures (Cowen et al 1999). The water bottle and connecting tube must be sterilised and changed between each patient use. Sterile bottled or 0.2-µm filtered water must be used. (Note: bottled supermarket water is not sterile and is not suitable for this purpose.)

Cleaning

• The most important step in the process of endoscope reprocessing is scrupulous manual cleaning before disinfection.

• Endoscopes and accessories must be immersed in an anionic detergent solution, at ambient temperature, immediately after removal from the patient, and cleaned and reprocessed as soon as possible.

• Equipment must be fully disassembled before reprocessing. All endoscopes are supplied with appropriate cleaning adaptors and accessories. Manufacturers’ instructions must be followed.

• Cleaning should be carried out according to the detailed guidelines in Infection Control in Endoscopy (Cowen et al 1999). The fine channels within endoscopes are difficult to clean, and a variety of internal disruptions, including surface abrasions, splitting and cracking of channels and partial joint springing of accessories, may impair the cleaning process.

Disinfection and sterilisation

• For duodenoscopes used for ERCP (which are in contact with critical sites), a low-temperature sterilisation process, such as hydrogen peroxide plasma (HPP) or peracetic acid (PAA) sterilisation in an automated microprocessor-controlled closed system, is preferred, if this equipment is available and the scopes can tolerate this treatment. The key principle is that instruments that enter sterile tissues must be sterile.

• High-level chemical disinfection is the minimum reprocessing standard for all endoscopes because the instruments are in contact with the mucosal surface (semicritical sites). This may be achieved, for example, by complete immersion in a solution of a chemical disinfectant, registered by the Therapeutic Goods Administration (TGA) as a high-level instrument-grade disinfectant solution. Further details are given in Section 16 of these guidelines.
Following low-temperature sterilisation or high-level disinfection, endoscopes must be rinsed in an acceptable grade of water (see Section 17.2.1), purged with alcohol and thoroughly air-dried before storage on hangers designed specifically for that purpose. A minimum of 150 mL of water should be flushed through each channel of the endoscope to remove all traces of disinfectant residue. A greater volume may be required according to the length of the instrument. Because the instrument is used in sterile (critical) sites, each channel of a duodenoscope must be rinsed with sterile bottled or 0.2-µm filtered water (not bottled supermarket water) to avoid contamination with environmental organisms such as pseudomonads and mycobacteria.

Sterile water must be used in endoscope water-feed systems.

All endoscopes should be leak tested after immersion and before cleaning and disinfection or sterilisation, to identify problems that may result in damage to the scope during reprocessing.

After effective cleaning and disinfection, the instrument must be dried before storage to prevent environmental organisms (eg pseudomonads) from multiplying in the channels before the endoscope is reused. However, as any residual dampness may allow proliferation of organisms, scopes should be reprocessed again after storage (see Reprocessing again before use, below).

With rapidly evolving technologies and dynamic product development in the area of infection control, instruments that can be easily dismantled and steam sterilised may become widely available in the future, bringing major advantages.

Automated reprocessing

Washer–disinfectors

Automated endoscope reprocessors (washer–disinfectors) may be used effectively in the reprocessing of endoscopes. It is critical that HCWs using automated washer–disinfectors understand the principles of machine operation and the limitations of each machine (eg some do not have flow alarms). Currently, it is necessary to brush the internal channels of the endoscope before placing it in the washer–disinfector. However, some innovative automated washer–disinfectors now available in Australia include cleaning mechanisms in their cycles (see Section 16.3.7).

Further details of automated endoscope reprocessors can be found in Infection Control in Endoscopy (Cowen et al 1999).

Automated low-temperature chemical sterilisation processing

Automated PAA- and HPP-based chemical processing systems offer highly effective systems of endoscope disinfection and sterilisation, provided the chemicals are compatible with the endoscopes (see Section 16.5.6). Use of these systems does not preclude the need to preclean instruments and
equipment. Where automated systems are used, the system must be regularly monitored for efficacy and performance in accordance with the manufacturer’s technical instructions. Occupational health and safety issues involved for the handling of the chemicals should be considered (see Section 7.4).

Reprocessing again before use

There is a risk that residual dampness will allow remaining organisms to proliferate, so all scopes that have not been terminally sterilised (ie packaged) must be reprocessed (preferably sterilisation or a minimum of high-level disinfection) after patient use and then a second time on the day of use. Duodenoscopes used for ERCP must be reprocessed as close as possible to the time of the procedure (Cowen et al 1999) because this is a high-risk procedure and the possible recontamination time should be kept to a minimum.

17.2.4 Prevention of CJD transmission

Endoscopes cannot be adequately processed for CJD infectious agents. If a scope is used in a patient in a risk group for CJD (Section 31.9), it should be handled as described in Section 31.14. In CJD risk patients, alternative options to endoscopic diagnosis should be sought without prejudice to patient care.

If a scope has been reused after use on a patient who is subsequently diagnosed with CJD, a lookback investigation may be necessary to identify at-risk patients (see Section 31.16).

17.3 Bronchoscopes

Flexible or rigid bronchoscopes may be used for direct visualisation of the tracheobronchial tree. Flexible fibreoptic bronchoscopes are commonly used in diagnostic procedures, with the patient under sedation. Rigid bronchoscopes are usually used in operating room situations, with the patient under general anaesthetic.

17.3.1 Risk factors

When patients with active tuberculosis have a bronchoscopy, there is a risk of transmission of *Mycobacterium tuberculosis* (see Sections 11.5.5 and 29.8). When this has occurred, it appears to have been due mainly to inadequate cleaning before disinfection or sterilisation (Wheeler et al 1989, Bryce et al 1993, Fraser et al 1992, Reeves and Brown 1995).

Atypical mycobacteria, which are frequently present in tap water, can contribute to biofilm formation in older models of automated washer–disinfectors without self-disinfection cycles (Middleton 1997). The organisms may be transmitted to bronchoscopes during reprocessing and then to the patient during bronchoscopy. This can lead to misdiagnosis and inappropriate
treatment of tuberculosis because of the appearance of acid-fast stained bacilli in cultures or on direct microscopy. In addition, immunocompromised patients are at a higher risk of succumbing to infections caused by atypical mycobacteria and other opportunistic respiratory pathogens.

The infectious agent causing CJD presents a theoretical risk for contamination of bronchoscopes (see Section 17.3.4).

### 17.3.2 Level of processing required

Because the lower airways are usually sterile (critical site), sterilisation is required if available. High-level disinfection is the minimum level of reprocessing required.

When an invasive procedure (eg biopsy) is planned, all accessories must also be sterilised before the procedure.

### 17.3.3 Reprocessing procedures

Rigid bronchoscopes should be sterilised by steam sterilisation.

Flexible bronchoscopes should be reprocessed with a low-temperature sterilisation system, such as PAA or HPP, if it is available and provided the scopes are compatible with the process.

For high-level disinfection, after appropriate cleaning, bronchoscopes should be soaked in a high-level instrument-grade disinfectant for the time stated on the manufacturer’s label to eradicate *Mycobacterium tuberculosis*. After disinfection, the instrument and its channels should be immersed and rinsed thoroughly with sterile water, rinsed with 70% alcohol and dried with compressed air.

Disposable covers are recommended for use on bronchoscopes and accessories (eg detachable camera heads), when available.

Bronchoscopes that have not been terminally sterilised (ie packaged) should be reprocessed again on the day of use, as for endoscopes (see Section 17.2.3).

### 17.3.4 Prevention of CJD transmission

Bronchoscopes cannot be adequately processed for CJD infectious agents. If a scope is used in a patient in a risk group for CJD, it should be handled as described in Section 31.14.

If a scope has been reused after use on a patient who is subsequently diagnosed with CJD, a lookback investigation may be necessary to identify at-risk patients (see Section 31.16).
17.4 Other fibreoptic scopes and associated equipment

17.4.1 Types of instruments

Instruments used in sterile sites

Other fibreoptic scopes that are used in sterile (critical) sites include laparoscopes, cystoscopes, thorascopes, hysteroscopes, ureterscopes and arthroscopes. Ancillary equipment for these procedures includes cameras, biopsy forceps and light leads.

Instruments used in nonsterile sites

Other fibreoptic scopes used in mucosal (semicritical) sites include sinoscopes, laryngoscopes, oesophagoscopes and urethrascopes. Ancillary equipment is the same as that for sterile sites.

17.4.2 Risk factors

Items that breach the protective integrity of the skin and mucous membranes provide infectious agents with direct access to sterile tissue sites.

The infectious agent for CJD presents a theoretical risk in the use of fibreoptic scopes (see Section 17.4.5).

17.4.3 Level of processing required

For use in sterile (critical) sites, fibreoptic scopes and their associated auxiliary equipment must be sterile at the time of use, as indicated in Table 16.1. Where access for cleaning is difficult, or the invasive accessories are heat sensitive, the use of sterile single-use accessories is preferred.

For use in mucosal (semicritical) sites, fibreoptic scopes and their associated auxiliary equipment should be sterile at the time of use or, as a minimum, high-level disinfected, as indicated in Table 16.1.

17.4.4 Reprocessing procedures

Equipment must be thoroughly cleaned and dried before sterilisation.

Sterilisation should be by a low-temperature sterilisation system such as PAA or HPP, if it is available, or by high-level disinfection. The reprocessing procedures should be the same as those described for other endoscopes and bronchoscopes (see Sections 17.2 and 17.3).

Associated invasive accessories should be packaged for steam sterilisation or used immediately following their removal from a low-temperature sterilisation process.
All fibreoptic scopes that have not been terminally sterilised (ie packaged) should be reprocessed again on the day of use, as for endoscopes (see Section 17.2.3).

17.4.5 Prevention of CJD transmission

Fibreoptic scopes cannot be adequately processed for CJD infectious agents. If a scope is used in a patient in a risk group for CJD, it should be handled as described in Section 31.14. If a scope has been reused after use on a patient who is subsequently diagnosed with CJD, a lookback investigation may be necessary to identify at-risk patients (see Section 31.16).

17.5 Respiratory and anaesthetic apparatus

17.5.1 Types of equipment and risk factors

Items of equipment that are introduced into the patient’s airway can provide direct access for potential pathogens. There is a potential for patient-to-patient transmission of infection (such as tuberculosis).

Aerosol transmission of infectious agents has been documented via respiratory equipment, including spirometry or pulmonary function testing apparatus (Hazeleus et al 1991) and anaesthetic apparatus (Joseph 1952). Moist gases can transport infectious agents along breathing circuits and nebulisers can harbour infectious agents. Transmission of infection may also occur through resuscitation and analgesic respiratory equipment used in hospitals (operating rooms, intensive care units, accident and emergency departments, and delivery suites), medical and dental practices, ambulances and first aid areas.

17.5.2 Level of processing required

Respiratory, anaesthetic, resuscitation and similar apparatus and ventilators used in anaesthesia and in intensive care units are generally classed for use in mucosal (semicritical) sites and therefore should be sterilised wherever possible. If items cannot withstand sterilisation, they must be exposed to at least thermal disinfection or high-level chemical disinfection (see Table 16.1).

While there may be an additional cost involved in sterilising semicritical components of the breathing system, using disposable circuitry and incorporating filters, this should be balanced against the reduced risk of transmission of infection.

17.5.3 Reprocessing procedures

Items of equipment that may be contaminated by patient-to-patient transmission of infections such as tuberculosis should be single use. Reuseable equipment should be capable of at least thermal disinfection or high-level chemical disinfection (see Table 16.1).
It is preferable that all patient circuits contain a filter capable of removing particulates and aerosols from the gas pathway. The common position for this filter is in the reciprocating gas flow immediately adjacent to the patient. If the filter is not placed in this position but is positioned on the expiratory limb between the expiratory hose and the absorber head, a second protective filter must be placed on the inspiratory limb because the gas flow is not totally unidirectional.

If a filter is used, all items between the patient and the filter, including the filter, must be discarded after a single patient use. Items retrieved from the patient should be drained and dried of condensed moisture. The filter should be visually inspected to ensure that there is no moisture that could compromise the filter’s integrity.

If no filter is used, the disinfection must include all of the breathing circuit (ie the mask or tube and connections, the inspiratory and expiratory hoses, the inspiratory and expiratory connections, the carbon dioxide absorber and one-way valves, the reservoir hose and reservoir bag and any monitoring devices within the breathing circuit exposed to the respiratory gases). Components that cannot be disinfected should be discarded and replaced.

If lubricant is used on tubes for insertion into the patient’s airway, it should be obtained from single-use sachets that are then discarded. Tracheal tubes, laryngeal masks, pharyngeal airways, suckers and equipment used to introduce these items, such as laryngoscope blades and introducers, must be cleaned, sterilised and dried before reuse, or discarded after a single use. Demand and inhalation valves used in resuscitation and analgesic equipment should be dismantled, cleaned, sterilised and dried and then checked for performance after each patient use. It is very important that these items of equipment are dry before use.

Further information may be obtained from the Australian and New Zealand College of Anaesthetists, the Australian Society of Anaesthetists, and the Thoracic Society of Australia and New Zealand (see Appendix 7), and AS/NZS 4187.

17.5.4 Respiratory function laboratories

All items must be cleaned and reprocessed according to manufacturers’ instructions, because heat, chemicals and gases may damage some equipment. After cleaning and disinfection, it is essential that all items are rinsed with sterile water and air-dried before use. Reprocessed equipment should be stored in covered containers.

Barrier filters are single-use items and may be used to protect all equipment that can be contaminated with patient expirates, where the equipment is not disinfected or replaced between patients. There is evidence that the use of barrier filters will reduce the risk of transmission of infection (Side et al 1999).
It is important to be aware that the use of filters does not preclude the need for cleaning. Mouthpieces, nose clips, tubing and other equipment on the patient side of a filter should be replaced with clean, sterilised or high-level disinfected components between patients.

When choosing barrier filters, it is important to verify the resistance and efficacy of filtration at flow rates up to at least 14 L/second. The resistance of the breathing circuit, including the filter, should be < 2.5 cm water per litre per second at flow rates up to 14 L/second (American Thoracic Society standard). The filter should have a low effective deadspace (50 mL).

In respiratory function laboratories, equipment considered to be semicritical includes reusable mouthpieces, reusable nose clips, one-way breathing valves, pneumotachograph screens, turbine assemblies, mouth shutters and specialised nebulisers used for bronchial challenge tests. These items must be disassembled and thoroughly cleaned before reprocessing, using either sterilisation or high-level disinfection. Gloves should be worn when handling equipment contaminated with saliva (standard precaution). Equipment distal to a barrier filter or one-way breathing valves should be cleaned at least once daily to remove particulate matter and moisture (Crockett and Grimmond 1993).

The outside surface of tubing that is in direct contact with or handled by patients should be cleaned between patients. The environment of the laboratory should be maintained by regular cleaning with detergent and be kept dust free.

Routine handwashing should be performed before and after each patient contact.

Items labelled as ‘single patient use’, including peak flow meters and nebulisers used for bronchodilators and oesophageal balloons, must not be reprocessed.

The effectiveness of infection control procedures can be independently verified by culturing swabs taken from respiratory equipment (internal surfaces of spirometers and the proximal side of flow spirometers). While some laboratories do this regularly, it is sufficient to carry out random spot checks.

17.5.5 Items and equipment for use in noncritical sites

Noncritical sites are defined as intact skin; they do not include intact mucosal sites, which are considered to be semicritical sites. Items or equipment for use in noncritical sites (e.g., anaesthetic armboards and stethoscopes), or which do not come into direct contact with patients (e.g., the surface of the anaesthetic machine or resuscitator), should be cleaned after each use (see Table 16.1).
Anaesthetic and respiratory washer–disinfectors that comply with AS 2945\(^3\) can be used to process anaesthetic and respiratory equipment that is not required to be sterile at the time of use (see AS/NZS 4187 and AS/NZS 4815 for details).

17.6 Asthma spacers used with metered-dose inhalers (MDIs)

17.6.1 Risk factors
An asthma spacer should be used with a metered-dose inhaler (MDI) in the following instances:

- by all adults who have poor coordination when using an MDI;
- by children of all ages (children under four years can use an MDI and a small-volume valved spacer with a face mask);
- during acute attacks; and
- by patients using inhaled steroids by MDI, particularly at higher doses (National Asthma Council 2002).

### IMPORTANT NOTE

**Spacer devices used with MDIs**
Although there have been no instances reported, deep inhalation of medication from spacer devices used with MDIs could result in cross-infection. Respiratory devices are considered semicritical and should be reprocessed appropriately (see Section 16.2.2). To minimise the risk of cross-infection from waterborne organisms such as *Legionella pneumophila* (CDC 1997a) following the cleaning process, care should be taken to drain the spacer and ensure no residual water is left in the spacer chamber.

17.6.2 Reprocessing standards for health care settings
Hands should be thoroughly washed and dried before handling asthma spacers.

Spacers should be for the exclusive use of a single individual. Health care establishments should maintain a store of spacers to ensure that new spacers are always available when required. If multiuse is necessary (in an emergency) the spacer should be reprocessed using thermal disinfection (see Section 16.4.2).

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\(^3\) AS 2945 (1998) *Batch-type washer/disinfectors for health care facilities.*
Spacers should be washed in a hot water and detergent solution before steam sterilisation and pasteurisation. The spacer should be dipped in a diluted detergent solution and left to drain (without rinsing) until it is dry, ensuring that no residual water is left in the spacer. If steam sterilisation is not available, spacers should be pasteurised. If pasteurisation is not possible, see Section 17.6.3.

**IMPORTANT NOTE**

**Drying spacers**

Do not use a cloth to dry the spacer. This could produce an electrostatic charge that may cause drug particles to adhere to the walls of the spacer, resulting in less deposition in the lungs.

### 17.6.3 Reprocessing procedures in a community setting

**Home use**

A spacer is a personal item and should be for the exclusive use of an individual and not shared with anyone else. Hands should be washed and dried before using a spacer. Every 1–2 weeks, spacers should be washed in a hot water and detergent solution and left to drain without rinsing, ensuring that no residual water is left in the spacer.

**First aid kits in community settings, including schools**

First aid kits should contain a reliever MDI and matching spacer device. A spacer should be used to administer asthma medication to a child. Normally, a person should carry their own reliever MDI and spacer. In an emergency, an MDI and spacer from a first aid kit may be used; they must be reprocessed before reuse, as follows.

Spacers should be washed in a hot water and detergent solution and left to drain (without rinsing) until dry. When the spacer is dry, the mouthpiece should be wiped thoroughly with a 70% alcohol solution (to prevent electrostatic charge production). A cloth should not be used to dry the spacer. This could produce an electrostatic charge that may cause drug particles to adhere to the walls of the spacer, preventing the correct dose being delivered to the lungs.

In schools or care settings, each child for whom asthma medication has been prescribed should have their own spacer and a supply of medication, clearly labelled with the name of the child and next-of-kin contact details. Parents or carers have a responsibility to convey clear instructions from the medical practitioner to the school or care setting about the child’s medication requirements.
17.7 Resuscitation manikin facepieces and accessories

When resuscitation manikins are used for training purposes, the parts of the manikin that come into contact with oral secretions should be changed or reprocessed between use to avoid transmitting infections between trainees (see Section 17.7.2).

17.7.1 Risk factors

The mucous membranes of the mouth and saliva may be the source of respiratory pathogens such as influenza virus, HBV and streptococci. These pathogens may colonise manikin facepieces after use by a first aid trainee and be transferred to other users if cleaning and disinfection of the facepiece between users is inadequate.

17.7.2 Reprocessing procedures

Manikin facepieces and accessories are used in first aid training. They can be thermally disinfected but this may not be an option in field training situations (e.g., sportsgrounds, beaches). Such facepieces should therefore be thoroughly cleaned with warm water and detergent, rinsed and dried before disinfection with an appropriate disinfectant. The pieces must be dry before immersion in disinfectant to ensure that the disinfectant solution is not diluted; dilution would result in inadequate disinfection over the contact period. Before use, it is essential to rinse the item free of residual disinfectant with water.

The Australian Resuscitation Council and first aid training providers should be contacted for further advice (see Appendix 7).

17.8 Diagnostic ultrasound transducers

17.8.1 Risk factors

Diagnostic ultrasound transducers are used in many sterile (critical) situations, including renal, hepatic and hepatobiliary studies, for the review of vascular surgical repairs, and for some endobronchial and gynaecological operations.

They are also used in mucous membrane (semicritical) sites (transvaginal, transrectal and transoesophageal ultrasound).

Potential sources of infection associated with vaginal ultrasound include infectious agents transmitted by blood and genital secretions, such as HIV, HBV, HCV, cytomegalovirus, Neisseria gonorrhoeae, Chlamydia trachomatis, Trichomonas vaginalis and human papilloma virus. Other infectious agents are associated with rectal or oesophageal ultrasound.
Abdominal ultrasound examination is generally considered to be a low-risk procedure where it involves contact with intact skin (noncritical site). However, there is a potential for transmission of bacteria such as *Staphylococcus aureus*, particularly in a patient with an abdominal wound.

The infectious agent for CJD presents a theoretical risk for the use of ultrasound transducers in the brain or spinal cord (see Section 17.8.3).

### 17.8.2 Level of reprocessing required

The external surfaces or covers of diagnostic ultrasound transducers that are to be used in sterile (critical) sites must be sterile. Wherever possible, transducers that are capable of being sterilised should be used. Low-temperature chemical sterilising technologies suitable for processing heat-sensitive items include the PAA and HPP sterilisation systems (see Section 16.5.6). However, some ultrasound transducers may be made of materials that do not withstand exposure to these chemical agents.

Instruments that contact nonsterile mucous membranes (semicritical sites) usually require either sterilisation (if possible) or high-level disinfection with a compatible instrument-grade disinfectant, as a minimum, in accordance with manufacturers’ instructions. Unless sodium hypochlorite is labelled as a high-level instrument-grade disinfectant, it may not be suitable for reprocessing these instruments.

Instruments that are only in contact with intact skin (noncritical sites) should be cleaned in accordance with the manufacturer’s instructions where available.

### 17.8.3 Prevention of CJD transmission

Ultrasound transducers cannot be adequately processed for CJD infectious agents. Ultrasound transducers applied to the brain or spinal cord of a patient in a risk group for CJD should be destroyed or quarantined as described in Section 31.12. If the transducer has been applied to low-infectivity tissue of a patient in a risk group for CJD, it should be handled as described in Section 31.14.

If an ultrasound transducer has been reused after use on a patient who is subsequently diagnosed with CJD, a lookback investigation may be necessary (see Section 31.16).

### 17.8.4 Precautions during procedures

Standard precautions (see Section 2.2) should always apply where there is a potential for contact with blood or body substances, nonintact skin or mucous membranes, and should therefore be used with transvaginal and transrectal ultrasound procedures.
For transoesophageal ultrasound, disposable sheaths may be available, but care should be taken to ensure that they do not detach during the procedure. Less effective alternative covers include condoms and gloves.

Probes for transvaginal and transrectal ultrasound procedures must be sheathed in a disposable impermeable cover that is changed for each patient. Care should be taken to ensure that the sheath is not overstretched (overstretching may result in perforation) and that it does not detach during the procedure. It is essential that, for each new procedure, the cover is either sterile or appropriate for use in a semicritical site. The probe itself should be reprocessed according to the manufacturer’s instructions where available.

The disposable cover should be thick enough to resist tearing or perforation during use. The preferred option is water-repellent polyethylene surgical drape sheeting (at least 38 µm thick), which can be cut to adequately cover the transducer. Its thickness makes it a more reliable barrier to water than commercially available plastic wraps. Less effective alternative covers include condoms and gloves (Storment et al 1997). A material other than latex should be used for patients who are known to be latex-sensitive (Douglas et al 1997).

At the end of each procedure, the cover should be removed and discarded, taking care not to contaminate the surface of the instrument. Surgical drape is also preferred for this reason. After removing all the gel from the transducer, the instrument should be cleaned (AIUM 1995) with warm water and a neutral detergent in accordance with the manufacturer’s instructions. A small brush may be used for crevices or angles on the instrument, depending on its design.

Although use of a disposable cover reduces the level of risk of transmission of infection or contamination, covers can be perforated or contain small, unrecognised defects. For this reason, after thorough cleaning in warm water and detergent, the transducer should be soaked in a high-level instrument-grade disinfectant recommended by the transducer manufacturer for the time required for high-level disinfection. After disinfection, the instrument should be thoroughly rinsed and dried before reuse with a new cover.

For abdominal ultrasound in cases where there is an open wound, a disposable cover should also be used. After the procedure, the cover should be discarded and the probe reprocessed.

Gel used in ultrasound procedures can also be a potential source of infection; care should be taken to ensure there is no risk of contamination of the gel used during the procedure (Weist et al 2000). For surgical use, gel should be sterile. Gel containers should not be refilled or reused, because they may have become contaminated.
Further information on ultrasonic devices can be found in Guidelines for Disinfection of Transvaginal Transducers (ASUM 1999), which can be obtained from the Australasian Society for Ultrasound in Medicine (see Appendix 7). However, these guidelines should be read in conjunction with AS/NZS 4187 (and also see Section 17.8.2 concerning the use of high-level instrument-grade disinfectants for instruments to be used in semicritical sites).

17.9 Thermometers

Glass thermometers are reusable, but they should be used on one patient only, for the duration of that patient’s stay in the health care establishment, and then be cleaned and disinfected before use on other patients. Thermometers should be cleaned with warm water and detergent, then disinfected with alcohol (an alcohol wipe is suitable and soaking is not necessary) and stored dry. For home visits, thermometers may be transported in a carry case — this should either be disposable or be cleaned and disinfected together with the thermometer before reuse.

The use of disposable covers for thermometers used in body cavities, including the ear, mouth, vagina or rectum, should be encouraged. The thermometer should be wiped over after each use. However, daily cleaning and disinfection, as above, is still required, because covers may be defective or become damaged during use. Thermometers used in sterile body cavities must be sterile.

17.10 Cryotherapy

Care should be taken to ensure that liquid nitrogen canisters do not become contaminated during cryotherapy procedures, because viruses and bacteria may survive immersion in liquid nitrogen. Where liquid nitrogen is used for routine removal of warts, sufficient liquid nitrogen should be decanted into a styrofoam cup and a fresh cotton-tipped applicator should be used for each application. Any residual or remaining contents of the cup should be discarded. Similar precautions should be taken with carbon dioxide and other cryotherapy systems used in the treatment of skin conditions (see Section 34.2.1).
17.11 Ophthalmic and optometry equipment

The cornea and conjunctiva are regarded as semicritical sites. Contact lenses should not be shared. Diagnostic contact lenses should be reprocessed in accordance with the manufacturer’s recommendations. Internal components of the eye are sterile. Instruments that enter the eye or contact components that enter the eye (e.g., phacoemulsification handpieces) should be reprocessed as sterile instruments.

Because of the known infectivity of CJD in the eye (see Table 31.1), special care should be taken when patients in either higher- or lower-risk categories for CJD (see Section 31.9) are undergoing ophthalmic or optometric procedures. Instruments that come into contact with the posterior segment of the eye (retina, optic nerve) in these patients should be either destroyed or reprocessed and quarantined in accordance with the guidelines in Tables 31.4 and 31.9.

17.12 Implantable items

Implantable items must be sterile at the time of use, and should not be ‘flash’ sterilised (AS/NZS 4187). Implanted devices should not be reimplanted.

Some manufacturers have TGA approval to allow reprocessing of implantable items (see Section 16.2.4) that have been opened but have not had contact with tissue (that is, have been opened but not used). Manufacturers’ instructions for reprocessing must be followed explicitly in these instances.

17.13 Instruments labelled ‘single-use device’

Instruments labelled ‘single-use device’ should be discarded after use, in accordance with manufacturers’ recommendations and consistent with their TGA approval status.

Establishments may wish to consider reprocessing some expensive instruments labelled ‘single-use device’ (e.g., cardiac solid electrodes).

The TGA’s advice about reprocessing ‘single-use’ instruments is as follows:

Devices listed on the Australian Register of Therapeutic Goods (ARTG) as ‘single use’ should be used only once. In July 2001, the Australian Health Ministers’ Advisory Council (AHMAC) agreed that any reprocessing of single use devices for reuse is a manufacturing activity and that this should be regulated by the TGA. AHMAC also agreed that the regulation of the re-manufacture of single use devices for reuse should meet the same regulatory requirements and standards as apply to the original manufacturer. Any reprocessing would therefore only occur in a Good Manufacturing Practices (GMP) licensed facility that includes a monitoring system.
to ensure microbiological safety and product integrity. The TGA is developing a regulatory proposal for reprocessing of single use devices, but is not in the position to license reprocessing facilities until this regulatory proposal has been fully considered by all relevant stakeholders and finalised.

This option may be used only for instruments that are capable of withstanding reprocessing that involves additional heat or chemical sterilisation methods without compromising product safety and integrity.
18 Environmental cleaning and spills management

Key points

- Routine cleaning of work areas is important because deposits of dust, soil and microbes on surfaces can transmit infection.
- Health care establishments must have management systems for dealing with blood and body substance spills. Protocols for spills management should be included in procedures manuals and emphasised in ongoing education and training programs.
- The basic principles of spills management are as follows:
  - standard precautions apply where there is a risk of contact with blood or body substances;
  - spills should be cleaned up before the area is disinfected; and
  - aerosolisation of spilled material should be avoided.
- Standard cleaning equipment (including solutions, water, buckets, cleaning cloths and mop heads) should be readily available for spills management and stored in a place known to all health care workers.
- All cleaning items should be changed routinely. They should also be changed immediately following the cleaning of blood or body substance spills.
- Contaminated areas such as operating rooms or isolation rooms must be cleaned after each session.

18.1 Routine environmental cleaning

Regular cleaning of work areas is important for the successful application of standard and additional precautions for controlling infection in health care establishments.

Deposits of dust, soil and microbes on environmental surfaces can transmit infection. Routine cleaning and maintenance is therefore necessary to maintain a safe environment in health care establishments. The following basic principles should be followed:

- written cleaning protocols should be prepared, including methods and frequency of cleaning; and
Part 3—Effective work practices and procedures

Infection Control in the Health Care Setting

18.1.1 Surface cleaning

Floors should be cleaned daily, or as necessary.

• Floors in hospitals and day-care facilities should be cleaned daily, or as necessary, with a vacuum cleaner fitted with a particulate-retaining filter, which should be changed in accordance with the manufacturer’s instructions (Ayliffe et al 1999).

• The exhaust air should be directed away from the floor to avoid dust dispersal.

• A ducted vacuum cleaning system can also be used, as long as safe venting of the exhaust air is ensured.

• Damp dusting is acceptable. Brooms disperse dust and bacteria into the air and should not be used in patient/clinical areas. Dust-retaining mops, which are specially treated or manufactured to attract and retain dust particles, do not increase airborne counts as much as ordinary brooms and remove more dust from surfaces (Ayliffe et al 1999). However, brooms and dust-retaining mops should not be used in clinical areas where there is a high risk of infection associated with dust (eg burns units).

Procedure for routine surface cleaning

• Work surfaces should be cleaned and dried before and after each session, or when visibly soiled. Spills should be cleaned up as soon as is practical (see Section 18.2).

• A neutral detergent and warm water solution should be used for all routine and general cleaning.

• When a disinfectant is required for surface cleaning, the manufacturer’s recommendations for use and occupational health and safety instructions should be followed.

• Buckets should be emptied after use, washed with detergent and warm water and stored dry.

• Mops should be laundered or cleaned in detergent and warm water, then stored dry.
**The ideal detergent**

Detergents used for environmental cleaning should physically remove dirt/soils, suspend it in water and rinse free with little or no residue. Detergents should be low irritant to minimise skin problems for HCWs in contact with them.

Neutral pH detergents are best for environmental cleaning because they are less likely than acid or alkali detergents to damage metals such as stainless steel (Gardner and Peel 1998) or to cause skin irritation.

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**Wet areas**

Toilets, sinks, washbasins, baths, shower cubicles, all fittings attached to ablution facilities and surrounding floor and wall areas should be cleaned at least daily, or more frequently as required. Additional cleaning may be required for particular rooms (eg rooms with patients requiring additional precautions).

Cleaning methods should avoid generation of aerosols.

**Walls and fittings**

Walls, blinds and curtains should be cleaned regularly and when they are visibly soiled. Curtains should be changed regularly and as necessary. Carpets should be vacuumed daily.

**Maintenance of cleaning equipment**

Cleaning items (including solutions, water, buckets, cleaning cloths and mop heads) should be changed routinely. They should also be changed immediately following the cleaning of blood or body substance spills, or after each session for contaminated areas such as operating rooms or isolation rooms. These items should be washed/cleaned in detergent and warm water, rinsed and stored dry between uses. Detachable mop heads should be laundered between uses.

**Spills of laboratory cultures of human pathogens**

Spills of laboratory cultures should be absorbed on to paper towels and disposed of as clinical waste. The contaminated surfaces should be treated with 2.0–2.5% sodium hypochlorite, left for one hour and cleaned again with paper towels that are disposed of as clinical waste.

**Cleaning for CJD infectious agents**

Spills of central nervous system tissue or cerebrospinal fluid should be absorbed onto paper towels and disposed of by incineration. The surface should then be soaked with 1 molar sodium hydroxide or 2.0–2.5% sodium hypochlorite, left for one hour and cleaned again with paper towels that are disposed of by incineration.

Spills of blood or other body fluids and tissues should be cleaned using standard spill management procedures.
Gloves used as personal protective equipment when cleaning contaminated surfaces should be incinerated after use.

**DISCUSSION POINT**

**To disinfect or not to disinfect?**

Disinfectants are often used to decrease the risk of exposure to bloodborne viruses after spills of blood or body substances onto environmental surfaces. However, viruses are more fragile than bacteria and require a living cell to remain viable. Therefore, removing physical debris, including any proteinaceous matter, cleaning with detergent and water and leaving dry is all that is routinely required to remove viruses.

Where there is the possibility of some material remaining on a surface where cleaning is difficult (eg between tiles) and there is a possibility of bare skin contact with that surface, then a disinfectant may be used after the surface has been cleaned with detergent and water (see Section 18.2.1).

### 18.2 Management of blood and body substance spills

#### 18.2.1 General

Health care establishments should have management systems for dealing with blood and body substance spills, and procedural manuals should include protocols and emphasise ongoing education or training programs. The basic principles of blood and body substance spills management are:

- standard precautions apply (see Section 2.2), including use of personal protective equipment as applicable (see Section 13);
- spills should be cleared up before the area is cleaned (adding cleaning liquids to spills increases the size of the spill and should be avoided); and
- generation of aerosols from spilled material should be avoided.

Using these basic principles, the management of spills should be flexible enough to cope with different types of spills, taking into account the following factors:

- the nature of the spill (eg sputum, vomit, faeces, urine, blood or laboratory culture);
- the pathogens most likely to be involved in these different types of spills (eg stool samples may contain viruses, bacteria or protozoan pathogens; sputum may contain *Mycobacterium tuberculosis*);
- the size of the spill (spot, small or large spill);
- the type of surface (eg carpet or impervious flooring);
- the area involved (ie whether the spill occurs in a contained area such as a microbiology laboratory or in a public area such as a hospital ward or outpatient area); and
- whether there is any likelihood of bare skin contact with the soiled surface.
It is generally unnecessary to use sodium hypochlorite for managing spills but it may be used in specific circumstances (see Section 18.1.1). It is recognised, however, that some HCWs may feel more reassured that the risk of infection is reduced if sodium hypochlorite is used routinely. In that case, the practice need not be discouraged, but the HCW should be made aware that there is no evidence of benefit from an infection control perspective.

If a spill of tissue infected with CJD occurs (eg brain tissue), the contaminated item or surface should either be destroyed by incineration or cleaned with either sodium hydroxide or sodium hypochlorite according to the guidelines given in Table 31.9.

In areas such as hospital wards, waiting rooms and patient treatment areas, blood and body substance spills should be dealt with as soon as possible. In operating rooms, or in circumstances where medical procedures are under way, spills should be attended to as soon as it is safe to do so.

Spots or drops of blood or other small spills can easily be managed by wiping the area immediately with paper towelling and then cleaning with water and detergent. A hospital-grade disinfectant can be used on the spill area after precleaning.

Where large spills have occurred in a ‘wet’ area, such as a bathroom or toilet area, the spill should be carefully washed off into the sewerage system and the area flushed with water and detergent.

Large blood spills that have occurred in ‘dry’ areas (such as a hospital ward or a patient treatment area in office practice) should be contained and generation of aerosols should be avoided.

Granular formulations that produce high available chlorine concentrations can contain the spilled material and are useful for preventing aerosols. A scraper and pan should be used to remove the absorbed material. The area of the spill should then be cleaned with a mop and bucket of water and detergent. The bucket and mop should be thoroughly cleaned after use and stored dry.

Care should be taken to thoroughly clean and dry areas where there is any possibility of bare skin contact with the surface (eg on an examination couch).
18.2.2 Cleaning equipment (spills kit)

Standard cleaning equipment, including a mop and cleaning bucket plus cleaning agents, should be readily available for spills management and should be stored in an area known to all HCWs. This is particularly important in patient areas such as hospital wards or treatment areas. To facilitate the management of spills in areas where cleaning materials may not be readily available, a disposable ‘spills kit’ could be used, with the following items:

- a large (10 L) reusable plastic container or bucket with fitted lid, containing the following items;
- appropriate leakproof bags and containers for disposal of waste material;
- a designated, sturdy scraper and pan for spills (similar to a ‘pooper scooper’);
- about five sachets of a granular formulation containing 10,000 ppm available chlorine or equivalent (each sachet should contain sufficient granules to cover a 10-cm diameter spill);
- disposable rubber gloves suitable for cleaning (vinyl gloves are not recommended for handling blood);
- eye protection (disposable or reusable);
- a plastic apron; and
- a respiratory protection device (for protection against inhalation of powder from the disinfectant granules, or aerosols, which may be generated from high-risk spills during the cleaning process).

With all spills management protocols, it is essential that the affected area is left clean and dry. Disposable items in the spills kit should be replaced after each use of the kit.

Sodium hydroxide spills kits should be available for areas at risk for higher-risk CJD spills, such as neurosurgery units, mortuaries and laboratories.

18.2.3 Spills in laboratories

The handling of spills within laboratories depends on the nature of the material and the volume. Small spills that can be cleaned up without generating aerosols can be managed as outlined above. Large spills of high-risk material with generation of aerosols will require the use of personal protective equipment, including appropriate respiratory protection.

Further details of spills management in laboratories can be found in AS/NZS 2243.3.1

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Key points

Linen and laundry

+ Health care establishments and commercial linen services should have documented policies and procedures for the collection, transport and storage of all linen. Appropriate personal protective equipment should be worn when handling soiled linen. Linen heavily soiled with body substances or other fluids should be contained within suitable, securely closed, impermeable bags.

Food services

+ Special conditions apply to food-handling procedures in health care establishments because some patients are at increased risk of contracting severe foodborne illnesses.

+ Preparation of food requires particular attention to handling of raw materials, personal hygiene, kitchen hygiene and time–temperature control of all food-handling operations, including cooking, cooling, reheating and distribution.

+ Food handling should comply with relevant State/Territory regulations and with national food safety standards.

+ Food service departments should use a food safety plan based on the ‘hazard analysis critical control points’ (HACCP) approach to food preparation rather than a traditional (recipe-based) approach.

+ Trolleys and refrigerators should be used only for their designated purposes.

19.1 Hospital laundries and commercial linen services

Health care establishments and commercial linen services should have documented policies and procedures for the collection, transport, processing and storage of all linen. AS/NZS 4146 provides guidelines for correct laundry practice. Standard precautions should be followed (see Section 2). The basic principles of linen management are as follows:

- place linen in appropriate bags at the point of generation;

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• contain linen heavily soiled with body substances or other fluids within suitable impermeable bags and close the bags securely;
• do not rinse or sort linen in patient care areas (sort it in appropriate areas); and
• separate clean from soiled linen and transport/store separately.

Care should be taken to ensure that sharps and other objects are not inadvertently discarded into linen bags. Bags should not be overfilled, as this may prevent closure, increase the risk of rupture of the bags in transit and increase the risk of injury to waste handlers.

AS 4480.1\(^2\) provides guidelines for correct care and laundering of sheepskins.

A hot water and detergent solution is adequate for cleaning most laundry items. Water temperature and time for correct thermal disinfection is stated in AS/NZS 4146. Disposable linen and protective clothing should be used for neurosurgery or interventional neuroradiology on patients in a risk group for CJD (see Section 31.12 and Table 31.6).

19.2 Food services

19.2.1 Introduction

Food service establishments are frequently identified as places where mishandling of food has led to outbreaks of foodborne disease (Bryan 1990). Hospitals and other health care establishments represent a special case of food service operation.

Some patients are at increased risk of severe foodborne illness, and particular care must be taken to minimise the risk of infection or toxic poisoning through the food service system. Historically, *Clostridium perfringens*, a spore-forming anaerobe able to multiply at 12–55°C, has posed special problems in food service situations (Andersson et al 1995, Ryan et al 1996, Meer et al 1997). However, any foodborne pathogen poses some risk; with the array of food service systems now available to health care establishments, no organism can be singled out for special attention. *Salmonella* spp (Dryden et al 1994, L’Ecuyer et al 1996), *Listeria monocytogenes* (Elsner et al 1997) and viruses (Cáceres et al 1998) have been implicated in recent overseas outbreaks of health care associated infections. Some outbreaks have occurred in foods usually considered to be ‘low risk’ (Lund 1993, Nguyen and Carlin 1994, Hocking et al 1997), indicating that all foods should be considered to be potential sources of infection and included in the food safety program.

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Preparation of food requires attention to raw materials, personal hygiene, kitchen hygiene, and especially time–temperature control of all food-handling operations, including cooking, cooling, reheating and distribution.

19.2.2 Australian food standards

Food preparation and handling in health care establishments should comply with relevant State/Territory regulations. Assuring safe food requires identification and control of microbiological, chemical and physical hazards. Since 1995, Food Standards Australia New Zealand (formerly the Australia New Zealand Food Authority) has been developing uniform national food safety standards based on the ‘hazard analysis critical control points’ (HACCP) approach (see Section 3.2). Four standards have been drafted that require businesses to:

- notify the relevant authority of their existence and the nature of the business;
- develop and comply with a food safety program;
- carry out specific practices in relation to food handling, cleaning/disinfecting and personal hygiene;
- provide for food recalls;
- ensure that staff and supervisors have skills and knowledge in food safety; and
- ensure that food premises and equipment meet with specified design and construction requirements.

This approach gives industry greater flexibility to achieve safe food outcomes, whilst incorporating modern food safety practices based on a preventative approach. When finalised, the standards will be adopted into the Australia New Zealand Food Standards Code (FSANZ 2000, 2001) and incorporated into the food standards legislation of each State and Territory. Each State and Territory is currently at a different stage in implementing these standards.

19.2.3 HACCP-based food safety programs

HACCP is an approach to infection control that identifies specific hazards and specifies measures for their control. It is based on seven basic principles, which can be applied to identify hazards and determine and monitor critical control points.

The Victorian Government has anticipated the national standards, and already requires food businesses to develop HACCP-based food safety programs and register these with local councils (Food Safety Victoria 1999). This includes food service operations in health care establishments, although such establishments may not strictly be food businesses as defined in the draft legislation.
It seems likely that other States and Territories will follow the Victorian position, requiring kitchens in health care establishments to comply with the proposed legislation and have their food safety plans registered and subjected to external audit. Even if this does not occur, there are sound technical and management reasons for kitchens in health care establishments to develop and implement HACCP-based food safety plans relevant to their processes.


Food service departments should take a systematic approach to HACCP.

It is recommended that food service departments in health care establishments take a systematic approach to HACCP, instead of the traditional approach based only on cooking procedures. The ‘recipe-based’ approach may not address all the steps that a food product passes through, including receipt of goods, meal service and distribution.

An important aspect of a food safety plan is the development of an accurate flow diagram for each production system or process. Figure 19.1 shows a theoretical flow diagram that can be applied to many food service lines. Following observation during normal production, the operation is divided into the key activities. Minor activities that occur at each step are also noted for consideration. Using the flow diagram as a guide, the HACCP team should conduct a hazard audit for each process line. An example is given in Table 19.1.

### Table 19.1  Example hazard audit table for a product

<table>
<thead>
<tr>
<th>Step</th>
<th>Hazard</th>
<th>Control measure</th>
<th>Critical control points</th>
<th>Critical limit</th>
<th>Monitoring procedure</th>
<th>Corrective action</th>
<th>Records</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Campden and Chorleywood Food Research Association (1997)
19.2.4 Support programs

The application of good manufacturing practice throughout the food service chain is an integral part of a properly constructed HACCP plan. This includes factors that have become known as prerequisite or support programs, including supplier control, cleaning and sanitation, personal hygiene and staff training. The Australia and New Zealand Food Standards 3.2.2 and 3.2.3 cover the issues that should be addressed by HACCP support programs. Further information is available in the literature (e.g., Sperber et al. 1998).

Food handlers’ personal hygiene is particularly important, as bacteria can be transferred from the handler to the food and food-contact surfaces during preparation. Furthermore, some people are carriers of pathogenic organisms. For example, 2–6% of people are permanent carriers of *Listeria monocytogenes* (Paul et al. 1994, Hocking et al. 1997).

Figure 19.1  Theoretical HACCP flow diagram for many food service lines

Good manufacturing practice is an integral part of a properly constructed HACCP plan.
19.2.5 Special issues for health care establishments

Cook–chill food production systems

An increasing trend in health care establishments is to use ‘cook–chill’ food service systems to extend the life of prepared food products. The time and temperature control of product chilling and subsequent storage and handling are critical in cook–chill systems because bacteria can grow in the extended time between food production and consumption. The storage temperature for cook–chill systems should be 0–3°C, which is lower than that required for conventional cold storage (Institute of Hospital Catering 1997, NSW Health 1995ab). The storage time (shelf life) must also be closely monitored and may vary according to the production method used, as well as the storage temperature (Abhayaratna and Zemanovic 1992, NSW Health 1995ab).

Listeria monocytogenes

Although storage below 3°C controls the growth of most pathogenic bacteria, *Listeria monocytogenes* can multiply at temperatures as low as 1°C. Although growth is slow at such low temperatures, prolonged storage of products can result in significant levels of bacteria (Hocking et al 1997).

To control the risk of *Listeria monocytogenes* infection, food safety programs in health care establishments need to use strict time and temperature control, alternative bactericidal processes (eg chlorine sanitation of raw vegetables) and avoidance of certain high-risk foods (Brackett 1987, Hurst and Schuler 1992, Bartlett 1993).

Texture modified meals

Texture modified meals, which are provided to people with chewing and/or swallowing problems, have a greater risk of bacterial contamination than other foods. This category of food includes all food that has been pureed or minced after cooking (Tallis et al 1999) Where possible, food should be pureed before cooking. Where this is not possible (for example with pureed fruit), particular care must be taken to minimise cross-contamination. Strict time and temperature control must be maintained (Food Safety Victoria 1999).

Nutritional implications

There have been recommendations that some items should be removed from the menus of health care establishments or should have restricted shelf lives, due to the potential risk associated with these foods (eg dairy-based desserts and drinks, some salad vegetables, and cold cut meats) (NSW Health 1999). However, this approach would make it more difficult for health care establishments to provide adequate nutrition to some patient groups, and could increase the incidence of malnutrition (Zador and Truswell 1987, Ferguson et al 1997) and lead to poorer patient outcomes (Reilly et al 1988, Coats et al 1993, Callagher-Allred et al 1996, Chima et al 1997).
With the implementation of an appropriate HACCP-based food safety program that addresses the process issues of the health care establishment concerned, such measures should not be necessary.

19.2.6 Food handlers and hygiene

HCWs who handle food should receive appropriate education about personal hygiene and foodborne diseases.

HCWs with active diarrhoea should not handle food until they have been cleared for food-handling duties by a medical practitioner. Open skin lesions should be covered to prevent potential food contamination with bacteria (eg staphylococci). HCWs who are carriers of certain enteric pathogens (eg salmonella) should obtain clearance from a medical practitioner before resuming food-handling duties. State/Territory health department regulations governing food handlers should be followed.

19.3 Refrigerators

Food should not be stored with contaminated material, clinical specimens or medical products such as drugs, vaccines and blood. Food storage refrigerators for HCWs should be clean and the temperature monitored according to the Food Standards Code (FSANZ 2001).

Vaccines and other medications should be stored in accordance with the manufacturer’s instructions and the ‘cold chain’ maintained as described in The Australian Immunisation Handbook 8th Edition (Section 1.10; NHMRC 2003).

Blood should be stored in accordance with AS 3864\(^3\) (see Section 25.3.5).

19.4 Ice machines

Ice machines in health care establishments have been implicated in outbreaks of infection and as potential reservoirs of infectious agents (Laussucq et al 1988, Burnett et al 1994, Graman et al 1997) and should comply with AS/NZS 3350.2.24. Ice machines should be maintained and serviced regularly. Implements (eg scoops, tongs) should be used only for their intended purpose. Water supplied to ice machines should comply with State/Territory guidelines for potable water.

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\(^3\) AS 3864 (1997) and Amendment 1 (1998) Medical refrigeration equipment — For the storage of blood and blood products.

19.5 Trolleys

Mechanical transport is often the most efficient way of distributing equipment in hospitals and other large health care establishments. Trolleys should be appropriate for their intended purpose, be dedicated to one purpose (food, linen, sterile equipment, waste etc) and should be enclosed or draped. Trolleys should comply with occupational health and safety requirements and should be cleaned every day (more frequently when soiled) to make sure they are maintained in a clean, hygienic condition.
20 Therapeutic devices

Key points

**Indwelling urinary devices**
- Indwelling urethral and suprapubic catheters provide a route for infectious microorganisms to enter the urinary tract and bladder.
- Devices should not be left indwelling unless absolutely necessary because the incidence of infection increases with the length of time the catheter is in place (almost 100% by one month).
- Health care establishments should ensure that health care workers (HCWs) are trained in the correct aseptic insertion methods and in the maintenance of devices to reduce the risk of infection.
- Patients should be told about any risks associated with their device and about its maintenance. The importance of noninterference should be stressed.

**Intravascular access devices**
- Intravascular access devices are potential sites for local infections and provide a route for infectious agents to enter the bloodstream and cause serious bloodstream infections.
- Intravascular devices should only be used when absolutely necessary and must not remain in situ unnecessarily.
- Health care establishments should ensure that HCWs are trained in strategies to minimise the risk of infection, including the rigorous use of aseptic technique for insertion and maintenance of the device.

20.1 Indwelling urinary devices — urethral and suprapubic catheters

20.1.1 Description and role

A urinary catheter is a tubular flexible or nonflexible instrument passed into the bladder either through the urethra or through the abdominal wall above the symphysis pubis to:

- empty the contents of the bladder;
- obtain a sterile urine specimen; or
- determine the amount of residual urine in the bladder after voiding.
A flexible urinary catheter inserted into the bladder either via the urethra or abdominal wall may be left ‘indwelling’ as a passage for drainage.

20.1.2 Infection risks

Indwelling urethral and suprapubic catheters are a potential portal of entry for infectious microorganisms. These can enter the bladder from colonisation at the entry site or by microbes contaminating ports from external sources, such as the hands of health care workers (HCWs) or the skin of the patient.

About 10% of hospitalised patients have an indwelling urinary catheter. The incidence of infection is directly related to the length of time that the catheter is in place. For the first two weeks of catheterisation, there is a linear relationship between acquisition of new infections and the duration of catheterisation; 50% of patients become infected by day 15 of catheterisation, and almost 100% by one month (APIC 1999).

A break in aseptic technique during the insertion of the catheter or when servicing the drainage/collection system may allow microorganisms to enter and cause a urinary tract infection. Serious infections associated with indwelling urinary devices can occur, with 1–2% proceeding to septicaemia (APIC 1999).

The following strategies should be used to avoid infection:

• The device should not be left indwelling unless absolutely necessary.

• The same aseptic precautions should be carried out for urethral or suprapubic catheterisation as for a minor surgical procedure.

• HCWs who perform catheterisation should be trained and competent in the technique (Pratt et al 2001).

• To avoid trauma, HCWs should select the smallest bore catheter that will not be associated with leakage.

• The urethral insertion site should be cleaned (using either soap or water or a suitable antiseptic solution) and then dried.

• Sterile water-soluble lubricant must be applied to the catheter before it is inserted into the urethra, to reduce friction and trauma to the urethral opening.

• A closed sterile drainage/collection system should be attached to the catheter and maintained at all times.

• If there is no balloon on the catheter (to hold it in place), the device should be stabilised against movement.

• If the site is to be dressed (e.g. suprapubic), the dressings surrounding the device must be sterile.

Faecal bacteria can be transported to the urinary meatus. Wiping following bowel movements should be carried out from front to back.
Vaginitis should be treated promptly and effectively to reduce the risk of spreading infection from the vagina to the opening of the urethra.

### 20.1.3 Management issues

#### Health care workers

Policies and procedures regarding the insertion, maintenance and changing regimes of indwelling urinary devices should be written and reviewed every three years and/or updated as necessary. These policies should be readily accessible.

Orientation programs and regular education programs should include instruction on the importance and principles of catheterisation and the care of the patient with an indwelling urinary device.

#### Patients

The patient should understand the nature of an indwelling urinary device and the reason for its insertion. Emphasis should be placed on noninterference with the device or the collection system other than by people who are competent in the use of the device and in aseptic technique.

In many cases there are no symptoms in catheterised patients who have significant bacteriuria. In others, suprapubic pain and urethral burning may develop. The patient should alert HCWs to pain or discomfort, fever, chills or sweats.

#### Patient care and maintenance of devices

- Increased intake of fluids should be encouraged (unless medically contraindicated) to facilitate the removal of microorganisms and debris.
- Perineal/vulval washing should be carried out regularly (twice daily), as well as after a bowel motion.
- Cleaning of the catheter and the insertion site should be carried out regularly (twice daily) to avoid encrustation.
- Closed drainage/collection systems should not be opened unless necessary.
- The ports should be aseptically swabbed with an antimicrobial solution and allowed to dry immediately before use in order to prevent the entry of microorganisms into the line.
- The interruption of urine flow should be avoided, as should the interruption of routine irrigation of urinary catheters.
- Urine samples should be collected from the closed system with a syringe and needle (after cleaning the port), not by breaking the connection between the catheter and the drainage/collection system, and never from the drainage tap attached to the collection container itself.
• Before collecting urine samples or emptying the collection container, HCWs should wash their hands and then put gloves on. They should wash their hands after removing the gloves.

• The collection container should neither be raised above the level of the urethra nor allowed to trail on the floor.

• If there is a risk of urinary reflux when the patient is being moved, the tubing should be clamped temporarily, then unclamped afterwards.

Further maintenance issues

Additional measures that have been applied to the management of urinary catheters, but for which there are no data confirming efficacy, include:

• replacing the collecting system when sterile closed drainage has inadvertently been violated;

• separating infected and noninfected catheterised patients; and

• regular bacteriological monitoring of catheterised patients.

The following points should also be noted:

• Routine changing of urinary catheters at arbitrarily fixed intervals in the absence of leakage, malfunctioning or palpable concretions in the lumen is not recommended.

• Continuous irrigation of the bladder as an infection control measure has not been shown to reduce urinary tract infections.

• Applying antimicrobial ointment to the urethral meatus has not reliably been shown to reduce the incidence of urinary tract infections.

• The addition of antiseptic or antimicrobial agents to the collection system container has not yielded conclusive results (APIC 1999).

Devices

Before use, all equipment must be checked for:

• expiry dates;

• integrity of containers/packages; and

• the correct amount of sterile water required to be inserted if the device has a balloon.

After insertion:

• the catheter and drainage system must be inspected at least daily and the results documented; and

• the date and time of catheter changes should be documented.
In infection control in the health care setting, the optimal time limit for replacing catheters depends upon individual circumstances and the type of catheter used. Health care establishments should have written policies on the time limit.

In establishments (or particular areas within establishments) where the incidence of catheter-related urinary tract infections is higher than acceptable standards from national health care associated infection surveillance data, consideration may be given to silver-hydrogel-impregnated indwelling urinary catheters. In a recent study it was found that this antiseptic impregnated catheter was most effective in reducing catheter-associated urinary tract infections (CAUTIs) if infection was caused by enterococci, coagulase-negative staphylococci or candida, but had little effect on CAUTIs caused by gram-negative bacilli (Maki et al 1998).

Environment

Urethral catheterisation is usually carried out in a clinical setting and the environment should be managed as for minor surgical procedures. Before the procedure, the environmental surfaces involved should be effectively cleaned. The same effective cleaning should be done before the insertion of a suprapubic catheter, although this procedure is often carried out in an operating room.

Device reprocessing

Indwelling urinary catheters have narrow hollow lumens and cannot satisfactorily be cleaned. Also, the physical characteristics of the latex or plastics may not withstand cleaning and resterilising (Collignon et al 1996). These items, together with drainage/collection systems, are manufactured for single use only and must not be reused.

20.1.4 Monitoring and surveillance

Routine bacteriological testing is not cost effective. Health care establishments should devise a sampling system concentrating on departments with higher rates of indwelling urinary device related infections and act upon the results (Meers et al 1997).

20.2 Intravascular access devices (catheters)

20.2.1 Description and role

Indwelling intravascular access devices provide a route for administering fluids, blood products, nutrients and intravenous medications; for monitoring haemodynamic function; for maintaining emergency vascular access; and for obtaining blood specimens. They are an integral part of patient care (Pearson 1996). Intravascular devices are usually inserted into veins — intravenous insertion — but can, on occasion, be intra-arterial (e.g. for blood pressure monitoring). Most venous catheters that are inserted are short (less than 5 cm) and are inserted into peripheral veins (e.g. smaller veins in the arms).
Central venous catheters (CVCs) are increasingly being used; these are usually much longer (more than 15 cm) and remain in place for longer than peripheral vein catheters. Central veins are defined as the larger veins of the body that lie within the ‘central’ parts of the body (chest and abdomen). Some CVCs may be inserted via a peripheral vein site, with their tip advanced until it is situated within a central vein. These are known as peripherally inserted central catheters (PICCs).

Intravascular access devices provide potential routes for infectious agents to cause local infection or to enter the bloodstream. They are now a common source of serious illness or death for some patients. The risk of infection associated with them can be minimised by adherence to appropriate infection prevention precautions. The use of intravascular devices is also associated with noninfective risks (eg pneumothorax occurring during CVC insertion via the subclavian vein).

To minimise the risks associated with catheter use, intravascular access devices should be used only when absolutely necessary and must not remain in situ unnecessarily.

**20.2.2 Infection risks**

Serious infections associated with intravascular devices are common. In Australia over 3500 bloodstream infections occur per year (bacteraemia or fungaemia). In the United States and Europe, there are likely to be over 500,000 bloodstream infections per year. The reported associated mortality rate varies between 5% and 25%. Many patients have serious underlying diseases, making them more susceptible to infections. The increased mortality in seriously ill patients that can be directly attributed to intravascular catheter bloodstream infection is about 10% (Crump and Collignon 2000).

Two or more prospective studies have identified the following independent risk factors for intravascular device related infections (APIC 1999):

- prolonged hospitalisation before insertion of the intravascular device;
- prolonged duration of insertion of the device;
- heavy microbial colonisation of the insertion site;
- heavy microbial colonisation of the cannula/catheter hub;
- catheter insertion in the internal jugular vein compared with subclavian or femoral vein insertion; and
- antibiotic use during catheterisation.

Changes in medical and nursing practices can influence many of these risk factors. For example, prolonged duration of catheter insertion is common even when the intravascular catheter is no longer essential. CVCs should not be left in place for intravenous feeding (total parenteral nutrition) when absorption may be possible through a nasogastric tube (Collignon 1995). Heavy
colonisation of the catheter hub is not uncommon, but is usually secondary to contamination by the hands of HCWs. This can be reduced by improved aseptic technique and by trying to minimise the number of times the catheter hub is flushed or used.

Most infectious agents reach the intravascular device tip from skin flora colonising the entry site wound or microbes contaminating the delivery system hubs from external sources (eg HCWs’ hands or the skin of the patient).

Contamination of infusion solutions is currently considered a relatively rare occurrence.

20.2.3 Strategies for minimising infection

The risk of cross-infection by HCWs can be reduced by:

• the use of insertion techniques that ensure sterility of the device while it is being inserted;

• thorough handwashing with an appropriate antimicrobial solution before putting on sterile gloves and inserting the intravascular device, or when changing/maintaining solution containers, lines or dressings;

• cleaning the insertion site with an effective antiseptic approved by the health care establishment’s pharmacy/drugs and therapeutics committee (the cleaned area must be completely dry before the device is inserted); and

• for CVC catheters, the wearing of sterile barrier attire and the use of large sterile drapes during the insertion of central lines or guide-wire exchange.

Strategies that best reduce the risks are:

• adequate aseptic technique during insertion and maintenance of the device;

• the use of new device materials that decrease the adherence of infectious agents; and

• appropriate limits on the duration of device use (APIC 1999).

Other strategies for avoiding infection are:

• excess hair removal by clipping (not shaving) before insertion; and

• selection of a catheter with a smaller lumen than that of the vessel to be entered to reduce the incidence of trauma, which predisposes to infection.
20.2.4 Management of devices

Health care workers

Policies and procedures regarding the insertion and maintenance of intravascular access devices should be written and reviewed every three years and/or updated as necessary and approved by an authoritative body (infection control committee and/or drugs and therapeutics committee). These policies must be readily accessible.

Maintenance guidelines should include:

• hub and injection port care;
• whether CVC and PICC line tips must be sent for microbial examination and culture upon removal (usually only where clinical sepsis was suspected would catheters be sent for culture); and
• the optimal time after which solution containers with additives should be changed.

During orientation programs, relevant HCWs should be made aware of the importance and principles of safe intravascular access. The health care establishment should provide planned, regular education programs for all HCWs whose duties include any aspect of intravascular access and management.

Patients

The patient should understand the nature and reason for any intravascular therapy. Only appropriate HCWs should handle the cannula/catheter, lines and solution containers.

Devices

• Before use, all equipment must be checked for:
  – expiry dates;
  – integrity of the container/package;
  – macroscopic contamination; and
  – clarity of solution (if meant to be clear).

• The insertion sites must be cleaned with antimicrobial solution and allowed to dry (see Section 7.3). Insertion of the devices must be performed using aseptic technique.

• Stabilisation of the devices (with tape) reduces the potential for complications such as phlebitis, subcutaneous infiltration, sepsis and cannula/catheter movement. Sterile tape only should be used to stabilise the devices. Dressings covering the devices must be sterile.

• The date and time of insertion should be documented in the patient’s progress notes, in the care plans and on the occlusive dressing.
• The injection ports must be aseptically swabbed with an antimicrobial solution immediately before use, in order to prevent infectious agents entering the vascular system.

• The site must be inspected, attended and documented at least daily. Regular, standardised site inspection and dressing change minimises intravascular device related sepsis.

• It is recommended that administration sets be changed aseptically every 24–48 hours, upon suspected contamination or when the integrity of the product has been compromised. The type of solution or frequency of drug administration may dictate a more frequent set change.

• Peripheral venous sites should be changed every 48 hours (up to 72 hours if therapy is to cease).

• The device, associated giving set and site of insertion should be changed at the first sign of phlebitis (Collignon et al 1984).

• All catheters inserted in a lower extremity or without proper asepsis during an emergency must be changed as soon as a satisfactory site can be established in an upper extremity.

• Removal of the device should be carried out aseptically and a sterile dressing applied.

• The date and time of site changes must be documented.

• The optimal time limit for replacing catheters, administration sets or fluid containers depends upon individual circumstances. Duration of use limits and the priority assigned to corrective measures should be established relative to reported aggregate infection rates and where possible to established benchmarks. Health care establishments that fail to achieve low infection rates should consider adopting more conservative limits (Health Canada 1997).

Where the incidence of catheter-related bloodstream infection in a health care establishment (or particular area of a health care establishment) remains significantly greater than 1%, or greater than expected based on national health care associated infections surveillance data, consideration should be given to the use of commercially available antiseptic-impregnated cuffs and catheters. Silver-impregnated cuffs or chlorhexidine–silver sulfadiazine-impregnated catheters should be considered if the catheter duration is less than 2–3 weeks (APIC 1999). When prolonged intravenous access via a CVC is likely, catheters such as Hickman catheters — which have a cuff, are tunneled subcutaneously and are associated with a lower sepsis rate than standard CVCs — should be used.
Environment

Dust, soil and microbial contaminants on environmental surfaces are not very likely potential sources of nosocomial infection whilst intravascular access devices are in situ. However, the environmental area and surfaces should be effectively cleaned before intravascular devices are cleaned, maintained or removed.

Device reprocessing

Intravascular devices are manufactured for single use only and must not be reused. The narrow lumens of catheters and lines cannot be satisfactorily cleaned and the plastic may not withstand cleaning and sterilising (Collignon et al 1996). These items, together with solution containers, are manufactured for single use only and must not be reused.

20.2.5 Monitoring and surveillance

Each health care establishment must tailor its surveillance systems to maximise the use of all health care resources, given outcome priorities, population characteristics and institutional objectives. Establishments should clearly define the nature of intravascular device-associated infections, the documentation required and any action to be taken.

Data collection should be tied to action in risk reduction, in process and systems improvement and in the achievement of desired outcomes for patient care.
21 Surveillance and outbreak investigations

### Key points

- All health care facilities, including office practices, should collect data on health care associated infections, infection control breaches, outbreaks of infectious disease and antimicrobial resistance. The surveillance systems used by different health care establishments depend on the type and size of the establishment, its case mix, and the facilities and resources available.

- Effective surveillance systems can monitor changes in the rate of infection against a baseline rate, evaluate the effectiveness of new infection control policies and facilitate the early detection of outbreaks.

- A comprehensive ‘minimum data set’ forms the basis of all surveillance systems. Surveillance of health care associated infections draws information about the agent, host, environment and risk factors from a number of data sources (eg medical and pharmacy records, and laboratory data) and should include the incidence and prevalence of antibiotic-resistant bacteria and resistance genes. Postdischarge surveillance and surveillance of community-based health care practices should also be considered.

- When an outbreak is detected, the health care establishment’s infection control management system should be notified and an outbreak control team formed. The principles for investigating outbreaks in health care establishments are the same as for community-based outbreaks; to stop the outbreak and prevent it reoccurring, an epidemiological investigation is conducted to identify the aetiological agent, the route(s) of transmission, exposure factors and the population at risk.

- Because of the increasing risk of litigation, all outbreaks, however minor, should be investigated thoroughly and the outcomes of the investigations documented. Therefore, all establishments should have adequate resources for the detection and control of outbreaks.

### 21.1 Introduction

Surveillance of health care associated infections or events is a continuous or periodic activity of data collection, analysis, interpretation and timely feedback of results to clinicians so that they may learn and apply appropriate clinical management intervention.
Surveillance of health care associated infection or events requires:

- the use of standardized definitions (where none exist, use definitions that have the widest possible peer acceptance);
- the use of standardized methodology for identification of at-risk patient groups and the cases of health care associated infection or events that manifest in these groups;
- data analysis using rates and/or process control charts (the frequency of analysis will depend on the size of the at-risk patient groups surveyed and the number of cases identified within each group); and
- timely feedback of interpretation of data to clinical and management staff.

Surveillance procedures should be carried out in each health care establishment to obtain baseline information on the frequency and type of health care associated infections at the establishment. Any increase in the rate of infection can then be quickly recognised and appropriate infection control action taken to minimise transmission to other patients and health care workers (HCWs). A change in infection rates against a baseline rate can also be used to evaluate the effectiveness of new infection control policies and procedures.

The risks to patients or HCWs of acquiring a health care associated infection are described in Section 4. The nature and frequency of such infections varies in different health care settings. For example, in acute care, hospital patients are undergoing a range of invasive procedures and antibiotics, which may facilitate the emergence of antibiotic-resistant bacteria, are used frequently. Patients in long-term care, such as residential aged care, are often immunocompromised due to age or medications. Outbreaks of foodborne infections and skin conditions such as scabies are known to occur in these environments.

Where it is necessary for a patient’s personal information, including health information, to be used or disclosed for purposes other than the purpose for which the information was originally collected, it will be necessary for establishments to take account of specific requirements under the Privacy Act 1988 and any other legislative or ethical guidelines.

The National Health and Medical Research Council 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. It is available on the Department of Health and Ageing website.¹

21.1.1 Critical incidents

If there has been a breakdown in an infection control procedure or protocol, a 'lookback' investigation may be necessary to identify, trace, recall, counsel and test patients or HCWs 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 (eg failure of sterilisation or disinfection), the local public health unit should be advised immediately.

21.2 Surveillance methods

21.2.1 General

Surveillance systems should be flexible enough to accommodate technological changes within health care establishments, shortening lengths of stay, and the necessity to provide post-discharge surveillance, including surveillance of procedures carried out in the community (eg 'hospital in the home' programs). Where possible, denominator data should be collected in all situations for the calculation of rates of infection.

Different health care establishments may have different methods of surveillance to monitor health care associated infections. For example, some establishments may have a higher-risk patient profile and therefore carry out more frequent and detailed monitoring.

To work within the resources available for surveillance, most health care establishments will choose a 'sentinel' at-risk patient group for routine surveillance. This group should be chosen only after examining historical surveillance data to identify the group considered most at risk and the 'core' business patient groups (McLaws and Caelli 2000). Where health care establishments do not have historical data, the infection control committee should identify their at-risk groups after examining results from laboratory-based data or performing a point prevalence survey of surgical and intravascular line patients in situ. There are three main types of surveillance program:

- Active surveillance by infection control practitioners who directly observe the selected at-risk patients and their medical records to collect denominator and numerator data. This practice is suited to the important health care associated infections such as surgical site infections and intravascular line-related bloodstream infections (BSIs).

- Passive surveillance. This may involve the use of case mix (diagnostic related group) and/or laboratory-based data or the monitoring of antibiotic resistance patterns, especially the frequency of multiresistant organisms (eg extended B-lactamase producing gram-negative bacteria, methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant enterococci).
• An alternative to active surveillance of intravascular-related BSIs is the use of passive laboratory-based surveillance for the identification of BSIs, with a quarterly audit of patients to establish the type and the number of intravascular line-days. The BSI rate per 1000 line-days by specific line types can then be calculated.

A 'minimum data set' for the surveillance of health care associated infections should include:

• details of the infected individual (name or other unique identifier);
• gender;
• hospital record number;
• ward or location in the hospital;
• name of the consultant and/or unit involved;
• date of admission, date of onset of infection and date of discharge or death (so that length of stay attributed to the health care associated infection can be calculated and community acquired infections excluded from further analysis);
• site of infection/colonisation;
• organism isolated or otherwise identified (eg serology);
• relevant characteristics of the organism (eg antibiotic sensitivity, biotype or genotype); and
• acknowledgment of appropriate data use against relevant privacy legislation.

This minimum data set should also include information on medical treatment/procedures at the time of infection, any other information relevant to possible causes of the infection (including the patient’s underlying medical risk factors), clinical outcome and an assessment of whether the incident was preventable.

21.2.2 Occupational exposure and accidents with infection

Incidents of occupational exposure to blood and body fluids should be identified in all health care establishments. In addition, they should be incorporated in State/Territory and national systems for surveillance. An enhanced data set for occupational exposure to risk materials should include:

• the extent of the exposure;
• the site and severity of the injury;
• the nature of the exposure (percutaneous or mucous membrane exposure);
• the location in the establishment (ward or other location);
• the activity or procedure;
• the implement causing the injury;
• the infectious agent involved, if known;
• details of the treatment and prophylaxis given; and
• the outcome of the incident.

For blood and body fluid exposures (needlestick and similar injuries), the following details should also be recorded:
• identifying details of the source patient; and
• information on bloodborne virus risk and/or other relevant infectious disease risks.

These items are also relevant for recording potential transmission from an infected HCW to a patient.

21.2.3 Benchmarking and comparison

Comparison of infection rates between establishments and the publication of such comparisons is a contentious issue and needs careful consideration and sensitive handling. In large establishments, the best and most effective surveillance will target areas of high infection risk. However, to generate meaningful infection rates, the data need to be appropriately risk-adjusted, especially when they are released beyond the institution. Surveillance systems in small institutions should collect data on health care associated infections across the whole range of services provided.

Data collated to form a national picture must be interpreted with caution: the data may not be comparable, and the range of institutions involved will introduce confounding factors inherent in all surveillance systems. Differences specific to health care establishments include the catchment area of referral, the level of referral, the size of the institution and the specialty services provided. Problems of data interpretation can be overcome when surveillance systems are set up with clearly defined surveillance objectives, including the expected outputs of surveillance.

21.2.4 Surveillance of antibiotic-resistant organisms

Hospitals and diagnostic pathology laboratories should support comprehensive programs for the surveillance and management of antibiotic-resistant organisms.

Several groups are collecting national data:
• Since 1985, the Australian Group on Antibiotic Resistance has collected data on the antibiotic susceptibility of *Staphylococcus aureus* from hospital laboratories around the country.

• The Australian Gonococcal Surveillance Program was established as a long-term collaborative program conducted by reference laboratories in each State/Territory, to monitor the antibiotic susceptibility of gonococcal isolates. Data have been published quarterly since 1981, and annual reports since 1996.
• The Surveillance Network is a United States based organisation that collects qualitative and quantitative antimicrobial test results. A representative group of Australian laboratories and hospitals began contributing data in 1999.

The Commonwealth Government Response to the Report of the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) recommends that a comprehensive antibiotic resistance surveillance system be established as part of a national antibiotic resistance management program (recommendations 10 and 11). The overall surveillance system should include medical, food-producing animal and veterinary areas, with an emphasis on the food chain, molecular studies of resistance genes and environmental connections.

21.2.5 Health care associated infection surveillance in Australia

Many hospitals participating in the accreditation system of the Australian Council on Healthcare Standards record health care associated infections, particularly surgical site infections and bloodstream infections. States and Territories are encouraged to establish mechanisms to oversee the development, standardisation, collection and collation of health care associated infection data in their jurisdiction. Such State- and Territory-based systems are currently being developed. The use of standardised surveillance definitions and methods will facilitate the collection of data at a national level. Appendix 1 provides examples of consensus definitions for surgical site infection and bloodstream infections.

In establishing a national surveillance system, the objectives should be clearly defined. These may include:
• reducing infection rates within health care establishments;
• establishing endemic infection rates;
• identifying outbreaks;
• driving evidence-based changes in clinical practice;
• improving clinical performance in health care establishments; and
• evaluating control measures.

21.3 Outbreak investigation

21.3.1 Outbreak identification

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...
as pharmacy records. In some instances, the occurrence of an outbreak may be obvious, such as in an episode of food poisoning that affects both HCWs and patients. It is more usual, however, for the outbreak to have an insidious onset that may not be immediately apparent.

The existence of an outbreak should be brought to the attention of the health care establishment’s infection control management system and, where necessary, the relevant health authority. An outbreak control team should be formed. As a minimum, this should include:

- a senior representative from the affected clinical service;
- an infection control practitioner (or equivalent); and
- an infectious diseases physician/microbiologist with infection control experience.

Depending on the size and severity of the outbreak, it may be necessary to involve occupational health and safety staff, hospital administrators, engineers and public health officials. One person (often the infection control practitioner; see Section 8.4) should be given the responsibility for coordinating the investigation and subsequent control activities. 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.

Hospital and public health (reference) laboratories have an important role in health care associated infection surveillance.

There needs to be adequate laboratory support — if not locally, then from a reference laboratory. It is particularly important to ensure that outbreak isolates are stored for further investigation, because many infectious agents that cause outbreaks in health care establishments are endemic organisms, and it may be necessary to use a typing system to evaluate which isolates are part of any putative outbreak. A simple antimicrobial susceptibility testing may be enough to distinguish isolates, but, against a background of increasing resistance, it may be necessary to use more sophisticated methods of typing, such as randomly amplified polymorphic DNA and pulse field gel electrophoresis. These may be available only from specialised facilities such as reference laboratories, tertiary care hospitals or universities.

### 21.3.2 Investigation procedures

The principles for investigating outbreaks in health care establishments are the same as for community-based outbreaks. There are three basic steps:

- describing the outbreak;
- developing a hypothesis; and
- 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 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 health care establishments, 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 HCW:patient ratios).
- Develop a hypothesis and test it by comparison with the facts.
- Analytical epidemiology, such as a case–control or retrospective cohort study, can be undertaken quickly to test the hypothesis.
- 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 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.

### 21.4 Outbreak control

Preliminary control measures should be introduced as soon as possible and in association with the local health authority. Heightened surveillance should be introduced to assess the impact of all control measures. As soon as possible, information about the outbreak, the investigation and the results should be conveyed to the committee that deals with infection control issues in the establishment.
All outbreaks provide the opportunity to educate HCWs about infection control matters.

21.5 Lookback investigations

‘Lookback investigation’ refers to the process of identifying, tracing, recalling, counselling and testing patients or HCWs who may have been exposed to an infection in a health care setting.

One example is the case of an HCW who has undertaken exposure-prone procedures on surgical patients and is later found to be positive in a test for hepatitis B virus. If it is determined that the HCW was infectious at the time the exposure-prone procedures were undertaken, the patients with whom he or she had contact could have been infected and would need to be informed of this risk and offered testing and counselling.

Another example is a breakdown in the normal processes of cleaning and disinfection or sterilisation of instruments (such as endoscopes) that may have allowed the transfer of infection from one patient to another.

Lookback investigations are undertaken by blood transfusion services when it has been determined that a person who has donated blood or tissue has subsequently tested positive for a bloodborne virus that was not detected at the time of the donation.

Any type of lookback investigation has the potential to result in a great deal of publicity. This can cause unnecessary anxiety in patients treated at the establishment who have not been exposed to the risk of infection, as well as anger and distress among patients who were put at risk of infection.

As well as provoking publicity and anxiety, lookback investigations can take up a great deal of time and resources and should not be undertaken lightly. The level of infectivity of the affected individual, the type and extent of procedures undertaken and the probable risk to patients need to be carefully considered by those with expertise in these matters. The State/Territory health department should be involved at the outset, and a planning team established with members who have expertise in infection control, microbiology, the discipline involved (surgery, obstetrics etc), public relations, and legal and indemnity issues. Representatives of the management of the health care establishment concerned and the State/Territory health department should also be included.

The procedures to be undertaken and how these are presented to patients at risk and the public should be clearly established at the outset. These procedures should also clearly set out protocols for the timely tracing, counselling and referral of potentially exposed individuals. Test results should be made available with minimal delay, and the planning team should ensure that the project is completed and a final report produced as soon as possible.
21.6 Haemovigilance

Haemovigilance is a surveillance system for monitoring and analysing transfusion hazards of blood and plasma products in order to improve the safety of the transfusion process. The term haemovigilance was first used in Europe; over the past few years several countries, including France and the United Kingdom, have established such national surveillance systems for monitoring the adverse effects of transfusions.

In France, there is a compulsory haemovigilance system that collects information from physicians and hospitals on serious and nonserious incidents. The United Kingdom has the voluntary, confidential Serious Hazards of Transfusion Scheme. In 1998, the Australian Red Cross Blood Service established the Haemovigilance Working Party to consider whether haemovigilance plays a role in further improvements in what is universally considered to be a very safe blood supply. At the time of writing these guidelines, the working party had not produced any recommendations for a national haemovigilance scheme.

Infection issues relating to blood and blood products for transfusion are discussed further in Section 25.
22 Protection for health care workers

22.1 Introduction

Infection protection for health care workers (HCWs) must be an integral part of the infection control and occupational health and safety programs of any health care establishment (see Section 8). HCWs in this context include all HCWs who have the potential for occupational exposure to infectious material. Measures to protect HCWs from infection fall into five categories:

- physical protection
  - personal protective equipment (see Section 13)
  - immunisation (see Section 22.3.3);
- education;
- reporting systems;
- safe systems of work, design/physical environment and appropriate facilities for infection control; and
- health screening, where appropriate.

Key points

+ Health care establishments should provide infection protection measures for all health care workers (HCWs). These must include physical protection (personal protective equipment and immunisation), appropriate educational material and programs, effective reporting systems for breaches of protocols, implementation of safe work practices and provision of health screening.

+ All HCWs should be assessed at the start of their employment and offered testing for specific infections before being rostered in high-risk areas. Particular attention should be paid to immune status, skin conditions and pregnancy.

+ Health care establishments should ensure that, where an HCW is known to be particularly susceptible to health care associated infections, the HCW’s duties are assessed to ensure that the welfare of patients and other HCWs is safeguarded.

+ HCW vaccination programs should reference the most recent edition of The Australian Immunisation Handbook (currently NHMRC 2003).

+ Employers should provide information on the risks associated with pregnancy and should assist pregnant HCWs to avoid infectious circumstances that may present a risk to the HCW (mother) or foetus.
Within health care establishments, work practices must be developed and implemented to ensure compliance with infection control standards, appropriate deployment of HCWs and continuing education.

As part of their overall infection control training program, health care establishments must implement specific education on the physical protection and immunisation services provided by the establishment. These programs must emphasise the establishment's policies and the need for compliance. Education should be provided as part of the initial orientation of new HCWs and be reinforced through regular continuing education programs.

Health care establishments must have in place a system for reporting breaches of the infection control protocols for the protection of HCWs. The system should form part of the risk management process for the establishment and should be monitored at a senior management level.

The system must ensure accurate and timely reporting of incidents involving a breach of the infection control protocols as they affect HCWs. In addition, the incident report process should include notes on remedial and follow-up action taken before the process is considered complete.

### 22.2 Health status of health care workers

Some medical conditions increase HCWs' predisposition to infection if they come into contact with certain infectious patients (eg immune status, some skin conditions). There are many areas within health care establishments where HCWs with these conditions can work safely, and there are few tasks that such HCWs are unable to perform safely. Health care establishments have a responsibility to manage and supervise such HCWs in ways that both acknowledge their right to work and safeguard the welfare of patients and HCWs. This responsibility includes the need to identify such HCWs and inform them of the problems they are likely to encounter in particular circumstances.

#### 22.2.1 Immune status of health care workers

Although other factors may also be involved, substantial depression of immune function predisposes a person to infection. People who are immunosuppressed to this extent would normally be unable to work, but if they are employed as clinical contact workers they are at risk of acquiring health care associated infections. Examples of predisposing conditions include:

- neutropenia (less than 1000 neutrophils per mm$^3$), which is often associated with cancer chemotherapy;
- disseminated malignancy; and
- infection that produces immunodeficiency (eg human immunodeficiency virus, HIV).
22.2.2 Skin conditions (noninfectious)

HCWs with either shedding and/or weeping skin conditions or damaged skin may readily be colonised by health care associated microorganisms. These HCWs may not be harmed by the acquisition of such microorganisms but may disseminate them widely. For example, it is not recommended that such HCWs be placed in wards containing patients with methicillin-resistant staphylococci. These employees should be identified by personal history screening and advised of the problems posed by their condition.

Examples of noninfectious skin conditions include:

- allergic eczema;
- psoriasis; and
- exfoliative dermatitis.

These conditions are not infectious unless they are secondary to an underlying infection.

22.2.3 Pregnancy

Some infectious agents that cause congenital abnormalities are encountered in some hospitals more commonly than in the community.

22.3 HCW health screening

Three types of routine screening and assessment of HCWs are proposed:

- routine personal assessment of disease and immune status;
- immunisation; and
- laboratory and other testing.

The diseases that are important for inclusion in each of these procedures are shown in Table 22.1 and discussed further in Sections 22.3.1 to 22.3.3. Consent must be obtained before screening (see Section 10.7).

On employment, HCWs should be informed of the health care establishment’s health screening policies, and should be counselled about appropriate work placement in accordance with these policies.
### Table 22.1 Assessment and immunisation of clinical contact health care workers before employment or rostering

<table>
<thead>
<tr>
<th>Personal medical history</th>
<th>Immunisation</th>
<th>Laboratory/other testing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disease</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>All HCWs should be offered:</td>
<td>All HCWs in hospitals should routinely be offered pre-employment tuberculin skin test and regular retesting of those who are tuberculin skin test-negative, depending on level of risk. Tuberculin skin test-positive HCWs should be followed up with a chest X-ray and clinical review.</td>
</tr>
<tr>
<td>Rubella</td>
<td>• influenza vaccination</td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>• Td booster(^b)</td>
<td></td>
</tr>
<tr>
<td>Mumps</td>
<td>HCWs who have not been previously immunised or naturally infected should be offered the following vaccinations:</td>
<td></td>
</tr>
<tr>
<td>Chickenpox (varicella)</td>
<td>• hepatitis B</td>
<td></td>
</tr>
<tr>
<td>Herpes simplex</td>
<td>• MMR</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>• varicella</td>
<td></td>
</tr>
<tr>
<td>Immune disorders (including medication such as immunosuppressants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exfoliative and weeping skin conditions(^a)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special circumstances</th>
<th>Special circumstances</th>
<th>Special circumstances</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCWs performing exposure-prone procedures have an ongoing responsibility to know their infectious status for:</td>
<td>Some microbiology staff should be immunised against diseases caused by infectious agents with which they work, including:</td>
<td>If there is any doubt about previous infection/immunisation, HCWs should be offered testing for:</td>
</tr>
<tr>
<td>• HIV/AIDS</td>
<td>• Japanese encephalitis</td>
<td>• hepatitis A</td>
</tr>
<tr>
<td>• hepatitis B</td>
<td>• hepatitis A</td>
<td>• hepatitis B</td>
</tr>
<tr>
<td>• hepatitis C</td>
<td>• meningococcal infection</td>
<td>• measles(^c)</td>
</tr>
<tr>
<td></td>
<td>• typhoid</td>
<td>• rubella</td>
</tr>
<tr>
<td></td>
<td>• Q fever</td>
<td>• varicella</td>
</tr>
<tr>
<td></td>
<td>• plague</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• rabies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Australian bat lyssavirus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• pertussis (using DTPa)</td>
<td></td>
</tr>
</tbody>
</table>

HCWs who work in communities with substantial indigenous populations, or custodial carers and carers of the intellectually impaired, should be offered hepatitis A vaccination

HCWs who work in communities with substantial indigenous populations, or custodial carers and carers of the intellectually impaired, should be offered hepatitis A vaccination

After exposure to blood or body fluids contaminated with blood, including needlestick or sharps injuries with a potential for bloodborne virus infections, HCWs should be offered testing for: \(^d\)

- HIV
- hepatitis C
- hepatitis B

---

\(^a\) For positive exfoliative conditions, ascertain the diagnosis and current treatment.

\(^b\) Boosters should be given as recommended in the most recent edition of *The Australian Immunisation Handbook* (NHMRC 2003).

\(^c\) If serological testing can be done quickly and cheaply, it may be cost effective to screen HCWs providing direct patient care during a measles outbreak (CDNANZ and MEAC 2000).

\(^d\) For further information see Section 23 and Appendix 8.

Note: For further information on immunisation refer to the most recent edition of *The Australian Immunisation Handbook* (currently NHMRC 2003).
22.3.1 Routine assessment of disease and immune status

HCWs should be assessed before they are employed or rostered in specific areas (e.g., women of childbearing age working in neonatal, oncology or intensive care units, where they may be at risk of exposure to infectious reproductive hazards such as cytomegalovirus). This personal assessment should take the form of an interview (verbal questionnaire). On occasion, serological testing may also be useful. HCWs involved in exposure-prone procedures should know their HIV, hepatitis B virus (HBV) and hepatitis C virus (HCV) status (see Section 24). Following substantial exposure to blood or potentially blood-contaminated secretions, HCWs should be offered testing for antibodies to HIV, HBV and HCV (see Section 23).

22.3.2 Laboratory testing

All HCWs with patient contact should have a routine tuberculin skin test before starting a new job. Staff working in high-risk areas (e.g., microbiology laboratory, respiratory ward) should be retested every year if their initial test was negative. Others who initially test negative should be regularly retested and should be retested if they have been exposed to a patient with tuberculosis. The frequency of screening for people who have not had a Bacille Calmette–Guerin (BCG) vaccine should depend on the level of risk.

Routine screening for staphylococcal, streptococcal and salmonella carriers is not recommended. Screening may be instituted if an outbreak or epidemic occurs, and if HCWs are felt to be either at risk or potentially associated with spread of the infection. Carriers of the bacteria involved would not normally transmit infection unless they were excreting bacteria in high numbers (e.g., from paronychia or chronic sinusitis).

22.3.3 Immunisation

The most recent edition of *The Australian Immunisation Handbook* (currently NHMRC 2003) 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 (e.g., where an HCW is pregnant). HCWs should therefore be offered the following immunisations:

- Hepatitis A immunisation is recommended for HCWs in paediatric wards, intensive care units and emergency departments that provide for substantial populations of Aboriginal and Torres Strait Islander children, and nursing and medical staff in rural and remote indigenous communities.
- Hepatitis B immunisation is recommended for all staff directly involved in patient care, embalming or the handling of human blood or tissue.
- Rubella immunisation, preferably using measles–mumps–rubella (MMR) vaccine, should be offered to all HCWs born during or since 1986 who are either without immunisation records or seronegative upon screening.
• A booster dose of adult/adolescent formulation diphtheria–tetanus–pertussis (DTPa) vaccine on a single occasion is recommended for HCWs working with young children.

• Chickenpox (varicella) immunisation should be offered to nonimmune HCWs with no history or serological evidence of chickenpox or shingles.

• At the start of their employment, all HCWs should be screened for previous TB exposure by personal medical history or immunisation and should undergo an initial two-step tuberculin skin test. BCG vaccine is of uncertain value, but may be offered to tuberculin skin test-negative HCWs at high risk, or in accordance with State/Territory guidelines (see Section 29.8.3).

• Laboratory staff should be immunised against any other pathogenic organisms that they may encounter in their facility, such as Japanese encephalitis virus, hepatitis A virus (HAV), meningococcus, typhoid, Q fever, plague and rabies (see Table 22.1).

• Child care staff should also be immunised against HAV, measles, mumps, rubella and varicella–zoster (nonimmune HCWs with no history of chickenpox or shingles).

Health care establishments should have education programs to support their immunisation strategy and reinforce the need for compliance. Refusal of immunisation by any HCW should be recorded, together with a reason for such refusal, if provided. Further details are given in Table 22.1.

22.3.4 Immunisation/health screening records

Health care establishments should develop, maintain and regularly update immunisation/health screening cards and/or records for all HCWs during their employment. These records should be maintained in accordance with the establishment’s policy for the retention of medical records. HCWs should have access to their individual medical screening records on request, and extracts of these screening records should be available to HCWs whenever they change their place of employment.

It is recommended that HCWs maintain their own personal records of all immunisations and screening (see Section 5.2).

22.3.5 Infection exposure management

Details of the postexposure prophylactic management required for specific infections are shown in Table 22.2.

**DISCUSSION POINT**

Blood collected but not tested

HCWs who do not wish to undergo testing at the time of exposure may be offered the option to have blood collected and stored but not tested. Blood that is collected and stored for this purpose must be retained for a minimum of 12 months.
### Table 22.2 Postexposure prophylaxis and precautions for health care workers

<table>
<thead>
<tr>
<th>Infectious agent</th>
<th>Recommended tests</th>
<th>Situation in which prophylaxis/precautions are recommended</th>
<th>Prophylaxis/precautions available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronavirus</td>
<td>All workers in a SARS team should have their temperatures taken and recorded twice daily. X-ray changes are one of the essential criteria for definition of a case.</td>
<td>Limit non-essential HCW contact with SARS patients. HCWs to avoid direct contact with SARS patient secretions and excretions.</td>
<td>A record should be kept of any reports of unprotected exposure to SARS cases. The management, active/passive surveillance and quarantine depend on the status of the SARS case and should be reviewed on a case-by-case basis by the infection control team (further information available at <a href="http://www.health.gov.au/sars.htm">http://www.health.gov.au/sars.htm</a>).</td>
</tr>
<tr>
<td>Cytomegalovirus (CMV)</td>
<td>Particularly for HCWs working in neonatal units, transplant units and caring for HIV-positive patients. For nonimmune pregnant HCWs.</td>
<td>Wash hands after all patient contact and after contact with urine or saliva.</td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenza type B virus (HIB)</td>
<td>Not advised</td>
<td>Not advised</td>
<td></td>
</tr>
<tr>
<td>Hepatitis A virus (HAV)</td>
<td>For those who have had close contact with a case during the two weeks before, and up to one week after, the onset of jaundice (eg handled faecal waste).</td>
<td>Give NIGH within two weeks of exposure. Hepatitis A vaccine should also be given. If more than 2 weeks has elapsed since exposure, hepatitis A vaccine could be given alone but there is no evidence it will be effective.</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B virus (HBV)</td>
<td>HCWs undertaking exposure-prone procedures should know their HBV status. Test source of blood as soon as possible for HBsAg. Test blood of the recipient for antibodies to HBsAg, or store blood for future testing, and then retest at 3 and 6 months if source is positive. For those who have had significant exposure (percutaneous, ocular or mucous membrane) to blood or potentially blood-contaminated secretions.</td>
<td>Wash site of exposure with soap and water. Flush affected mucous membranes with large volumes of water. If recipient does not have antibodies to hepatitis B (HBsAg), and source is HBsAg-positive or cannot be identified and tested rapidly, give a single dose of HBIg within 48–72 hours and start a course of HBV immunisation at the same time in susceptible HCWs who have not previously been immunised. HBV vaccine should be given within 7 days of exposure, repeated at 1–2 months and at 6 months after the first dose. If the HCW is a known nonresponder to HBV immunisation, HBIg should be given within 72 hours (NHMRC 2003).</td>
<td>Recinded</td>
</tr>
</tbody>
</table>

*Note: NIGH refers to Newcastle immunoglobulin.*
Table 22.2 (cont’d) Postexposure prophylaxis and precautions for health care workers

<table>
<thead>
<tr>
<th>Infectious agent</th>
<th>Recommended tests</th>
<th>Situation in which prophylaxis/precautions are recommended</th>
<th>Prophylaxis/precautions available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis C virus (HCV) – interim recommendations pending release of National Hepatitis C Testing Policy.</td>
<td>HCWs undertaking exposure-prone procedures should know their HCV status. Test source of blood as soon as possible for antibodies to HCV. Blood should also be taken from the recipient as soon as possible (baseline sample) and either tested immediately or stored for future testing. If the source is HCV antibody positive, the recipient should be tested at 3 and 6 months, in addition to the baseline test.</td>
<td>For those who have had significant exposure (percutaneous, ocular, or mucous membrane) to blood or potentially blood-contaminated secretions.</td>
<td>Wash site of exposure with soap and water. Flush affected mucous membranes with large volumes of water. No specific PEP for HCV. See Appendix 8 (ANCAHRD Bulletin No 29) for further information.</td>
</tr>
<tr>
<td>Human immuno-deficiency virus (HIV)</td>
<td>HCWs undertaking exposure-prone procedures should know their HIV status. Test source of blood as soon as possible for antibodies to HIV. If source is HIV positive, gather information on stage of infection, current and previous antiretroviral therapy to decide on appropriate PEP regimen. Test blood of the recipient for antibodies to HIV, or store blood for future testing; retest at 1, 3 and 6 months if source is positive. Follow up to detect any febrile illness occurring within 3 months of exposure.</td>
<td>For those who have had significant exposure (percutaneous, ocular or mucous membrane) to blood or potentially blood-contaminated secretions.</td>
<td>Wash site of exposure with soap and water. Flush affected mucous membranes with large volumes of water. If source is HIV positive or cannot be identified and tested rapidly or is at high risk of seroconverting, 2 or 3 antiretroviral drugs (including ZVD or lamivudine) should be administered to recipient within 24–36 hours after exposure (preferably within 2 hours). Continue therapy for 4 weeks. Gloves should be used and hands washed regularly.</td>
</tr>
<tr>
<td>Measles virus</td>
<td>Active surveillance for measles among HCWs who may have been exposed during a measles outbreak.</td>
<td>For nonpregnant, nonimmune HCWs.</td>
<td>MEWR within 72 hours of exposure or NIGH if 3–7 days after exposure. Ensure nonimmune HCWs are immunised. All exposed non-immune HCWs should be excluded from direct patient contact from 5 days after first exposure to 21 days after last exposure, or until 7 days after rash appears if measles develops (CDC 1998a).</td>
</tr>
<tr>
<td>Infectious agent</td>
<td>Recommended tests</td>
<td>Situation in which prophylaxis/precautions are recommended</td>
<td>Prophylaxis/precautions available</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Neisseria meningitidis</em></td>
<td></td>
<td>Only if HCW engaged in close contact with infected person (e.g., mouth-to-mouth resuscitation)</td>
<td>Chemoprophylaxis with rifampicin. If unsuitable, use ceftriaxone or ciprofloxacin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For those who have contamination of unbroken skin with blood or body fluids, or needlestick injuries and lacerations, from patients with known or suspected CJD.</td>
<td>Wash skin with detergents and large quantities of warm water. Avoid vigorous scrubbing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For those who have had ocular exposure to blood or CSF from patients at high risk of CJD.</td>
<td>Immediately institute normal eye washing procedures using warm water.</td>
</tr>
<tr>
<td>Prion (Creutzfeldt–Jakob disease; CJD)</td>
<td>None available</td>
<td>For pregnant HCWs if nonimmune (i.e., no previous natural infection or immunisation).</td>
<td>NIGH soon after exposure. Ensure nonimmune HCWs are immunised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All HCWs</td>
<td>All exposed non-immune HCWs should be excluded from direct patient contact from 7 days after first exposure until 21 days after the last exposure, or until 5 days after rash appears if rubella develops (CDC 1998a).</td>
</tr>
<tr>
<td>Rubella virus</td>
<td>Serological follow-up of NIGH recipients for up to 8 weeks.</td>
<td>For those determined to be at risk of infection depending on circumstances of exposure (e.g., deep penetrating wound, wound with extensive tissue damage or wound containing foreign bodies).</td>
<td>Clean and disinfect wound. If 5 or more years have elapsed since HCW was last immunised, a booster dose of a tetanus-toxoid-containing vaccine should be administered as soon as possible. Where the recipient has not received 3 or more doses of a tetanus toxoid-containing vaccine or where there is doubt about their tetanus immunisation status, TIG and a tetanus toxoid-containing vaccine should be administered as soon as possible (double TIG dose if more than 24 hours have elapsed since injury).</td>
</tr>
<tr>
<td>Clostridium tetani (tetanus)</td>
<td></td>
<td>For those determined to be at risk of infection depending on circumstances of exposure (e.g., deep penetrating wound, wound with extensive tissue damage or wound containing foreign bodies).</td>
<td>Clean and disinfect wound. If 5 or more years have elapsed since HCW was last immunised, a booster dose of a tetanus-toxoid-containing vaccine should be administered as soon as possible. Where the recipient has not received 3 or more doses of a tetanus toxoid-containing vaccine or where there is doubt about their tetanus immunisation status, TIG and a tetanus toxoid-containing vaccine should be administered as soon as possible (double TIG dose if more than 24 hours have elapsed since injury).</td>
</tr>
</tbody>
</table>
### 22.4 Pregnant health care workers

Both the employer and a pregnant HCW have an obligation to reduce risks to the foetus. Certain infections can pose a risk to pregnant women and foetuses if acquired during pregnancy. Some of these infections can be acquired in the workplace — for example cytomegalovirus (CMV), hepatitis viruses, HIV, parvovirus, rubella virus and varicella–zoster virus. In general, adherence to standard and additional precautions, vaccination and high standards of general hygiene in the workplace should protect HCWs.

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It is the responsibility of pregnant HCWs to advise their medical practitioner and employer of their pregnancy.

Information on the risks associated with pregnancy should be available in the workplace in the form of pamphlets or other information. It is the responsibility of pregnant HCWs to advise their medical practitioner and employer of their pregnancy.

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#### Table 22.2 (cont’d) Postexposure prophylaxis and precautions for health care workers

<table>
<thead>
<tr>
<th>Infectious agent</th>
<th>Recommended tests</th>
<th>Situation in which prophylaxis/precautions are recommended</th>
<th>Prophylaxis/precautions available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varicella–zoster virus (VZV)</td>
<td>Test pregnant HCWs for anti-VZV antibodies.</td>
<td>For pregnant HCWs who are susceptible to varicella infection.</td>
<td>ZIG⁸ within 96 hours of exposure. If unavailable, use NIGH. Ensure nonimmune HCWs are immunised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All HCWs (with VZV)</td>
<td>All exposed nonimmune HCWs should be excluded from direct patient contact for the duration of the rash</td>
</tr>
</tbody>
</table>

CSF = cerebrospinal fluid; ddI = dideoxyinosine; ddC = dideoxycytidine; HBIG = hepatitis B virus immunoglobulin; HBsAg = hepatitis B virus surface antigen; HCW = health care worker; MMR = measles–mumps–rubella vaccine; NIGH = normal immunoglobulin (human); PCR = polymerase chain reaction; PEP = postexposure prophylaxis; SARS = severe acute respiratory syndrome; TIG = tetanus immunoglobulin; ZDV = zidovudine (also called azidothymidine or AZT); ZIG = high-titre varicella–zoster immunoglobulin

⁸ Requests for HBIG should be directed to the local State/Territory director of the Australian Red Cross Blood Service.

The decision to use antiretroviral PEP should be made promptly, in conjunction with a specialist HIV physician, and with the full consent of the affected person. Doctors should stress to the affected person the importance of strict compliance with the treatment regimen and describe the potential side effects and the appropriate course of action if these are experienced.

Further details are given in the Guidelines for the Control of Measles Outbreaks in Australia (CDNANZ 2000).

Following advice from the local infection control officer, susceptible HCWs who refuse immunisation may be redeployed to duties not requiring direct patient care. Alternatively, until the HCW receives either the MMR vaccine or a dose of NIGH within the specified time frames, the HCW may be excluded from the facility until 14 days after their last exposure. Furthermore, if a susceptible HCW has not previously received any doses of a measles-containing vaccine they should be offered a second dose of MMR four weeks after the first dose.

Rifampicin is not recommended for use in pregnant women. The side-effects of rifampicin should be explained to recipients. Ceftriaxone is potentially safer in pregnancy.

NIGH does not prevent rubella infection. It may, however, prolong the incubation period, which may marginally reduce the risk to the foetus and reduce the likelihood of clinical symptoms in the mother.

ZIG is available from the local State/Territory Director of the Australian Red Cross Blood Transfusion Service on a restricted basis.

Note: The current edition of The Australian Immunisation Handbook (NHMRC 2003) should be consulted for further detail about vaccines and immunoglobulins.
The employer should advise pregnant HCWs of the special risks associated with pregnancy and give them an opportunity to avoid patients with specific infections. All women of childbearing age should be counselled regarding their immune status in relation to varicella and hepatitis B; if necessary, they should be offered immunisation before they become pregnant. All information about the immune status and pregnancy of HCWs must remain confidential: an HCW is only required to provide information about her pregnancy for her own benefit.

The following information relates to infections that are both significant in pregnancy and have some possibility of being acquired through patient care. It is not meant to be a comprehensive account of all infections having relevance to pregnant women. Infections due to herpes simplex virus, Toxoplasma gondii, Treponema pallidum, Neisseria gonorrhoeae, Chlamydia trachomatis, Listeria monocytogenes and human papilloma virus are not considered, because these are likely to be incidental infections and not acquired through patient contact.

The following information is based on advice given in The Australian Immunisation Handbook, the current edition of which (NHMRC 2003) should be consulted for further details.

22.4.1 Rubella

Confirming rubella immunity is part of routine antenatal screening, with consent. However, serious congenital abnormalities associated with rubella most commonly follow infection occurring in the first trimester. For this reason, the rubella antibody status of HCWs should be checked at employment, particularly for women of childbearing age (see Section 28.13.3). If rubella antibody is absent or below protective levels, the HCW should be offered vaccination on beginning employment. Rubella vaccination should be avoided in early pregnancy, and conception should be avoided for two months following vaccination, although no case of congenital rubella syndrome has been reported following inadvertent vaccination shortly before or during pregnancy. Where necessary, those vaccinated can be tested for seroconversion two months after vaccination, and revaccinated if necessary.

Postexposure prophylaxis with human normal immunoglobulin (NIGH) will not prevent infection in nonimmune contacts and is therefore of little value for protection of pregnant women exposed to rubella. It may, however, prolong the incubation period, which may marginally reduce the risk to the foetus. It may also reduce the likelihood of clinical symptoms in the mother. NIGH should be used only if termination of pregnancy due to confirmed rubella infection would be unacceptable. In such cases, it should be given soon after exposure. Serological follow-up of recipients is essential, and should continue for up to eight weeks.
22.4.2 Hepatitis B

Recommended routine HBV screening/testing, immunisation and response to blood and body fluid exposures are described in Section 28.4.3. Routine antenatal screening to determine HBV immune status is commonly performed, with the consent of the person being tested.

While the safety of the HBV vaccine for the developing foetus has not yet been confirmed by a large-scale trial, HBV infection in a pregnant woman may result in severe disease for the newborn. Pregnancy should therefore not be considered a contraindication to administration of HBV immunoglobulin (HBIG) or HBV vaccination.

22.4.3 Cytomegalovirus

CMV is commonly encountered in urine and saliva, but there is little evidence that female HCWs have acquired the virus as a result of patient contact or, in particular, that it has resulted in foetal infection (Lipscomb et al 1984, Murph et al 1998). Routine antenatal screening is not recommended even for HCWs in high-risk areas, but can be offered on an individual basis.

Further details on the occurrence, prevention and management of CMV infection are given in Section 28.1.

Pregnant HCWs, or those contemplating pregnancy, should be counselled about the risks of CMV infection, mode of transmission and safe work practices.

22.4.4 Varicella–zoster virus (chickenpox and shingles)

There is some evidence that infection with varicella–zoster virus (VZV) may be more severe in pregnant than in nonpregnant women (Pierre et al 1992, Enders et al 1994, Baren 1996). Fewer than 5% of women of childbearing age do not have immunity to VZV. Even individuals who cannot recall having had chickenpox have an 80% chance of having had VZV. Each establishment should decide whether to test for VZV status, on the basis of risk in the particular setting (not on the basis of potential pregnancy).

If chickenpox occurs during the first 20 weeks of gestation, intrauterine foetal infection and occasionally foetal damage can occur (Enders et al 1994, Lecuru et al 1995). Foetal varicella syndrome is rare (2–3% of affected pregnancies) and clues to its presence may be found at a 20-week ultrasound scan. The most dangerous time to acquire chickenpox during pregnancy is at term or immediately after term (Lecuru et al 1994, 1995) This is because there is a high chance that the newborn infant may be exposed and may have little or no immunity. The newborn may then become seriously ill with VZV infection.
For these reasons, pregnant HCWs who are not immune should not care for patients with chickenpox or shingles. If a female HCW is unsure whether she has had chickenpox, is unsure whether she is pregnant or is contemplating pregnancy, she may have her VZV antibody status checked. VZV vaccine is not recommended during pregnancy, and those who have received the vaccine should not become pregnant for one month after vaccination. If inadvertent exposure occurs, VZV immunoglobulin (ZIG) may be given to the pregnant HCW within 96 hours of exposure to the virus. If ZIG is unavailable, NIGH may be given.

Acyclovir and related agents (eg famivir or valciclovir) are available for the treatment of acute VZV infection. The decision to give a pregnant woman either ZIG or acyclovir is controversial, however, and should be made by a specialist on an individual case basis.

22.4.5 Parvovirus

Parvovirus (B19) infection early in pregnancy may affect the foetus, causing aplastic anaemia that later becomes manifest as midsemester hydrops foetalis. If possible, pregnant HCWs should avoid contact with patients who are infected with human parvovirus. However, this is hard to achieve in practice, apart from avoiding immunosuppressed patients who may experience prolonged shedding of the virus. For other patients, infectivity usually ceases before there is evidence of B19 infection.

22.5 Tuberculosis

Australia has been particularly fortunate in its low incidence of tuberculosis (TB) (Dawson 1998) As a result, few young HCWs have been exposed to the disease in childhood; as a group, HCWs are particularly vulnerable to infection.

HCWs have varying risks for TB. Those working in TB-risk areas (medical wards, chest clinics, bronchoscopy units, radiology units, TB laboratories, HIV-dedicated wards and autopsy rooms) are at greatest risk of occupational exposure.

However, the prevalence of TB in trainee HCWs is likely to rise as a higher proportion of immigrants from countries in which TB is endemic participate in the workforce. In addition, there has been a worldwide increase in TB, particularly drug-resistant cases, and this may be reflected in an increase of cases amongst HCWs generally.
22.6 Laboratory and mortuary staff

Laboratory and mortuary staff should be offered immunisation against the potential infectious hazards they may encounter in their working environment. AS/NZS 2243.3 summarises specific immunisation that should be considered for these workers.¹

¹ AS/NZS 2243.3 1995 Safety in laboratories, Part 3 — Microbiology.
23 Needlestick and other blood or body fluid incidents

Key points

+ Health care establishments must have protocols for dealing with needlestick and other blood or body fluid incidents involving either patients or health care workers (HCWs).

+ Occupational hazards for HCWs from needlestick and other blood or body fluid incidents include human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV).

+ HCWs must report occupational exposures immediately. Treatment protocols should include removal of contaminated clothing and thorough washing of the injured area with soap and water. Affected mucous membranes should be flushed with large amounts of water.

+ The exposed person should have a medical evaluation, including the collection of information about medications they are taking and underlying medical conditions or circumstances. Postexposure prophylaxis and counselling should be available and offered.

+ Patients exposed to blood or other body fluids must be informed of the exposure by a designated professional, while confidentiality is maintained about the source of the blood. Baseline serum should be collected from the patient and expert counselling provided on the implications of what has happened. Patient refusal of testing and serum storage should be documented.

+ The person whose blood or body fluids are the source of an occupational exposure or other injury should be evaluated for infection with HIV, HBV and HCV.

+ The Australian National Council for AIDS, Hepatitis C and Related Diseases (ANCAHRD)\(^1\) has published a comprehensive bulletin for the management of exposure to blood and body fluids contaminated with blood, including needlestick/sharp injuries. Bulletin No 29: Needlestick and Blood Accidents is attached to this document as Appendix 8 and should be used as a guide when establishing an organisational protocol for managing this type of injury.

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\(^1\) Formerly known as Australian National Council on AIDS (ANCA), and superseded from September 2003 by the Ministerial Advisory Committee on AIDS, Sexual Health and Hepatitis.
23.1 Protocols for needlestick and other blood or body fluid incidents

All health care establishments must develop their own infection control protocols for communicable diseases, including clear written instructions on the appropriate action to take in the event of needlestick and other blood or body fluid incidents involving either patients or health care workers (HCWs), including:

- the physician, medical officer or other suitably qualified professional to be contacted;
- the laboratory that will process emergency specimens;
- the pharmacy that stocks prophylactic medication; and
- procedures for investigating the circumstances of the incident and measures to prevent recurrence (this may include changes to work practices, changes to equipment, and/or training).

HCWs should be educated to report occupational exposures immediately after they occur.

The protocols should also include details for prompt reporting, evaluation, counselling, treatment and follow-up of occupational exposures to bloodborne viruses. Treatment should be available during all working hours, and on call after hours (eg through an on-call infectious diseases physician). HCWs should be educated to report occupational exposures immediately after they occur.

Patients exposed to blood or other body fluids must be informed of the exposure by a designated professional, while confidentiality is maintained about the individual source of the blood. Baseline serum should be collected from the patient and expert counselling provided on the implications of the event. Postexposure prophylaxis and appropriate long-term follow-up should be offered where applicable. Patient refusal for testing and serum storage should be documented. In the event of seroconversion, all reasonable attempts should be made to confirm that the virus strain transmitted is identical in the patient and the source.

Health care establishments should provide support and counselling, and advise that further counselling can be arranged with occupational health nurses, infection control nurses, infectious diseases physicians or HIV liaison officers at teaching hospitals or sexually transmitted disease clinics.

People nominated to provide support to affected individuals should have an appropriate knowledge of factors involved in the transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV), and have counselling expertise. Where this is not possible (eg in rural and remote areas) a person with appropriate knowledge of disease transmission should counsel and support affected individuals.

Note: It is most important that, in order to maintain the confidentiality of the exposed person and the source, individual records be maintained.
23.2 Definitions

The following body fluids pose a risk for bloodborne virus transmission:

- blood, serum, plasma and all biological fluids visibly contaminated with blood;
- laboratory specimens that contain concentrated virus;
- pleural, amniotic, pericardial, peritoneal, synovial and cerebrospinal fluids;
- uterine/vaginal secretions; and
- semen.

The following terms are used in this discussion:

**Exposed person** — the person exposed to blood or body fluid.

**Source individual** — the person whose blood or body fluid was inoculated into or splashed onto the affected person. The source individual may sometimes not be identifiable (e.g., when an affected person has been injured by a needle/instrument and it is not known on whom it was used).

**Exposure** — an injury that involves direct skin contact with a body fluid listed above and in which there is compromised skin integrity (such as an open wound, abrasion or dermatitis), or in which there is direct mucous membrane contact. For exposure to skin, the larger the area of skin exposed and the longer the time of contact, the more important it is to verify that all the relevant skin area is intact.

23.3 Risk of transmission of bloodborne viruses

23.3.1 Human immunodeficiency virus

Prospective studies of HCWs occupationally exposed to HIV have estimated that the average risk of HIV transmission after an exposure to HIV-infected blood is 0.3% (3 in 1000) (Bell 1997, Boaventura 1997, Tokars et al 1993, Patz and Jodrey 1995, Cardo et al 1997) and after a mucous membrane exposure is 0.09% (9 in 10,000) (Ippolito et al 1993). Although HIV infection has been reported after skin exposure to HIV-infected blood, the average risk of HIV transmission after this exposure is extremely low, and no HCWs enrolled in prospective studies have seroconverted after isolated skin exposures (Weiss et al 1988, CDC 2001).

Epidemiological and laboratory studies suggest that the following factors may be associated with an increased risk of HIV transmission (Cardo et al 1997):

- injury with a device visibly contaminated with blood;
• injury with a hollow bore needle that has been placed directly in an artery or vein of the source patient;
• deep injury to the exposed person; and
• a source patient with advanced HIV disease or high viral load (however, transmission to an HCW has been demonstrated in at least one case from a person with undetectable plasma viral load).

23.3.2 Hepatitis B virus
HBV infection is a recognised occupational hazard for workers who are exposed to blood or body fluids (see Section 28.4). In source patients who are positive for HBV surface antigen (HBsAg), transmission rates are much higher than for HIV (about 6–30%), particularly if the source is HBV e antigen (HBeAg) positive (Zuckerman 1995, Patz and Jodrey 1995).

23.3.3 Hepatitis C virus
Since the introduction of HBV vaccination over the past decade, HCV has replaced HBV as the most commonly identified cause of viral hepatitis among HCWs (Zuckerman et al 1994, Petrosillo et al 1995) (see Section 28.5). When a source patient is positive for HCV antibody, transmission rates are higher than for HIV. The risk of transmission is relatively low (about 3–10%) in comparison to HBV (Patz and Jodrey 1995).

23.4 Management of the source individual
The person whose blood or body fluids are the source of an occupational exposure or other injury should be evaluated for infection with HIV, HBV and HCV. Information available in the medical record or from the source person may suggest or rule out infection with each virus. If the source is known to have HIV infection, then information on stage of infection and current and previous antiretroviral therapy should be gathered and used in deciding the most appropriate regimen of postexposure prophylaxis (PEP). If the HIV, HBV or HCV status of the source person is unknown, the source person should be informed of the incident and asked to consent to testing for these viruses, with appropriate pre- and post-test counselling. If consent cannot be obtained (e.g. the patient is unconscious), procedures should be followed that comply with legislation in the relevant State/Territory.

At the time of injury, the source individual should be tested for:
• HIV antibody;
• HBsAg; and
• HCV antibody.
If the HCV antibody test is positive, HCV polymerase chain reaction (PCR) should be performed to test for HCV RNA. Transmission is much less likely to occur from a source who is PCR negative.

If the status of the source individual is known at the time of the incident, the exposed person should be managed as described in Section 23.5.

Reasonable efforts should be made to identify the source. If the source remains unknown, appropriate follow-up should be determined on an individual basis, depending on:

- the type of exposure;
- the likelihood of the source being positive for a blood pathogen; and
- the prevalence of HIV, HBV and HCV in the community of the likely source.

### 23.5 Management of the exposed person

#### 23.5.1 Immediate management

**Immediate care of the exposure site**

Contaminated clothing should be removed, and the injured area should be washed well with soap and water (an antiseptic could also be applied). Any affected mucous membranes should be flushed with large amounts of water. If the eyes are contaminated, they should be rinsed gently but thoroughly with water or normal saline, while kept open.

**Evaluation of the exposure**

The exposed person should be examined to confirm the nature of exposure and counselled about the possibility of transmission of bloodborne disease.

**Evaluation and testing of the exposed person**

The exposed person should have a medical evaluation, including the collection of information about medications they are taking and underlying medical conditions or circumstances. All exposed people should be assessed to determine the risk of tetanus. Depending on the circumstances of the exposure, the following may need to be considered:

- tetanus immunoglobulin;
- a course of adsorbed diphtheria tetanus vaccine — adult formulation (Td vaccine); or
- Td booster.

The most recent edition of *The Australian Immunisation Handbook* should be consulted for further details (currently NHMRC 2003).
The exposed person would normally be tested for HIV antibody, HCV antibody and antibody to HBV surface antigen (HBsAg) at the time of the injury, to establish their serostatus at the time of the exposure. Expert counselling on the implications of the event, PEP and appropriate long-term follow-up should be offered.

HCWs who do not wish to undergo testing at the time of the exposure may be offered the option to have blood collected and stored but not tested. Blood that is collected and stored for this purpose must be retained for a minimum period of 12 months.

If the source person is found to be HIV, HBV and HCV negative, no further follow-up of the exposed person is generally necessary, unless there is reason to suspect the source person is seroconverting to one of these viruses, or was at high risk of bloodborne viral infection at the time of the exposure. If the source is positive for one of these viruses, pregnancy testing should be offered to women of childbearing age who have been exposed and whose pregnancy status is unknown.

23.5.2 Postexposure prophylaxis (PEP)

Human immunodeficiency virus PEP

Depending on the circumstances of exposure to HIV, and the characteristics of the source, PEP may be recommended, offered but not actively recommended, or not offered (CDC 1998a).

- **HIV PEP recommended** — for percutaneous exposure to potentially infectious blood or body fluids (increased risk of HIV transmission).

- **HIV PEP offered (but not actively recommended)** — for ocular mucous membrane or nonintact skin exposure to potentially infectious blood or body fluids (less increased risk of HIV transmission).

- **HIV PEP not offered** — for any exposure to non-bloodstained urine, saliva or faeces (not potentially infectious for HIV).

As only a small proportion of occupational exposures to HIV result in transmission of the virus, the toxicity of PEP must be carefully considered against its efficacy. The exposed person should be informed of these side effects, and that there are only limited data on the efficacy of PEP. If the exposed person is pregnant, she should be informed about the available limited data on the toxicity of these drugs in pregnant women.

**Choice of drugs**

HIV PEP is a complex area of treatment, and PEP should be prescribed only by, or after consultation with, a doctor experienced in the use of antiretroviral drugs. Currently, most HIV exposures are treated with a two-drug regime (CDC 1997b). As the data for efficacy are strongest for zidovudine (ZDV), also known as azidothymidine (AZT) (Cardo et al 1997), the drugs used are usually ZDV and lamivudine (also known as 3TC). The antiretroviral drug history of
the source patient should be considered in making this decision. The addition of a third antiretroviral drug (usually a protease inhibitor) may be considered for exposures that are particularly high risk (CDC 2001). These are percutaneous exposures with either high-risk source or injury characteristics such as:

- source characteristics of advanced acquired immunodeficiency syndrome (AIDS), primary HIV infection, low CD4 lymphocyte count and known high viral load; and

- injury characteristics of hollow-bore needle, deep puncture, visible blood on device and needle used in source patient’s artery or vein.

Didanosine and ddC currently have no role in PEP.

**Timing**

The HIV/AIDS Clinical Trials and Treatments Advisory Committee of the Australian National Council on AIDS, Hepatitis C and Related Diseases (ANCAHRD) has recommended that chemoprophylaxis should ideally be started within 1–2 hours of the exposure. However, recent data showing complete viral suppression with triple therapy in primary HIV infection suggest that this therapy can appropriately be considered at any point after exposure. The committee also suggests that the exposed individual should receive counselling as soon as possible after the exposure, then be offered repeat counselling within 48–72 hours. It must be emphasised that knowledge of the efficacy and the short- and long-term toxicity of PEP is incomplete and the safety of most of the new antiretroviral agents in pregnancy is unknown. Therapy should be continued for four weeks (CTTAC 1997).

**Hepatitis B virus PEP**

If the source is positive for HBsAg, then, depending upon the type of exposure, HBV PEP may be considered if the exposed person is not already immune. However, no further action is required if the person is already known to be immune to HBV (antiHBsAg ≥ 10 mIU/mL), or if testing within 48 hours of the injury shows the exposed person to be immune to HBV. Testing for HBeAg (hepatitis B ‘e’ antigen) and/or HBV DNA in persons who are HBsAg antigen positive can assist in determining the risk of transmission.

If the exposed person is not immune to HBV, or is of unknown immune status, then HBV immunoglobulin should be given within 48–72 hours of exposure. In addition, HBV vaccine should be started for HCWs who are susceptible and have not received HBV vaccine. If the exposed person is a known nonresponder to HBV vaccination, HBV immunoglobulin (HBIG) should be given within 48–72 hours (CDC 2001; see Table 22.2). Blood should be drawn for testing before HBV PEP is given (NHMRC 2003).
Hepatitis C virus PEP

At the time of writing, there is no PEP for HCV. Expert advice should be sought following a needlestick injury. When the source of a needlestick injury is positive for HCV antibody, HCV RNA testing should be undertaken to assess likelihood of transmission. The option of interferon–ribavirin and prophylaxis is under review.

23.5.3 Postexposure counselling

A specialist with knowledge of bloodborne infections should follow up the incident. If it is demonstrated that a person has been exposed to a bloodborne pathogen, they should not donate blood, semen, organs or tissue for six months, and should not share implements that may be contaminated with even a small amount of blood (eg razors or toothbrushes). For HIV and HBV, they should be informed of the risk of transmission to sexual and injecting partners for a six-month period, and be counselled about issues of safe sex and safe injecting. If PEP is indicated, or there is a risk of acute infection with HIV, HCV or HBV, they should be offered advice on pregnancy and breastfeeding based on an individual risk assessment. In the case of HIV, patients should be advised of the remote risk of seroconversion up to 12 months after exposure, particularly if specific PEP was undertaken.

23.5.4 Follow-up for the exposed person

If the source person is seronegative for HIV, HBsAg and HCV, baseline testing or further follow-up of the exposed person normally is not necessary. If the source person has recently engaged in behaviours that are associated with a risk for transmission of these viruses, baseline and follow-up HIV antibody testing of the exposed person should be considered (see Appendix 8).

23.6 Incidents involving blood or body fluids contaminated with the infectious agent for CJD

23.6.1 Needlestick or other body fluid exposure

If a needlestick or other exposure to blood or body fluids from a patient with known or suspected CJD occurs:

- immediately wash the wound/area with large amounts of soap and water (Brown et al 1984); and
- report the incident according to normal procedures for the health care establishment.
Washing with sodium hydroxide

Some authorities have suggested using sodium hydroxide (NaOH) to wash areas contaminated with blood or other fluids from patients in a risk group for CJD. NaOH should not be used on the skin as PEP, because:

• high concentrations could cause a deterioration of the skin surface, allowing further absorption of infectious agents; and

• low concentrations have questionable value against the activity of prions.

23.6.2 Postexposure counselling and follow-up

The exposed person should seek further counselling and information from their employer and general practitioner. Information may also be obtained from the Australian Government Department of Health and Ageing (Freecall: 1800 802 306).
24 Bloodborne viruses: issues for infected health care workers and students

Key points

- Health care workers (HCWs) who undertake exposure-prone procedures are professionally and ethically obliged to know their infectious status for HIV, HBV and HCV and should seek voluntary testing where appropriate.
- HCWs must not perform exposure-prone procedures if they are:
  - human immunodeficiency virus (HIV) antibody positive;
  - hepatitis B e antigen (HBeAg) positive and/or HBV DNA positive at high titres; or
  - hepatitis C virus (HCV) antibody positive and HCV RNA positive (by polymerase chain reaction or similar test).
- Under current notification requirements, medical practitioners 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.
- Similar infection control precautions, professional conduct codes, protection of privacy and confidentiality procedures apply to health care trainees as to qualified HCWs.
- Health care establishments should have comprehensive occupational health programs to manage HCWs with functional impairment from any cause. HCWs who need to modify their work practices because they are infected with a bloodborne virus should be provided, 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.

24.1 General issues

Concern from both the community and from health care workers (HCWs) about the risk of acquiring bloodborne viruses in health care settings has led to a review of infection control policies and procedures. It has also highlighted the need for national guidelines for HCWs, including students, who may be infected with bloodborne viruses such as human immunodeficiency virus (HIV), hepatitis B virus (HBV) or hepatitis C virus (HCV). The rights of both
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The patient (to know the bloodborne virus status of their HCW) and of the HCW (to privacy) need to be carefully considered. Measures to protect patients and HCWs should be compatible with existing protection available to citizens under legislation and common law. These measures must also give due consideration to the training and expertise of HCWs infected with a bloodborne virus.

All reasonable measures must be taken to prevent patients acquiring life-threatening infections as a consequence of their treatment.

Transmission of bloodborne viruses from HCWs to patients in the health care setting is extremely rare (LaBrecque et al 1986, Bell et al 1995, Health Canada 1998). However, all reasonable measures must be taken to ensure that patients are protected from the risk of acquiring life-threatening infections as a consequence of their treatment, and that HCWs have a safe working environment (ACT DHCC 1999).

Part 4 (Managing infectious diseases in the health care setting) provides specific information on HBV, HCV and HIV.

Reports that there are other hepatitis viruses (eg hepatitis G virus) associated with persistent viraemia and needlestick injury suggest that blanket rules are likely to create many administrative and practical dilemmas. Individual case assessment by State/Territory and/or professional advisory boards is therefore recommended.

Implementation of standard precautions and adoption of nationally recommended procedures for sterilisation and disinfection will minimise the risk of transmission of bloodborne viruses in the health care setting. Additional precautions may be required where there are complicating circumstances, such as HIV-positive patients with infectious pulmonary tuberculosis. Viral co-infections, such as HIV co-infection with HBV and/or HCV, can lead to increased individual viral load and therefore infectivity.

Preoperative testing of a patient for infectious agents should be on the basis of clinical indication, and medical practitioners should exercise their professional judgment in ordering any clinically relevant test, with patient consent and appropriate pretest and post-test counselling.

24.2 Testing and reporting of health care workers

24.2.1 Infectious status

Although there is no mandatory requirement for testing, there is a strong emphasis on the professional and ethical obligations of HCWs who perform exposure-prone procedures to know their infectious status for bloodborne diseases (see Section 24.3).

There is no consensus on how often regular testing should be carried out, but as a minimum it should be done after an incident occurs (eg sharps injury). All HCWs should assess their individual risk of exposure to bloodborne viruses, including HIV, HBV and HCV, and seek voluntary testing where appropriate.
In addition, HCWs who have completed their full course of hepatitis B virus immunisation should seek postimmunisation testing to identify poor responders. The most recent edition of *The Australian Immunisation Handbook* should be consulted for further details (currently NHMRC 2003).

Patient testing is commonly perceived as a means of identifying the level of risk, but it does not diminish the risk and is not a substitute for infection control. HIV testing does not take into account the window period for HIV, when a patient may be infectious but this is undetectable by testing. The window period for HIV is usually three months but it can, very rarely, be longer (Petersen et al 1994, Ciesielski and Metler 1997). Delayed seroconversion was reported eight months after a needlestick injury to a hospital cleaner in France (Meyohas et al 1995). The use of polymerase chain reaction (PCR) testing for HIV/viral RNA can identify 90% of infections within four weeks, significantly reducing this waiting period.

Routine screening has other disadvantages. For HIV testing, nonspecific reactivity in enzyme-linked immunosorbent assay (ELISA) testing will occur much more frequently than true positive results in the Australian population, which has a very low prevalence of unidentified HIV-infected people. In addition, reliance on testing may diminish emphasis on more important strategies that prevent cross-infection, such as standard precautions.

### 24.2.2 Responsibilities of infected health care workers

HCWs have an obligation to care for the safety of others in the workplace (this includes fellow workers and patients) under both common law and the *Occupational Health and Safety and Welfare Act 1986*.

**Nominated risk categories**

HCWs must not perform exposure-prone procedures if they are:

- HIV antibody positive;
- HCV antibody positive and HCV RNA positive (by PCR or similar test); or
- hepatitis B e antigen (HBeAg) positive and/or HBV DNA positive at high titres.

The titre of HBV DNA that represents significant risk has not been identified with certainty. The United Kingdom Department of Health has suggested that greater than 1000 genome equivalents per millilitre represents a risk (see Discussion Point in Section 24.3). It is likely that further information will be forthcoming in this area.

In most States/Territories, bloodborne viruses such as HIV, HBV and HCV are all legally notifiable diseases and should be notified to the chief health officer or the State or Territory health department by name or by code (see Appendix 2).
An HCW infected with a bloodborne virus should be assessed in consultation with their treating medical practitioner, who should make a recommendation about the continued involvement of the HCW in direct patient care. The practitioner should also determine (and make recommendations to the employer) about the infected HCW’s ability to:

- perform to the accepted professional standard without compromising the safety of others or themselves in the workplace; and
- continue to comply with State/Territory health regulations.

An HCW who undertakes exposure-prone procedures (see Section 4.3.2 and Glossary for definition) and who is infected with a bloodborne virus should modify their work practices so that they no longer participate in exposure-prone procedures where there is established evidence of a risk of transmission of infection from HCW to patient. They should also undergo frequent medical follow-up by a medical practitioner with appropriate experience. The HCW and/or the medical practitioner may seek confidential advice from a relevant registration board (medical, nursing, dental etc) and/or a State/Territory health department review panel (see Section 24.3 on HCWs who undertake exposure-prone procedures).

HCWs with a bloodborne virus are not excluded from employment or functions they can safely perform under policies in place in the facility. However, such HCWs have a clear responsibility to:

- know their infectious status;
- follow the treatment recommended by the medical practitioner; and
- modify their involvement in direct patient care to eliminate exposure-prone procedures.

When an HCW infected with a bloodborne virus accepts these responsibilities, routine disclosure to patients of the HCW’s infectious status is unnecessary, as standard infection control procedures continue to apply in the workplace.

When standard infection control procedures are applied, there is no increased risk of patients acquiring a bloodborne virus from an HCW.

A policy that provides for patients to be informed of an individual infected HCW’s status may lead to public confusion about the real and perceived risk of bloodborne virus transmission between HCW and patient. Maintaining confidentiality should encourage HCWs to seek appropriate testing, counselling and treatment and to disclose their serological status to their employers. There is no onus of confidentiality on a patient who is informed about the infectious status of an HCW.

HCWs could respond to questions about their own health (from people in their workplace) by stating that infection control procedures are in place to protect both HCWs and patients.
24.2.3 Responsibilities of medical practitioners caring for infected health care workers

To conform to present legislation, medical practitioners are legally required to notify the chief medical officer or the State/Territory health department of cases of HIV, HBV and HCV either by name or code (see Appendix 2). In addition, the medical practitioner may be legally obliged to bring to the attention of the appropriate registration board (medical, nursing, dental etc) any registered professional person who is unable to practise competently or who poses a threat to public safety. Applicable State/Territory legislation must be followed in these instances.

Decisions about the working practices of an HCW infected with a bloodborne virus are complex. Treating medical practitioners may seek expert opinion to assist them by requesting the relevant State/Territory health department to convene an expert panel. This panel should comprise medical practitioners who have relevant experience with patients with the particular bloodborne virus, as well as an expert in infection control and an HCW from the same profession as the infected worker who is familiar with the work practices the HCW is engaged in. The treating medical practitioner may describe the medical and occupational context to the panel to gain advice. The infected HCW should not need to be identified during the initial investigation of potential risk.

Confidential advice may also be sought from the relevant professional registration board, although the identity of the HCW should be formally notified to this board only if it is established that the HCW is placing patients at risk of infection with a bloodborne virus. In the case of HCWs not covered by a registration board, treating doctors should direct general enquiries to an appropriate authority (usually the State/Territory medical board or chief health officer).

Treating medical practitioners should not notify employers of the bloodborne virus status of the HCW unless the HCW gives their consent for this to occur. When appropriate, treating doctors should counsel the infected HCW to help them make an appropriate choice about employment. The treating medical practitioner should also take into account the psychosocial needs of the HCW and refer them as appropriate for specialist counselling and support.

The medical practitioner caring for an HCW who may be immunodeficient should determine when the level of immunocompromise is significant, and should maintain a high index of suspicion for the appearance of opportunistic infection in the HCW.

24.2.4 Responsibilities of health care establishments

Health care establishments should have comprehensive occupational health programs in place to manage HCWs with functional impairment from any cause. Such programs should evaluate workers' fitness for duty based on competence, ability to perform routine duties and compliance with established guidelines and procedures. Confidentiality must be maintained. HCWs may...
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prefer to consult a medical practitioner outside their workplace, in order to separate occupational health and documentation of clinical care. Confidentiality for the HCW infected with a bloodborne virus not only safeguards personal rights, but is also in the public interest.

It is the responsibility of the HCW’s employer (including self-employed HCWs), in consultation with registration boards or health department expert panels, to ensure that HCWs, with consent, have access to appropriate testing, counselling and immunisation programs. Relevant documentation, including written consent, must be maintained for specific screening and immunisation activities.

For their own protection, HCWs with significant immunodeficiency from any cause should not be involved in the care of patients with certain communicable diseases — for example, tuberculosis, varicella–zoster virus and cytomegalovirus (CMV). Immunodeficient HCWs should be advised of the possible risks of live vaccines, including Bacille Calmette–Guerin (BCG) vaccine, that are available for HCWs in health care establishments.

Confidentiality and counselling

Confidentiality for any HCW infected with a bloodborne virus not only safeguards personal rights, but is in the public interest. The right to confidentiality will encourage HCWs to seek appropriate testing, counselling and treatment and to consider disclosure of their serologic status to their employers.

Counselling should be offered pre- and post-testing.

24.3 Health care workers who undertake exposure-prone procedures

24.3.1 Infectious status

HCWs undertaking exposure-prone procedures have an ongoing responsibility to know their infectious status for HIV, HBV and HCV, and should not perform exposure-prone procedures where there is established evidence of a risk of transmission of infection from HCW to patient (see definition of exposure-prone procedures in Section 4.3). HCWs who engage in exposure-prone procedures should be encouraged to seek routine testing if they believe they are at risk of occupational or other exposures. In particular, HCWs who perform exposure-prone procedures should be encouraged to have voluntary testing if they are:

- untested and presently performing exposure-prone procedures;
- about to begin performing exposure-prone procedures;
- involved in a significant occupational exposure to blood or body substances;
• involved in a significant nonoccupational exposure to blood or body
  substances (including needle sharing or unprotected sexual intercourse with
  an individual infected with HIV or HBV, or with a person at increased risk of
  HIV); or

• untested for 12 months.

A significant exposure includes needlestick injuries with deep penetration
through skin or mucous membrane, injection of blood, or large-bore hollow
needles. Other exposure, such as superficial needlestick injuries, mucosal
exposure and contamination of nonintact skin, should be assessed by a
clinician to determine if the exposure is considered significant.

If there is any uncertainty about the level of risk involved, the matter should be
referred to State/Territory and/or professional advisory boards or in
accordance with local legislation and regulations for individual assessment.

**Human immunodeficiency virus**

Individuals with HIV test results that have been confirmed as positive by a
State/Territory reference laboratory must not perform any procedure where
there is a significant risk of HIV transmission. All exposure-prone procedures
pose significant risks of HIV transmission. In some States or Territories, an
HIV-infected HCW will be excluded from performing any exposure-prone
procedures. Where there is any uncertainty about the level of risk involved,
individuals should be assessed by a State/Territory and/or professional
advisory board on a case-by-case basis to determine their continuing
participation or modification of work practices.

**Hepatitis B virus**

HCWs who test positive for HBV surface antigen (HBsAg) should seek the
advice of a State/Territory health and/or professional advisory board before
they perform exposure-prone procedures.

HCWs who test positive for HBeAg must not perform exposure-prone
procedures, as people with HBeAg pose a higher risk of infection to contacts
than those who are HBsAg positive but HBeAg negative (Zuckerman 1995).

It has been suggested that viral load, measured by a nucleic acid amplification
test, can be used as an indicator of infectivity for HCWs who are HBsAg
positive but HBeAg negative (see discussion point below).
DISCUSSION POINT

**Hepatitis B viral load and exposure-prone procedures**

Recently, the United Kingdom Department of Health issued a circular outlining the need to further test HBsAg-positive but HBeAg-negative HCWs, and exclude those with a viral load (HBV DNA) of greater than 1000 genome equivalents per millilitre from performing exposure-prone procedures (Department of Health 2000). The circular also suggests retesting all HBsAg-positive but HBeAg-negative HCWs with a viral load of less than 1000 genome equivalents per millilitre every 12 months, as viral loads may fluctuate over time.

However, these suggested viral load levels are not yet conclusive as a measure of potential infectivity. Other factors, such as antiviral treatment, may also affect infectivity.

**Hepatitis C virus**

HCWs with HCV viraemia (ie HCV antibody-positive and PCR-positive) must not perform exposure-prone procedures, as there is a risk of transmitting infection in such situations. Individuals with indeterminate HCV antibody test results should not be excluded from performing exposure-prone procedures on the basis of test results alone. If HCV antibody results are positive or indeterminate, however, HCWs should be clinically assessed by an experienced medical practitioner, over a reasonable period of time, for any sign of current/active infection. Where there is insufficient evidence of current/active infection, the treating medical practitioner, or the individual concerned, should seek the advice of State/Territory and/or professional advisory boards or in accordance with local legislation/regulations.

The situation should be reviewed once further information becomes available about the real risk of inoculation injury to surgeons performing exposure-prone procedures and the risks to patients if infected HCWs perform exposure-prone procedures.

**Treatments**

Treatment of HBV, HCV and HIV infection has changed the outcome, chronic carriage rate and probably the risks of infection transmission in blood or body fluid exposures. These factors should be added to the assessment of the treated HCW with bloodborne virus infection.

### 24.4 Assistance for HCWs who have occupationally acquired a bloodborne virus

HCWs whose work practices have been modified because of infection with a bloodborne virus should be provided, where practicable, with opportunities to continue appropriate patient care activities in their current position or a redeployed position, or to obtain alternative career training. Health care establishments should consider whether the redeployed post should be ‘equivalent’ to the previous position and, if so, in what respects.
Health care establishments should address the question of when (or if) HCWs who have been infected with HCV and treated should be allowed to return to performing exposure-prone procedures if they become PCR-negative in conjunction with negative test results from other methods that indicate viral clearance. This is also an issue for HCWs with HBV who were previously HBeAg-positive or PCR-positive, but who subsequently become negative for these parameters.

Visiting medical officers and agency nurses who become infected due to occupational exposure should be eligible for assistance under the same conditions as permanent employees.

24.5 Lookback investigations of patients cared for by HCWs infected with a bloodborne virus

Selective lookback investigations should be considered when there is evidence of significant breakdown of standard infection control practices (such as the presence of exudative dermatitis) during the time the HCW was probably infected with the bloodborne virus, to ensure that those cared for were not placed at risk. Current evidence suggests that, in most circumstances, the benefit from lookbacks may be low, but each case should be assessed individually.

Compliance

States and Territories should have systems in place to ensure compliance with these recommendations.

24.6 Recommendations for health care students

Students should be subject to the same infection control and professional conduct requirements as qualified HCWs and their health status should be accorded the same protection of privacy and confidentiality. Students should not be placed in risk-exposure situations. Training institutions should develop strategies that allow students to acquire clinical skills without risk to themselves or other people.

Immunisation and testing for bloodborne viruses

Health care students are at increased occupational risk for some diseases that can be prevented through immunisation. Training institutions should ensure that all health care students are immunised according to the special risk group recommendations in the latest edition of The Australian Immunisation Handbook (currently NHMRC 2003). Students should understand the importance of voluntary testing for bloodborne viruses and their ongoing obligation to know their infectious status.
Counselling for students

Courses that provide training in careers that involve invasive procedures should include information, counselling, opportunities for testing and career advice. Pretest and post-test counselling should be provided to students who undertake voluntary testing for bloodborne viruses. Post-test counselling for students who test positive for a bloodborne virus and who are involved in exposure-prone procedures should include career advice and alternative programs for consideration. Consideration should be given to placing some limitations on the subsequent registration (conditional registration) of students infected with a bloodborne virus who agree to a modified program. For example, they should not perform exposure-prone procedures. However, medical students infected with a bloodborne virus should be allowed to complete their degree (AMA 1997).

Training institutions should offer support and counselling services to students, including processes for dealing with illness, impairment or disability that may prevent the student from completing their course. Each training institution should clearly outline any course requirements that could be affected by the student’s infectious status. The policies and implications of any disability or impairment (including risks to themselves and their patients) should be explained to students before admission to the course.
25 Blood and blood products for transfusion

Key points

- Premises where blood is collected for the preparation of plasma supplied to a fractionation centre must operate to agreed standards of good manufacturing practice and be licensed.

- Maintenance of the sterility chain throughout the processes of blood collection, processing, storage and distribution is essential to minimise blood component contamination. Specimens of blood should be appropriately handled to eliminate or minimise the possibility of inadvertent contact with blood by health care workers or the public.

- In Australia, every blood donation collected by the Australian Red Cross Blood Service is currently screened for human immunodeficiency virus-1 (HIV-1) and HIV-2 antibodies; hepatitis B virus surface antigen (HBsAg); hepatitis C virus antibody; human T-cell leukaemia virus 1 (HTLV-1) antibody; and syphilis.

- Accumulating epidemiological information and laboratory studies have indicated that transmission of the classical forms of the Creutzfeldt–Jakob (CJD) infectious agent by blood products is highly unlikely. However, the bovine spongiform encephalopathy (BSE or ‘mad cow’) epidemic in cattle in the United Kingdom has raised new concerns because of the emergence of a new strain of CJD (‘variant CJD’) in humans associated with that epidemic. In September 2000, Australian Government and State/Territory health ministers agreed to place a temporary ban on blood donations from people who resided in the United Kingdom for a cumulative period of six months or more between 1980 and 1996.

25.1 Introduction

Throughout the processes of blood collection, processing, storage and distribution, it is essential to maintain the sterility chain to minimise blood component contamination. This section reviews the specific infection control principles in relation to blood and blood components, including risk reduction strategies. The general principles of infection control should also be applied in this setting.
The potential for the spread of infectious disease through blood transfusion has always been recognised. Syphilis and hepatitis were shown to be transmissible by blood. The use of cold storage and the development of serological tests have decreased the risk of syphilis considerably. The realisation that pooled plasma and fractionated albumin transmitted hepatitis led to Cohn’s fractionation method for albumin, incorporating terminal pasteurisation of the albumin solution to inactivate the infectious agent. This was the first deliberate viral inactivation step in the manufacture of a blood product and it remains a benchmark for safety.

The infectious agent associated with the main form of transfusion-transmitted hepatitis, then called ‘serum hepatitis’, was recognised in the 1960s and was later shown to be a virus, which was designated hepatitis B virus (HBV). This virus fortunately generates a large excess of serologically detectable antigen — the so-called ‘Australia antigen’ — in its early replication phase. The ability to screen blood for the antigen using increasingly sensitive test methods significantly reduced the disease as a transfusion risk in developed countries. It also highlighted the existence of a smaller incidence of parenterally transmitted hepatitis, which could not be detected and excluded using the HBV antigen test.

Years of investigation and the application of molecular techniques allowed the most common non-B parenteral hepatitis virus — hepatitis C virus (HCV) — to be characterised and tested, leading to the development of increasingly sensitive tests to considerably reduce the transfusion risk from this virus.

Similarly, the diagnostics industry was able to rapidly use the knowledge of the replication and culture of human immunodeficiency virus (HIV) to develop serological tests for the detection of HIV-infected donors. This led to a large drop in the incidence of transfusion-associated acquired immunodeficiency syndrome (AIDS), a situation that was further enhanced with the development of improved assays based on synthetic antigens. Some blood services went further and screened for the antigen associated with HIV in order to decrease the ‘window period’ of infectivity between infection and the development of serologically detectable antibody.

Recent developments in molecular testing techniques have led to the introduction of nucleic acid amplification testing (NAT) for the detection of viral agents in blood. Using this methodology, viral gene sequences are probed and amplified, allowing minute amounts of viral genome to be detected before conventional serological markers are detectable. Most health services in developed countries have introduced NAT for HCV. NAT screening for HIV will soon be a standard of best practice. No doubt other viruses will eventually be screened using this technology. However, these methods are not a substitute for, but a supplement to, current testing regimens.
Blood donor medical examination and questioning have been mainstay practices of blood banking for many years. Scientific advances in testing and manufacturing chemistry have reduced the infectious risk of blood to the lowest it has ever been. Nevertheless, pressures brought about by public and political perceptions demand ever higher safety levels. It is crucial that in pursuing very small reductions in risk from hypothetical risk factors, such as the variant form of Creutzfeldt–Jakob disease (vCJD; see Section 25.5.6), the blood industry does not introduce additional risks. While vCJD is a hypothetical and unquantifiable risk, HIV and HCV are real risks, with potentially lethal side effects from transfusion with infected blood.

25.2 Regulatory requirements

Under the provisions of the Commonwealth Therapeutic Goods Act 1989, premises where blood is collected for the preparation of plasma to be supplied to a fractionation centre must be licensed. Licences are approved if the blood collection centre producing the source plasma operates to the agreed standards, which are detailed in the Australian Code of Good Manufacturing Practice for Therapeutic Goods, Blood and Blood Components (TGA 1995). The code covers every aspect of manufacture, process control and quality assurance. The Therapeutic Goods Administration (TGA) has recently extended its remit to include fresh blood components, and the revised code (combined Human Blood and Tissue Code) is currently undergoing industry consultation.

The two main areas of international regulatory guidance in blood products are the Food and Drug Administration (FDA) in the United States and the European Medicines Evaluation Agency (EMEA) in Europe. The FDA has jurisdiction over fresh blood components as well as plasma derivatives. The EMEA has jurisdiction over plasma derivatives; European national authorities are responsible for fresh components.

25.3 Bacterial contamination

Bacterial contamination of blood components was one of the earliest recognised complications of blood transfusion, and it remains a cause of severe transfusion reactions (Goldman and Blajchman 1991, Wagner et al 1994, Hogman and Engstrand 1998). These reactions are more common with platelet transfusions, because room-temperature storage permits the proliferation of many bacterial species. Most species isolated from contaminated platelet concentrates are gram-positive and are part of the normal flora that are thought to enter the bloodbag during venesection (Hogman and Engstrand 1998). Bacterial contamination causing serious septic complications is very rare after red cell transfusion, with approximately half the reported cases being secondary to Yersinia enterocolitica. Y. enterocolitica contamination probably occurs via donor leucocytes harbouring living
infectious agents that are released when the leucocytes disintegrate. *Y. enterocolitica* can grow well at 4°C and produce a potent endotoxin (Hogman and Engstrander 1998). Both for whole blood and for plasma, the risk increases towards the end of the stored-blood shelf life.

It is important to consider potential sources of contamination, and implement strategies to reduce transfusion-associated sepsis.

All areas where blood collection, processing, testing, handling and/or storage activities are conducted must be kept clean to minimise microbial load in the environment.

25.3.1 Blood donor selection

Most bacteraemic people are symptomatic and therefore are not usually eligible as blood donors. Occasionally, however, ‘well’ blood donors have episodic bacteraemia. This may occur during incubation of a bacterial illness, during recovery from a bacterial illness or during chronic low-grade infection, or it may be associated with minor procedures such as dental work.

Blood collection centres must have:

- donor selection guidelines that minimise potential donor bacteraemia, based on medical history and behavioural assessment; and
- a system to allow feedback from donors about postdonation illness (which may result in the recall of blood components that may have become bacterially contaminated).

25.3.2 Blood collection

Contamination of blood collected in recycled glass bottles has become much less common since the introduction of single-use integrally connected plastic bloodbags (closed systems) and rigorous control of manufacturing (Hogman and Engstrander 1998). Although rarely observed, contamination has been reported from inadequately sterilised bloodbags or bloodbag overwraps (Wagner et al 1994). To minimise the risk of contamination at the time of blood collection, meticulous attention must be paid to disinfection and the use of sterile equipment.

Blood collection centres must ensure that:

- HCWs performing venepuncture are appropriately trained;
- the venepuncture site on the donor’s arm, usually the antecubital fossa, is free of any skin lesions, rash or scarring that could cause contamination of the blood unit;
- the venepuncture site is thoroughly cleaned and disinfected using a validated procedure (Goldman et al 1997);
- care is taken not to touch the cleaned venepuncture site before needle insertion;
Blood and blood products for transfusion

• blood is collected into an approved bloodbag that is listed on the Australian Register of Therapeutic Goods (ARTG L), is pyrogen-free and sterile and contains sufficient anticoagulant for the quantity of blood to be collected;
• bloodbags and apheresis solutions are stored according to manufacturers’ instructions (TGA 1995); and
• items used during the venepuncture process are sterile and, where possible, single use and disposable.

Gloves must be worn in the following situations:
• for any contact with blood, body substances or mucous membranes, including the handling of blood or blood-soiled equipment or items and cleaning up blood spills;
• when an HCW who is involved in a possible blood contact has broken skin; and
• whilst an HCW is receiving training in venesection.

25.3.3 Blood processing

Blood that will be used for component preparation should be collected into a primary bloodbag with integrally attached satellite bags, so that the contents are not exposed to air or outside elements during preparation and separation of components (ie a closed system). Sterile connection docking devices allow the system to be entered and bloodbags and tubing to be introduced without breaking the integrity of the system. The shelf life of the components prepared in this way is the same, in general, as for those prepared in a regular closed system. Sterile connection docking devices must be validated and kept clean. If the airtight system is entered, it becomes an open system and the allowable storage times change. Components stored at 2–8°C must be used within 24 hours, or within four hours if stored at 20–24°C (American Association of Blood Banks 1996).

Unless protective shielding is in place, protective eyewear or face-shields must be worn in the following situations:
• when using equipment containing blood under pressure (eg plasma expressors);
• when using heat sealers; and
• when there is a risk of splashing, splattering or spraying of blood or body substances to the face during any procedure or in any situation.

25.3.4 Bacteriological screening

Microbial contamination testing should be carried out periodically in order to verify the continuing reliability of the quality process (TGA 1995). Where contamination is demonstrated, records must show what action has been taken to identify the contaminant and its possible source.
25.3.5 Blood component storage and transport

Refrigeration or freezing minimises proliferation of bacteria that might have entered the unit during venepuncture or were present in the circulation of the donor. Maintaining the temperature of whole blood at up to 24°C for a short period after collection may reduce bacterial contamination, because active leucocytes present in the blood can clear contaminating bacteria (Hogman et al 1993).

Blood components need appropriate storage and transport conditions, which must meet the conditions outlined in the current TGA Code of Good Manufacturing Practice for Therapeutic Goods — Blood and Blood Components (TGA 1995).

Blood should be stored in monitored refrigerators in accordance with AS 3864.1. Recording thermographs or suitable electronic continuous recording equipment and audible alarms should be installed for all blood storage equipment. The alarm signal must be activated at a temperature that allows HCWs to take proper action before the stored blood reaches undesirable temperatures.

25.3.6 Thawing of frozen plasma

Fresh frozen plasma for transfusion must be thawed in a waterbath at 30–37°C, in a nonwater contact bath (which is better than a simple waterbath) or in an approved, purpose-built microwave device (Goldman and Blajchman 1991). When plasma products are thawed in a waterbath, caution must be taken to maintain sterility. This can be achieved as follows:

- Disinfect and empty the waterbath frequently and after any blood spillage (surveillance cultures may be needed to verify a low microbial load).
- Avoid water contamination of bloodbag entry ports by wrapping bloodbags in plastic overwrap or positioning them upright with entry ports above the water level.
- Dry bags with a lint-free cloth before use.

25.3.7 Pretransfusion inspection of blood components

All blood and blood components should be inspected before they are issued for transfusion. Blood collection centres should be notified if contamination is suspected or confirmed. The appearance of red cell components may be altered when bacterial contamination is present (Wagner et al 1994). Unusual appearances may include the following:

- segment colour much lighter than that of the bloodbag;
- red cell mass more purple or darker than usual;
- zone of haemolysis just above cell mass;

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All blood and blood components should be inspected before they are issued for transfusion.

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1 AS 3864 (1997) and Amendment 1 (1998) Medical refrigeration equipment — For the storage of blood and blood products.
• visible clots;
• murky or discoloured plasma; or
• presence of blood or plasma in the ports or at sealing sites in the tubing, which suggests inadequate sealing or closure.

Bacterial contamination of platelets should be suspected if:
• there are grossly visible aggregates; or
• there has been cessation of platelet ‘streaming’ or ‘swirling’.

The tubing and plastic bag of frozen plasma products should be checked for cracks.

25.3.8 Contamination of bloodbag surfaces

Care must be taken to prevent any substances or dirty or moist surfaces coming into contact with bloodbags, as the plastics used are permeable to some substances. Where a bloodbag surface is contaminated with blood, this may be removed by wiping the bag with lint-free cloth dampened in water, then wiping the bag with alcohol. Bloodbags that are grossly contaminated should be discarded; where possible, the source of the contamination should be identified and removed.

The plastics used to manufacture the bags for blood and blood products and other intravenous fluids are permeable to some chemicals, such as the inks used in felt-tipped pens and glues used for labelling. Only the label should be written on, as required; it is recommended that paper strips be used for infusion times.

25.3.9 Unused bags of blood or blood products

Unused bags of blood and blood products should be returned to the Australian Red Cross Blood Service (ARCBS), by whom they will be checked for integrity and, where possible, reissued. Care in the handling of these bags (when not required for a patient) will ensure that their contents are not unnecessarily wasted due to careless handling.

25.4 Viral contamination

Although the safety of the transfusion blood supply has improved dramatically over the past 15 years, there are still risks of infection associated with blood transfusion. In addition to improvements in donor selection and laboratory testing, there is a need to identify, develop and implement methods to inactivate or deplete viruses in blood products.
25.4.1 Donor selection

The ARCBS has developed guidelines for the selection of blood donors, to assist its HCWs to determine the appropriateness of collecting blood from potential donors. The guidelines are based on both medical history and lifestyle factors. The decision to accept a blood donation is based on both the safety of the person donating the blood and the safety of the individual receiving the blood. The guidelines are regularly reviewed and updated.

25.4.2 Laboratory screening

Within Australia, every blood donation collected by the ARCBS is currently screened for:

- HIV-1 and HIV-2 antibodies;
- HBV surface antigen (HBsAg);
- HCV antibody;
- human T-cell leukaemia virus 1 (HTLV-1) antibody; and
- syphilis.

The major risk of transfusion-transmitted infection results from the collection of a unit of blood during the infectious window period for these agents. The window period is the period in early infection when the virus is circulating in the blood but conventional tests are unable to detect viral antigens or antibodies. The window period can be reduced by nucleic acid amplification technology (NAT), including polymerase chain reaction (PCR) or transcription-mediated amplification. Both these procedures amplify segments of viral nucleic acids to the level at which they can be readily detected; NAT procedures for HIV and HCV have been introduced by Australian blood banking services.

25.4.3 Viral inactivation of fresh frozen plasma

Some international blood services provide alternatives to fresh frozen plasma in an attempt to improve viral safety. There are two alternatives, but both have significant limitations.

The solvent–detergent (SD) method uses the organic solvent TNBP (tri-n-butyl-phosphate) with the nonionic detergent Triton X–100 to disrupt the lipid-containing structures in enveloped viruses, thus causing them to lose their infectivity (Edwards et al 1987, Hellstern et al 1992). SD-prepared plasma is manufactured from pools of ABO blood group-specific plasma from up to 2500 donors. However, the moderately large number of donations pooled to produce SD-prepared plasma theoretically increases the risk of transmission of agents not inactivated by the SD process, or of those not neutralised by passive cotransfusion of pathogen-specific antibody. SD-plasma is also expensive.
Treatment of plasma with methylene blue (MB), a phenothiazine dye, and irradiation with visible light inactivates a wide range of enveloped and nonenveloped viruses. MB binds to nucleic acids, especially guanine residues, because of its highly cationic nature. Illumination leads to the generation of local reactive oxygen species, especially local singlet oxygen, which are the active principles of the photo-oxidative MB viral inactivation process (Tuite and Kelly 1993, Muller-Breitkreutz and Mohr 1995, Muller-Breitkreutz et al 1995). MB plasma does not require pooling of donations, and thus avoids the risk of a potential increase in overall viral transmission rates from transfusion. However, the MB technique is prone to technical failure, and its metabolites are potentially genotoxic.

These products are not currently available in Australia because of the above limitations and a poor cost–benefit ratio. This situation is regularly reviewed by ARCBS.

25.4.4 Decontamination of cellular blood components

Over the past 10 years, there has been extensive research into methods for inactivating infectious pathogens in cellular components.

Decontamination processes against a broad array of infectious pathogens, irrespective of type, would provide a measure of safety against transfusion-associated infectious agents undetected by current pretransfusion tests. This could protect against new viral pathogens entering the donor population before effective donor screening assays can be implemented. Several potential inactivation technologies for treatment of platelet concentrates have been described, including psoralens activated with long-wavelength ultraviolet light, merocyanine 540 activated with visible light and phthalocyanines activated with ultraviolet B without a photoactive agent. Several other technologies, such as hypericum, ozone and MB, have been applied to red cells. To date, clinical trials have begun on only one of these systems (noval psoralen S–59) (Corash 1999).

25.4.5 Handling and transport of blood specimens

Specimens of blood should be appropriately handled to eliminate or minimise the possibility of inadvertent HCW or public contact with blood. The following procedures should be used:

- Specimens should be placed in a leakproof, sealable primary container; snap-top closures should be avoided. The specimen’s primary container should then be transported within a secondary container.

- Request slips should be protected from contamination. The use of a double-compartment clear plastic bag is recommended.

- HCWs receiving specimens should examine all containers for leaks. If the outside of the primary container is contaminated, it should be appropriately cleaned.
• If a request form, or paperwork associated with a specimen, is contaminated, it should be placed in a clear plastic bag and a photocopy taken. The copy should then be annotated and the original safely discarded.

• Specific warning labels on specimens collected from patients with known infectious diseases, such as HIV, are not recommended. All specimens should be regarded and treated as infectious and the confidentiality of patients should be protected.

• Specimens for transport between institutions should be packed and labelled in compliance with the carrier’s conditions, government and postal regulations and International Air Transport Association regulations, whichever are appropriate.

25.5 Contamination with the infectious agent for CJD

Accumulating epidemiological information and laboratory studies have indicated that transmission of the classical forms of the CJD infectious agent by blood products is highly unlikely. However, the emergence of variant CJD (vCJD) has raised new concerns (see Section 25.5.6).

25.5.1 Epidemiological evidence

Five published case–control studies have analysed over 600 CJD cases. None of these studies showed that blood transfusion increased the risk for CJD (Esmonde et al 1993a, Wientjens et al 1996, van Duijn et al 1998). Investigations of recipients of blood components from known CJD donors have not revealed transmission of the CJD agent (Heye et al 1994, Evatt et al 1998), although these cohort studies are limited by the small numbers of such recipients. Because of the need for long-term follow-up, the value of these studies is likely to be limited unless there is a high transmission rate.

National mortality surveillance performed by the United States Centers for Disease Control and Prevention (CDC) indicates that patient populations with increased exposure to blood or blood products are not at increased risk of CJD (Holman et al 1996). During an 18-year period (1979–96), 4468 cases of CJD were reported to CDC. When death records were searched, none of these cases was reported to have had haemophilia, thalassaemia or sickle cell disease. More directed evaluation of people with haemophilia has not shown a link to CJD.

In one study, brain tissue from 24 haemophiliacs who died with neurologic disease was examined: none had evidence of CJD (Evatt et al 1998). In a second study, brain tissue from 33 haemophiliacs in the United Kingdom, who died of various causes, was examined; none had evidence of CJD (Lee et al 1998). Additional surveillance of cryoprecipitate recipients is under way in Seattle in the United States. In 1997, no CJD cases had been reported among 101 patients who together received over 238,000 units of cryoprecipitate.
between 1979 and 1985. Between 12.5 and 18.5 years later, 76 of these subjects were alive (CBER 1999). Three of these recipients were known to have received at least one unit of cryoprecipitate from donors known to have developed CJD.

25.5.2 Laboratory studies

While some laboratory experiments have demonstrated that manufacturing significantly lowers the amount of the CJD infectious agent in plasma derivatives, others have shown that blood and plasma fractions from experimentally infected animals transmit CJD to recipient animals when directly injected into the brain, but not through transfusion of blood (Brown et al 1994, 1998; Brown 1995).

25.5.3 Donor selection

Despite the evidence cited above, policies are in place for the exclusion of donors at risk of developing CJD (see Section 31.17). However, this is done more on the principle of collecting blood from healthy individuals than because of any perceived risk of CJD transmission by blood. ARCBS permanently defers donors:

- with a diagnosis or family history of transmissible spongiform encephalopathies, including CJD, fatal familial insomnia and Gerstmann–Sträussler–Sheinker disease;
- with possible exposure through treatment with pituitary hormones, including growth hormone and gonadotrophins; and
- who are recipients of dura mater grafts or corneal grafts (ARCBS 1998).

This is consistent with international practice. In the United States, the FDA requires ‘indefinite’ deferral of donors with a family history of CJD and individuals with possible exposure through treatment with pituitary hormones, including growth hormone and gonadotrophins, and recipients of dura mater grafts (ARCBS 1998). The European position is to permanently defer such individuals (Council of Europe 1995).

25.5.4 Plasma fractionation

Plasma derivatives are unlikely to transmit disease in humans because:

- a CJD-implicated plasma unit would be diluted into a large plasma pool, leading to a low number of infectious units in a dose of the final product;
- intravenous and intramuscular inoculation alone is less efficient than intracerebral inoculation for CJD transmission; and
- further processing of plasma pools by Cohn’s fractionation, and manufacturing processes such as column chromatography, precipitation, and filtration, have been shown to diminish titres of CJD-like agents in spiking experiments using scaled-down manufacturing procedures (TSEAC 1998).
25.5.5 Recall policies

If a donation from a high-risk CJD donor is included in a pool for manufacture of plasma products, a product recall is not currently required. However, it is advisable to recall any fresh components from the donor if the products are still ‘in date’.

The FDA’s original guidance required recall of both plasma products and fresh components (CBER 1996). This was modified (CBER 1998) to restrict plasma product recall to cases of vCJD (see Section 25.5.6), but the recall provisions for in-date fresh components were maintained. Thus, recall is mandatory for fresh components (such as whole blood) and cellular products if they are still in date when a donor is identified as being at risk of CJD. The modification of the FDA’s policy for plasma products brought the FDA into line with the European policy as stated by the EMEA, which has never required recall of plasma products because of CJD (EMEA 1995).

A similar policy for fresh components is followed by most individual national health authorities in Europe, and is reflected in World Health Organization (WHO) consensus statements. This policy is also followed by the ARCBS. As the impact on the blood supply of such a recall is significantly less than a recall of plasma products, this policy is reasonable.

It remains to be seen whether the modification of the FDA’s recall policy is reflected in practice. Some European authorities decided to recall plasma products when a CJD donor had contributed to the pool, despite the EMEA’s policy.

25.5.6 Variant CJD

A precautionary policy is warranted until more is known about the possibility of vCJD transmission by blood components or plasma derivatives.

The risk of transmission of vCJD by blood or blood products has not been accurately determined, although the risk is currently being evaluated by laboratory and epidemiological studies. Variant CJD appears to be distinct from the classical forms of CJD (cCJD), both clinically and biologically, so transmissibility cannot confidently be predicted from studies of cCJD. Experimental studies have raised concerns about the potential for the vCJD agent to be transmitted by blood (Houston et al 2000). A precautionary policy is therefore warranted until more is known about the possibility of vCJD transmission by blood components or plasma derivatives.

Donor selection

So far, vCJD has only significantly affected the United Kingdom. Some countries have revised their blood donor policies to exclude donors who have resided in that country. Such policies assumed a high profile with the decision by the United States to defer ‘indefinitely’ donors who resided in the United Kingdom for a six-month period during 1980–96. This policy was immediately mirrored by Canada’s Therapeutic Products Program. New Zealand followed shortly afterwards. In Australia in September 2000, the Australian Government and State/Territory health ministers agreed to place a temporary
ban on blood donations from people who lived in the United Kingdom for more than a six-month period during 1980–96. The risks in relation to vCJD will be kept under review by a special expert committee of the National Health and Medical Research Council (NHMRC) established to monitor the condition.

Recall policies

Both the FDA and the EMEA require product recall if plasma products are manufactured from a pool subsequently shown to include a vCJD donation (CBER 1999, CPMP 1998). This policy extends to excipients included in certain biological drugs.

The policy for recalling fresh components is the same as for cCJD.

25.6 Emerging infectious agents

ARCBS constantly monitors scientific developments in this area and actively reviews donor selection guidelines, testing strategies and communication with stakeholders to ensure the safety of the Australian blood supply.
26 Organs and tissues for transplantation

Key points

- A wide variety of organs and tissues are transplanted in Australia, including kidney, heart, liver, lungs, pancreas, cornea, bone, bone marrow and placental cord blood. The Transplantation Society of Australia and New Zealand has produced guidelines for the solid organs, cornea and bone, but not for stem cell transplantation by bone marrow or cord blood.

- Transplant recipients range from patients who need urgent transplantation to save their lives to patients for whom transplantation is not essential but would offer an improved quality of life. The risks that these groups are prepared to face differ significantly.

- A range of testing procedures to screen donors of vascularised organs for hepatitis A, B and C virus infections should be considered so that a decision to transplant or not can be based on the status of the donor and recipient.

- To reduce the risk of transmission of Creutzfeldt–Jakob disease (CJD), people in a risk category for the disease (see Section 31.9), people who die in psychiatric hospitals, and people who die with any obscure undiagnosed neurological disorder should be excluded from the routine donation of organs and tissues. However, tissues from a person in the lower-risk CJD group may be used if the recipient is elderly, has been fully informed of the risk, and the transplant procedure is a matter of life or death.

26.1 Introduction

A wide variety of organs and tissues are transplanted in Australia, including kidney, heart, liver, lungs, pancreas, cornea, bone, bone marrow and placental cord blood. Guidelines produced by the Transplantation Society of Australia and New Zealand\(^1\) cover solid organs, cornea and bone, but not stem cell transplantation by bone marrow or cord blood (HSA and ASBT 1985, TSANZ 1989).

Transplant recipients vary considerably in the seriousness of their underlying organ failure. At one extreme, a patient with hepatic coma in intensive care and a patient on a mechanical ventricular-assist device to maintain cardiac output are both in urgent need of transplantation as the only alternative to death. Most patients on the waiting lists have less urgent needs (eg stable renal dialysis patients, or those with chronic liver failure or cardiac failure). However,

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7–20% of these ‘less urgent’ patients will die each year awaiting transplants. Some patients, such as those waiting for a corneal graft, do not have a life-threatening condition, but transplantation would offer substantial improvement to their quality of life.

The risks that each group is prepared to face in order to receive a transplant therefore vary considerably. A patient with fulminant hepatic failure and hepatitis B virus (HBV) infection would probably accept an HBV-infected, but functioning, liver. A patient with a less urgent condition, on the other hand, would not want to be exposed to any substantial risk of infectious disease transmission.

In some instances, the avoidance of infectious disease from organ donations requires a more stringent standard than for blood. HBV is transmitted from an HBV surface antigen (HBsAg)-negative, HBV core antibody (HBcAb)-positive donor liver in a high proportion of cases (Radomski et al 1996, Van Thiel et al 1999) but is not transmitted with the same frequency from a heart or a kidney from the same donor (Wachs et al 1995).

Transplant recipients are preferably accommodated in single rooms but do not require positive pressure room ventilation unless they are allogeneic bone marrow recipients.

### 26.2 Donor selection

#### 26.2.1 Hepatitis B virus

**Liver donors**

All potential liver donors must be tested for HBsAg and HBcAb. All donors positive for either test should be excluded as donors for HBV-negative recipients, other than in exceptional circumstances (when urgent patients are listed for transplantation). Donors positive for HBsAg represent the highest risk for transmission. HBcAb-positive donors should be considered for HBsAg-positive recipients in transplant units with protocols that use lamivudine and HBV immunoglobulin cover for transplantation (Dodson et al 1999, Meisel et al 1999, Van Thiel et al 1999).

**Heart, lung, kidney, pancreas or other vascularised organ donors**

All potential donors of hearts, lungs, kidneys, pancreas or other vascularised organs (except liver — see above) must be tested for HBsAg. Organs from HBsAg-positive donors must not be used for HBsAg-negative recipients. There is no current evidence of transmission of HBV by HBsAg-negative donors in Australia. There is a single case report of one in 42 kidney recipients of HBcAb-positive HBsAg-negative kidneys becoming infected with HBV (Madayag et al 1997). There is therefore insufficient information at this time to change the current practice of only testing for HBsAg.
Nonliver organ recipients from donors known to be HBsAg-negative but HBcAb-positive should ideally be immune and/or immunised against HBV and must give specific consent to the transplant.

Banked and nonvascularised tissue

All donors of banked and nonvascularised tissue, including cornea, bone and heart valve, must be tested for HBsAg and should be tested for HBcAb (testing of donors was introduced in 2001). The nonurgent and non-life-threatening nature of the indications for tissue transplantation mean that all donors positive for HBsAg represent a potential risk for transmission of HBV and their tissues must not be used. Donors negative for HBsAg but positive for HBcAb represent an unknown risk for the transmission of HBV (Satterthwaite et al 1997) and their tissues should not be used other than in exceptional circumstances. If tissues from positive donors are considered, prophylactic treatment of the recipient should also be considered, and consent must be obtained.

Table 26.1 Summary of recommendations for HBV-infected organ donors and recipients

<table>
<thead>
<tr>
<th>Organs/tissues</th>
<th>Testing required</th>
<th>Donor</th>
<th>Recipient</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>HBsAg and HBcAb</td>
<td>HBsAg and/or HBcAb-positive</td>
<td>HBV-negative</td>
<td>Not recommended (except in exceptional circumstances)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HBcAb-positive</td>
<td>HBsAg-positive</td>
<td>Possible in units that use lamivudine and HBV immunoglobulin cover for transplantation</td>
</tr>
<tr>
<td>Heart, lung, kidney, pancreas and other vascularised organs</td>
<td>HBsAg</td>
<td>HBsAg-positive</td>
<td>HBsAg-negative</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HBsAg-negative</td>
<td>Any</td>
<td>Recommended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HBsAg-negative/ HBcAb-positive (if known)</td>
<td>Any</td>
<td>Possible for immune and/or immunised recipients with specific consent</td>
</tr>
<tr>
<td>Banked and nonvascularised tissues</td>
<td>HBsAg and HBcAb</td>
<td>HBsAg-positive</td>
<td>Any</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HBsAg-negative</td>
<td>Any</td>
<td>Not recommended except in exceptional circumstances with prophylactic treatment and specific consent</td>
</tr>
</tbody>
</table>

HBsAg = HBV surface antigen; HBcAb = HBV core antibody

* Testing for HBcAg is not recommended for nonliver transplant donors or recipients at this stage.

26.2.2  Hepatitis C virus

Transmission risk from organ donors

Organ donors in the United States have a mean prevalence of being anti-hepatitis C virus antibody (anti-HCVAb)-positive of approximately 5% (Pereira et al 1994). A similar level is found in Australian or New Zealand donors. These figures are significantly greater than random blood donors (0.3%) (Mison et al 1997, Whyte and Savoia 1997, Tanaka et al 1998).

Not all anti-HCVAb-positive subjects are currently HCV infected. It has been estimated that approximately 50% of HCVAb-positive organ donors are HCV polymerase chain reaction (PCR) test-positive (Pereira et al 1994, Pessoa and Wright 1997). Only donors who are positive for HCV RNA (by PCR test) have been shown to transmit infection (Dore et al 1997) and up to 100% of PCR-positive donors transmit infection to recipients (Pereira et al 1994). There are no demographic data to distinguish anti-HCVAb-positive/PCR-positive from anti-HCVAb-positive/PCR-negative subjects (Pereira et al 1994).

Nonliver allograft recipients

There is evidence that HCV-infected kidney and cardiac allograft recipients have a significantly worse long-term outcome following transplantation than do patients not infected with HCV (Mathurin et al 1999). There are, however, some short-term studies that do not show this. Only preliminary data are available on cardiac transplants (Roth et al 1994). There are no data yet on lung transplants. From the literature, it is difficult to distinguish HCV-positive subjects who were anti-HCVAb-positive before transplant from those who acquired the infection after transplantation.

Natural history of HCV infection after liver transplant

Some data indicate that HCV infection in liver transplants results in significant liver disease. However, five-year survival rates do not, as yet, show significant differences between anti-HCVAb-positive and anti-HCVAb-negative recipients (Gane et al 1996, Everhart et al 1999). Emerging data suggest that patients with higher pretransplant and post-transplant viral loads have worse outcomes (Charlton et al 1998). Earlier data indicated that patients with genotype 1b who required liver transplant also had worse outcomes (Gane et al 1996), but this has not been supported in all studies.

Use of HCV-positive liver allografts

Some data suggest that recipients of HCV-positive liver allografts do not have a worse outcome than other allografts (Testa et al 1998). Indeed, when HCV-positive grafts are transplanted into HCV-positive recipients with different genotypes, the recipients who develop the donor genotype have a better outcome (Vargas et al 1999).
26.3 Creutzfeldt–Jakob disease and transmissible spongiform encephalopathies

To reduce the risk of transmission of Creutzfeldt–Jakob disease (CJD), the following people should be excluded from the routine donation of organs and tissues:

- people in the higher- and lower-risk groups (see Section 31.9 for risk group definitions);
- people who die in psychiatric hospitals, with the exception of those in whom CJD has been specifically excluded; and
- people who die with any obscure undiagnosed neurological disorder, including dementia (AGMPSE 1981, Lazarus 1993).

Agencies that are responsible for recruiting organ/tissue donors and for the banking of tissues (e.g., corneas, heart valves, skin) should be aware of the risk of CJD and should have criteria and procedures in place for exclusion of tissues from individuals in the above groups (Busch et al 1997, Eastlund 1995, Hogan et al 1999, Lazarus 1993).

In all cases where materials for transplantation, grafting, or tissue banking are derived from postmortem material, it is strongly recommended that the brain of the donor is assessed and cleared by a specialist neuropathologist. Paraffin blocks of brain tissue from such donors should be archived for future reference. It is likely that rapid screening tests based on immunoassays for the PrPSc prion protein isoform will become available in the near future.
Materials from the above patient groups should not be used for the preparation of any therapeutic products or laboratory reagents (e.g., thromboplastin or Kveim test material) (de Silva and Will 1993, du Bois et al 1993). The question of organ donation from people at risk of variant CJD, such as those who have lived in the United Kingdom for over six months between 1980 and 1996, is currently under review.
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Key points

+ Any strategy used for infection control should be based on the use of standard precautions, as a minimum level of control, supplemented by additional precautions where standard precautions may be considered insufficient to prevent infection.

+ Additional precautions are based on three specific routes of disease transmission (airborne, droplet and contact). Infection control practices for each specific disease must take account of its mode of transmission.

27.1 Introduction

This part of the guidelines includes specific information on diseases that may be encountered as health care associated infections in the health care setting. It contains comments and guidelines on the prevention of transmission of infection, health care worker (HCW) protection issues related to the management of patients with these diseases, and preventive measures for patients and HCWs at particular risk of serious infection.

27.2 Infection control strategy

As outlined in Section 2 of these guidelines, effective infection control involves a two-tiered approach:

• **standard precautions** for the basic level of infection control (recommended for the treatment and care of all patients — see Section 2.2); and

• **additional precautions** for situations where standard precautions may be insufficient to prevent transmission of infection (recommended for specific patients known or suspected to be infected or colonised with highly transmissible pathogens that can cause infection in health care settings — see Section 2.3).

The level of precaution required is based on modes of transmission of infectious agents. Standard precautions provide adequate protection for bloodborne diseases and additional precautions relate to three specific routes of transmission:

• airborne transmission;
• droplet transmission; and
• contact transmission.
Table 27.1 shows the three modes of transmission for which additional precautions are required and examples of diseases requiring them. An outline of the procedures involved is given in Section 2.3.

### Table 27.1 Examples of diseases requiring additional precautions, by mode of transmission

<table>
<thead>
<tr>
<th>Mode of transmission</th>
<th>Examples of diseases</th>
</tr>
</thead>
</table>
| **Airborne transmission** | Tuberculosis — suspected or confirmed  
| | Measles  
| | Varicella (chickenpox)  
| | Zoster (shingles) disseminated  
| | Viral haemorrhagic fevers, eg Ebola fever  
| | SARS |
| **Droplet transmission** | Neisseria meningitidis septicaemia/meningitis  
| | Whooping cough (caused by Bordetella pertussis)  
| | Influenza  
| | Measles  
| | Parvovirus B19 infection  
| | Respiratory syncytial virus infection  
| | Rubella  
| | Group A streptococcal infections in infants and young children  
| | Group A streptococcal pneumonia or scarlet fever in all age groups  
| | SARS |
| **Contact transmission** | Resistant bacteria (MRSA, VRE and others named by infection control committee)  
| | Herpes simplex (neonatal or mucocutaneous)  
| | Highly contagious skin infections/infestations (ie impetigo, scabies, pediculosis [lice])  
| | Measles (contact with respiratory secretions)  
| | Varicella (chickenpox)  
| | Zoster (shingles), localised and disseminated  
| | Infants/young children (less than six years), or any incontinent patient with:  
| | – enteroviral infection  
| | – hepatitis A  
| | – rotavirus enteritis, shigellosis, giardiasis or other forms of gastroenteritis  
| | SARS |

HCW = health care worker; MRSA = methicillin-resistant Staphylococcus aureus; SARS = severe acute respiratory syndrome; VRE = vancomycin-resistant enterococci; VZV = varicella–zoster virus

---

a All HCWs should know their VZV, measles, mumps and rubella immune status (only immune HCWs should care for these patients).
b Additional precautions (contact transmission) also apply for these diseases.
c Droplet transmission precautions for meningococcal infections only need to be continued until the patient has had 24 hours of effective antibiotic treatment. The same applies for Group A streptococcal infections, as far as pharyngeal carriage is concerned. However, Group A streptococcal infections may need to be isolated in special circumstances, such as burns units, until there is evidence of clearance of the organism from the burn.
d Refer to specific local policy.
27.3 Diseases for which specific information is included

Not all diseases have been included in Table 27.1. The list includes those that have a high risk of transmission in the health care setting, and those that, although rarer, have major implications for public health.

The following viral diseases are described in further detail in Section 28:

- cytomegalovirus infection
- infectious mononucleosis (glandular fever)
- viral hepatitis (hepatitis A, hepatitis B, hepatitis C)
- herpes simplex infections
- human immunodeficiency virus (HIV) infection/acquired immunodeficiency syndrome (AIDS)
- influenza
- measles
- parvovirus B19 infection
- respiratory syncytial virus infection
- rotaviral enteritis
- rubella
- chickenpox (varicella) and shingles (zoster)
- viral haemorrhagic fevers (Lassa fever, Marburg haemorrhagic fever, Ebola haemorrhagic fever, Crimean–Congo haemorrhagic fever)
- severe acute respiratory syndrome (SARS).

The following bacterial diseases are described in Section 29:

- gastroenteritis and enteric diseases
- legionellosis
- listeriosis
- meningococcal infection
- whooping cough (caused by *Bordetella pertussis*)
- staphylococcal infection
- streptococcal infection
- tuberculosis.
Diseases associated with the following antibiotic-resistant bacteria are considered in Section 30:

• methicillin-resistant *Staphylococcus aureus* (MRSA);
• vancomycin-resistant *Enterococcus faecium* and *E. faecalis* (VRE: van A and van B types);
• multidrug-resistant *Mycobacterium tuberculosis*; and
• multiresistant gram-negative bacilli.

Creutzfeldt–Jakob disease (CJD) is considered in Section 31. Other diseases (scabies, pediculosis etc) are considered in Section 32.

An overview of recommended precautions for all these diseases is shown in Table 27.2.
## Table 27.2 Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mode of transmission</th>
<th>Recommended precautions</th>
<th>Precautions for pregnant HCWs</th>
<th>Immunisation* and testing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viral diseases</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cytomegalovirus (CMV)</td>
<td>Contact (mucosal contact with infectious tissues, secretions and excretions)</td>
<td>Standard precautions and basic hygiene</td>
<td>Inform of risks and give opportunity to be tested for susceptibility</td>
<td>Pregnant HCWs may be tested to determine their susceptibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immunodeficient HCWs should be permitted to minimise contact with known CMV-infected patients</td>
<td>Counsel about hygiene and permit to minimise contact with CMV-infected patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seronegative pregnant HCWs may be redeployed to care for patients unlikely to be excreting CMV</td>
<td></td>
</tr>
<tr>
<td><strong>Infectious mononucleosis (glandular fever)</strong></td>
<td>Contact with saliva (via oropharyngeal route)</td>
<td>Standard precautions and basic hygiene</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Hepatitis A</strong></td>
<td>Contact (faecal–oral route)</td>
<td>Standard precautions for continent patients Additional precautions (contact transmission) for incontinent patients — a single room with ensuite toilet is desirable Infected HCWs should avoid contact with nonimmune patients and HCWs</td>
<td>NA</td>
<td>Immunise HCWs at high risk</td>
</tr>
<tr>
<td><strong>Hepatitis B</strong></td>
<td>Bloodborne (direct contact with blood or body substances)</td>
<td>Standard precautions</td>
<td>NA</td>
<td>Immunise all HCWs, particularly clinical contact and laboratory staff Test for seroconversion after 3 months. Reimmunise if seronegative or if poor serological response (ie &lt;10 IU/L) HCWs performing EPPs have a responsibility to know their HBV status Blood incident testing protocol appliesb</td>
</tr>
</tbody>
</table>
Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mode of transmission</th>
<th>Recommended precautions</th>
<th>Precautions for pregnant HCWs</th>
<th>Immunisationa and testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral diseases (cont’d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Bloodborne (direct contact with blood or body substances)</td>
<td>Standard precautions</td>
<td>NA</td>
<td>HCV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blood incident testing protocol appliesb</td>
</tr>
<tr>
<td>Herpes simplex virus</td>
<td>Contact (droplet spread by direct contact or indirectly by</td>
<td>Standard precautions</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>virus infection</td>
<td>fomites or by contact with infected lesions)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Bloodborne (direct contact with blood or body substances)</td>
<td>Standard precautions</td>
<td>In cases of needlestick injury, counsel pregnant HCWs about risks of using zidovudine (ZDV)</td>
<td>HCV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blood incident testing protocol appliesb</td>
</tr>
<tr>
<td>Influenza</td>
<td>Respiratory (droplet spread)</td>
<td>Additional precautions (droplet transmission)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single room or cohort placement in cases of outbreaks, particularly for children and elderly patients</td>
<td></td>
<td>Annual immunisation is recommended for HCWs</td>
</tr>
</tbody>
</table>

NA: Not applicable
### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mode of transmission</th>
<th>Recommended precautions</th>
<th>Precautions for pregnant HCWs</th>
<th>Immunisation* and testing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viral diseases (cont’d)</strong></td>
<td></td>
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<tr>
<td>Measles</td>
<td>Respiratory (airborne and droplet spread and direct contact with infected throat or nasal secretions)</td>
<td>Additional precautions (airborne and droplet transmission) with a well-fitting P2 particulate respirator to be worn A negative pressure single room, with the door closed, for infected patients during infectious period Preclude nonimmune exposed HCWs from direct patient contact from 5 days after first exposure until 21 days after last exposure (see Table 22.2) Infected HCWs should be precluded from contact with susceptible persons until 7 days after rash appears (see Table 22.2)</td>
<td>MMR should not be given to pregnant women and women should avoid pregnancy for 2 months after immunisation</td>
<td>Screen by verbal medical history; Nonimmune HCWs should be offered MMR vaccine</td>
</tr>
<tr>
<td>Parvovirus B19 infection</td>
<td>Respiratory (droplet spread)</td>
<td>Additional precautions (droplet transmission) for infected people and those at high risk of complications of infection Infected HCWs should take sick leave or be rostered to avoid contact with patients</td>
<td>Roster to avoid contact with infected patients during the first half of the pregnancy term of nonimmune HCWs</td>
<td>NA</td>
</tr>
<tr>
<td>Respiratory syncytial virus infection</td>
<td>Contact (direct oral or indirect with fomites) Respiratory (droplet spread)</td>
<td>Additional precautions (droplet and contact transmission) — isolate patients from other at-risk patients and cohort manage Infected HCWs should take sick leave or be rostered to avoid patient contact</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Rotaviral enteritis</td>
<td>Contact (faecal–oral route) Respiratory (droplet spread)</td>
<td>Additional precautions (contact transmission) — patients should be isolated from other at-risk patients Hyperimmune bovine colostrum should be given to all patients in ward if several other patients are infected Infected HCWs should be precluded from contact with at-risk patients</td>
<td>NA</td>
<td>NA</td>
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</table>
### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
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<tr>
<td><strong>Viral diseases (cont’d)</strong></td>
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<tr>
<td>Rubella</td>
<td>Respiratory (droplet spread)</td>
<td>Additional precautions (droplet transmission) and single room. Preclude nonimmune exposed HCWs from direct patient contact from 7 days after first exposure until 21 days after last exposure (see Table 22.2)</td>
<td>Risk to nonimmune pregnant HCWs (congenital deformities in foetus), so roster to avoid contact with rubella-infected patients</td>
<td>Screen by verbal medical history and serology Nonimmune HCWs should be offered MMR vaccine Test for seroconversion 2 months after immunisation and reimmunise if seronegative</td>
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<td></td>
<td>Contact spread</td>
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<tr>
<td>Varicella–zoster (chickenpox and shingles)</td>
<td>Chickenpox: Respiratory (airborne) Contact</td>
<td>Additional precautions (airborne and contact transmission for chickenpox or disseminated shingles; contact transmission for localised shingles)</td>
<td>Avoid contact unless immune Vaccine should not be given during pregnancy and vaccinees should not become pregnant for 1 month after immunisation</td>
<td>Screen by verbal medical history and serology Nonimmune nonpregnant HCWs should be offered varicella vaccine Nonimmune pregnant HCWs should be offered ZIG</td>
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<tr>
<td></td>
<td>Shingles (localised): Contact</td>
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<tr>
<td></td>
<td>Shingles (disseminated): Respiratory (airborne) Contact</td>
<td>Preclude nonimmune exposed HCWs from direct patient contact from 10 days after first exposure to 21 days after last exposure (see Table 22.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chickenpox and shingles in immunocompromised patients: Respiratory (airborne) Contact</td>
<td>Infected HCWs should avoid contact with susceptible persons until all lesions are dry (see Table 22.2)</td>
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<tr>
<td></td>
<td></td>
<td>Immunodeficient HCWs should not be involved in the care of varicella–zoster-infected patients</td>
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<tr>
<td>Viral haemorrhagic fevers (VHF)</td>
<td>Mucosal or parenteral exposure to contaminated blood or other body fluids Lassa fever also transmitted by aerosols of contaminated body fluids</td>
<td>Contact State/ Territory quarantine officer. Additional precautions (airborne and contact transmission) — all specimens from patients with a suspected VHF should be handled at PC4. Advice on management of patients and their body fluids should be obtained from State/ Territory health authorities</td>
<td>Roster to avoid contact with a possible or confirmed VHF case</td>
<td>NA</td>
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*Table continued on next page*
### Severe acute respiratory syndrome (SARS)

- Early evidence suggests respiratory droplets, direct contact with respiratory secretions, indirect contact with contaminated fomites, fine particle aerosols or faeces.
- HCWs should wear gloves, P2 (N95 equiv) masks and long-sleeved disposable gowns.
- Disposable gowns and masks should be discarded as clinical waste.
- Personal eyewear (e.g., spectacles) should be disinfected using an appropriate process.
- Contaminated fomites should also be disposed of as clinical waste.
- HCWs should wash their hands immediately after seeing patients.
- Patients should be kept in respiratory isolation rooms (negative pressure ventilation).
- Special precautions are required for procedures such as intubation, suctioning and use of nebulisers. Items used should be single-use and disposed of as clinical waste.
- Immunodeficient HCWs should not be involved in the care of SARS patients.

### Not enough information yet

- SARS has been associated with some preterm deliveries in Hong Kong.

### Vaccine currently not available (may be available mid-2005)

### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
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<th>Precautions for pregnant HCWs</th>
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<tbody>
<tr>
<td>Viral diseases (cont’d)</td>
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</tr>
<tr>
<td>Severe acute respiratory syndrome (SARS)</td>
<td>Early evidence suggests respiratory droplets, direct contact with respiratory secretions, indirect contact with contaminated fomites, fine particle aerosols or faeces</td>
<td>HCWs should wear gloves, P2 (N95 equiv) masks and long-sleeved disposable gowns. Disposable gowns and masks should be discarded as clinical waste. Personal eyewear (e.g., spectacles) should be disinfected using an appropriate process. Contaminated fomites should also be disposed of as clinical waste. HCWs should wash their hands immediately after seeing patients. Patients should be kept in respiratory isolation rooms (negative pressure ventilation). Special precautions are required for procedures such as intubation, suctioning and use of nebulisers. Items used should be single-use and disposed of as clinical waste. Immunodeficient HCWs should not be involved in the care of SARS patients.</td>
<td>Not enough information yet. SARS has been associated with some preterm deliveries in Hong Kong.</td>
<td>Vaccine currently not available (may be available mid-2005)</td>
</tr>
<tr>
<td>Gastrointestinal infections</td>
<td>Contact (faecal–oral route)</td>
<td>Standard precautions</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Airborne transmission of viral gastrointestinal pathogens</td>
<td>Additional precautions (contact transmission) for incontinent patients — a single room with ensuite toilet is desirable. Infected HCWs or food handlers with diarrhoea should take sick leave.</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Legionellosis</td>
<td>Aerosolised contaminated water (not person to person)</td>
<td>Standard precautions</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

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<thead>
<tr>
<th>Disease</th>
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<th>Precautions for pregnant HCWs</th>
<th>Immunisationa and testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listeriosis</td>
<td>Usually via contaminated foods</td>
<td>Standard precautions — ensure hygienic food handling practices are maintained</td>
<td>Pregnant HCWs should avoid contact with potentially infective materials and foods</td>
<td>NA</td>
</tr>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Bacterial diseases (cont’d)</td>
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<tr>
<td>Meningococcal infection</td>
<td>Respiratory (droplet spread from nose or throat)</td>
<td>Additional precautions (droplet transmission) for 24 hours after beginning treatment. Standard precautions once treatment is initiated. Rifampicin or related compounds recommended for close contacts (e.g. mouth-to-mouth resuscitation of an infected person)</td>
<td>Rifampicin not recommended for use in pregnant women</td>
<td>Routine immunisation not recommended for HCWs, except in case of outbreaks</td>
</tr>
<tr>
<td>Pertussis (whooping cough)</td>
<td>Respiratory (droplet spread)</td>
<td>Additional precautions (droplet transmission) — single room for known cases for at least 5 days after the start of antibiotic treatment. Exclude suspected cases from contact with young children and infants, particularly those not immunised. HCWs with pertussis should avoid contact with susceptible patients until five days after the start of effective antibiotic therapy</td>
<td>NA</td>
<td>Vaccine available, but not recommended for people over 8 years of age</td>
</tr>
<tr>
<td>Staphylococcal infection</td>
<td>Contact and droplet</td>
<td>Additional precautions (contact transmission) for MRSA — clean gloves and gown, dedicated or disposable equipment, single room with its own bathroom facilities or cohort patients infected with same strain. HCWs with sepsis should be excluded from clinical contact and food preparation unless lesions fully covered. HCWs with predisposing skin conditions should be rostered away from patients with staphylococcus infection</td>
<td>NA</td>
<td>Routine screening for non-MRSA not warranted. Screen HCWs for exfoliative skin conditions</td>
</tr>
</tbody>
</table>
### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
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</thead>
<tbody>
<tr>
<td><strong>Bacterial diseases (cont’d)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptococcal infection</td>
<td>Respiratory (droplet spread)</td>
<td>Standard precautions. If patient is excreting large amounts of the organism, a separate room with its own toilet and bathing facilities should be used. If patient has respiratory tract infection, implement additional precautions (droplet transmission). Cover lesion and provide clinical contact HCWs with systemic and local treatment. HCWs with acute streptococcal pharyngitis should receive antibiotic treatment and be rostered off duty for at least the first 24 hours of treatment.</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Tuberculosis</strong></td>
<td>Respiratory (airborne spread)</td>
<td>Additional precautions (airborne transmission) — use a P2 particulate respirator (see Section 29.8). Negative pressure single room (see State/Territory tuberculosis guidelines). Tuberculin skin test-positive HCWs (with no previous history of a BCG) should be followed up with a chest X-ray and clinical review.</td>
<td>NA</td>
<td>Pre-employment and exit screening (tuberculin skin test recommended). Regular screening for tuberculin skin test-negative HCWs depending on level of risk. BCG of uncertain value but may be offered to tuberculin skin test-negative HCWs.</td>
</tr>
<tr>
<td><strong>Transmissible spongiform encephalopathies</strong></td>
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<tr>
<td>CJD</td>
<td>Contact with infected CNS or neural tissue</td>
<td>Additional precautions. Reusable instruments must be destroyed by incineration, or cleaned, reprocessed and quarantined. Details of management procedures are given in Section 31.</td>
<td>NA</td>
<td>Developments in screening and testing are still at an early stage.</td>
</tr>
</tbody>
</table>
### Table 27.2 (cont’d) Precautions for preventing transmission of infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
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<th>Precautions for pregnant HCWs</th>
<th>Immunisation⁵ and testing</th>
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<tbody>
<tr>
<td><strong>Other diseases</strong></td>
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<tr>
<td>Scabies</td>
<td>Contact (direct skin-to-skin)</td>
<td>Additional precautions (contact transmission) apply for at least 24 hours after beginning appropriate treatment</td>
<td>NA</td>
<td>Consider treating on admission all patients from communities with endemic scabies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HCWs with scabies should be rostered to avoid patient contact for 24 hours after beginning appropriate treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pediculosis (head &amp; body lice)</td>
<td>Contact (direct skin-to-skin, hair brushes and accessories)</td>
<td>Additional precautions (contact transmission) apply for at least 24 hours after beginning appropriate treatment</td>
<td>NA</td>
<td>Consider treating on admission all patients from communities with endemic pediculosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HCWs with pediculosis should be precluded from direct patient contact until effective treatment has been undertaken (see Section 32.2)</td>
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</tbody>
</table>

AIDS = acquired immunodeficiency syndrome; BCG = Bacille Calmette–Guerin vaccine; BSE = bovine spongiform encephalopathy; CJD = Creutzfeldt–Jakob disease; CNS = central nervous system; EPP = exposure-prone procedure; HBsAg = hepatitis B virus surface antigen; HBV = hepatitis B virus; HCV = hepatitis C virus; HCW = health care worker; HIV = human immunodeficiency virus; HSV = herpes simplex virus; MMR = measles–mumps–rubella vaccine; MRSA = methicillin-resistant Staphylococcus aureus; NA = not applicable; TSE = transmissible spongiform encephalopathy; ZDV = zidovudine; ZIG = varicella zoster virus immunoglobulin

⁵ Immunisation: Some details are provided in the text of Sections 28–29. For further details and the most up-to-date advice, see the latest edition of *The Australian Immunisation Guidelines* (currently NHMRC 2003).

⁶ Blood incident testing protocol: Following significant exposure to blood or potentially blood-contaminated secretions, test source for HBsAg, anti-HCV antibodies and anti-HIV antibodies and recipient for anti–HBsAg antibodies, anti-HCV antibodies and anti-HIV antibodies. Retest the recipient at one, three and six months (see Section 23).

28 Viral diseases

Key points

- The major viral diseases of concern in the health care setting are cytomegalovirus infection, infectious mononucleosis (glandular fever), viral hepatitis (caused by hepatitis A, B and C viruses), herpes simplex virus infection, human immunodeficiency virus infection, influenza, measles, parvovirus B19 infection, respiratory syncytial virus infection, rotavirus enteritis, rubella, chickenpox (varicella), shingles (zoster), viral haemorrhagic fevers and severe acute respiratory syndrome (SARS).

- Many of these viral diseases are widespread in the community and are not significantly more common in the health care setting. However, without effective infection controls, they may be readily transmitted from patient to patient and, to a much lesser extent, from patient to health care worker (HCW) and vice versa.

- For some viral diseases, susceptibility is universal, whereas for others, specific groups are at higher risk, including those without immunisation or naturally acquired immunity, immunocompromised patients, the elderly or the very young.

- In all instances of viral diseases in the health care setting, standard precautions and procedures are required. However, in many specific circumstances, additional precautions and procedures are needed. Management of patients, HCWs, instruments and environment varies according to the source of infection and mode of transmission of each viral disease.

28.1 Cytomegalovirus infection

28.1.1 Disease description

Aetiology

Disease is caused by infection with human cytomegalovirus (CMV), which is a herpesvirus.

Clinical manifestations

In most healthy adults, CMV infection is subclinical, but occasionally CMV produces illness similar to glandular fever. If pregnant women become infected there is a small but significant possibility of foetal damage (Hatherley 1985). CMV (especially primary infection) can cause severe and life-threatening problems in immunosuppressed patients (de Jong et al 1998).

Most neonatal infections are asymptomatic.
Occurrence

CMV is likely to be encountered both in the community and in hospitals. Any age group may acquire the virus. All people, irrespective of age, gender or illness, can excrete virus. About 40% of adults in developed countries and almost 100% of the adult population in developing countries are seropositive (Chin 2000).

Thirty per cent of women of child-bearing age in Australia are seronegative for CMV and thus susceptible to primary CMV infection in pregnancy (Sfameni et al 1986).

Generally, CMV infection in HCWs, even those working in high-risk areas such as neonatal and transplant units and those caring for HIV-positive patients, is not significantly more common than in the general community (Demmler et al 1987). After primary infection, young children excrete CMV in urine and saliva in larger amounts and for longer periods than do adults. There is a high incidence of asymptomatic excretion of CMV among infants and toddlers. For this reason, isolation of children known to be excreting CMV is not recommended. To avoid CMV infection, washing hands after all patient contact and after contact with urine and saliva is essential. Avoidance of direct contact with saliva (e.g. kissing toddlers on the mouth) is also important.

28.1.2 Transmission

Source of infection

Virus is excreted in urine and saliva for many months after primary infection, and may be shed continually or intermittently for many years by symptomatic patients or asymptomatic carriers. CMV is also excreted in milk, cervical secretions and semen, and may be present in blood. After perinatal or neonatal infection, virus may be shed for up to six years (Chin 2000). Adults tend to excrete the virus for shorter periods but latent infection is common.

Mode of transmission

CMV is transmitted by mucosal contact with infected tissues and body fluids. The foetus may be infected in utero or the infant may acquire the disease perinatally. CMV-seronegative women who care for children over the age of two years have a lower risk of infection than those caring for younger children (Adler 1985, 1989).

High rates of transmission of CMV from infants to adults and cross-infection between children in day-care centres have been recorded (Adler 1989). Studies of CMV infection rates among hospital workers have not convincingly demonstrated an increased risk for workers in nurseries for newborns or on paediatric wards (Yeager 1975, Ahlfors et al 1981, Dworsky et al 1983). However, one study (Friedman et al 1984) describes a significantly higher seroconversion rate among nurses working in an intensive care unit of a children’s hospital.
Risk of acquisition

All seronegative HCWs are at risk of infection, although most infections are asymptomatic. However, if the HCW is pregnant, consequences to the foetus may be severe. The highest-risk groups for serious disease caused by CMV are infants born to carrier mothers, patients with debilitating diseases, those being treated with immunosuppressive drugs and those with congenital or acquired immunodeficiency disorders.

28.1.3 Management

Patients

Because there are difficulties in detecting excretors, and because simple hygiene and standard precautions prevent infection of HCWs and patients, the emphasis for control should be placed on education in hygiene rather than on screening of patients.

Health care workers

Immunodeficient and pregnant HCWs should be informed of the risks of CMV infection, and advised to avoid direct and prolonged contact with CMV infection (eg where a person is known to be excreting CMV). However, it is not practicable to identify all such patients, as only a small proportion of antibody-positive patients excrete the virus.

Infection of HCWs with CMV is largely preventable by applying standard precautions (see Section 2.2), including the use of gloves and regular handwashing (Pomeroy and Englund 1987). Pregnant HCWs and those who work in childcare units should be provided with an opportunity to determine their susceptibility by antibody testing. They should be counselled about hygiene and permitted, but not required, to minimise contact with known CMV-infected patients.

CMV-seronegative women who care for children over the age of two years have a lower risk of infection (Pass et al 1990, Bale et al 1999). Rostering seronegative pregnant employees to care for older children may therefore further minimise their risk.

CMV immunoglobulin is available for the prevention and treatment of CMV infection in certain individuals at high risk of infection. However, its value is unclear.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
28.2 Infectious mononucleosis (glandular fever)

28.2.1 Disease description

Aetiology

Disease is caused by infection with Epstein–Barr virus (EBV), which is a human herpesvirus.

Clinical manifestations

The disease is an acute illness. Typical clinical symptoms include fever and sore throat. Recovery normally occurs within a few weeks, but a small proportion of patients may take several months to recover fully.

Occurrence

About 80% of young adults are immune, having previously acquired infection asymptomatically. However, a proportion of HCWs, particularly those in the 18–25 year age group, is susceptible to EBV infection.

28.2.2 Transmission

Source of infection

EBV is present in saliva and may be excreted during, or for a prolonged period (more than a year) following, either symptomatic or asymptomatic infection.

Mode of transmission

Close contact is usually required to transmit infection.

Risk of acquisition

All nonimmune people are at risk of infection. Most adults are immune, although a proportion of younger adults may be susceptible.

28.2.3 Management

Patients

Standard precautions should be observed (see Section 2.2).

Health care workers

HCWs should employ standard precautions. There is no need to restrict HCWs with active glandular fever from direct patient care (see Health Canada 1998).

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
28.3 Hepatitis A

28.3.1 Disease description

Aetiology

Disease is an acute hepatitis caused by the hepatitis A virus (HAV).

Clinical manifestations

Initial symptoms include fever, lethargy, anorexia, nausea and abdominal pain, usually followed within a few days by jaundice. Incubation is 15–50 days depending on the dose (average 28–30 days). Many infections, particularly in children, are asymptomatic and are only diagnosed by laboratory testing. The disease ranges from a mild illness lasting a few weeks to, in rare cases, a severely disabling disease lasting several months. Although severity of symptoms increases with age, the mortality rate is low (< 1/1000) and patients usually recover without sequelae or recurrence of disease. Complete recovery usually takes several months (Chin 2000).

Occurrence

HAV is a hepatotrophic virus. The disease is likely to be encountered both in the community and in hospitals and may occur as sporadic cases or epidemics.

28.3.2 Transmission

Source of infection

Patients excrete the virus and are infectious during the incubation period and for about a week after jaundice presents. Infants may excrete the virus for up to six months.

Mode of transmission

Transmission is person-to-person by the faecal–oral route, and through food and water contaminated by human faecal material (Rosenblum et al 1991, Balayan et al 1983). Rare cases of transmission through blood or blood products have been reported (Lemon 1994).

Risk of acquisition

Susceptibility to HAV is universal, and natural infection is believed to confer immunity for life.
28.3.3 Management

Patients

Patients suffering from suspected or confirmed HAV, who are faecally continent, should be nursed with standard precautions (see Section 2.2). If they are incontinent or have an altered mental state or poor hygiene, a separate room with facilities (including toilet) that are not shared with other patients is advised. Additional precautions (contact transmission) should be observed with such patients (see Section 2.3). Adequate handwashing facilities for HCWs and patients are essential.

Immunisation with hepatitis A vaccine is recommended for individuals in the groups outlined below.

Health care workers

HCWs infected with HAV should either take sick leave or be rostered to avoid contact with nonimmune patients and HCWs, as appropriate.

Even though standard precautions should be used at all times, pre-employment hepatitis immunisation is recommended for those in occupational groups at risk of exposure to HAV.

Immunisation

Vaccines are available that give protection against HAV only, or against both HAV and HBV. The combined HAV/HBV vaccine should be considered for those at risk of acquiring both infections, including medical and nursing undergraduate students.

Hepatitis A vaccine is recommended for individuals from the following groups (NHMRC 2003):

- injecting drug users (administered as the combined hepatitis A/ hepatitis B vaccine);
- patients with chronic liver disease;
- haemophiliacs who may receive pooled plasma concentrates;
- people with intellectual impairment; and
- occupational groups at risk of HAV exposure:
  - nursing and medical HCWs in paediatric wards, intensive care units and emergency departments that provide for substantial populations of indigenous children;
  - nursing and medical HCWs in rural and remote indigenous communities;
  - carers and HCWs working for or with people with intellectual impairment;
  - other HCWs and laboratory staff likely to encounter HAV;
hospital workers who work with hospital sewerage systems (eg plumbers); and
childcare staff.

To avoid the expense of unnecessary immunisation, it is recommended that the following be screened for pre-existing immunity to HAV:

- those born before 1950;
- those who spent their early childhood in HAV-endemic areas, including in indigenous Australian communities; and
- those with an unexplained previous episode of hepatitis or jaundice.

The presence of either total anti-HAV antibodies or anti-HAV IgG on screening shows that the person has presumably had HAV infection (perhaps undiagnosed) and can be assumed to be immune and not in need of HAV immunisation.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.4 Hepatitis B

28.4.1 Disease description

Aetiology

Disease is caused by the hepatitis B virus (HBV).

Clinical manifestations

HBV is a hepatotrophic virus and causes an acute hepatitis after an incubation period that ranges from six weeks to six months. Disease onset is often insidious, with symptoms including anorexia, nausea, vomiting, abdominal discomfort or pain, rash or joint pain. Fever does not always occur, but jaundice often presents later. Following acute disease, most people recover, the mortality rate being about 1% in hospitalised patients.

Presentation of infection ranges from subclinical, which can be diagnosed only by laboratory tests, to fulminant liver disease with necrosis and death.

Occurrence

As many as 10% of infected adults may continue to carry the virus in their blood for a long period of time, even a lifetime. Approximately 90% of infants who acquire the infection perinatally become chronic carriers. These carriers become a potential source of infection to others. Certain population groups have a higher than normal frequency of the carrier state: injecting drug users,
chronic haemodialysis patients and those with chronic debilitating illness (eg autoimmune disease and lymphoma) are more likely to become chronic carriers after acute infection than are immunocompetent people. Between 25% and 40% of carriers do not belong to recognised risk groups. Following the introduction of blood donor screening and immunisation for HBV, the frequency and risk of infection is diminishing.

28.4.2 Transmission

Source of infection

People acutely or chronically infected with HBV, and who are seropositive for HBV surface antigen (HBsAg) may be infectious to others. The risk of transmission of HBV from carrier mothers to neonates, and from patients to nonimmune HCWs via needlestick injuries, depends on the viral titre in the contaminant, and correlates with the presence or absence of HBV ‘e’ antigen (HBeAg) in the source patient. Estimates of infectivity range from 2% (HBeAg absent) to 40% (HBeAg present) (Alter et al 1976, Gerberding 1995, Werner and Grady 1982). Blood from infected patients with titres of HBsAg below the threshold of laboratory detection is rarely infectious (Alter et al 1972ab, Gerberding 1995).

Transmission of blood from HCWs to patients only occurs if an injury to the operator causes bleeding during a surgical or dental procedure. It has been estimated that about 1% of surgeons are infected with HBV. See Section 24 for further discussion of HCWs infected with HBV.

Mode of transmission

HBV is transmitted in the health care setting by parenteral exposure to infected tissues, including blood or other body fluids. The virus may also be transmitted by exposure of mucous membranes, such as eyes, nose and mouth, to infected material.

Risk of acquisition

All people who are seronegative and have not been immunised against HBV or previously infected with HBV are at risk of infection. The rate of transmission by parenteral exposure to infected body tissues or fluids is variable (see Source of infection, above).

28.4.3 Management

Patients

Standard precautions (see Section 2.2) should be used to minimise risk of exposure to HBV.
Univalent and combination HBV vaccines are approved for use in Australia. In 1996, the NHMRC recommended a universal HBV immunisation program for infants and adolescents. This universal program is in addition to recommendations for selective HBV immunisation of the following groups:

- any users of injectable drugs who have not been infected (human immunodeficiency virus (HIV)-positive injecting drug users should receive twice the normal dosage or a standard dose of the double-strength dialysis formulation of vaccine);

- haemodialysis patients (immunise patients with twice the normal dose of vaccine or three separate doses of double-strength dialysis formulation, preferably before enrolment into the haemodialysis program);

- patients with clotting disorders who receive blood product concentrates (immunisation should be initiated at the time their specific clotting disorder is identified);

- individuals with chronic liver disease and/or hepatitis C virus (HCV) who are HBsAg negative, as the health of such individuals may be severely affected by a superimposed HBV infection; and

- people with intellectual impairment attending either long-term residential or acute care establishments.

Patients at risk of severe or complicated disease (immunocompromised people and those with pre-existing liver disease not related to HBV) and those in whom a poor response to HBV immunisation is expected (eg haemodialysis patients) should be tested for seroconversion to anti-HBV antibodies three months after the third dose of vaccine. Those who do not respond should be offered a further dose of vaccine as either a fourth double dose or a further set of three doses at monthly intervals. Persistent nonresponders should be informed about the need for HBV immunoglobulin (HBIG) within 72 hours of parenteral exposure to HBV (NHMRC 2003).

Health care workers

HCWs will often encounter chronic carriers of HBV in health care establishments and specific provision should therefore be made to protect them. All HCWs should therefore be immunised against HBV using the schedule outlined in The Australian Immunisation Handbook (NHMRC 2003).

Univalent and combination HBV vaccines are approved for use in Australia. Before beginning employment, HCWs should be screened by personal medical history and tested if they are in any doubt about previous infection or immunisation. In accordance with NHMRC recommendations, nonimmune HCWs (including microbiology laboratory staff) should be offered HBV immunisation as soon as possible at the start of employment and should be tested for antibodies to HBsAg at three months after the third dose of vaccine.
Those who do not respond should be offered a fourth double dose of vaccine or a further three doses at monthly intervals. Persistent nonresponders should be informed about the need for HBIG within 72 hours of parenteral exposure to HBV.

Following significant exposure (percutaneous, ocular or mucous membrane) to blood or potentially blood-contaminated body secretions, the source should be tested for HBsAg, and the recipient should be tested for antibodies to HBsAg and retested at three and six months postexposure.

If an HCW has not been immunised, is not known to be immune to HBV or is a persistent nonresponder to immunisation, then HBIG should be offered within 72 hours of significant exposure to blood or potentially blood-contaminated secretions from a known HBV carrier or an unknown source, with another dose within one month. HBV immunisation should be offered at the same time.

A clear protocol for management of HCWs involved in blood accidents should be available and its effectiveness regularly reviewed (see Section 23). HCWs who perform exposure-prone procedures have an ongoing responsibility to know their HBV infectious status.

Particular precautions apply to HCWs who are known to be acutely or chronically infected with HBV (see Section 24).

**Instruments and environment**

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

### 28.5 Hepatitis C

#### 28.5.1 Disease description

**Aetiology**

Disease is caused by infection with hepatitis C virus (HCV). The virus was conclusively identified in 1989, and subsequent serological surveys have found that HCV is responsible for approximately 90% of all transfusion-related cases of non-A, non-B hepatitis (Mandell et al 1995).

**Clinical manifestations**

Although acute HCV infection is frequently asymptomatic, and fulminant HCV infection is rare, HCV causes chronic hepatitis in a high proportion of those infected. This may ultimately result in the development of chronic liver disease, cirrhosis and hepatocellular carcinoma (Ivatson et al 1995; Weimann et al 1995, Colombo and Covini 1995).
Occurrence

In Australia, over 160,000 diagnoses of HCV were reported by the end of 2000, with a further 16,566 diagnoses made to the end of 2001. The number of notifications over the period 1996–2000 has remained relatively stable in the range of 18,000–22,000 per year. Although there may be some duplicate reporting of HCV, it is likely that many people remain undiagnosed and therefore not reported.

Overall the male to female ratio of HCV notifications remains stable at 1.7:1. Approximately equal numbers of male and female cases are reported in the 15–19 year age group. Most recent estimates suggest that the incidence of newly acquired hepatitis C infections in Australia is between 10,000 and 11,000 cases per year (NCHECR 2001).

Of the existing pool of past HCV infections, about 75% are thought to have a history of injecting drug use, with less than 20% having had a blood transfusion prior to mid-February 1990 (Strasser et al 1995) when screening was introduced. Occupational exposure and nonsterile tattooing practices account for a small proportion (Kaldor et al 1992).

28.5.2 Transmission

Source of infection

Acutely and chronically infected people are infectious. Infectivity is thought to be related to viral titre.

Mode of transmission

In the health care setting, HCV may be transmitted by parenteral exposure to blood or other body fluids. Perinatal transmission has been recorded with risk of transmission related to viral load.

Risk of acquisition

Patient-to-patient transmission of HCV has been associated with endoscopic procedures, including endoscopic sphincterotomy (Tennenbaum et al 1993, NHMRC 1997), routine upper gastrointestinal endoscopy (Crenn et al 1988) and colonoscopy (Bronowicki et al 1997). Failure to comply with recommended cleaning and disinfection protocols has been evident in the majority of adequately investigated transmissions (Tennenbaum et al 1993, Bronowicki et al 1997, Cowen et al 1999).

28.5.3 Management

Patients

Standard precautions (see Section 2.2) are recommended as the principal means of preventing occupational spread of HCV. Adherence to standard precautions should provide adequate protection for HCWs.
Health care workers
Active immunisation is not available and there is no evidence that passive immunisation is effective.

HCWs who perform exposure-prone procedures have an ongoing responsibility to know their HCV infectious status, which is best determined by antibody testing and associated supplementary tests.

Assessment of any incident involving blood should include a review of the HCV status of the source individual and, if positive, the exposed person.

Instruments and environment
Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

### 28.6 Herpes simplex virus infection

#### 28.6.1 Disease description

**Aetiology**
Disease is caused by infection with herpes simplex virus (HSV), a herpesvirus. Two serotypes (HSV1 and HSV2) can be distinguished immunologically.

**Clinical manifestations**
Herpes simplex virus causes vesicular lesions of the oropharynx and of the genital area. It can occasionally cause lesions elsewhere (eg finger, buttock) and in neonates and immunocompromised patients it may cause a generalised vesicular rash.

**Occurrence**
The virus is widespread in the community with 50–90% of adults having antibodies to HSV1 (Chin 2000). Infection with HSV1 usually occurs in childhood before the age of five years, and HSV2 infection usually begins after the start of sexual activity (Chin 2000).

#### 28.6.2 Transmission

**Source of infection**
The vesicular lesions contain infectious virus. Virus may also be present in saliva and in vaginal fluid even when vesicles are not present.

**Mode of transmission**
The virus can be transmitted by droplet spread, by direct contact and, indirectly, by fomites or by a third person.
Risk of acquisition

Susceptibility to primary infection is universal. Latent infection is common and may be reactivated by fever, intercurrent disease, trauma or physiological changes.

28.6.3 Management

Patients

Additional precautions (contact transmission) should be observed for patients with lesions that disseminate infectious virus.

HCWs should wear gloves whenever contact is made with any herpetic lesion or with a patient's mouth or genital area, or when handling a patient with a vesicular rash. Mouth-to-mouth resuscitation should be replaced by mechanical ventilation with a bag and mask. Where there is a risk of saliva being sprayed from the mouth, as in dental procedures, goggles and mask should also be worn.

Health care workers

HCWs with herpetic lesions should wear gloves or some other effective occlusive dressing when the lesions are vesicular (virus is not shed from crusted lesions). Covered lesions present minimal risk. HCWs who perform exposure-prone procedures have an ongoing responsibility to know their HSV infectious status, which is best determined by antibody testing and associated confirmatory tests, and should avoid any invasive procedures while lesions are present.

HCWs with vesicles that cannot be covered (as in oral herpes) should not come into contact with newborn babies or immunocompromised patients, and should be excluded from operating rooms and delivery suites.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.7 Human immunodeficiency virus/acquired immunodeficiency syndrome

28.7.1 Disease description

Aetiology

Disease is caused by infection with human immunodeficiency virus (HIV), a retrovirus. Two serologically distinct types, HIV1 and HIV2, have been recognised.
Clinical manifestations

HIV can cause a severe, life-threatening condition known as acquired immunodeficiency syndrome (AIDS). This syndrome represents the late clinical stage of infection with HIV, which most often results in progressive damage to the immune system, resulting in opportunistic infections and malignancies and other organ damage. Between two weeks and several months following infection, seroconversion may result in an acute self-limited illness, similar to mononucleosis, lasting for a week or two. Infected people may then be free of symptoms or clinical signs for many months or years before other clinical manifestations, including opportunistic infections and malignancies and constitutional and neurological disorders, appear (Chin 2000).

The concentration of HIV in the bloodstream is very high in the early stages of infection, including the ‘window’ period between acquisition of HIV and the seroconversion illness that typically occurs 2–4 weeks after contact (Ciesielski and Metler 1997). During this period the antibody test is negative, although tests for HIV DNA are positive. After the resolution of the seroconversion illness, HIV viral load decreases due to host immune responses and stabilises at a lower level. As immunodeficiency progresses and AIDS develops, the HIV viral load rises again. Viral load is also influenced by antiretroviral therapy. Most patients on combination antiretroviral therapy have a low HIV viral load.

Occurrence

During 2000, it was estimated that, after adjustment for reporting delay, there were 206 diagnosed cases of AIDS in Australia, and 123 deaths following AIDS. In addition, there were 723 new HIV diagnoses after adjustment for multiple reporting. Cumulatively to the end of 2000, there were 8564 diagnoses of AIDS, 6000 deaths following AIDS (adjusted for reporting delay) and 18,171 diagnoses of HIV infection (adjusted for multiple reporting) (NCHECR 2001).

28.7.2 Transmission

Source of infection

Infectivity is believed to begin shortly after primary infection and continue throughout life, irrespective of whether the patient is symptomatic.

Mode of transmission

HIV is a bloodborne and sexually transmissible virus. HIV may be transmitted by direct contact with blood or other body fluids, through mucous membranes, nonintact skin or through percutaneous injury. The risk of HIV transmission ranges from close to 100% in the transfusion of an HIV-infected unit of blood, to 0.1–3.0% per act of unprotected receptive anal intercourse, and 0.1–0.2% per act of unprotected receptive vaginal intercourse.
Risk of acquisition

Patients

There has been one series (involving four patients) of patient-to-patient transmission of HIV in a surgical setting (Chant et al 1993). It is believed that a breakdown of standard infection control procedures was involved.

Health care workers

The risk to HCWs of acquiring HIV in the course of their employment is very small.

- In the occupational setting, blood is the single most important source of HIV infection, so only those exposed to blood are significantly at risk.
- Exposure to blood through the percutaneous route is significantly more likely to result in transmission of HIV than is mucous membrane exposure.

Although a few episodes of HIV transmission after skin exposure have been documented, no HCWs enrolled in prospective studies have seroconverted after such an exposure. For an HCW, the average risk for HIV infection after a percutaneous needlestick injury with HIV-infected blood is estimated to be 0.3% (Bell 1997) and the risk associated with mucous membrane exposure is estimated to be about 0.09% (Ippolito et al 1993). The risk for transmission of HIV from patient to HCW clearly exceeds that of HCW to patient (Bell 1991). The risk to patients of contracting HIV through blood transfusion is exceedingly low; all blood for transfusion in Australia has been tested for HIV antibody since 1985, and there has been only one known case of transfusion-acquired HIV since that time (see Section 23.3.1).

At the time of writing, there have been no known cases of HIV transmission from HCW to patient in Australia. Internationally, there have been only two documented series of HIV transmission from HCW to patient. One occurred in the United States, where six patients became infected with HIV from a Florida dentist (Ciesielski et al 1991). This transmission was considered to be the result of a lapse in infection control procedures. More recently, HIV transmission occurred in one patient following prolonged orthopaedic surgery in France (Lot et al 1999). No further cases of transmission of HIV from HCW to patient have been detected, despite lookback studies of large numbers of patients who have been cared for by an HIV-infected HCW. Retrospective studies carried out for the United States Centers for Disease Control and Prevention (CDC) as of 1 January 1995, for patients of HIV-infected HCWs, indicate that of the 22,171 patients treated by 51 infected HCWs (29 dentists and dental students, 8 physicians and medical students, 13 surgeons or obstetricians and 1 podiatrist) no cases of transmission were documented from the infected HCW to the patient (Robert et al 1995).
A retrospective case–control study (Henry and Campbell 1995) of HIV seroconversion in HCWs after percutaneous exposure to HIV-infected blood, from January 1988 to August 1994, investigated factors that influence the risk of HIV infection. In this study, case HCWs had a documented occupational percutaneous exposure to HIV-infected blood, HIV seroconversion temporally associated with the exposure and no other concurrent exposure to HIV. Control HCWs had a documented occupational percutaneous exposure to HIV-infected blood, and were HIV seronegative at the time of exposure and at least six months later. Results indicated that for case HCWs, 94% of exposures were needlestick and 7% involved other sharp objects. For control HCWs, 91% of exposures were needlestick and 9% involved other sharp objects. The findings in this study indicate that an increased risk for HIV infection following percutaneous exposures to HIV-infected blood was associated with the following factors:

- a larger quantity of blood, indicated by visible contamination of the device; or
- a procedure using a hollow bore needle directly placed in a vein or artery, or a deep injury; or
- blood from a source with terminal illness.

28.7.3 Management

All health care establishments should implement standard precautions (see Section 2.2) as the primary basis for preventing HIV transmission.

Health care establishments should develop their own protocols for testing and preventing HIV transmission, based on the recommendations in these guidelines. The nature of the treatment provided, the health status of HCWs, especially in relation to skin conditions, and the consent and confidentiality rights of both patients and HCWs must all be taken into account.

Patients

Additional precautions for patients with HIV are required only for those patients with opportunistic infections such as infectious pulmonary tuberculosis.

Routine testing of patients for unidentified HIV is not recommended. Testing should be undertaken only on the basis of clinical assessment or where it is in the interests of both patients and HCWs. The provisions of confidentiality, privacy and consent for testing after counselling should be applied.

Health care workers

Health care establishments should provide HCWs with appropriate facilities and information about the risks of HIV transmission. Risk reduction strategies aimed at reducing exposure to blood and body fluids or contaminated sharps should be implemented.
Accident analysis should be included in occupational health programs. Such analysis can be a way of identifying risk exposure situations where special provisions can be applied (eg the use of special equipment).

Routine testing of HCWs for unidentified HIV is not recommended. Testing should be undertaken only on the basis of clinical assessment or where it is in the interests of both patients and HCWs. The provisions of confidentiality, privacy and consent for testing after counselling should be applied.

HCWs undertaking exposure-prone procedures have an ongoing responsibility to know their HIV status and, on the basis of confirmed test results, should not perform any procedure in which there is a risk of HIV transmission. Where there is any uncertainty about the level of risk involved, individuals should be assessed by their registration board or an expert panel on a case-by-case basis to determine their continuing participation or modification of work practices (see Section 24).

The treatment provided to people involved in blood accidents (postexposure prophylaxis, or PEP) may also influence outcomes. In the case–control study described above, the use of zidovudine (ZDV) postexposure reduced the risk of HIV infection by approximately 79% (Henry and Campbell 1995). Simple measures such as washing blood out of eyes and mouth after accidental exposure may also reduce the risk of infection. It is now recommended that two or three antiretroviral drugs be administered as PEP to HCWs who have sustained a significant occupational exposure to HIV (CDC 1997b). On the basis of animal studies, it is generally considered that if ZDV is going to have maximal prophylactic benefit it should be given as soon as possible after the injury. Although animal studies suggest that PEP is probably not effective when started later than 24–36 hours postexposure, the interval after which there is no benefit in humans is unknown (CDC 1997b). All antiretroviral agents may cause side effects — mild, chiefly gastrointestinal, side effects are frequently reported by patients receiving PEP. More serious side effects such as nephrolithiasis, abnormal liver function and pancytopenia have been reported with the use of combination antiretroviral PEP. The decision to use antiretroviral PEP should be made promptly, in conjunction with a specialist HIV physician, and with the consent of the affected person.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.8 Influenza

28.8.1 Disease description

Aetiology

Disease is caused by infection with either influenza type A or type B virus.
Clinical manifestations
Clinical symptoms include abrupt onset of fever, headache, myalgia, sore throat and cough. Extreme malaise lasts several days, and the disease is usually self-limiting with full recovery within about seven days.

Occurrence
Influenza is an acute respiratory viral infection that occurs throughout the whole community, including HCWs. The disease may occur as isolated cases, localised outbreaks, epidemics or pandemics. It is seasonal, with most cases reported from the middle of autumn to the end of winter each year.

28.8.2 Transmission
Source of infection
The period of communicability is believed to begin at the time of onset of symptoms, and continues for a period of 3–5 days in adults, and up to seven days in children.

Mode of transmission
Aerosolised respiratory secretions are the main source of transmission, but the virus can also be transmitted by direct contact with fomites, as it is relatively stable under conditions of low temperature and humidity.

Risk of acquisition
All people in contact with symptomatic influenza patients are at risk of the disease, unless they have been immunised with the current vaccine formulation. Influenza vaccine has an efficacy of about 70% (Palache et al 1993).

Those at particular risk from the complications of influenza include:
- the elderly;
- adults with chronic debilitating disease, such as cardiac, pulmonary, renal and metabolic disorders;
- children with cyanotic congenital heart disease;
- people receiving immunosuppressive therapy;
- Aboriginal and Torres Strait Islander adults aged 50 years and over; and
- residents of long-term care establishments.

28.8.3 Management
Details for the routine management of influenza in the health care setting are outlined below. However, at the time of a pandemic, the priority groups and the timing of immunisation may be quite different from those during interpandemic periods. In addition, the number of vaccine doses required to confer protection
and the optimal time for immunisation may differ. The Australian Pandemic Planning Committee is developing guidelines for vaccine use and will advise health authorities regarding priority groups, dosing schedules and timing of immunisation should a pandemic occur (NHMRC 2003).

Patients

Additional precautions (droplet transmission) should be observed (see Section 2.3). Respiratory isolation practices should be implemented, and patients treated symptomatically. Where possible, patients should be separated and the triage system implemented.

Influenza vaccine should be available to any healthy person to help minimise the incidence of influenza. Children as young as six months can be immunised. HCWs should be aware that there is an increased risk of minor adverse events (following influenza vaccination) in children under five years of age (Gruber et al 1993, Belcher 1993).

Annual immunisation is recommended for:

- all individuals aged 65 years and older;
- Aboriginal and Torres Strait Islander people aged 50 years and older;
- children (6 months of age and over) and adults with chronic cardiac conditions including cyanotic congenital heart disease, coronary artery disease and congestive heart disease;
- children (6 months of age and over) and adults with chronic suppurative lung disease, including bronchiectasis, cystic fibrosis and chronic emphysema;
- children (6 months of age and over) and adults with chronic illnesses requiring regular medical follow-up or hospitalisation in the preceding year, including diabetes mellitus, chronic metabolic diseases, chronic renal failure, haemoglobinopathies or immunosuppression;
- people with immune deficiency, including HIV;
- residents of nursing homes and other long-term care facilities;
- contacts of high-risk patients (ie HCWs, staff of nursing homes and long-term care facilities, and household members of people in high-risk groups).

Health care workers

HCWs who contract the disease should take sick leave, or be deployed elsewhere to avoid patient contact, as appropriate.

To further protect patients, annual immunisation is also recommended for health care providers, including HCWs in long-term care establishments, and providers of home care to people at high risk (eg nurses, volunteer workers) (NHMRC 2003).
Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.9 Measles

28.9.1 Disease description

Aetiology

Disease is caused by infection with measles virus, a morbillivirus of the Paramyxoviridae family.

Clinical manifestations

Measles is an acute, highly infectious disease characterised by fever, rash, conjunctivitis, coryza, cough and Koplik spots on the buccal mucosa. The rash sometimes results in desquamation. The disease is more severe in infants and adults than in children. Complications of measles include middle ear infections, pneumonia and encephalitis. A late complication, resulting from chronic infection with measles virus, is subacute sclerosing panencephalitis.

Occurrence

Before the introduction of an effective vaccine, measles was a common childhood disease. Measles immunisation programs have markedly decreased the incidence of the disease, although periodic outbreaks occur, mainly in non-immunised people. At present, most disease occurs in children too young to be immunised, and those too old to have been immunised as children (Gidding et al 1999, Papania et al 1999, CDC 1999, Miller et al 1999).

28.9.2 Transmission

Source of infection

Patients are infectious from shortly before the onset of symptoms until about four days after appearance of the rash.

Mode of transmission

Measles virus is transmitted by aerosols or direct contact with nasopharyngeal secretions, or less commonly by items recently contaminated by infectious material.

Risk of acquisition

Susceptibility is universal in those who have never had the disease and who have not been immunised. Clinical measles or immunisation confers immunity, probably for life.
28.9.3 Management

The following information is based on the *Guidelines for the Control of Measles Outbreaks in Australia* (CDNANZ and MEAC 2000), which should be consulted for further details.

Patients

Additional precautions (airborne and droplet transmission) should be observed (see Section 2.3). Susceptible people should wear a surgical mask when entering the room of a measles patient.

HCWs should be aware that an individual with measles can enter their health care establishment at any time and that there is a continuous risk of health care associated spread of measles. All staff should be familiar with isolation procedures to reduce measles exposure and should inform the establishment’s infection control practitioner immediately measles is diagnosed. HCWs should consider the wider public health ramifications when diagnosing a case of suspected measles, and collaborate closely with the local public health unit (CDNANZ and MEAC 2000).

HCWs should check the immunisation status of all children and young adults attending their health care establishment for any reason. If not fully immunised, the patient should be offered the appropriate immunisation if it is not contraindicated. This should be implemented at all immunisation clinics, doctors’ rooms, public and private clinics, health centres and hospital emergency and outpatient wards (CDNANZ and MEAC 2000). Consideration should be given to the use of the combined measles–mumps–rubella (MMR) vaccine. Pre-immunisation screening by history has been shown to be cost-effective (Ferson et al 1994).

Health care workers

HCWs with measles symptoms should be precluded from contact with susceptible persons until the results of appropriate tests to confirm measles are known. They may return to work if they have serological evidence of immunity (ie are IgG seropositive and immunoglobulin M (IgM) seronegative) or four days after appearance of the rash if they develop measles (CDNANZ and MEAC 2000).

Susceptible HCWs are at significant risk because this disease is often complicated in adults. Such HCWs should be identified by verbal medical screening for history of either infection or previous immunisation (Duclos et al 1999). Pre-immunisation screening by history has been shown to be cost-effective (Ferson et al 1994).
All HCWs who have not received two doses of a measles-containing vaccine or do not have adequate measles antibody titres at the time of employment and have no contraindications should be offered MMR immunisation (CDNANZ and MEAC 2000). Tuberculin skin testing should not be carried out for at least one month after the MMR immunisation.

Susceptible HCWs exposed to measles should be offered a dose of MMR vaccine within 72 hours postexposure, or a dose of immunoglobulin if they were exposed between three and seven days earlier. Until the HCW receives either the MMR vaccine or immunoglobulin, or if they do not receive either of these within the specified timeframes, they should be precluded from contact with susceptible people until 14 days after their last exposure. Furthermore, if a susceptible HCW has not previously received any doses of a measles-containing vaccine, a second dose of MMR should be offered four weeks after the first dose.

Instruments and environment
Additional precautions (airborne and droplet transmission) should be observed in addition to routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18).

28.10 Parvovirus

28.10.1 Disease description

Aetiology

Disease is caused by infection with human parvovirus B19. Diagnosis is by serology and/or viral DNA detection.

Clinical manifestations

In children, human parvovirus B19 causes ‘fifth disease’ (erythema infectiosum), a rubella-like illness with a distinctive facial rash — the ‘slapped cheek’ syndrome. In adults, arthritis is often observed and may persist for weeks or even months. Both the rash and arthritis are due to circulating immune complexes of the virus and antibody. The incubation period is about 10–14 days.

The virus grows in the erythroid progenitor cells in the bone marrow. In patients with haemolytic anaemia, B19 infection causes aplastic anaemia, which may be severe but resolves once the patient is convalescent. Immunosuppressed patients may be unable to clear the virus and persistent anaemia ensues. Administration of normal pooled immunoglobulin may assist the patient to eliminate the virus. Infection in the first half of pregnancy may affect the foetus, causing aplastic anaemia that later becomes manifest as
midsemester hydrops foetalis (Gilbert 2000, Skjoldebrand-Sparre et al 2000). Foetal death occurs in less than 10% of cases (Yaegashi 2000). Intra-uterine transfusion has been used successfully in the management of this condition (Goodear et al 1998).

Occurrence
Community and school outbreaks occur at irregular intervals. A significant proportion of adult contacts are susceptible and may become infected. In temperate climates, epidemics tend to occur in winter and spring. Health care associated outbreaks of parvovirus B19 involving infection of patients and HCWs, including pregnant HCWs, have been reported.

28.10.2 Transmission
Source of infection
Most cases are believed to be infectious before the appearance of the rash, and probably not thereafter. Those with parvovirus-induced aplastic anaemia are infectious up to a week after onset of symptoms. Immunosuppressed patients with chronic infection may be infectious for some years (Broliden et al 1998).

Mode of transmission
Natural transmission is via the respiratory route.

Risk of acquisition
Susceptibility to infection is universal, and immunity is conferred by the development of antibodies. Those most at risk from the severe complications of infection are the immunocompromised, patients with haemolytic disease and women during the first half of pregnancy.

28.10.3 Management
Patients
Additional precautions (droplet transmission) should be observed for infected patients (see Section 2.3), and by those at high risk of the complications of infection. At present there is no vaccine.

Health care workers
HCWs with parvovirus B19 infection should be precluded from contact with susceptible persons while they are considered infectious (ie before the appearance of a rash). HCWs at high risk of the complications of infection should be rostered to avoid patients with parvovirus B19 infection. At present there is no vaccine.
Instruments and environment

The virus is very resistant in the environment and in biological materials such as blood or plasma. Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed (Schwarz 1994).

28.11 Respiratory syncytial virus (RSV) infection

28.11.1 Disease description

Aetiology

Disease is caused by respiratory syncytial virus (RSV), a paramyxovirus.

Clinical manifestations

In infants, up to 40% of cases present as lower respiratory tract infection, including bronchiolitis, pneumonia and tracheobronchitis. Low-grade fever, accompanied by coughing and wheezing, is common. In more severe cases, profound respiratory distress can occur, resulting in hypoxia, cyanosis and apnoea.

Occurrence

RSV is a significant respiratory tract pathogen in young children and a major cause of lower respiratory infection in infants. The virus is widespread and causes seasonal outbreaks in temperate climates, with peak incidence usually in late autumn and winter.

28.11.2 Transmission

Source of infection

Patients are infectious from shortly before the onset of symptoms, and for the duration of the illness. In a small proportion of infants, shedding of the virus may occur for several weeks after resolution of symptoms.

Mode of transmission

RSV may be transmitted directly by oral contact, by exposure to aerosolised respiratory secretions or, indirectly, by contact with fomites, such as contaminated eating utensils, handkerchiefs, towels and toys (Hall 1987).

Risk of acquisition

The risk of acquisition is universal, and the risk of serious disease is greatest in infants (Bruckova et al 1979), children, the elderly, immunocompromised people (Englund et al 1991) and those with chronic heart or respiratory disease. Infection with RSV induces short-lived antibodies, and those who are reinfected generally have a milder illness.
28.11.3 Management

Patients

Additional precautions (contact and airborne transmission) should be observed (see Section 2.3). Patients should also be nursed in isolation from other at-risk individuals, such as infants, the elderly, the immunocompromised and those with chronic heart or respiratory disease. In situations where there are several patients with RSV, such as in hospital paediatric wards, patients can be cohort managed.

Health care workers

HCWs with RSV should be precluded from contact with susceptible persons. HCWs at risk from the serious sequelae of RSV infection should not have contact with patients with this condition.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.12 Rotaviral enteritis

28.12.1 Disease description

Aetiology

Disease is caused by infection with rotavirus.

Clinical manifestations

The disease is seen mainly in children and is characterised by fever, vomiting and watery diarrhoea, although diarrhoea is uncommon in children less than three months of age. In young children, severe dehydration and death may ensue if treatment is delayed.

Occurrence

Rotavirus infection presents as a gastrointestinal disease. The virus is widespread, and most children have been infected by the time they are three years old (Mrukowicz et al 1999). Most infections in the first month of life are asymptomatic. About one-third of infections after one month of age are associated with diarrhoea, with the peak incidence of clinical disease in the 6–24-month age group (Schumacher and Forster 1999, Murphy et al 1977). The virus will sometimes cause diarrhoea in adults, particularly the elderly (Marrie et al 1982, Dupuis et al 1995) and immunocompromised.
28.12.2 Transmission

Source of infection

Patients are infectious during the acute phase, and for up to eight days after recovery. Immunocompromised patients may excrete the virus for 30 days or more.

Mode of transmission

The most likely route of transmission is believed to be faecal–oral, although exposure to aerosolised respiratory secretions may be a secondary source of infection.

Risk of acquisition

Children aged 6–24 months, who have not been exposed to the virus, are most at risk from symptomatic disease. Immunocompromised people and the elderly are also at increased risk.

28.12.3 Management

Patients

Additional precautions (contact transmission) should be observed (see Section 2.3). Patients should be nursed in isolation from other at-risk patients. In paediatric settings, cross-infection occurs when several patients are hospitalised with rotavirus. Transmission between patients in the hospital setting can be prevented by giving hyperimmune bovine colostrum to all patients in the ward where there are cases of rotavirus (Davidson et al 1989).

Health care workers

In addition to standard precautions, HCWs with rotavirus infection should either take sick leave or be rostered to avoid contact with at-risk patients.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

28.13 Rubella

28.13.1 Disease description

Aetiology

Disease is caused by infection with rubella virus, a togavirus.
Clinical manifestations

Rubella is a mild disease characterised by a low-grade fever and a maculopapular rash. Children generally have few symptoms, but adults frequently have fever, headache, lethargy, mild coryza and conjunctivitis and, occasionally, arthritis.

Occurrence

In general, women of child-bearing age are immune because of community immunisation programs, but males remain at risk. Rubella in males may cause significant debility (1–2 weeks away from work) and infected male HCWs can transmit infections to patients and other HCWs.

28.13.2 Transmission

Source of infection

Patients are infectious for about one week before, and for several days after, the onset of rash. Infants with congenital rubella syndrome may excrete the virus for several months after birth.

Mode of infection

Rubella infection is readily transmitted by droplets and through close contact with infected patients.

Risk of acquisition

All people who have not been immunised, or who have not had rubella, are susceptible. Infants infected in utero up to the 20th week of gestation are at highest risk of congenital rubella syndrome.

28.13.3 Management

Patients

Additional precautions (droplet transmission) should be observed (see Section 2.3).

Monovalent rubella vaccines and combination MMR vaccines are available for routine immunisation in Australia. All women found on antenatal screening to be susceptible to rubella should be immunised after delivery and screened before the next pregnancy. Either monovalent rubella vaccine or MMR can be used for this purpose (NHMRC 2003).

Health care workers

Due to the risk of congenital deformities in the foetus, nonimmune pregnant HCWs should be rostered to avoid contact with rubella-infected patients.
Monovalent rubella vaccines and MMR vaccines are available for routine immunisation in Australia (NHMRC 2003). Immunisation will reduce the likelihood of HCWs acquiring rubella. Pre-immunisation screening by history has been shown to be cost-effective (Ferson et al 1994). All male and female HCWs, including students, should be screened. Those without immunisation records, or who are seronegative, should be immunised both for their own protection and to avoid the risk of transmitting rubella to pregnant patients. Where necessary, those immunised can be tested for seroconversion two months after immunisation and be reimmunised if seronegative.

MMR should be offered to nonimmune HCWs. Women of child-bearing age given MMR should be advised not to become pregnant for two months after immunisation. Tuberculin skin testing should not be carried out for at least one month after MMR immunisation.

All HCWs born since 1970 should have either two documented doses of MMR vaccine or serologic evidence of immunity to measles, mumps and rubella.

**Instruments and environment**

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

### 28.14 Varicella–zoster (chickenpox and shingles)

#### 28.14.1 Disease description

**Aetiology**

Disease is caused by infection with varicella–zoster virus (VZV), a herpesvirus.

**Clinical manifestations**

Acute VZV infection in humans usually presents as chickenpox (varicella), which in adults can occasionally be a debilitating illness, particularly during pregnancy (see Section 22.4.4). Infection of adults is generally more severe than infection of children (Chant et al 1998). There is also some evidence that the infection may be more severe in pregnant than in nonpregnant women (Pierre et al 1992, Enders et al 1994, Baren 1996).

Reactivation of VZV infection can occur as shingles (zoster), usually decades after the initial infection. Reactivation takes the form of a cluster of vesicles involving a single dermatome. Blister fluid from the vesicles is infectious and contact can result in primary varicella infection (chickenpox) in a nonimmune contact.
Viral diseases

Occurrence

Acute VZV infection (chickenpox) occurs worldwide, with about 95% of people having been infected by early adulthood. With the introduction of VZV vaccine in some countries, the incidence of clinical chickenpox is expected to decline. Susceptible HCWs may acquire VZV from patients who have either chickenpox or shingles. This occurs frequently in people with HIV infection or immunosuppression due to other causes (e.g., disseminated malignancies).

28.14.2 Transmission

Source of infection

Patients may be infectious for up to two days before the appearance of chickenpox lesions. Communicability persists for up to five days after vesicles first appear in acute infection, and patients with shingles should be regarded as infectious for up to a week after the rash appears. Immunocompromised people remain infectious for longer periods.

Mode of transmission

Acute VZV (chickenpox) is readily transmissible. Transmission occurs from person to person by direct contact, or by droplet or airborne spread of virus from either the respiratory tract or vesicle fluid. Precautionary measures such as masks are only partially effective in preventing transmission to susceptible people.

Risk of acquisition

Susceptibility to VZV is universal in people who have not been previously infected or immunised. VZV is one of the most infectious of all communicable diseases. In the household setting, secondary attack rates range up to 90% in susceptible siblings.

28.14.3 Management

Patients

Additional precautions (airborne and contact transmission) should be observed for patients with chickenpox (see Section 2.3). Additional precautions (contact transmission) should be observed for patients with localised shingles and additional precautions (airborne and contact transmission) should be observed for patients with disseminated shingles. Masks are not completely effective in preventing transmission, so susceptible persons should avoid contact with patients with chickenpox.

The NHMRC has approved the use of VZV vaccine for children from 12 months of age (see NHMRC 2003).
Health care workers

HCWs (especially pregnant women) should not have direct contact with patients infected with VZV unless they have a definite history of previous chickenpox or serological evidence of previous infection. For high-risk situations (e.g., oncology, organ transplants), the VZV immune status of HCWs should be determined before rostering them in these areas. Screening by history is recommended. Immunodeficient HCWs should not be involved in the care of patients with VZV infection.

Before starting employment, HCWs should be screened by personal medical history and tested if in any doubt about previous infection or immunisation. An enzyme-linked immunosorbent assay (ELISA) is available that reliably detects the presence of serum antibodies to VZV after natural infection (but not after immunisation). Immunisation with VZV is recommended for nonimmune HCWs, particularly for nonimmune women before pregnancy and for nonimmune carers of immunosuppressed people. The vaccine should not be given during pregnancy and women who are immunised should not become pregnant for one month after immunisation (see NHMRC 2003). If an HCW has a history of clinical chickenpox, testing is not necessary since they will be immune. Further details on the prevention and management of VZV infection in pregnant HCWs is given in Section 22.4.4.

Before beginning employment or placement in paediatric wards, paediatric HCWs with patient contact should be asked if they remember having had VZV infection. Those who have had the disease are considered immune but all other HCWs should have their immune status assessed by ELISA as soon as possible (Ferson et al. 1990).

If susceptible HCWs are in contact with VZV, they should be assessed medically during the incubation period and precluded from contact with susceptible or immunocompromised patients. Zoster immunoglobulin (ZIG) prophylaxis should be considered in accordance with NHMRC guidelines (see NHMRC 2003). In such cases, use of high-titre ZIG, available from the Australian Red Cross Blood Transfusion Service on a restricted basis, should be considered for the prevention of varicella. ZIG must be given early in the incubation period (within 96 hours of exposure). Normal immunoglobulin (human) (NIGH) can be used for the prevention of varicella if ZIG is unavailable. ZIG should be given to pregnant women who are susceptible to varicella infection (they should have been tested for anti-VZV antibodies).

Treatment with acyclovir or related compounds may be indicated if lesions develop.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
28.15 Viral haemorrhagic fevers (VHFs)

28.15.1 Disease description

Aetiology

Viral haemorrhagic fevers (VHFs) are a group of viral diseases. The most clinically important viruses are:

- Lassa fever virus (an arenavirus);
- Marburg virus (a filovirus);
- Ebola virus (a filovirus); and
- Crimean–Congo haemorrhagic fever virus (a bunyavirus).

Clinical manifestations

VHFs usually present as febrile illness with headache, myalgia, sore throat, cough and vomiting. Some patients have a cough, chest pain, abdominal tenderness and skin rash. In severe cases, patients may suffer extensive haemorrhaging, accompanied by a purpuric rash and bleeding from almost any part of the body, including intestine, eyes, gums, nose, mouth, lungs and uterus. Encephalopathy and multiorgan failure are common in severe cases and the case mortality rate is high.

Occurrence

VHFs present a significant risk to Australia due to the ease of international travel. However, despite recent outbreaks in Africa, there have been no instances of confirmed infection with these viruses in Australia.

28.15.2 Transmission

Source of infection

Patients are infectious while they are symptomatic and until the virus has been cleared from blood and body fluids. Lassa fever virus has been found in respiratory secretions of a symptomatic patient and in urine during the convalescent phase. Sexual transmission of Ebola virus and Lassa fever virus has been recorded, and Ebola virus has been found in seminal fluid for up to two months after the onset of symptoms.

Mode of transmission

Recent evidence on the mode of transmission of these viruses indicates that the main risk of transmission in the health care setting is from mucosal or parenteral exposure to contaminated blood or other body fluids. Lassa fever virus may also be transmitted by exposure to aerosols of contaminated body fluids, particularly nasopharyngeal secretions and urine (Stephenson et al 1984).
VHFs are classified as dangerous biological agents (high individual and community risk; AS/ANZ 2243.3\(^1\)). Transport and handling of specimens therefore requires special precautions.

**Risk of acquisition**

Susceptibility to these viruses is universal.

**28.15.3 Management**

**Patients**

Patients and their body fluids are highly infectious. Specific advice on management of suspected VHF infections should be sought from the chief quarantine officer in each State/Territory, who should be contacted immediately.

Lassa fever, Marburg haemorrhagic fever, Ebola haemorrhagic fever and Crimean–Congo haemorrhagic fever are quarantinable diseases.

All patients with suspected VHF and their specimens and bodily secretions should be handled at Physical Containment Level 4 (PC4).

All specimens must be handled with appropriate safeguards. The specimens should not be sent through the normal courier mechanisms (human or other), to ensure that accidents do not occur as a consequence of mishandling or misplacement. The laboratory manager and infection control practitioner must be alerted immediately to ensure appropriate handling of specimens.

**Health care workers**

There are no vaccines available for VHFs. Additional precautions should also include rostering pregnant HCWs to avoid contact with a possible or confirmed VHF case.

**Instruments and environment**

PC4 containment (AS/NZS 2243.3) procedures should be used for waste or contaminated materials where a VHF is confirmed or suspected.

Contact the State/Territory human quarantine officer to discuss waste containment and disposal requirements.

**28.16 Severe acute respiratory syndrome (SARS)**

Note: Severe acute respiratory syndrome (SARS) is considered an ‘emerging’ disease at the time of the release of these guidelines. More current and specific SARS information can be found at http://www.health.gov.au/sars.htm.

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28.16.1 Disease description

Aetiology

A disease caused by a novel coronavirus and characterised by atypical pneumonia.

The World Health Organization (WHO) issued a global alert about SARS on 12 March 2003. The outbreak was originally detected in Guandong Province in southern China, and the disease has since spread to over 29 countries.

Clinical manifestations

SARS presents as fever, coughing, sneezing and respiratory symptoms (shortness of breath or difficulty breathing), with changes of atypical pneumonia on chest X-ray.

Any person suspected of having SARS should have a chest X-ray performed. X-ray changes are one of the essential criteria for definition of a case.

Occurrence

People with SARS do not necessarily have severe illness. Some have mild to moderate ‘cold’ symptoms that resolve without any treatment. In such instances, they may unknowingly infect others with the SARS virus. People who are frail or in poor general health or who have chronic diseases are more likely to suffer severe illness when infected.

28.16.2 Transmission

Source of infection

In the incubation period, SARS is not transmitted from person to person. Infectivity begins in the prodromal period of fever and non-specific symptoms. When respiratory symptoms develop, there is a higher level of infectivity. Very severe cases (‘super spreaders’ who are extremely unwell) have high levels of transmission.

Mode of transmission

Droplet and direct contact appear to be the predominant modes of transmission, although airborne and indirect transmission through fomites remains a possibility. Transmission via contact with faeces from infected persons is also possible.

Risk of acquisition

SARS is highly infectious to close contacts, particularly HCWs providing clinical care and support.
28.16.3 Management

Patients

Infection control measures for suspected and confirmed SARS patients should include the following:

- Use standard precautions (ie hand hygiene).
- Use contact and droplet precautions (ie use of long-sleeved gowns, gloves and protective eyewear for contact with patient or environment).
- Use airborne precautions; that is, an isolation room with negative pressure relative to the surrounding area and use of a P2 (N95 equivalent) mask (respirator) for all persons entering the room.
- The patient should be cared for in a respiratory isolation room (with ensuite). The door to the patient’s room must remain closed.
- Patient movement should be restricted (and if they must leave their room, a surgical mask must be in place).
- Avoid the use of nebulisers, chest physiotherapy, bronchoscopy, gastroscopy or any intervention that may disrupt the respiratory tract.
- Surgical masks should be placed over nasal oxygen prongs.
- Preferably, disposable long-sleeved gowns and face protection should be worn.

Health care workers

Each establishment’s infection control team should review the radiology department to identify risky procedures, advise and educate staff, and ensure appropriate protocols are in place (see Section 22.1).

Limit non-essential HCW contact with SARS patients. HCWs are to avoid direct contact with SARS patient secretions and excretions.

A record should be kept of any reports of unprotected exposure to SARS cases. Management, active/passive surveillance and quarantine depend on the status of the SARS case and should be reviewed on a case-by-case basis by the infection control team (further information is available at http://www.health.gov.au/sars.htm).

All workers in a SARS team should have their temperatures taken and recorded twice daily.

Immunocompromised HCWs should not care for SARS patients.
Instruments and environment

Use disposable equipment wherever possible in the treatment and care of patients with SARS and dispose of it appropriately as clinical waste.

Personal eyewear (ie spectacles) should be disinfected using an appropriate process.

If devices are to be reused, they should be cleaned and disinfected or sterilised to the minimum level of reprocessing required for specific items in use, as specified in Table 16.1.

Note: single-use (labelled disposable) or single-patient use intubation and suction equipment should not be reused on another patient, as it cannot be reprocessed adequately to ensure safety.

Environmental surfaces should be cleaned with warm water and detergent in accordance with Section 18.1.1. A hospital-grade disinfectant with an additional general virucidal claim on the label should be used after this treatment.

See also Sections 16 and 17 for cleaning and reprocessing procedures.
29 Bacterial diseases

Key points

- Common bacterial diseases of concern in the health care setting include gastrointestinal infections (mainly salmonellosis, campylobacteriosis, shigellosis and Clostridium difficile-associated diarrhoea), legionellosis, listeriosis, meningococcal infection, whooping cough (pertussus), staphylococcal infection, streptococcal infection and tuberculosis.

- Most bacterial diseases are widespread in the community and are not significantly more common in the health care setting. However, without effective infection control, they may be readily transmitted from patient to patient and, to a much lesser extent, from patient to health care worker and vice versa. Some bacterial diseases are not common in the community (eg legionellosis and tuberculosis) but are nevertheless significant diseases.

- Susceptibility to bacterial infection frequently varies with age and with health status. Immunisation or naturally acquired immunity may confer protection in some instances (eg pertussis), but not in others (mainly enteric bacterial pathogens).

- In all instances of bacterial disease in the health care setting, standard precautions and work practices are required. However, in specific circumstances, additional precautions and work practices, which are related to the mode of transmission of the disease, are needed.

29.1 Gastroenteritis and enteric bacterial pathogens

29.1.1 Disease description

Aetiology

The more commonly diagnosed infectious agents include salmonella serotypes, Campylobacter spp, Shigella spp and Clostridium difficile.

Clinical manifestations

Abdominal pain, diarrhoea, nausea, vomiting and fever are common features of gastroenteritis.

Occurrence

Gastrointestinal infections are relatively common in the community, and there is no seasonality in incidence. Individuals may carry pathogens asymptomatically, sometimes for long periods.
However, not all diarrhoea occurring in health care establishments is infectious and not all gastrointestinal infections result in diarrhoea.

### 29.1.2 Transmission

#### Source of infection

Both symptomatic patients and asymptomatic carriers may be infectious. There are several pathogens that may be carried for long periods of time.

#### Mode of transmission

Gastrointestinal pathogens are transmitted by the faecal–oral route. The most likely sources of infection in health care establishments are other patients (especially paediatric patients) and food (see Section 19.2). Frequent screening of food handlers is not practicable. Asymptomatic excretors of gastrointestinal pathogens are unlikely to transmit disease if standards of hygiene are high and methods of food preparation and storage prevent incubation of pathogens.

Salmonella and campylobacter are present in 'normal' poultry and other animals. Possible contamination from both human and nonhuman sources must be considered when developing procedures for preparing and storing food. Education of health care workers (HCWs) who handle food is the most effective method of reducing the risk of foodborne infections in health care establishments.

Sporadic cases of health care associated diarrhoea due to organisms other than *Clostridium difficile* are unusual, and gut pathogens such as *Shigella* spp, *Salmonella* spp (including *Salmonella enterica*) and *Campylobacter* spp are unlikely to be transmitted to HCWs caring for patients with diarrhoea if standard precautions are practised (see Section 2.2).

Cross-infection with *Clostridium difficile* can occur with spread from patient to patient, both from the contaminated environment and via the hands of HCWs.

#### Risk of acquisition

All age groups are susceptible, with immunocompromised patients and those on long-term antibiotic therapy being at highest risk.

### 29.1.3 Management

#### Patients

Outbreaks of gastrointestinal infections should be investigated and any suspected cluster should be brought to the attention of an infection control practitioner immediately.

Sporadic diarrhoea occurring more than 48 hours after admission should initially be investigated only for *Clostridium difficile*. 
Patients suffering from suspected or confirmed gastrointestinal infections (including *Clostridium difficile*) and who are continent should be nursed with standard precautions (see Section 2.2). If they are incontinent, a separate room with facilities (including toilet) that are not shared with other patients is advised. Adequate handwashing facilities for HCWs and patients are essential.

**Health care workers**

If HCWs caring for patients diagnosed with gastrointestinal infections become ill, they should be assessed for gut pathogens where appropriate, and infection control procedures should be re-examined.

HCWs with bacterial diarrhoea should not return to work until faecal cultures for the causative organism are negative. HCWs who handle food should not return to work until asymptomatic, and should not return to food-handling duties for another 48 hours after symptoms resolve. Known persistent carriers of salmonella should not handle food without assessment by infection control practitioners. Known carriers of salmonella should not work in food preparation areas without assessment of the premises and individual work practices.

Routine screening of HCWs for gastrointestinal pathogens is not recommended.

**Instruments and environment**

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

### 29.2 Legionellosis

#### 29.2.1 Disease description

**Aetiology**

Disease is caused by infection with *Legionella* spp, most commonly with *Legionella pneumophila*. In all, about 35 species of *Legionella* are recognised.

**Clinical manifestations**

Legionellosis is an acute bacterial disease characterised initially by anorexia, myalgia, lethargy and headache, followed soon thereafter by fever commonly reaching 40.5°C. Cough, abdominal pain and diarrhoea occur frequently. Severe infections may lead to respiratory failure and death.

**Occurrence**

Legionellosis may occur as sporadic cases or outbreaks, and is more frequently reported in summer and autumn. The incidence of infection increases with increasing age, with most cases occurring in those over 50 years old.
29.2.2 Transmission

Source of infection

The organism is found in many aqueous environments, including contaminated airconditioning cooling towers, hot water systems, humidifiers, spa baths and respiratory therapy devices.

Mode of transmission

Airborne transmission in water droplets is believed to be the major, if not sole, means of infection. Person-to-person transmission has not been demonstrated, so hospitalised patients with legionellosis do not pose a risk for cross-infection.

Risk of acquisition

People over the age of 50 are at highest risk, particularly those who smoke or have chronic lung disease, renal disease, diabetes or a malignancy or who are immunocompromised.

29.2.3 Management

Patients

Standard precautions are adequate for patients with legionellosis (see Section 2.2).

Health care workers

Standard precautions provide adequate protection for HCWs (see Section 2.2).

Instruments and environment

Routine reprocessing of instruments and equipment should be employed (see Sections 16 and 17).

Special precautions for the environment include adequate maintenance of potential reservoirs of infection, such as hot water and airconditioning systems, spa baths (see Section 11.5), humidifiers and respiratory therapy equipment (see Section 17.5).

29.3 Listeriosis

29.3.1 Disease description

Aetiology

Disease is caused by infection with *Listeria monocytogenes*. 
Clinical manifestations

Listeriosis is usually manifested as meningoencephalitis and/or septicaemia.

Occurrence

The disease primarily affects pregnant women, neonates, the elderly and immunocompromised individuals receiving radiation therapy, chemotherapy, haemodialysis or glucocorticosteroid medications.

29.3.2 Transmission

Source of infection

Listeria can be found on the surface of raw, unwashed vegetables and in certain processed foods, including soft cheeses (eg brie, camembert, fetta and ricotta), paté, some cold meats (eg cooked diced chicken and prepacked sliced meats) and packed salads (eg coleslaw). Listeria is only rarely transmitted by contact of open wounds with contaminated foods or sewage. Listeria is not unique to hospitals.

Mode of transmission

The disease is contracted by the consumption of contaminated foods (see Source of infection, above). Infants may contract the disease in utero or perinatally. Rare outbreaks have been associated with contaminated fomites or contact of wounds with contaminated sewage.

Risk of acquisition

Elderly and immunocompromised patients, and infants born to infected mothers, are at the highest risk of infection. Infection does not appear to confer subsequent immunity.

29.3.3 Management

Patients

Standard precautions (see Section 2.2) should be observed for patients with listeriosis. Pregnant women and immunocompromised people should avoid meals containing soft cheeses, diced chicken and cold processed meats.

Health care workers

General guidelines recommended for the prevention of listeriosis in a health care establishment are similar to those used to prevent other foodborne diseases:

- wash hands, knives and cutting boards after handling uncooked foods;
- keep uncooked meats separate from vegetables and from cooked and ready-to-eat foods;
- cook raw meats thoroughly;
• wash raw vegetables thoroughly before eating; and
• avoid serving pregnant women and immunocompromised people meals containing soft cheeses, diced chicken and cold processed meats.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

29.4 Meningococcal infection


The aims of the Meningococcal Guidelines are:
• to assist primary care practitioners with the emergency management of cases of suspected invasive meningococcal disease; and
• to assist public health practitioners with the prevention of further cases after a case of invasive meningococcal disease has been reported.

Topics covered in the Meningococcal Guidelines include:
• emergency management of suspected invasive meningococcal disease in general practice;
• early hospital management of suspected invasive meningococcal disease;
• laboratory tests and their use;
• public health management of sporadic cases of invasive meningococcal disease;
• public health management of outbreaks of invasive meningococcal disease; and
• reporting and public health surveillance of meningococcal disease.

Key points
• Meningococcal septicaemia has considerably greater mortality than meningococcal meningitis and is often characterised by a rapidly evolving petechial or purpuric rash that does not blanch under pressure. The rash in its early stages may consist of a few haemorrhagic spots located in a place such as the groin or on the feet.
• Meningococcal disease may have clinical features not normally expected in children with acute systemic illnesses.
Practitioners should ensure that a patient with a systemic febrile illness, particularly a child, can be promptly reassessed should the need arise.

All general practitioners should have benzylpenicillin in their surgeries and emergency bags, and should be ready to administer it immediately to patients with a systemic febrile illness and a petechial or purpuric rash. The doses are: children aged < 1 year — 300 mg; children aged 1–9 years — 600 mg; adults or children aged 10 years or over — 1200 mg.

The early administration of benzylpenicillin, followed by urgent transfer to hospital, can be life saving. Ceftriaxone is a suitable alternative if available.

If clinical suspicion exists to warrant a referral for admission to hospital, the patient should receive benzylpenicillin prior to transfer.

A history of a rash following penicillin is not a contraindication for benzylpenicillin.

The local public health unit should be notified immediately to enable an appropriate public health response.

### 29.4.1 Disease description

#### Aetiology

Disease is caused by infection with *Neisseria meningitidis*.

#### Clinical manifestations

Bacteraemia is an essential component of invasive meningococcal infection, which may present as meningitis, septicaemia or, more rarely, septic arthritis or chronic systemic infection.

Presentation may be as acute bacterial meningitis (fever, headache, vomiting, neck stiffness) with or without petechial haemorrhages or other skin lesions seen with meningococcal bacteraemia.

Meningococcaemia without meningitis may occur without a rash, but more usually with a petechial or grosser haemorrhagic rash. Progression to overwhelming shock can be rapid and this type of infection has a much higher death rate than uncomplicated meningococcal meningitis.

#### Occurrence

Meningococcal disease affects mainly younger children and adolescents, but can occur at any age. It can kill previously healthy children within several hours of onset. An increasing incidence of disease and of outbreaks has been associated with the spread of virulent clones of both serogroup B and serogroup C meningococci. In Australia, the incidence of meningococcal disease has been increasing over the past decade.
29.4.2 Transmission

Source of infection

Nasopharyngeal carriers may be sources of infection. Patients with meningococcal septicaemia or meningitis usually become noninfectious within 24 hours of institution of appropriate therapy.

Mode of transmission

*Neisseria meningitidis* is spread by direct contact, including by respiratory droplets from the nose and throat of infected people.

Risk of acquisition

Meningococcal infection has sometimes been a concern to hospital HCWs in contact with these cases. The risk of acquisition of infection by hospital HCWs is extremely low, unless they are in prolonged direct contact with the patient or they undertake mouth-to-mouth resuscitation of infected patients. This situation is unlikely to arise in a hospital after a patient is diagnosed and treated. Once treatment is initiated in acute meningococcal infection, infectivity appears to decrease rapidly, despite the fact that penicillin is not effective in clearing nasal meningococci in carriers. The *Meningococcal Guidelines* recommend the use of rifampicin following parenteral penicillin, where that antibiotic has been used to treat meningococcal infection (CDNA 2001).

29.4.3 Management

Patients

Additional precautions (droplet transmission) should be observed for 24 hours after the initiation of specific therapy (see Section 2.3).

It is vital that all cases of meningococcal disease are notified, so that outbreaks can be identified. HCWs should be guided in the management of outbreaks by State/Territory health authorities. Close contacts who have become colonised with a virulent strain may develop invasive meningococcal disease: the risk is greatest in the first week after contact but may persist for many months. Those at risk include household members and contacts in day-care centres, who may have been exposed to the carrier who infected the index case in the 10 days preceding onset of illness in that case. People exposed to oral secretions (eg by kissing or by mouth-to-mouth resuscitation) are also at risk. All those at risk should receive chemoprophylaxis.

The *Meningococcal Guidelines* should be consulted on the recommended chemoprophylaxis (CDNA 2001). No chemoprophylactic strategy is 100% effective. The most important aspect of prophylaxis is the need for immediate medical attention for any contact who develops a febrile illness within days or
weeks of contact with a person with invasive meningococcal infection. In any such situation, depending upon the clinical circumstances, it will often be appropriate to culture a blood sample and start treatment without delay as for invasive meningococcal infection.

An outbreak of meningococcal disease in an institutional or community setting is a public health emergency needing a rapid response from both clinicians and public health practitioners. The decision to control an outbreak with an immunisation program will depend on identifying a well-defined population at risk, and estimating the magnitude of ongoing risk. The Meningococcal Guidelines should be consulted when conducting such immunisation programs for the control of outbreaks of meningococcal disease (CDNA 2001).

Health care workers

Postexposure prophylaxis is not recommended for HCWs unless they have carried out mouth-to-mouth resuscitation on an infected person. For information on PEP for meningococcal disease, the NHMRC Guidelines for the Control of Meningococcal Disease in Australia (NHMRC 1996a) should be consulted.

Routine immunisation of staff with current meningococcal vaccines is not recommended, as the risk of meningococcal disease in Australia is relatively low. Immunisation is, however, recommended for microbiology laboratory staff who may be exposed to meningococcus and people with inherited defects of properdin or complement, or functional or anatomical asplenia (see NHMRC 2003).

Instruments and environment

Additional precautions (droplet transmission) should be observed (see Section 2.3).

29.5 Pertussis (whooping cough)

29.5.1 Disease description

Aetiology

Disease is caused by infection with the gram-negative coccobacillus Bordetella pertussis.

Clinical manifestations

Pertussis (whooping cough) is a serious, sometimes fatal, respiratory infection. The cough becomes paroxysmal usually within 1–2 weeks and often lasts 1–2 months or longer. Patients frequently expel clear, thick mucous and vomiting is common. Infected adults may have a persistent cough, but without the paroxysms seen in children.
Occurrence

Pertussis is endemic in Australians of all ages. Outbreaks occur periodically but the incidence is low in communities with high immunisation rates.

29.5.2 Transmission

Source of infection

Humans are thought to be the only natural reservoir. Children may be infected by a sibling or an infected adult.

Mode of transmission

Pertussis is a highly infectious disease, spread by respiratory droplets. The incubation period is usually 7–10 days. Individuals may be infectious from seven days after exposure to three weeks after the onset of typical paroxysms. The initial catarrhal stage of the illness has an insidious onset and is the most infectious period.

Risk of acquisition

Risk of infection decreases after administration of appropriate antibiotics but treated patients may be infectious for up to five days. Nonimmunised or partially immunised children are at risk of infection. Immunity has been shown to wane in adults, so teenagers and adults are also at risk. HCWs involved in the care of nonimmunised children should be aware that adult pertussis does occur.

29.5.3 Management

Patients

Additional precautions (droplet transmission) should be observed (see Section 2.3). Known cases should be accommodated in a single room for at least five days after starting appropriate antibiotic treatment. Suspected cases should be isolated from young children and infants, particularly those not immunised. If there has been inadvertent exposure of patients to an infectious individual with pertussis in the previous 10 days, then erythromycin prophylaxis should be offered.

Infants in Australia are immunised with acellular pertussis vaccine, given together with diphtheria and tetanus as DTPa vaccine or with diphtheria, tetanus and hepatitis B virus as DTPa–hepB (see NHMRC 2003).

Health care workers

HCWs diagnosed with pertussis infection should be treated and rostered to avoid contact with susceptible patients until five days after the start of effective antibiotic therapy. HCWs with persistent cough should be tested for pertussis, and similarly excluded from patient contact until the result of the test is known.
It is not currently recommended that pertussis vaccines be used after eight years of age, although the use of acellular pertussis vaccines in adults is currently being tested. If there has been inadvertent exposure of HCWs to an infectious individual with pertussis in the previous 10 days, then erythromycin prophylaxis should be offered. Chemoprophylaxis is not routinely recommended for HCWs caring for infected children.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

29.6 Staphylococcal infection

29.6.1 Disease description

Aetiology

Disease is caused by infection with coagulase-positive strains of *Staphylococcus aureus* and less commonly coagulase-negative *S. epidermidis*.

Clinical manifestations

*Staphylococcus aureus* commonly causes cellulitis and wound infections. It may also cause more serious conditions such as osteomyelitis and bacteraemia. Enterotoxin-producing staphylococci may also cause food poisoning.

Occurrence

*Staphylococcus aureus* is present on the skin and in the nose of approximately 30–50% of the general population, and may be more common in HCWs.

29.6.2 Transmission

Source of infection

Usually an asymptomatic carrier, or a patient with a purulent staphylococcal lesion, is the source of infection.

Mode of transmission

*Staphylococcus aureus* is transmitted by direct contact with a colonised or infected person. Airborne transmission also occurs, but to a lesser extent. Nasal secretions contain large numbers of bacteria that will contaminate the hands. Staphylococci can penetrate into the deeper layers of the skin, where they live and multiply in the pores and hair follicles. Hands colonised in this way can be washed and scrubbed without removing the organisms. Antiseptic lotions may help to reduce the skin carriage of staphylococci.

Methicillin-resistant *Staphylococcus aureus* is discussed in Section 30.2.
Risk of acquisition

The risk of transmitting organisms from HCW to patient depends on the underlying medical condition of the patient, on the extent of skin shedding by the HCW and on the extent of contact between the two. Infections are relatively common among patients, who may themselves sometimes be carriers and heavy shedders of the microorganisms.

HCWs with exfoliative skin conditions are at increased risk of both acquiring and transmitting infection. HCW carriers, including asymptomatic nasal carriers, who maintain high standards of hygiene, implement standard precautions, and do not have either an exfoliative skin condition or overt sepsis (eg paronychia) are unlikely to transmit significant numbers of staphylococci. Sinusitis, in particular, may be associated with heavy shedding.

29.6.3 Management

Patients

Standard precautions should be observed (see Section 2.2).

Identification by clinical assessment of those patients with presumptive staphylococcal sepsis should be made. Routine laboratory screening for colonisation is not warranted.

If a patient is excreting large numbers of Staphylococcus aureus (eg from an infected wound), they should be accommodated in a single room with its own toilet and bathing facilities. Standard precautions must be maintained (see Section 2.2).

If a patient has a Staphylococcus aureus respiratory tract infection and is dispersing the organism into the air (eg by cough), then the patient should preferably be accommodated in a respiratory isolation room with negative pressure ventilation (see Section 11.5.4).

Measures to protect patients from staphylococcal infections are best directed at identifying heavy shedders.

Contamination of food with enterotoxin-producing Staphylococcus aureus can cause food poisoning. Staphylococcal sepsis on the hands of HCWs preparing or handling food is the most likely source.

Health care workers

HCWs with conditions that predispose them to heavy shedding should be identified by verbal medical history and examination. The degree of shedding should be assessed by culturing sites of potential carriage (eg skin lesions, anterior nares, axilla and groin) but routine laboratory screening for colonisation is not warranted. If an outbreak occurs, selective screening may be necessary.
Provision of a roster system and/or treatment program for heavy shedders should be made. Heavy shedders should not be rostered to work in high-risk areas, but should be suitably redeployed.

Preclude people with skin lesions from clinical contact and food preparation unless lesions can be fully covered.

HCWs with predisposing conditions (eg dermatitis) should be rostered away from patients known to be infected with *Staphylococcus aureus*.

Gloves must be worn when contact is made with infected lesions (ie standard precautions).

Hands must be thoroughly washed before and after significant patient contact.

**Instruments and environment**

Routine reprocessing for instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

### 29.7 Streptococcal infection

#### 29.7.1 Disease description

**Aetiology**

Disease is caused by infection with group A (beta haemolytic) *Streptococcus pyogenes*.

**Clinical manifestations**

*Streptococcus pyogenes* is a common cause of pharyngitis, skin infections such as cellulitis, and wound infections. It is also a cause of scarlet fever and rheumatic fever and can contribute to more serious conditions, such as necrotising fasciitis and bacteraemia. Streptococcal infections are sensitive to penicillin, although the response can be slow in invasive infections (eg bacteraemia).

Antibiotic therapy relatively quickly decreases the numbers of bacteria present in wounds and rapidly lowers the risk of cross-infection.

**Occurrence**

Streptococcal pharyngitis occurs more frequently in temperate climates than tropical zones. The age/frequency distribution is unimodal, with a peak at 6–12 years of age. It is uncommon in children less than three years of age. Cases occur throughout the year, but peak in late winter and early spring.
Streptococcal impetigo occurs throughout the year — most frequently in young children in late summer and autumn. Erysipelas and scarlet fever occur sporadically, with seasonal and geographic distributions similar to streptococcal pharyngitis.

29.7.2 Transmission

Source of infection

Outbreaks of health care associated infection have been traced to asymptomatic carriers of the organism. Pharyngeal, nasal, skin, anal and vaginal carriers have been implicated. Patients with overt disease, such as impetigo and pharyngitis, are also infectious. Outbreaks of pharyngeal infections have followed ingestion of contaminated foods, particularly milk, eggs and their products.

Mode of transmission

Aerosol transmission by patients or asymptomatic carriers is common. Aerosol transmission by expelled respiratory secretions from symptomatic patients or asymptomatic carriers is common. Patients with purulent discharges are generally infectious for up to 24 hours after the start of appropriate therapy. Infection may sometimes occur through direct contact with contaminated fomites.

Risk of acquisition

Most people are generally susceptible to streptococcal pharyngitis or scarlet fever, but some have developed immunity due to inapparent infection.

29.7.3 Management

Patients

Acute septic lesions (impetigo, cellulitis, paronychia) and acute pharyngitis should be assessed for pathogenic streptococci.

If a patient is excreting large numbers of these organisms from an infected wound, they should be accommodated in a single room with its own toilet and bathing facilities. Standard precautions (ie gloves when wounds are dressed or examined) must be used when attending these patients (see Section 2.2).

If a patient has a group A streptococcal respiratory tract infection, and is dispersing this organism into the air (eg by cough), additional precautions (droplet transmission) should be implemented in addition to standard precautions for at least the first 24 hours of effective antibiotic treatment (see Section 2.3). The patient should preferably be accommodated in a respiratory isolation room with negative pressure ventilation (see Section 11.5.4).
Health care workers

Acute septic lesions (impetigo, cellulitis, paronychia) and acute pharyngitis should be assessed for pathogenic streptococci. Clinical contact staff with streptococcal lesions should cover those lesions and be given systemic and local treatment. Similarly, HCWs with acute streptococcal pharyngitis should receive antibiotic treatment and should be precluded from direct patient contact for at least the first 24 hours.

Instruments and environment

Routine reprocessing of instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

29.8 Tuberculosis (TB)

29.8.1 Disease description

Aetiology

Tuberculosis (TB) is caused by infection with Mycobacterium tuberculosis-complex spp, predominantly M. tuberculosis. Disease due to M. bovis or M. africanum is only occasionally reported in Australia.

Clinical manifestations

Many initial infections with M. tuberculosis or related species are asymptomatic. Approximately 90–95% of those who have the bacterium become latent carriers who have a lifelong risk of developing clinical (active) disease. Approximately 10% of infected adults will develop such clinical disease in their lifetime, about half of those in the first five years after infection (but predominantly in the first year) and the other half later in life. The risk of developing disease is much greater in infants and young children, and in those with impaired immune function.

Early clinical symptoms include fatigue, weight loss, fever and night sweats. In more advanced disease, hoarseness, cough with blood-stained sputum and chest pain are common.

Occurrence

There are approximately 1000 new cases of TB notified each year in Australia, of which 60–70% are pulmonary TB. Extrapulmonary TB is much less common, but infection can occur in any organ or tissue, including meninges, lymph nodes, pleura, pericardium, kidneys, bones, joints, larynx, skin, peritoneum, intestines and eyes. Miliary TB may also occur.
About 75% of notified cases of pulmonary TB are bacteriologically confirmed, with less than 50% of bacteriologically confirmed cases being sputum-smear positive for acid-fast bacilli (ie the most important form of TB in terms of transmission of infection).

Within this relatively low incidence of TB, subsegments of the population (eg indigenous Australians, migrants from high TB-risk countries) have a higher TB burden. In particular, some young immigrants are more prone to rapid progressive disease following TB infection. Immunocompromised patients are at high risk of developing active TB if they become infected with *M. tuberculosis*.

### 29.8.2 Transmission

**Source of infection**

Symptomatic or asymptomatic people with viable bacilli in their sputum may be infectious. Untreated or inadequately treated patients may be sputum-positive intermittently for many years, although children with primary TB are generally not infectious. Patients usually become noninfectious within a few weeks of beginning appropriate therapy.

**Mode of transmission**

TB is usually transmitted by exposure to airborne droplet nuclei produced by people with pulmonary or laryngeal disease, during coughing and sneezing. Prolonged close contact with such patients increases the risk of transmission.

The aerosol droplets of less than 5 µm diameter produced by TB patients contain acid-fast bacilli. These droplets can remain afloat and viable in the environment unless they are removed by planned infection control procedures. When inhaled, the acid-fast bacilli can settle in the lungs, where they may result in TB infection and may remain viable for the lifetime of the new host. People with TB infection of this nature without evidence of clinical disease are not infectious and are asymptomatic. Not all of those who have progressed to active pulmonary TB have respiratory symptoms capable of producing droplet nuclei into the environment and onto new hosts. It should be emphasised that HCWs can also be exposed during procedures such as cough induction, bronchoscopy, intubation and autopsy, particularly when these involve a patient with undiagnosed TB. Other respiratory tract sites (eg in laryngeal TB) are also a significant source of organism transmission. Infection by direct contact with mucous membranes or skin lesions is very rare.

Bovine TB may result from drinking unpasteurised infected milk or by aerosol transmission from infected animals to farmers or animal handlers.
Risk of acquisition

The risk of acquisition is related to the degree of exposure to the infectious agent. The greatest risk of disease occurs from 6–12 months after exposure. For people with latent infection, susceptibility to reactivation is increased in those with immunosuppression, or debilitating diseases such as diabetes, cancer and renal failure, and in those who engage in substance abuse or who are malnourished. Reactivation of latent infection accounts for a large proportion of cases in elderly people.

29.8.3 Management

There is a hierarchy of individual risk for HCWs, patients and visitors to health care establishments, as well as a hierarchy of potential for transmission of TB in different establishments.

TB control measures should reflect the order of risk to those in health care settings. Thus, in the hierarchy of TB control, the most important aim is to decrease the risk of exposure of both HCWs and patients to infectious cases of TB. Since it is the undiagnosed TB patient who presents the most risk, infection control protocols should ensure rapid detection, isolation, diagnosis and treatment of TB. Next in the hierarchy are those measures that reduce the risk of infection from infectious droplet nuclei, followed by measures based on HCW screening.

At one extreme, small hospitals only rarely catering for active TB may maintain minimal measures against its transmission. At the other, major hospitals should have in place, documented and operational, most of the requirements of TB infection control. In between these two extremes, variable degrees of TB infection control protocols are required and should be devised based on local epidemiology and assessment of risks.

Each health care establishment should develop its own TB infection control policy appropriate for its estimated risk of health care associated infection.

Patients

Additional precautions (airborne transmission) should be observed (see Section 2.3). People (HCWs and visitors) should wear a P2 particulate respirator (see Section 13.4) when entering a TB patient’s room until effective treatment has been verified, or where normal treatment measures are not likely to be effective (eg disease due to drug-resistant strains of M. tuberculosis). Care should be taken to ensure that all people who use these masks are instructed in the correct fit and wearing of the masks. When the patient is required to leave a TB isolation room (eg for chest X-ray), they should wear the mask if their TB is considered infectious. TB patients should be educated to cover their mouths and noses while coughing or sneezing, and to dispose of used tissue in a closed container for incineration.
Medical procedures that present a particular risk of cross-contamination from an infectious patient include bronchoscopy (see Sections 11.5.5 and 17.3) and the use of respiratory and anaesthetic apparatus (see Section 17.5).

Bacille Calmette–Guerin (BCG) immunisation is recommended for neonates born to patients with leprosy or TB. In the case of neonates born to patients with TB, BCG should be given after completion of isoniazid prophylaxis, as isoniazid will inactivate BCG. BCG immunisation and protective preventive treatment (usually with isoniazid) have often been inappropriately compared with each other in providing protection against TB. Although BCG immunisation in the general population and in adults is no longer considered to be indirectly effective against transmission of TB, its benefit in preventing complicated TB, particularly in children, is well documented (NHMRC 2003).

If active TB occurs during pregnancy, standard antituberculosis therapy (ie isoniazid, rifampicin and ethambutol) can be used safely (Brost and Newman 1997).

Immunocompromised patients should not be accommodated in the same area of the establishment as known or suspected TB cases.

Health care workers

HCWs working in TB-risk areas (medical wards, chest clinics, bronchoscopy units, radiology units, TB laboratories, HIV-dedicated wards and autopsy rooms) are at greatest risk of occupational exposure.

At the start of employment, all HCWs should be screened by personal medical history for previous infection or immunisation and should undergo an initial two-step tuberculin skin test (see also Section 22.5). HCWs working in high-risk areas (eg microbiology laboratories and respiratory wards) should be retested yearly if their initial skin test is negative. Other Mantoux-negative HCWs should be regularly retested (the frequency depending on their level of risk). HCWs who test positive should be followed up with a chest X-ray and clinical review.

When designing HCW screening protocols, special attention should be given to:

• minimising the risk of an HCW with active TB working in a setting involving patients with increased risk of disease when infected (eg neonates, immunocompromised patients); and

• minimising the risk of exposure to TB of HCWs at particularly high risk of developing disease if infected (eg immunocompromised HCWs).

Immunodeficient HCWs should not be involved in the care of patients with tuberculosis.
Whenever a patient is diagnosed with active pulmonary TB, HCWs with a high risk of exposure should be investigated. Their tuberculin skin test status, nature of exposure and other factors associated with active infection should be assessed.

BCG immunisation is of uncertain value, but can be offered to tuberculin skin test-negative HCWs at high risk from TB. However, BCG immunisation is not recommended for immunodeficient HCWs. The decision to undertake a program of BCG immunisation is often a matter for staff health authorities, who should follow the guidelines as set down by their State/Territory TB control unit. These authorities should arrange for periodic surveillance of tuberculin reactivity, or should initiate special surveys after accidental exposure, in keeping with the policy of their State/Territory. BCG vaccine may also be useful to prevent infection of HCWs by multidrug-resistant TB, and would certainly be more effective than offering complicated preventive therapy.

**Instruments and environment**

Routine reprocessing for instruments and equipment (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
Antibiotic-resistant bacteria

30 Antibiotic-resistant bacteria

30.1 Introduction

Organisms with acquired resistance to multiple antibiotics are common in many hospitals. Currently, the important multiresistant bacteria are:

- methicillin-resistant (or multiresistant) *Staphylococcus aureus* (MRSA);
- vancomycin-resistant *Enterococcus faecium* and *Enterococcus faecalis* (VRE);
- multidrug-resistant tuberculosis (MDR-TB).

Of these, MRSA is the most prevalent. Additional precautions are recommended for all patients colonised or infected with MRSA or VRE.

Many of these bacteria are amplified by the use of broad-spectrum antibiotics, and may colonise patients and sometimes health care workers (HCWs). These organisms do not appear to be more virulent than the antibiotic-sensitive strains but, because of their resistance patterns, are more difficult to treat if infection occurs.
30.2 Methicillin-resistant *Staphylococcus aureus* (MRSA)

30.2.1 Disease description

**Aetiology**

Disease is caused by infection with coagulase-positive *Staphylococcus aureus* with acquired resistance for methicillin and commonly one or more other antibiotic classes. There are currently three main types of MRSA circulating within Australia (Turnidge and Bell 2000):

- classical methicillin-resistant MRSA, also termed eastern Australia (EA) MRSA (resistant to beta-lactams, erythromycin, gentamicin and trimethoprim–sulfamethoxazole);
- community MRSA, also termed Western Australia (WA) MRSA or Kimberley MRSA (resistant to methicillin and beta-lactams, generally sensitive to gentamicin); and
- community MRSA different from WA MRSA, but similar to community strains in New Zealand and other South Pacific islands.

**Clinical manifestations**

As with other strains of *Staphylococcus aureus*, MRSA may cause skin lesions (impetigo, folliculitis) and systemic infections such as abscesses, pneumonia, osteomyelitis, sepsis, endocarditis and meningitis.

**Occurrence**

EA MRSA is common in many hospitals, and has a high propensity to become endemic (ie present at all times within a health care establishment). Additional precautions (contact transmission) are recommended for all patients colonised or infected with MRSA (see Section 2.3).

Despite vigorous attempts at eradication over the last 20 years, MRSA continues to be the major health care associated pathogen in Australian acute care institutions.

MRSA is endemic in the majority of Australian teaching hospitals. Occasional episodic outbreaks occur, especially in intensive care units. There is a high patient morbidity and mortality in association with health care associated MRSA, especially in:

- intensive care units;
- cases of infected vascular and orthopaedic prostheses;
- cases of surgical wound infection; and
- cases where sepsicaemia and pneumonia develop.

MRSA is endemic in the majority of Australian teaching hospitals.
Community strains of MRSA are currently most prevalent in Western Australia, but are being seen more often in South Australia and the Northern Territory as well (Turnidge and Bell 2000). It has recently been reported that a different type of community strain, which appears to be similar to a community strain seen in New Zealand, has been identified in the eastern states (Nimmo et al 2000). While these types of MRSA appear more frequently in the community, they are capable of causing health care associated infections and outbreaks if introduced into a health care setting.

Intermediate glycopeptide-resistant MRSA have recently been detected in other countries, and health care establishments need to be aware that glycopeptide resistance is possible in MRSA.

### 30.2.2 Transmission

#### Source of infection

MRSA colonisation precedes infection. Infected and colonised hospital patients are the major primary reservoirs. People with purulent discharges or draining lesions are the most common sources during epidemics within health care establishments. Colonisation of hospital patients depends upon:

- length of hospital stay;
- nutritional status of patient;
- severity of underlying disease;
- presence of invasive devices;
- recurrent or recent antibiotic treatment; and
- presence of wounds.

Community reservoirs are less important and include:

- patients recently discharged from hospital;
- chronic leg ulcer patients;
- residents of long-term care establishments (eg aged care facilities, hostels);
- intravenous drug users;
- patients with dermatological disease (eg eczema); and
- insulin-dependent diabetics.

Carriage by HCWs is usually transient, but some may harbour MRSA in the nose or on the hands (contact dermatitis or eczema), and may act as primary reservoirs.

The level of MRSA infection is usually indicative of the overall infection rate of the health care establishment. It may reflect:

- overcrowding of wards;
Tackling the MRSA problem often reduces the overall burden of health care associated infections.

As the rate of MRSA infection rises, the global rate of health care associated infection rises within a health care establishment. Tackling the MRSA problem often reduces the overall burden of health care associated infections.

Mode of transmission

The major route of transmission of MRSA within health care establishments is from patient to patient via the hands of HCWs who acquire the organism after direct patient contact or after handling contaminated materials. This is usually associated with inadequate handwashing. Unfortunately it has been shown that HCWs, particularly physicians, frequently fail to wash their hands between patients.

Other forms of transmission, such as from colonised HCWs or from air or environmental surfaces, are usually less important. Certain body sites that are more resistant to eradication of MRSA include:

- tracheostomy sites;
- chronic leg ulcers;
- wounds; and
- rectal and perineal regions.

Risk of acquisition

Infants and chronically ill people are at most risk from infection. The elderly and debilitated in acute care settings, those with congenital or acquired immunodeficiency, and those being treated with steroids or antineoplastic drugs are particularly susceptible. The vulnerability of patients is largely determined by the presence of indwelling devices (peripheral intravascular lines, central lines, urinary catheters, surgical drains, endotracheal tubes) and treatment or prophylaxis with selective antibiotics. Areas known to accommodate vulnerable patients, and in which multiresistant organisms can become common, include intensive care areas (medical, surgical, general, neonatal), renal units and certain surgical units, especially cardiothoracic, orthopaedic, vascular and urology.

Residents of long-term care establishments can be at risk of becoming colonised with MRSA if other residents are colonised. Residents may then become a source of MRSA if they are transferred to an acute care establishment that cares for patients at risk of infection with MRSA. However, the risk of active infection in residents appears to be no greater than for the general public, unless those residents require treatment within an acute care establishment (see Section 38).
30.2.3 Management

Patients

Additional precautions (contact transmission) should be observed.

Management of MRSA depends upon two factors that vary according to the strain involved: the endemicity of the resistant organisms in the health care establishment, and the vulnerability of the patients in the wards where they occur. Where the organisms are not endemic to the establishment, rigorous application of additional precautions has been shown to be effective in containing or eliminating the problem, although this can be expensive and its cost effectiveness is unclear (BSAC et al 1998). These measures should be implemented where there is a clear risk to patients from active infection with MRSA, rather than from colonisation alone.

The objectives of infection control may differ depending on endemicity. In health care establishments where the organisms are nonendemic, the object should be elimination, while in establishments were they are endemic, the object should be minimisation of further transmission. Application of additional precautions is useful in both settings.

Elimination involves confining the organisms to the individuals who are first identified as colonised or infected and detecting other patients to whom the infection may have been transmitted (as for outbreak screening). Elimination is usually achieved by discharging colonised/infected patients. An alert system for readmission of these patients is required to make this fully effective, because carriage can be very prolonged. The role of routine broader screening of risk groups is less clear, and costs can be considerable.

Minimisation involves ensuring that further transmission to new patients is minimised. Segregation of known colonised and infected patients still plays a useful role. In high-risk patients and clinical areas (eg intensive care units), some form of ongoing screening program may be of benefit in identifying new admissions who are colonised, but this is not recommended as a routine procedure.

There are no universally agreed standards for infection control of multiresistant organisms. One approach is suggested in Table 30.1. Detailed recommendations on the control of MRSA are given by Humphreys and Duckworth (1997).

Additional precautions for MRSA include the following:

- A proper monitoring system should be in place. If it becomes apparent that the rate of MRSA is disproportionately high, then specific and locally appropriate preventive measures need to be developed. In this context, medical practitioners would be wise to collaborate with an infectious diseases physician, clinical microbiologist and/or infection control consultant to devise the most effective plan.
• Identify infecting organisms by bacterial culture.

• Assign patient to a single room with its own bathroom facilities, or cohort patients with presumed or known same strain of the organism (see Section 11).

• Wear a clean, nonsterile gown and gloves when entering room (see Section 13).

• Remove gown and gloves before leaving room and wash hands with antiseptic liquid handwash or alcohol-based hand rub. Ensure gown and gloves do not contact environmental surfaces before disposal.

• Use mask if patient has colonised respiratory secretions (see Section 13.4).

• Use dedicated equipment — stethoscope, sphygmomanometer, thermometer. Clean and disinfect before reuse.

• Use disposable equipment whenever possible.

• Instruments used for dressing changes should not be transferred from patient to patient but should remain by the patient’s bedside.

• Consider the surfaces and furniture within the rooms to be contaminated as well as the patients themselves.

• The optimal requirements for discontinuation of additional precautions for antibiotic-resistant organisms are unclear, and should be chosen in consultation with an infectious diseases physician, clinical microbiologist and infection control practitioner.

Table 30.1 Suggested approach to multiresistant organisms, based on endemicity of the pathogen and patient vulnerability

<table>
<thead>
<tr>
<th>Endemicity</th>
<th>Endemicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not endemic</td>
<td>Endemic</td>
</tr>
<tr>
<td>Single room</td>
<td>If practical, room with patients with known same strains (cohort manage)</td>
</tr>
<tr>
<td>Additional precautions for multiresistant organisms in nonendemic settings</td>
<td>Additional precautions for multiresistant organisms in endemic settings</td>
</tr>
<tr>
<td>Temporary screening program as for outbreak</td>
<td>Consider permanent screening program</td>
</tr>
</tbody>
</table>

Health care workers

MRSA poses a minimal health risk to HCWs. Additional precautions (contact transmission) should be observed. HCWs with skin conditions that predispose them to shedding should not care for patients with MRSA (see Section 22.2.2). There is no vaccine for MRSA.
Additional precautions for multiresistant organisms include:

- using a mask if the patient has respiratory secretions colonised with the organisms; and
- considering the surfaces and furniture within the rooms to be contaminated, as well as the patients themselves.

**Instruments and environment**

Routine reprocessing for instruments (see Sections 16 and 17) including meticulous cleaning of all patient care items (including stethoscopes, blood glucose monitors etc) before use on other patients, and routine cleaning of the environment (see Section 18) should be employed. Particular attention should be paid to cleaning horizontal surfaces (to remove dust) and miscellaneous cleaning equipment.

### 30.3 Vancomycin-resistant *Enterococcus faecium* and *E. faecalis*

#### 30.3.1 Disease description

**Aetiology**

Disease is caused by infection with *Enterococcus faecium* or *E. faecalis* with the *vanA* or *vanB* resistance gene to the antibiotic vancomycin.

**Clinical manifestations**

Enterococci may be cultured from surgical wound infections, liver and intra-abdominal abscesses, and foot ulcers in diabetic patients.

**Occurrence**

*Enterococcus faecium* and *E. faecalis* are commensal bacteria in the gastrointestinal tract of healthy individuals. VRE has a high propensity to become endemic. Additional precautions (contact transmission) are recommended for all patients colonised or infected with VRE (see Section 2.3).

Many of these bacteria are amplified by the use of broad-spectrum antibiotics and may colonise patients and sometimes HCWs. These organisms do not generally appear to be more virulent than sensitive strains but, because of their resistance patterns, are more difficult to treat if infection occurs.
30.3.2 Transmission

Source of infection

VRE readily colonises the bowel without causing symptoms of infection, but is not a cause of diarrhoea. If a patient with diarrhoea has VRE cultured from a faecal specimen without any other signs of systemic infection, they should be considered to be colonised.

Certain groups of patients are at increased risk for VRE colonisation or infection, such as patients who:

- are critically ill (e.g., in intensive care units);
- are immunosuppressed (e.g., oncology or transplant patients);
- have had intra-abdominal or cardiothoracic procedures;
- have a central venous catheter;
- have a prolonged hospital stay; or
- have had recent broad-spectrum antibiotic therapy, or who have received oral or intravenous vancomycin.

Most patients with VRE in Australia are colonised rather than infected, and become potential reservoirs of VRE.

There are no data on the epidemiology of VRE in long-term aged care establishments in Australia. However, overseas data suggest infection caused by VRE and transmission of VRE in these settings is rare.

Mode of transmission

A major route of transmission of VRE within health care establishments is from patient to patient via the hands of HCWs who acquire the organism after direct patient contact or after handling contaminated materials. This is usually associated with inadequate handwashing. Unfortunately it has been shown that HCWs, particularly physicians, frequently fail to wash their hands between patients.

Risk of acquisition

Vulnerability of patients is largely determined by the presence of indwelling devices (peripheral intravascular lines, central lines, urinary catheters, surgical drains, endotracheal tubes) and treatment or prophylaxis with selective antibiotics, rather than immunological impairment, although the latter can play an enhancing role. Areas known to accommodate vulnerable patients, and in which multiresistant organisms can become common, include intensive care areas (medical, surgical, general, neonatal), renal units and certain surgical units, especially cardiothoracic, orthopaedic, vascular, urology, haematology and oncology units.
30.3.3 Management

Patients

Additional precautions (contact transmission) should be observed (see Section 30.2.3).

There are no universally agreed standards for infection control of multiresistant organisms. One approach is suggested in Table 30.1. Detailed recommendations on the control of VRE have been published by HICPAC (1995).

Health care workers

No additional precautions are required for HCWs colonised with VRE. Staff should adhere to standard precautions, particularly with respect to handwashing and disinfection.

Instruments and environment

Enterococci persist in the environment. Disinfection with a hospital-grade disinfectant should be undertaken in addition to standard cleaning. Cleaning cloths and equipment should be appropriately reprocessed before use in other areas.

Standard sterilisation procedures for instruments should be employed.

30.4 Multiresistant gram-negative bacteria

30.4.1 Disease description

Aetiology

There is currently no agreed definition for multiresistant gram-negative bacteria. Multiresistant gram-negative bacteria are defined for the purpose of these guidelines as those gram-negative bacteria with resistance to two or more antibiotic classes to which they would usually be sensitive, including those that have extended beta-lactamase enzymes (ESBLs) and organisms known to express inducible beta-lactamase resistance (ESCAPPMs, or Enterobacter spp, Serratia spp, Citrobacter freundii, Acinetobacter spp, Proteus vulgaris and Proteus penneri, Providencia spp, Morganella morganii).

Clinical manifestations

As with other gram-negative bacteria, multiresistant strains may cause local wound infections and systemic infections such as abscesses, pneumonia, osteomyelitis, sepsis, endocarditis and meningitis.
Occurrence

Multiresistant gram-negative bacteria occur more often in acute care establishments, especially intensive care units. Patients with indwelling invasive devices (e.g., central venous catheters, urethral catheters) are more likely to be infected.

The organisms may also be seen in patients with long-term indwelling catheters, especially those who have had frequent antibiotic treatment or long-term antibiotic prophylaxis. Often these patients have bladder colonisation rather than infection, but they remain a source of infection both for themselves and for others via HCWs’ hands.

30.4.2 Transmission

A major route of transmission of multiresistant gram-negative bacteria within health care establishments is from patient to patient on the hands of HCWs who acquire the organism by direct patient contact or by handling contaminated materials. This is usually associated with inadequate handwashing. Unfortunately it has been shown that HCWs, particularly physicians, frequently fail to wash their hands between patients.

Transmission from patients with bladder colonisation may occur when HCWs manipulate urethral catheters or drainage bags.

30.4.3 Management

Patients

Additional precautions (contact transmission) are recommended in areas where other at-risk patients (e.g., those with invasive devices) are cared for.

Where there are two or more patients in any health care establishment with the same multiresistant gram-negative bacteria, an investigation should be undertaken for potential common sources (see Section 21.3).

In long-term care establishments, care should be taken in handling catheters and drainage bags where residents are known to be colonised. If possible, patients who have indwelling devices should not share rooms.

Health care workers

No additional precautions are required for HCWs colonised with multiresistant gram-negative bacteria. Staff should adhere to standard precautions, particularly with respect to handwashing and disinfection.

Instruments and environment

Routine reprocessing of instruments (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
30.5 Multidrug-resistant tuberculosis

30.5.1 Disease description

Aetiology

Multidrug-resistant tuberculosis (MDR-TB) is caused by infection with *Mycobacterium tuberculosis*-complex spp, predominantly *M. tuberculosis*, with resistance to a range of antibiotics.

Clinical manifestations

See Section 29.8.1.

Occurrence

About 2% of notified cases of TB are classified as multidrug resistant, being resistant to both isoniazid and rifampicin (see Section 29.8.1 for details about the occurrence of TB in Australia).

30.5.2 Transmission

See Section 29.8.2

30.5.3 Management

Patients

It is preferable that cases of MDR-TB be managed at establishments with expertise in this infection. Respiratory isolation precautions must be used (see Section 11.5.4), and patients’ movement around the establishment should be minimal. A particulate filter mask (see Section 13.4) should be worn in all circumstances where the patient is considered to be infectious, regardless of personal risk reduction measures or engineering controls.

Health care workers

HCWs should observe additional precautions (airborne transmission). In particular, the recommendations for mask use must be strictly followed, because in this situation normal risk-reduction measures are not completely effective.

Instruments and environment

Routine reprocessing of instruments (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
31 Classical Creutzfeldt–Jakob disease

Key points

+ This chapter provides recommendations for infection control procedures to minimise the risk of transmission of classical Creutzfeldt–Jakob disease (cCJD) in health care settings.

+ Variant CJD (vCJD) is excluded from the scope of this chapter as vCJD has not been reported in Australia to date. Infection control issues regarding patients with suspected or confirmed vCJD will be incorporated into Part 6, Appendix 9 once vCJD is reported in Australia and will be available on the Department of Health and Ageing website (www.health.gov.au).

+ There is presently no test available to detect cCJD infection before the onset of symptoms.

+ There is no evidence that cCJD can be transmitted through normal social or sexual contact.

+ The decision to implement additional precautions for equipment reprocessing is based on a risk assessment (Section 31.2.4) which incorporates the currently known infectivity of the tissue to which the instrument has been exposed (Section 31.2.2 and Table 31.1) and patient factors (Section 31.2.3 and Appendix 1 and 2). The additional precautions that may apply as a result of the risk assessment are outlined in Section 31.3 (and Table 31.2).

+ Although transmission of cCJD in the health care setting is very rare, Health Care Workers (HCW) should be aware of the potential for transmission by contaminated instruments or via contaminated higher-infectivity tissues.

+ The infective agent of cCJD (the prion) is resistant to routine reprocessing, making the additional precautions outlined in this chapter essential for the treatment of patients with an identified risk of cCJD infection.

31.1 Introduction

This chapter provides recommendations for infection control procedures to minimise the risk of transmission of classical Creutzfeldt–Jakob disease (cCJD) in health care settings.

The infective agent of cCJD (the prion) is resistant to routine reprocessing (as defined in AS/NZS 4187 Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities). This makes the additional precautions outlined in this chapter essential for treatment of patients with an identified risk of cCJD infection.
The decision to implement additional precautions for equipment reprocessing is based on the currently known infectivity of the tissue to which the instrument has been exposed (see Table 31.1) and patient risk factors (see Appendix 1 and 2). Alternative diagnostic and management strategies, if suitable and available, should be considered in patients at risk of cCJD, provided that the care of the patient is not compromised.

Continual advances in instrument design and reprocessing technology mean that recommendations to minimise the risk of cCJD transmission in health care settings should be regularly updated. Health care establishments should ensure that they have the most current version of this chapter by checking the Department of Health and Ageing website (www.health.gov.au).

Variant CJD (vCJD) is excluded from the scope of this document as vCJD has not yet been reported in Australia. Separate Infection Control Guidelines for vCJD address infection control issues regarding patients with suspected or confirmed vCJD and will be released on the Department of Health and Ageing website if vCJD is reported in Australia (www.health.gov.au) for incorporation into Part 6, Appendix 9 of the Infection Control Guidelines for the Prevention of Transmission of Infectious Diseases in the Health Care Setting (these guidelines). If you suspect a case of vCJD, contact your local State or Territory Health Department immediately.

31.1.1 Disease Categories

For simplicity, the term ‘classical CJD’ (cCJD) is used to describe all forms of human TSE (except vCJD), including (Collins et al 2001, 2004, Brown et al 2000):

1) Sporadic CJD
2) Inherited CJD
   a) Familial CJD
   b) Gerstmann-Sträussler-Scheinker Disease (GSS)
   c) Fatal Familial Insomnia (FFI)
3) Acquired CJD
   a) Health care associated (iatrogenic) CJD
   b) Kuru

31.1.2 Diagnosis

There is currently no minimally invasive test available to detect cCJD infection before the onset of symptoms. There is a pre-symptomatic period during which disease transmission is presumed to be possible. Definitive diagnosis of cCJD is by neuropathological examination of brain tissue following biopsy or autopsy. However, brain biopsy is not recommended as a routine procedure to confirm the clinical suspicion of cCJD.
Methods that may assist in diagnosis of cCJD and in excluding other causes of subacute dementia in symptomatic patients include (Zerr et al 2000, Shiga et al 2004):

- electroencephalograph (EEG);
- the presence of protein 14-3-3 in cerebrospinal fluid (CSF); and
- imaging techniques such as computerised tomography (CAT Scan) and magnetic resonance imaging (MRI).

31.2 Assessing the risk

The application of additional precautions to minimise the risk of transmission of cCJD is based on a risk assessment. The tissues or body fluids likely to be exposed during a procedure should be classified according to Section 31.2.2 (and Table 31.1) and the patient risk category should be identified according to Section 31.2.3. A risk assessment should then be performed according to Section 31.2.4. The additional precautions that may apply as a result of the risk assessment are outlined in Section 31.3 (and Table 31.2).

31.2.1 Modes of transmission

Most cases of cCJD are sporadic. However, there is evidence of iatrogenic transmission through neurosurgical instruments contaminated with central nervous system (CNS) tissue and through contaminated tissue implants or products (dura mater grafts, corneal grafts, pituitary products). Although transmission of cCJD in the health care setting is very rare, HCW should be aware of the potential for transmission from patient to patient by contaminated instruments or via contaminated tissues. There is no epidemiological evidence to indicate that HCW are at an increased occupational risk for cCJD. There is no epidemiological evidence that cCJD can be transmitted through normal social or sexual contact, mother-to-child transmission or via blood or blood products (Brown et al 1994, Collins et al 1999, Tamai et al 1992, Gajdusek 1977, Will 1993, Wientjens et al 1996).

31.2.2 Infectivity of human tissues

Table 31.1 is a guide to the known or predicted infectivity of body tissues and fluids of symptomatic and asymptomatic patients with cCJD. This information is based largely on studies of experimentally transmitted cCJD in non-human primates and other animals. Whilst there is likely a spectrum of infectivity from very low to medium to high infectivity, the classifications in Table 31.1 group the tissues and fluids according to the reprocessing that will be required after contact with these tissues (Brown 1994).
Table 31.1 Known or predicted infectivity of human body tissues and fluids for cCJD

<table>
<thead>
<tr>
<th>Infectivity category</th>
<th>Tissues</th>
<th>Secretions and excretions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-infectivity or medium-infectivity (Higher-infectivity)</td>
<td>Brain</td>
<td>CSF</td>
</tr>
<tr>
<td></td>
<td>Dura mater</td>
<td>Amniotic fluid</td>
</tr>
<tr>
<td></td>
<td>Pituitary gland</td>
<td>Faeces</td>
</tr>
<tr>
<td></td>
<td>Spinal cord</td>
<td>Breast milk</td>
</tr>
<tr>
<td></td>
<td>Posterior eye (including retina, vitreous humour and optic nerve)</td>
<td>Nasal mucus</td>
</tr>
<tr>
<td></td>
<td>Cranial and dorsal root ganglia</td>
<td>Saliva</td>
</tr>
<tr>
<td></td>
<td>Olfactory epithelium</td>
<td>Semen</td>
</tr>
<tr>
<td>Lower-infectivity or no detectable infectivity (Lower-infectivity)</td>
<td>Cornea (3)</td>
<td>Serous exudate</td>
</tr>
<tr>
<td></td>
<td>Anterior chamber of eye (3)</td>
<td>Sweat</td>
</tr>
<tr>
<td></td>
<td>Kidney</td>
<td>Tears</td>
</tr>
<tr>
<td></td>
<td>Liver</td>
<td>Urine</td>
</tr>
<tr>
<td></td>
<td>Lung</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lymph nodes/spleen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Placenta</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uterus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adipose tissue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adrenal gland</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blood &amp; blood products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bone marrow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral tissue (teeth, gingival tissue, dental pulp)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heart muscle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intestine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peripheral nerve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prostate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skeletal muscle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Testes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thyroid gland</td>
<td></td>
</tr>
</tbody>
</table>


(1) Referred to in this document as ‘Higher-infectivity’ tissues. Considerable Risk of Transmission (instruments having contact with these tissues will require additional reprocessing precautions- See Appendix 4).

(2) Low Risk of Transmission (instruments having contact with these tissues and fluids only, do not require additional reprocessing precautions- See Appendix 4).

(3) It is recommended that single use instruments be used in known high risk patients (Appendix 1, for risk assessment see Section 31.2.4).
31.2.3 Patient risk categories

The following risk categories identify individuals who may pose a risk of transmitting cCJD:

- **High-risk** – people who represent a *definite* risk of cCJD transmission (Appendix 1). These patients are generally showing neurological symptoms;

- **Low-risk** – people who represent a *potential* risk of cCJD transmission (Appendix 2). These patients may be showing neurological symptoms or may have an identified risk factor;

(NOTE: Individuals who have been contacted by a Health Department as part of a look-back procedure from exposure to surgical instruments that had previously been used on high or medium infectivity tissues from patients later found to have contracted cCJD are likely to have a very low, but unquantifiable risk for cCJD. Until further information on the likely risk of these individuals is available, they are conservatively placed in a low risk category.)

- **Background risk** – the general population who represent no identified increased risk of cCJD transmission.

31.2.4 Risk assessment

Diagnostic and therapeutic procedures are divided into those where higher-infectivity tissue is exposed and those where only lower-infectivity or no detectable infectivity tissue is exposed (see Table 31.1). Patients are divided into those with a high risk, those that are considered low risk and those with background risk.

Additional precautions (Section 31.3) are implemented when the patient is identified as being in a high- or low-risk category AND when the diagnostic or therapeutic procedure used involves the exposure of higher-infectivity tissues.

<table>
<thead>
<tr>
<th>Patient risk category</th>
<th>Procedures involving exposure to higher-infectivity tissues (see Table 31.1)</th>
<th>Procedures involving exposure to lower or no detectable infectivity tissues</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-risk patient</td>
<td>Use additional precautions</td>
<td>Use routine reprocessing precautions</td>
</tr>
<tr>
<td>Low-risk Patient</td>
<td>Use additional precautions</td>
<td>Use routine reprocessing precautions</td>
</tr>
<tr>
<td>Background risk patient</td>
<td>Use routine reprocessing precautions</td>
<td>Use routine reprocessing precautions</td>
</tr>
</tbody>
</table>

It is recommended that all patients undergoing surgical or diagnostic procedures in which higher-infectivity tissue will be exposed (e.g., neurosurgery, spinal cord surgery, ophthalmic surgery, pituitary surgery) should have their cCJD risk status (high-risk, low-risk, background-risk) determined prior to the procedure.
A template for a questionnaire to determine cCJD risk status is included in Appendix 3.

Questionnaires should be administered to patients by the health care practitioner conducting the procedure, prior to consent for the planned procedure, and the completed questionnaire included in the patient medical record. If, on the basis of responses to the questionnaire, the patient is determined to be in a high- or low-cCJD risk category, the planned procedure may be modified or a process initiated for the implementation of additional precautions for equipment reprocessing/disposal. Health care establishments should establish systems to ensure that risk assessment, where recommended, is undertaken and documented eg. linking the process to the health care establishment booking process.

Each health care establishment should have an action plan in place, so that if the questionnaire identifies a patient with a risk of cCJD, patient admission and treatment is not delayed. There is a need to ensure that patient care is not compromised and that any reasons for variations or delays in treatment are explained to the patient in order to encourage patients with identified risk factors to disclose their risk status to health care establishments.

A flow chart ‘Summary of Actions for a Surgical Procedure- cCJD Risk Assessment’ is included in Appendix 4.

31.3 Additional Precautions

Additional precautions are implemented when the patient is identified as being in a high- or low-risk category AND when the diagnostic or therapeutic procedure used involves the exposure of higher-infectivity tissues.

Relevant additional precautions that apply to the handling and reprocessing of surgical instruments and diagnostic equipment are shown in Table 31.2. For routine hospital, long-term residential or community care not involving exposure to higher-infectivity tissues, routine reprocessing procedures are all that are required for the management of cCJD patients.

31.3.1 Reasons for additional precautions

The ‘prion’, which is the infectious agent of cCJD, is resistant to routine reprocessing. The chemicals known to have some activity against prions include anionic detergents, hypochlorites and harsh acids and alkalis. However, their practical effectiveness and use in reprocessing is influenced by prior cleaning and prion strain. Occupational health issues surrounding the use of harsh acids and alkalis and potential for damage to instruments and equipment mean they are not recommended for use in reprocessing. (Brown et al 1982, Fichet et al 2004, Gibbs et al 1978, Jackson et al 2005, Tateishi 1980, Tateishi et al 1988, Taylor 1987, Taylor 2000).
Table 31.2 Additional precautions required for diagnostic or therapeutic procedures involving higher-infectivity tissues for patients in the high- and low-risk categories for cCJD

<table>
<thead>
<tr>
<th>Activity</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument reuse</td>
<td>Incinerate* instruments immediately after use</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Reprocess reusable instruments separately and keep for the exclusive use of an individual patient involved in a course of therapy (then incinerate* when no longer required)</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>For those low risk patients who are awaiting determination of risk status as either high risk or background risk (see Appendix 2); reprocess reusable instruments separately and quarantine instruments pending determination of risk status of patient (then incinerate* if deemed high- or low-risk, or reprocess and put back into circulation if risk is found to be background)</td>
</tr>
<tr>
<td>Intra-operative handling of instruments</td>
<td>Instruments used on higher-infectivity tissues should be separated from general instruments and equipment during the operative procedure, and should also be quarantined from other instruments in the reprocessing area to reduce the possibility of cross contamination.</td>
</tr>
<tr>
<td>Operating room set up</td>
<td>Cameras and other equipment not in contact with the higher-infectivity tissue should be covered in plastic to protect from splashing. Surgical drapes and plastic covers should be incinerated after use.*</td>
</tr>
<tr>
<td>Personal protective equipment (PPE)</td>
<td>All HCW should wear fluid repellent single-use PPE including gloves, gowns and full face shield if higher-infectivity tissue is exposed. PPE should be destroyed by incineration* after use.</td>
</tr>
<tr>
<td>Scheduling of patients</td>
<td>Operations or procedures should be scheduled to allow for appropriate cleaning of facilities.</td>
</tr>
<tr>
<td>Collection of specimens</td>
<td>Specimens should be collected into a secure-closing container and enclosed in a plastic bag for transportation. The container should be clearly labelled with patient identification details, including a cCJD risk alert to laboratory workers and other HCWs.</td>
</tr>
<tr>
<td>Anaesthetic equipment</td>
<td>Routine reprocessing</td>
</tr>
</tbody>
</table>

* or appropriate alternate approved method of medical waste destruction.

31.3.2 Additional precautions for destruction of equipment by incineration

Single use instruments should be used where possible. Contaminated articles should be placed immediately into the correct clinical waste container for disposal by incineration or alternate approved method of medical waste destruction (see Chapter 15.2). Needles, blades and other sharp articles should be placed in non-reusable sharps containers (in accordance with AS/NZS 4187:2003 Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities) and destroyed by incineration.
31.3.3 Additional precautions for reprocessing procedures

Thorough washing and cleaning with anionic detergents will reduce the level of instrument contamination by all micro-organisms and therefore would be expected also to decrease the risk of transmission of prions if any were present. High-level disinfectants such as glutaraldehyde, however, enhance the adherence of prions to surfaces, and thus are contraindicated for use on instruments that may potentially be contaminated by prions (Fichet et al 2004, Jackson et al 2005).

Instruments and equipment that need to be quarantined or kept for exclusive use a particular patient and have been exposed to higher-infectivity tissues should be reprocessed according to AS/NZS 4187 Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities with the following additional recommendations:

- Instruments that have been in contact with higher-infectivity tissues in high- or low-risk patients should be separated from other instruments in the operating room to avoid cross-contamination;
- The cCJD prion may be stabilised by drying on metal surfaces, thereby becoming more difficult to inactivate. To prevent drying, instruments potentially contaminated with higher-infectivity tissue should be immersed in a dedicated container in sterile water until they are reprocessed (for subsequent quarantine or exclusive use in that patient);
- Instruments should be cleaned in anionic detergent prior to further reprocessing;
- Contaminated instruments should be reprocessed in a separate batch, and not mixed with other surgical instruments at any stage of the reprocessing cycle;
- Ultrasonic cleaners may be used during reprocessing;
- Steam sterilisation at 134°C for 3 minutes is recommended;
- Items that have been identified as difficult to clean should be destroyed; and
- Equipment reprocessing staff should wear gloves, fluid-repellent gowns, masks and eye protection at all times when handling higher-infectivity tissues and instruments exposed to higher-infectivity tissues. After use, personal protective equipment (PPE) should be destroyed by either incineration or an appropriate alternate approved method of medical waste destruction.

- While alternative methods of reprocessing (proteases or alkaline detergents) are being actively researched, they are not yet being recommended as alternatives to destruction for instruments used on high- or low-risk patients in higher-infectivity tissues. In the future, it is likely that if a cleaning method is found to be effective in removing prions, it may be incorporated into routine reprocessing for all surgical instruments. Health care establishments should consider this when purchasing new instrument cleaning systems.
31.3.4 Additional precautions for tracking of reusable instruments

All procedures exposing higher-infectivity tissues, and companies that provide loan equipment, demonstration equipment or trial equipment for use in these procedures, should have systems in place to track individual instruments and equipment to the level of the individual patient. Tracking of instruments and trays will minimise the number of patients implicated in a look-back (Section 31.4.3), where a background risk patient is subsequently diagnosed with cCJD.

Any tracking and quarantine system must minimise the risk of accidental re-introduction of potentially infected equipment and instruments into the reprocessing area.

31.3.5 Additional precautions for quarantine of reusable instruments and equipment

Quarantine of equipment is the process by which instruments are separated, reprocessed, labelled and held aside for either of two courses of action; destruction or return to circulation. Quarantine of equipment should be used if the patient’s cCJD risk status is not known, including during an investigation by the State or Territory Health Department. The equipment should be quarantined until the risk status is clarified.

Once the risk status of a low risk patient is determined, equipment should be either returned to circulation after reprocessing or destroyed by incineration or alternate approved method of medical waste destruction. In some instances, the National CJD Incident Panel (see Section 31.4.2) may recommend additional reprocessing before instruments or equipment are returned to circulation. If a patient is categorised as either low-risk or high-risk for cCJD, the equipment may be quarantined for future exclusive use with that patient, and then destroyed by incineration or alternate approved method of medical waste destruction when no longer required.

31.3.6 Additional precautions for environmental cleaning of the operative area

Unless a spill of higher-infectivity tissues has occurred, routine containment and cleaning procedures should be used for the whole operative area, including surfaces. A spills kit (that includes occupational health and safety recommendations) should be available in areas where higher-infectivity tissues may be exposed, such as operating rooms, mortuaries and laboratories.
Contamination by spillage of higher-infectivity tissues from patients in either the low- or high-risk cCJD categories should be cleaned by first exposing the area to freshly prepared 1M sodium hydroxide (NaOH) or 20,000ppm (free chlorine) sodium hypochlorite for 1 hour at ambient temperature, followed by a rinse with water. Where surfaces cannot tolerate NaOH or hypochlorite, cleaning using anionic detergent and water will partially reduce infectivity by dilution.

Staff should be appropriately trained in cleaning of the operative area and in use of 1M NaOH and 20,000ppm sodium hypochlorite. Material Safety Data Sheets (MSDS) should be available for 1M NaOH and 20,000ppm sodium hypochlorite.

### 31.4 Surveillance

**cCJD is now a notifiable disease in all States and Territories in Australia.** Each State and Territory will have requirements for reporting notifiable diseases, including cCJD, and methods for providing advice regarding infection control issues. See Appendix 6 for State and Territory Health Department contact details.

#### 31.4.1 Surveillance by the Australian National CJD Registry (ANCJDR)

The Australian Government Department of Health and Ageing established the ANCJDR in 1993, based in the Department of Pathology at the University of Melbourne. The registry assists the department with the ongoing surveillance of cCJD cases in Australia, identifies cCJD risk factors for population health and should be involved in suspect cCJD cases by public health authorities. The contact details of the registry are provided in Appendix 6.

#### 31.4.2 Surveillance for Adverse Event Management

Since there is no test to reliably detect cCJD prior to the onset of symptoms, it is possible that surgical instruments used on a patient with asymptomatic cCJD might subsequently be used unknowingly on other patients after routine reprocessing, with a potential risk of transmission.

In the event of patients being exposed to instruments that have previously been exposed to higher-infectivity tissues in a patient that is subsequently found to have cCJD, the following should be immediately notified:

- the executive of the health care establishment; and
- the State or Territory Health Department (see Appendix 6).
In September 2004, the Australian Government established a National CJD Incident Panel. This panel provides expert advice in the event of an adverse event involving cCJD. The relevant State or Territory Health Department assumes responsibility and is accountable for determining action to be taken, the investigation, equipment management, patient risk assessment and the scope of a look-back investigation if it is required. The Health Department may request advice from the National CJD Incident Panel on specific look-back and infection control issues.

If equipment having direct contact with higher-infectivity tissue (Table 31.1) has been used in the past on a patient subsequently found to have cCJD, the equipment should be identified and withdrawn pending a decision from the State or Territory Health Department who may obtain advice from the National CJD Incident Panel. Upon this decision, the instruments will either be destroyed or returned to use following reprocessing. Other equipment that has not been in contact with a higher-infectivity tissue should not be withdrawn and should continue to be reprocessed using routine methods.

31.4.3 Look-back

The need for a look-back is determined by a risk assessment process undertaken by the State or Territory Health Department. A flow chart summarising the essential steps in a look-back procedure is provided in Appendix 5. The State or Territory Health Department in consultation with the health care establishment is responsible for tracing individuals suspected of exposure to cCJD. The National CJD Incident Panel is available to provide expert advice to inform decisions on the need for a look-back and infection control measures.

A plan for the look-back should be developed that allows for tracing of potentially exposed individuals and assessment of their potential exposure to risk. Consideration should be given to maintenance of confidentiality of patient details and the way in which information is provided (personal phone communication, face-to-face, written information), standardised or individualised information and involvement of the media.

31.4.4 Organs and tissues for transplantation

In all situations, the following people should be excluded from the routine donation of organs and tissues:

- people in the high-risk group (Appendix 1);
- people in the low-risk group (Appendix 2) (NB: tissues are excluded from donation, but organs may be allowed to be donated, if informed consent is given by the recipient);
- people who die in psychiatric establishments, with the exception of those in whom cCJD has been specifically excluded
- people who die of dementia; and
- people who die with any obscure undiagnosed neurological disorder.
Agencies that are responsible for recruiting organ/tissue donors and for the banking of tissues should be aware of the public health implications of cCJD and should have donor exclusion criteria and screening procedures in place, in accordance with the State or Territory transplantation legislation. The Transplantation Society of Australia and New Zealand (www.racp.edu.au/tsanz) have an example organ donation referral form.

Material from patient groups at risk of transmitting cCJD should not be used for the preparation of any therapeutic product or laboratory reagent (e.g. thromboplastin or Kveim test material).

### 31.5 Infection Control in other settings

#### 31.5.1 Dentistry

Oro-facio-maxillaiy surgical procedures that come into contact with higher-infectivity tissues in patients of high- or low-risk should be treated with additional precautions (Table 31.2). These procedures would include: (An example of higher-infectivity tissue exposed is provided in brackets)

- Major oral surgery procedures such as a maxillectomy involving orbit enucleation (optic nerve);
- Injection of the trigeminal ganglion (potential brain tissue, central nerve exposure);
- Oral surgical cancer procedures also combining a neurosurgical approach would involve exposure to tissue of higher-infectivity (potential brain tissue, central nerve exposure).

In all patients, including high- and low-risk patients (Appendix 1 and 2), instruments in contact with lower infectivity tissues (Table 31.1) through routine dental procedures can be routinely reprocessed. Dentists should take an appropriate medical history of all patients. Dentists who have patients identified as high- or low-risk should contact their State or Territory Health Department and the Australian Dental Association for additional advice on infection control procedures. Dental work on high- or low-risk patients involving exposure to higher-infectivity tissues should be performed at an establishment with HCW who are familiar with cCJD infection control procedures.

#### 31.5.2 Post Mortem Examinations

Additional precautions should be used for post mortem examinations involving exposure to high infectivity sites in patients with suspect cCJD or of high- or low risk, as per Table 31.2 (Bell and Ironside 1993, Budka et al 1995). A set of instruments dedicated to suspect cCJD patients should be used and kept separate to instruments used to harvest organs and tissues for donation.
Removal of the brain with either an electric bone saw or a hand saw should be performed with sufficient containment to avoid aerosol production.

All tissue samples from higher-infectivity sites should be treated as potentially infectious for cCJD until proved otherwise. Tissue or fluid samples should be collected into sealed containers with the cCJD risk status of the patient clearly labelled. High infectivity tissues should be handled under Physical Containment Level 2 (PC2). Due to the resistance to inactivation by aldehydes and alcohols, brain specimens should be fixed in 4% formaldehyde solution (10% formal saline), followed by immersion in formic acid (>96%) for one hour. For machine processing, tissues should be washed in formalin to prevent damage to containers by formic acid. For hand processing, tissues can be transferred directly from formic acid to ascending alcohol solutions.

Following post mortem, bodies should be sealed in plastic to avoid fluid leakage. Embalming of bodies should be avoided. Cadavers from high- or low-risk patients should not be used for teaching purposes.

Mortuary facilities with staff appropriately trained in cCJD infection control procedures should be available in capital cities and major regional centres in each State and Territory. Each State and Territory should have appropriate guidelines and procedures for funding post mortems for suspect cCJD patients and appropriate guidelines and procedures for funding transport of bodies of suspect cCJD patients to and from post mortem facilities.
Appendix 1: Individuals in the high-risk category for cCJD

### Classification of cCJD

<table>
<thead>
<tr>
<th>1</th>
<th>Sporadic TSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Definite</td>
</tr>
<tr>
<td></td>
<td>Neuropathologically/immunocytochemically confirmed</td>
</tr>
<tr>
<td>1.2</td>
<td>Probable</td>
</tr>
<tr>
<td>1.2.1</td>
<td>1 and 2/4 of II and III</td>
</tr>
<tr>
<td>1.2.2</td>
<td>Possible and positive 14-3-3 CSF assay</td>
</tr>
<tr>
<td>1.3</td>
<td>Possible</td>
</tr>
<tr>
<td></td>
<td>1 and 2/4 of II and duration &lt;2 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Accidentally transmitted TSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Definite</td>
</tr>
<tr>
<td></td>
<td>Definite TSE with a recognised health care acquired risk factor</td>
</tr>
<tr>
<td>2.2</td>
<td>Probable</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Progressive predominant cerebellar syndrome in human pituitary hormone recipients</td>
</tr>
<tr>
<td>2.2.2</td>
<td>Probable TSE with recognised health care acquired risk factor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Genetic TSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Definite</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Definite TSE and definite or probable TSE in first-degree relative</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Definite TSE with a pathogenic PRNP mutation</td>
</tr>
<tr>
<td>3.2</td>
<td>Probable</td>
</tr>
<tr>
<td>3.2.1</td>
<td>Progressive neuropsychiatric disorder and definite or probable TSE in first-degree relative</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Progressive neuropsychiatric disorder and pathogenic PRNP mutation</td>
</tr>
</tbody>
</table>

### Clinical signs and risk factors

#### 1. Sporadic TSE

- **Definite**: Neuropathologically/immunocytochemically confirmed
- **Probable**:
  - 1.2.1: 1 and 2/4 of II and III
  - 1.2.2: Possible and positive 14-3-3 CSF assay

#### 2. Accidently transmitted TSE

- **Definite**: Definite TSE with a recognised health care acquired risk factor
- **Probable**:
  - 2.2.1: Progressive predominant cerebellar syndrome in human pituitary hormone recipients
  - 2.2.2: Probable TSE with recognised health care acquired risk factor

#### 3. Genetic TSE

- **Definite**:
  - 3.1.1: Definite TSE and definite or probable TSE in first-degree relative
  - 3.1.2: Definite TSE with a pathogenic PRNP mutation
- **Probable**:
  - 3.2.1: Progressive neuropsychiatric disorder and definite or probable TSE in first-degree relative
  - 3.2.2: Progressive neuropsychiatric disorder and pathogenic PRNP mutation

### PRNP mutations

- PRNP mutations associated with FFI neuropathological phenotype: D178N-129M
- PRNP mutations associated with vascular PRP amyloid: Y145S
- PRNP mutations associated with proven but unclassified prion disease: H187R, 216 bpi
- Mutations associated with neuropsychiatric disorder but not proven prion disease: I138M, G142S, Q160S, T188K, M232R, 24 bpi, 48 bpi, 48 bpi + nucleotide substitution in other octapeptides
- PRNP mutations without clinical and neuropathological data: T188R, P238S
- PRNP polymorphisms with established influence on phenotype: M129V
- PRNP polymorphisms with suggested influence on phenotype: N171S, E219K, 24 bp deletion
- Other: The following people are also classified as being at high risk: carriers of disease-linked mutations of the PrP gene; and persons in whom the PrP gene has not been sequenced but who have two or more first degree relatives with cCJD (including GSS or FFI). **Note**: People who have had the PrP gene sequenced and are shown not to carry the disease-linked mutation can be classified as ‘background’ risk, unless they have other demonstrated risk factors.

Appendix 2: Individuals in the low-risk category for cCJD

People with a progressive neurological illness of less than one year’s duration, with or without dementia for whom a determination to assign a high-risk status or background risk status cannot be made following competent professional review.

People with a progressive neurological illness of less than one year’s duration, with or without dementia awaiting the outcome of a professional review to assign a high-risk status or background risk status.

Patients undergoing a diagnostic brain biopsy for progressive brain disease or patients undergoing neurosurgical investigations (including brain biopsy) or therapeutic procedures for a progressive disorder that includes dementia.

All genetically related members of any family in which there is a strong family history (two or more first-degree relatives) of dementia or neurological illness, and in which affected individuals have not been competently and completely assessed neurologically, specifically for cCJD.

Recipients of cadaver-derived human pituitary hormones (growth hormone and gonadotrophins) before 1986.

Recipients of dura mater homografts or transdural neurosurgery before 1990, or neurosurgical patients for whom the use of dura mater homografts cannot be excluded by reference to patient records.

Individuals who have been contacted by a Health Department as part of a look-back procedure from exposure to surgical instruments that had previously been used on high or medium infectivity tissues from patients later found to have contracted cCJD are likely to have a very low, but unquantifiable risk for cCJD that is thought to be above background risk. Until further information on the likely risk of these individuals is available, they are conservatively placed in a low risk category.
Appendix 3: Classical Creutzfeldt-Jakob Disease (cCJD) Risk Assessment Tool

INTRODUCTION

The following questions should be asked of a patient prior to undergoing surgery, investigations or a procedure involving any of the following higher-infectivity tissues:

(a) Brain, pituitary or dura mater
(b) Cranial and dorsal root ganglia
(c) Spinal cord
(d) Eye (Retina/Optic Nerve)
(e) Olfactory Epithelium

NB: if this is a repeat procedure and the following questions have already been answered, then they need not be completed again providing the patient’s neurological condition remains unchanged.

MEDICAL OFFICER QUESTIONS TO DETERMINE RISK STATUS

Q1. Do you think the patient may have cCJD?
   Yes    No

Q2. Has the patient had a first degree relative with cCJD?
   Yes    No

Q3. Does the patient have an unexplained progressive neurological illness of less than 12 months?
   Yes    No

Q4. Does the patient have a history of receiving human pituitary hormone for infertility or human growth hormone for short stature (prior to 1986)?
   Yes    No
Q5. Has the patient previously had surgery on the brain or spinal cord that included a dura mater graft (prior to 1990)?

Yes [ ] No [ ]

Q6. Has the patient been involved in a ‘look-back’ for cCJD or shown you a ‘medical in confidence letter’ regarding their risk for cCJD?

Yes [ ] No [ ]

**Action:** If the patient answers yes to any of the above questions, please contact infection control personnel in your health care establishment. Put into place the action plan for potential cCJD patients.

I have undertaken the appropriate action as required by the health care establishment infection control policies regarding cCJD.

Name of the Health Care Practitioner

Signature
Appendix 4: Summary of Actions for a Surgical Procedure – cCJD Risk Assessment

Is the patient classified as high risk (appendix 1) or low risk (appendix 2) for cCJD transmission?

YES

Use additional precautions (Table 31.2). Incinerate* instruments immediately after use

OR
For those low risk patients who are awaiting determination of risk status as either high risk or background risk (see Appendix 2): reprocess reusable instruments separately and quarantine instruments pending determination of risk status of patient (then incinerate* if deemed high-risk or low-risk, or reprocess and put back into circulation if risk is found to be background)

OR
Reprocess reusable instruments separately and keep for the exclusive use of an individual patient involved in a course of therapy (then incinerate* when no longer required)

NO

Proceed using routine reprocessing of instruments

Is the patient undergoing a procedure where higher-infectivity tissue (Table 31.1) will be exposed?

YES

NO

* or appropriate alternate approved method of medical waste destruction.
Appendix 5: Summary of Actions for a Look-Back

Patient identified as potentially cCJD after surgical procedure?

Quarantine instruments used on that patient and notify local health authority and ANCIJR

Request next-of-kin to authorize brain autopsy to diagnose cCJD with samples sent to ANCIJR

Definitive or probable cCJD

Obtain advice from State/Territory Health Department (who may consult with CJD Incidents Panel) to develop a plan of action and perform risk assessment

Instruments reprocessed appropriately, taking into account any additional reprocessing advised by CJD Incidents Panel

cCJD excluded

Instruments to be destroyed?

YES

Perform look-back if required. Follow up patients and decide communications strategy

NO

Destroy instruments by incineration or other approved method

Patient identified as potentially cCJD after surgical procedure?
Appendix 6 – Key Contacts

**Australian National CJD Registry (ANCJDR)**
Department of Pathology  
The University of Melbourne  
Parkville, Victoria 3052  
Telephone: (03) 8344 5868 or (03) 8344 1949  
Fax: (03) 8344 4004 Email: ANCJD-REG@unimelb.edu.au

**For media inquiries, please contact:**
Kay McNiece  
Director Media Unit  
Department of Health and Ageing  
Telephone: (02) 6289 5027  
Fax: (02) 6289 4044  
Mobile: 0412 132 585

**Key State and Territory Health Department Contacts**
All cases of suspect cCJD should be reported immediately to the local Health Department:

**ACT Health**  
Health Protection Service, Communicable Disease Control  
GPO Box 825  
Canberra City ACT 2601  
(02) 6205 2155  
Email: HealthACT@act.gov.au

**WA Health Department**
PO Box 8172  
Perth Business Centre  
Perth WA 6849  
Telephone: (08) 9222 4222

**SA Health Department**  
Communicable Disease Control Branch  
PO Box 6  
Rundle Mall  
Adelaide SA 5000  
Telephone: (08) 8226 7177

**VIC Department of Human Services**
50 Lonsdale Street  
Melbourne VIC 3000  
Telephone: 1300 651 160  
Email: infectious.diseases@dhs.vic.gov.au

**NT Department of Health and Community Services**
PO Box 40596  
Casuarina NT 0811  
Telephone: (08) 8999 2400

**TAS Department of Health and Human Services**
GPO Box 125  
Hobart TAS 7001  
Telephone: (03) 6233 3185

**NSW Health Department**
Locked Mail Bag 961  
North Sydney NSW 2059  
Telephone: (02) 9391 9000  
Email: NSWhhealth@doh.health.nsw.gov.au

**QLD Health Department**
GPO Box 48  
Brisbane QLD 4000  
Telephone: (07) 3234 0111
## Public Health Units in NSW

<table>
<thead>
<tr>
<th>Metropolitan Areas</th>
<th>Rural Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern Sydney / Central Coast</strong></td>
<td></td>
</tr>
<tr>
<td>Hornsby 02 9477 9400</td>
<td>Greater Southern Goulburn 02 4824 1837</td>
</tr>
<tr>
<td>Gosford 02 4349 4845</td>
<td>Albury 02 6021 4799</td>
</tr>
<tr>
<td><strong>South Eastern Sydney / Illawarra</strong></td>
<td></td>
</tr>
<tr>
<td>Randwick 02 9382 8333</td>
<td>Greater Western Broken Hill 08 8080 1499</td>
</tr>
<tr>
<td>Wollongong 02 4221 6700</td>
<td>Dubbo 02 6841 5569</td>
</tr>
<tr>
<td><strong>Sydney South West</strong></td>
<td></td>
</tr>
<tr>
<td>Camperdown 02 9515 9420</td>
<td>Bathurst 02 6339 5601</td>
</tr>
<tr>
<td>Liverpool 02 9828 5944</td>
<td>Hunter / New England 02 4924 6477</td>
</tr>
<tr>
<td><strong>Sydney West</strong></td>
<td></td>
</tr>
<tr>
<td>Penrith 02 4734 2022</td>
<td>Tamworth 02 6767 8630</td>
</tr>
<tr>
<td>Parramatta 02 9840 3603</td>
<td>Port Macquarie 02 6588 2750</td>
</tr>
<tr>
<td><strong>Justice Health Service</strong></td>
<td></td>
</tr>
<tr>
<td>Matraville 02 9289 2993</td>
<td>Lismore 02 6620 7500</td>
</tr>
<tr>
<td><strong>NSW Department of Health</strong></td>
<td></td>
</tr>
<tr>
<td>Nth Sydney 02 9391 9000</td>
<td></td>
</tr>
<tr>
<td><strong>NSW Health website</strong></td>
<td><a href="http://www.health.nsw.gov.au">www.health.nsw.gov.au</a></td>
</tr>
</tbody>
</table>

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References


32 Other diseases

Key points

- The most significant other diseases of concern in the health care setting are scabies (caused by infestation with the mite Sarcoptes scabiei) and pediculosis (caused by infestation with head lice, Pediculosis humanus capitis). These organisms are readily transmitted through human contact.
- Additional precautions should be observed where cases of scabies or head lice have been identified.

32.1 Scabies

32.1.1 Disease description

Aetiology

Disease is caused by infestation with the mite Sarcoptes scabiei.

Occurrence

Scabies is a parasitic skin infestation that occurs globally. There is no seasonality in its incidence.

Clinical manifestations

The mite burrows under the skin, causing intense itching, especially in bed at night or after a hot bath or shower.

Clinical symptoms may be different or even absent in the frail elderly or those with recent corticosteroid use, making diagnosis difficult during outbreaks in long-term care establishments.

32.1.2 Transmission

Source of infection

Human beings are the only source of infection and any person infested with either mites or eggs should be regarded as infectious. Patients with hyperinfestation (Norwegian scabies) are highly infectious because they shed large numbers of mites in skin scales.
Mode of transmission

Transmission of scabies is by direct skin-to-skin contact. In health care establishments, they are mainly transmitted by intimate direct contact with an infested person, even when high levels of personal hygiene are maintained (Gooch et al 1978, Danchaivijitr et al 1995). Transmission to health care workers (HCWs) has occurred during activities such as sponge-bathing patients or applying body lotions. Transmission between patients may also be possible when patients are ambulatory. Transmission via inanimate objects, such as clothing and bedding, is uncommon, and only occurs if the objects are contaminated immediately before contact with the new host because the mites do not survive very long out of contact with human skin.

Risk of acquisition

Susceptibility is universal. Rarely, some people may suffer hyperinfestation (Norwegian scabies), and these individuals are highly contagious.

Residents and HCWs in long-term care establishments that house patients with scabies may be more at risk of infestation than HCWs and patients in acute care establishments, mainly due to the type and frequency of skin-to-skin contact during care (eg hands within bed for prolonged periods).

32.1.3 Management

Patients

Additional precautions (contact transmission) should be observed for at least 24 hours after appropriate treatment is initiated. Consideration should be given, in consultation with an infectious disease specialist, to extending this period in the case of immunocompromised or heavily infested patients. Patients coming from communities with endemic scabies should be considered for treatment on admission (Gooch et al 1978, Danchaivijitr et al 1995, Jimenez-Lucho et al 1995).

Health care workers

HCWs with scabies should be rostered to avoid patient contact for 24 hours after the commencement of appropriate treatment.

Instruments and environment

Routine reprocessing of instruments (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.

32.2 Pediculosis (head lice)

32.2.1 Disease description

Aetiology

Disease is caused by infestation with Pediculus humanus capitis (head lice).
Occurrence

Head lice infestations are a worldwide phenomenon, occurring mainly among schoolchildren and in other institutional settings. Infestation is more a social problem than an infectious disease hazard, as head lice do not transmit any diseases. Head lice can infest any person regardless of socioeconomic status or cleanliness.

Clinical manifestations

Infestation may occur in the hair, eyebrows and eyelashes. The lice cause pruritic lesions on the scalp, neck and shoulders, which may lead to crusting and matting of hair. In extreme cases, the lesions may lead to the development of secondary bacterial infections.

32.2.2 Transmission

Source of infection

Humans are the only source of infestation. Any person infested with either lice or eggs (nits) is infectious.

Mode of transmission

Transmission occurs either by direct head-to-head contact, or via hair-care articles such as combs, brushes and hair accessories. Transmission to HCWs during provision of care is not highly likely unless direct head-to-head contact occurs.

Risk of acquisition

Susceptibility is universal. Head lice leave a febrile host, so fever can increase the risk of transmission.

32.2.3 Management

Patients

Additional precautions (contact transmission) should be observed for at least 24 hours after appropriate treatment is initiated. There are a number of effective treatments available, but lice can become resistant to specific treatments, so advice should be sought from public health departments about suitable preparations when eradication is difficult. Due to differences in product formulations, the manufacturer's directions for use should always be followed.

Health care workers

HCWs with head lice do not pose a risk to others unless direct head-to-head contact is likely to occur (eg during patient handling procedures). This type of contact should be avoided until no lice or eggs are visible.
Instruments and environment

Routine reprocessing of instruments (see Sections 16 and 17) and routine cleaning of the environment (see Section 18) should be employed.
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33 Operating rooms and day surgery units

Key points

- Each health care establishment undertaking surgery must have a specific protocol for operating room procedures, including specific requirements for surgical handwashing routines and handling of sharps.
- When individuals are being admitted to hospital or presenting at an emergency unit, a detailed medical history should be collected from them or their carers to identify conditions that may require additional precautions.
- All articles used in an operation must be sterile.
- The principles of sterile aseptic technique (see Section 6.1) must be applied to all operating room procedures. The principle of ‘confine and contain’ must be applied at all times for all patients.
- Sterile drapes must be used for the patient; all health care workers (HCWs) must wear full sterile operating room personal protective clothing.
- Patients should inform their doctor of their infectious status. Preoperative testing of patients should be on clinical indication.
- All HCWs in the surgical team should be vaccinated against hepatitis B. Surgical HCWs should not perform exposure-prone procedures if they are considered actively infectious with human immunodeficiency virus, hepatitis B virus or hepatitis C virus (see Section 24).
- HCWs with dermatitis or skin wounds should be excluded from the operating team.
- Operating lists should allow sufficient time for adequate infection control activities, including routine cleaning and the appropriate disposal of clinical waste.
- The operating room should be cleaned as soon as practicable after surgery, including the correct disposal of sharps and clinical waste and cleaning of all surfaces.
- Reusable instruments should be immersed in warm water and detergent as soon as possible after use and must then be thoroughly cleaned in a designated clean-up area before sterilisation.

33.1 Introduction

This section has been modified from Infection Control in Surgery, published by the Royal Australian College of Surgeons (RACS 1998).
The principles of sterile surgical technique, which prevents access of microorganisms to an operating field (see Section 6.1), must be used for all operating room procedures. This is achieved by methods that destroy bacteria and viruses (sterilisation) or that prevent them from contaminating objects that come into contact with the surgical field (use of sterile drapes and personal protective clothing).

Modern surgery is aseptic in the use of sterile instruments, sutures and dressings and in the wearing of sterile gowns and gloves by the operating team. In the ‘sterile field’, everything within a defined radius must be sterilised. All articles used in an operation must be sterile. All members of the operating team who are ‘sterile’ must touch only sterile articles; persons who are ‘unsterile’ must touch only unsterile articles.

Precautions should be taken to reduce microbiological risks, including the risk of transmission of hepatitis virus and human immunodeficiency virus (HIV) to patients and health care workers (HCWs) during all procedures in the operating room. To achieve this, the principle of ‘confine and contain’ applies at all times for all patients. Each patient and each operation should be considered as a potential source of contamination/infection. Therefore, it is essential that operating room HCWs demonstrate their knowledge of potential risks by ensuring that a ‘confine and contain’ approach is implemented for every procedure.

The surgeon in charge of the patient, the anaesthetist, and the registered nurse in charge of the room should be responsible for ensuring that all members of the operating team know the operating room procedures and infection control precautions that are to be taken, including any additional precautions that may be required. Staff involved in cleaning and sterilising instruments and equipment used in the operating room should also be informed of the need for any additional precautions.

Transmission of bloodborne viruses from health care worker to patient

In July 1990, the United States Centers for Disease Control and Prevention (CDC) reported the transmission of HIV to five patients by an infected Florida dentist during invasive dental surgery (Ciesielski et al 1994). A French surgeon transmitted HIV to a patient during a long orthopaedic operation (Dorozynski 1997).

Hepatitis B virus (HBV) is considerably more infectious than HIV; at least 25% of susceptible individuals develop hepatitis when exposed to needlestick injury with hepatitis B e antigen (HBeAg)-positive blood. However, transmission to patients should now be rare because effective immunisation is well established, and postexposure prophylaxis is available for individuals who have not responded to vaccination.
All HCWs in the surgical team should be vaccinated against HBV (see Section 22). Since the introduction of serological testing for HBV infection in the early 1970s, there have been published reports of over 300 patients, in 20 clusters, infected with HBV in association with treatment by an HBV-infected health care worker. These clusters have been linked to general practitioners, cardiopulmonary bypass pump technicians, obstetricians, gynaecologists, and cardiothoracic, abdominal, colorectal and oral surgeons.

Seven HCWs linked to published clusters were allowed to perform invasive procedures following modification of techniques (eg double gloves and restriction of high-risk procedures). In two instances, involving an obstetrician and an oral surgeon, hepatitis was transferred to patients after techniques had been modified.

It has been estimated that about 1% of surgeons are infected with HBV. Although transmission from surgeons to patients is uncommon, a recent study indicated that a surgeon who was HBeAg-positive, with a high serum HBV DNA concentration, infected 19 of 144 susceptible patients whilst performing surgery between July 1991 and July 1992, despite apparent compliance with infection control practices (Harpaz et al 1996).

In one reported case, a cardiac patient in the United Kingdom developed HCV infection following surgery. The probable source was an infected cardiac surgeon (PHLS 1995). In another study, a Barcelona cardiac surgeon with chronic hepatitis C virus (HCV) may have transmitted HCV to five of his patients during open-heart surgery between 1988 and 1993 (Esteban et al 1996).

### 33.2 Protocol for operating room procedures

Each health care establishment undertaking surgery should have a specific protocol for operating room procedures. This should include specific requirements for surgical handwashing routines.

#### 33.2.1 Preoperative procedures

- Patients should inform their doctor of their infectious status, particularly with regard to bloodborne diseases and any complicating factors, to ensure that appropriate care and treatment are provided and necessary additional precautions identified.

- Preoperative testing of a patient for infectious agents should be on the basis of clinical indication, and medical practitioners should exercise their professional judgment in ordering any clinically relevant test, with the patient’s consent. In the case of elective surgery, any testing considered relevant should be completed before admission.

- Discretion and patient confidentiality must be maintained in all circumstances.
Part 5—Infection control in specific health care settings

33-4

• Surgery lists should be scheduled on the basis of clinical urgency, and in such a way as to allow ample time for adequate infection control procedures to take place. The patient’s infectious or immune status should be considered in determining the patient’s position on the operating list in order to allow appropriate clinical management that may include the need for additional precautions. Operating room and anaesthetic HCWs who may be exposed to infectious material in the course of their duty should be informed of the patient’s infectious status before surgery.

• Preoperative shaving should be avoided. Clipping should be used as the standard process for hair removal in the operating room immediately before surgery. If hair is to be removed from the operating site, it can be clipped in the operating rooms without significantly increasing the wound infection rate, provided the clipper head is sterile (Alexander et al 1983, Masterson et al 1984). Shaving hair from the operating site, whether on the evening before operation or immediately before wound incision, can increase the risk of wound infection (Seropian and Reynolds 1971, Alexander et al 1983, Bird et al 1984). Depilatory creams are not recommended because they can cause serious skin irritation and rashes in a significant number of patients, which may lead to wound infection (Hamilton et al 1977).

33.2.2 Requirements for health care workers

• Surgical HCWs should not perform exposure-prone procedures if they are actively infectious with HIV, HBV or HCV (see Section 24).

• HCWs with skin abrasions, dermatitis or wounds of the skin should be excluded from the operating team. Definitive diagnosis and treatment is needed for HCWs with dermatitis or other skin irritations (eg those due to latex allergy).

33.2.3 Personal protective clothing and drapes

• Outside clothing must be changed for clean, laundered operating room attire of closely woven material.

• Impermeable, cuffed-wrist, sterile gowns should be worn by HCWs. Operating room gowns should be made of waterproof fabric with ability to ‘breathe’, should be comfortable to wear and should be of sufficient length to overlap with protective footwear.

• Open footwear must never be worn in the operating room. Calf-length, waterproof overboots should be worn where gross contamination is likely.

• Double sterile gloving (ie a double glove with the larger size glove on the inside) is recommended for all surgeons involved in operating room procedures. A prospective randomised study in which the hands and fingers of surgeons and first assistants were closely observed after surgical procedures found that penetration of the skin occurred in 51% of cases when a single layer of gloves was worn, but in 7% of cases when a double layer was worn (Hamilton et al 1977).
• If a glove is torn or a needlestick or other injury occurs, the gloves should be removed and hands washed when safety permits and new gloves should be put on promptly. The needle or instrument involved in the incident must also be removed from the sterile field. Needlestick and mucous membrane exposures are to be attended to immediately as safety permits, and reported to appropriate authorities.

• Head and facial hair should be fully covered with a cap or balaclava.

• Eye protection and face shields (see Section 13.3) are essential to avoid body fluid splashes to the conjunctiva. Masks with a fluid shield (attached plastic shield for eye protection), protective goggles, glasses, full face-shields, or surgical helmet systems should always be worn during procedures. A surgical (fluid-repellent) mask should be worn. It should be tied securely to cover the nose and mouth, and should be changed frequently.

• Full, ventilated total body suits (stretcher suits) may be used where there is a high level of risk of exposure to infectious aerosols.

• In the event of any ‘strike through’ of operating room clothing by body fluids, the HCW concerned should remove the contaminated clothing, shower and redress. The clothing should then be disposed of as prescribed for contaminated linen.

• HCWs who attend the patient should not leave the operating room until their outer gowns, gloves, masks and protective face-shields are removed.

• Operating room clothing should not be worn outside the operating room environs.

• Sterile drapes used in the operating room should be impervious. Drapes should incorporate systems for the containment of blood and irrigation fluids.

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**Surgical masks — do they really help?**

Surgical face masks have become a tradition because of the assumption that exhaled droplets would contaminate the surgical wound and cause infection. A tracer study has shown that although masks effectively prevent large droplets from escaping, smaller droplets can escape around the periphery of the mask (not through the fabric) and still gain access to the wound (Haeri and Wiley 1980).

In another study (Orr 1981), no masks were worn during operations for six months and the infection rate was then compared with a similar six-month period during the preceding four years. The infection rate was significantly lower during the period when masks were not worn.

Masks should protect the operating team from aerosolised fluids. Researchers have shown that, for ideal protection, a mask should be fluid-capture efficient and air resistant (Chen and Willeke 1992). At present, the wearing of a fluid-repellent deflector face mask is recommended mainly to protect the surgical team from blood-splatter and aerosolised fluids. This function might be better served by a face-shield, but that possibility has not yet been tested (Quebbeman 1997).
33.2.4 Operating room procedures and surgical techniques

Surgical team

The surgical team should be limited to essential members, but with sufficient supporters to tend to the patient’s needs without cross-contaminating the operating team. The roles of ‘circulating nurses’ and operating room HCWs should be clarified to prevent contact between potentially contaminated items and the surgical team. The number of students allowed to attend the operation should be limited.

Surgical handwashing

Surgical handwashing routines should be specified. Hands, nails and forearms should be washed thoroughly. The first wash for the day should be for a minimum of five minutes and subsequent washes for three minutes. Hands should be dried carefully using sterile towels. Care should be taken to ensure there is no hand contact with any nonsterile object. An appropriate skin disinfectant should be used during the scrub (see also Section 12.3).

An appropriate skin disinfectant should be applied at least two minutes (preferably five minutes) before starting aseptic or surgical procedures. The user should check the manufacturer’s label for the specific contact time for each antiseptic (see also Section 7.3).

Anaesthetic team

Whenever gloved hands are placed into a patient’s mouth, there is the potential to pass on bloodborne viruses if the patient has had a procedure in which the mucosal surfaces might have been compromised (e.g., laryngeal mask insertion). This method of cross-contamination can occur if the anaesthetist does not treat the immediate environment as an aseptic field and sterilise all that may be touched when handling successive patients. The environment should be treated in the same way as that of a dentist performing exposure-prone procedures, or gloves changed on each occasion that the anaesthetist’s hands enter a patient’s mouth (Perceval 1994).

Handling of sharps and avoidance of sharps injuries

- Health care establishments in which operative procedures are performed should develop and implement policies on the handling of sharps in surgical procedures.

- Before any surgical or operative procedure, the surgeon and scrub nurse should decide on the routine for passage of sharp instruments during the procedure. This may entail the designation of a ‘neutral zone’.

- Sharp instruments (see also Section 6.2) should not be passed by hand. A specified puncture-resistant sharps tray must be used for the transfer of all sharp instruments. Only one sharp must be in the tray at any time. If two surgeons are operating simultaneously (e.g., varicose veins operation on both legs), each surgeon needs their own sharps tray.
• All operating room HCWs, including surgeons, must be responsible for safe handling of sharp instruments.

• Hand-held straight needles should not be used.

• Needles must never be picked up with the fingers, nor the fingers used to expose and increase access for the passage of a suture in deep tissues. When suturing, forceps or a needle holder should be used to pick up the needle and draw it through the tissue.

• When suturing, surgeons may use a sterile thimble on the index finger of the less dexterous hand for protection.

• Where practical, suture needles should be cut off before knots are tied, to prevent needlestick injury. The sharp point of the needle should be sheathed in the jaws of the needle holder before the needle is cut off.

• Hands of assisting HCWs must not be used to retract the wound on viscera during surgery. Self-retaining retractors should be used, or a swab on a stick, instead of fingers.

• Certain instruments should be avoided unless essential to the procedure (e.g., sharp wound retractors, such as rake retractors and skin hooks).

• Wire sutures should be avoided where possible because of the high injury rate of surgeons using them. Whenever possible, the skin should be closed with staples following a surgical procedure.

• Blunt needles should be used to close the abdomen.

• The surgeon must avoid placing their less dexterous hand in potential danger.

• The diathermy and suction equipment should be placed on the opposite side of the table from the surgeon, thereby ensuring that the assistant does not reach across the table between the surgeon and nurse.

• Where appropriate, wound dressings with an impervious outer covering that will contain wound exudate should be used.

• Closed wound drainage systems should be used, including single-use articles.

• Care should be taken that blood-soaked sponges and swabs are kept in a sterile bowl on the surgical set-up and are carefully counted into a plastic bag when five have accumulated.

• After the operation, all blood should be cleaned from the patient’s skin using an aqueous solution of 0.05% w/v chlorhexidine or 0.5% cetrimide.

**Laser therapy and dermabrasion**

• The generation of a potentially infected aerosol plume during laser therapy requires purpose-designed plume suction that must be safely vented. The plume extractor must be as close as possible to the area of skin being worked on.
• The generation of airborne particulate matter and blood spray during dermabrasion requires the use of shielding to cover the entire faces of all HCWs in the work area. All HCWs must wear caps to protect the hair from such debris. As much as possible of the area in the vicinity of the procedure should be covered with either disposable or sterilisable drapes.

Instruments and equipment

• Reusable instruments and equipment used on sterile sites must be sterile and should be processed accordingly (see Sections 16 and 17).

Cleaning of the operating room and instruments

• To minimise the risk of spread of infection to other patients, adequate time must be allowed at the end of each case to allow for appropriate cleaning of the operating room and the appropriate disposal of clinical waste. For further details see the current Australian College of Operating Room Nurses (ACORN) Standards.

• Instruments for reuse should, as soon as possible after use, be immersed in warm water and detergent to prevent congealing or solidifying of blood and fatty materials, and must be thoroughly cleaned in the designated clean-up area before sterilisation. Where practicable, used instruments should be washed mechanically rather than by hand (see Section 16.3).

• Scalpel blades, needles and all other nonreusable sharps should be placed in a designated puncture-proof sharps container. Disposable containers must comply with AS 4031,\(^1\) reusable containers must comply with AS/NZS 4261.\(^2\) The container should be sealed and removed from the operating room for appropriate disposal.

• Clinical waste (excluding sharps) should be placed into an appropriate leak-resistant bag, sealed and removed from the operating room. Disposal of clinical waste must comply with State/Territory regulations (see also Section 15).

• Linen should be handled in accordance with the establishment’s linen service policy, with State/Territory health department guidelines and with Standards Australia guidelines for correct laundry practice (AS/NZS 4146\(^3\)).

• Between cases, all surfaces (operating table, instrument table, equipment used and the floor) should be carefully cleaned using warm water and detergent.

• Blood and other body fluid spills should be cleaned up immediately, using absorbent material such as paper towelling that should then be discarded into the clinical waste bag. Gloves must be worn. The area should then be cleaned with warm water and detergent. The area may be treated with

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1 AS 4031 (1992) and Amendment 1 (1996) Non-reusable containers for the collection of sharp medical items used in health care areas.
2 AS/NZS 4261 (1994) and Amendment 1 (1997) Reusable containers for the collection of sharp items used in human and animal medical applications.
sodium hypochlorite (1% or 10,000 ppm available chlorine) or other appropriate disinfectant, in accordance with the establishment’s spills management protocol. Disinfectant solutions should not be allowed to pool or remain on surfaces for longer than is required to effect disinfection, usually 10 minutes (see Section 18). Surfaces should be cleaned and dried after applying disinfectants.

- At the end of the day, after spot cleaning, the operating lights, all the furniture and equipment (including diathermy, suction and anaesthetic equipment and the operating table) should be cleaned with warm water and detergent and dried thoroughly. The floor should be mopped with warm water and detergent and left dry.

33.3 Additional operating room precautions

Additional precautions are required where the transmission of infection might not be contained by standard precautions. For example, this can occur in the following situations:

- where pulmonary tuberculosis (or any aerosolised pathogens) or pathogens that can be spread via environmental surfaces, such as methicillin-resistant Staphylococcus aureus (MRSA), are involved;
- where there is an established risk of transmission regardless of the nature of the procedure being undertaken; or
- where the procedure itself carries an established risk of blood accident or HCW/patient injury.

The exact nature of additional precautions to be implemented depends upon the mode of transmission (such as via aerosols), the type of microorganisms (eg Creutzfeldt–Jakob disease compared with Staphylococcus) and the procedure itself (eg where this carries an established risk of accidental injury).

Additional precautions may include the use of experienced surgeons and operating room HCWs to minimise the likelihood of accidents and complications, the use of special protective equipment (eg full-face visors), and the appropriate scheduling of patients on operating lists to ensure that the required additional precautions can be efficiently applied and infection of following patients avoided.

Where additional precautions are required, and in order to minimise surface contamination from aerosolised infectious material, patients may be anaesthetised in the operating room rather than the anaesthetic room.

Where additional precautions are required, and where it is possible, single-use equipment should be used (eg suction tips, bottles, tubing, drapes, gowns and sigmoidoscopes).
34 Office practice (general)

Key points

- Office-practice health care establishments include general practitioner rooms, dentist rooms, specialist consulting rooms, infant welfare clinics, immunisation clinics, sports medicine clinics, acupuncture clinics, physiotherapist rooms, podiatrist rooms and so on.

- The general principles of infection control that apply to large health care settings also apply to office practices, including for surgical procedures. Each individual practice should develop a manual of protocols to be carried out during all procedures.

- Sterilisation by steam under pressure is the preferred method of sterilisation in office practice. Health care workers should be trained in the use of the steam steriliser and the manufacturer’s instructions should be followed. Items must be thoroughly cleaned before sterilising.

34.1 Introduction

Office practice includes:

- general practitioner rooms;
- dentists’ rooms;
- specialists’ consulting rooms/clinics;
- infant welfare clinics;
- immunisation clinics;
- sports medicine clinics;
- acupuncture clinics;
- alternative therapists; and
- physiotherapists, chiropractors, podiatrists etc.

Most dentistry, and a range of minor surgery, is carried out in office practice. The principles of infection control apply equally to surgical procedures in hospital settings, in office situations and in mobile medical and dental clinics.
Office spaces and facilities will vary. Each practice should develop a manual of the protocols required for all procedures. These should be based on the principles, work practices and procedures covered in Parts 1–4 of these guidelines. The manual should be developed cooperatively with all health care workers (HCWs) involved in the delivery of the service, and should demonstrate clearly to HCWs, patients and regulatory bodies that the principles of infection control are understood and practised.

The protocol should be drawn up by reference to the various sections of this manual and recommendations should be tailored to the particular practice. In addition, an office infection control protocol or manual should include information about and specifications for:

- methods of handwashing (routine and surgical);
- personal protective equipment requirements;
- setting up the treatment area in preparation for a patient visit;
- defined areas of contamination that require personal protective equipment and cleaning between patients;
- changeover procedures between patients;
- management of blood or body fluid spills;
- handling and disposal of sharps;
- waste disposal;
- management of blood or body fluid exposure;
- processing of reusable items (cleaning, packaging, sterilisation, disinfection, storage);
- processing of radiographs;
- quality control mechanisms, including documentation of maintenance and monitoring programs for equipment;
- staff immunisation requirements;
- single-use items;
- solo operators (professionals who do not have an assistant present during direct patient contact);
- continuing education;
- recording of information during patient treatment;
- use of computers and computer-run equipment during patient treatment; and
- management of water lines that have direct patient contact.
34.2 **Sterilisation in office practice**

Sterilisation by steam under pressure is the preferred method of sterilisation in office practice, and is described in detail in Section 16.5.2. Dry heat sterilisers with fan-assisted mechanical air convection (see AS 2487\(^1\)) have had limited application (see Section 16.5.3) and are not recommended for office practices.

When purchasing a steam steriliser (autoclave) for use in office-based practice, consideration must be given to HCW training, quality control (see AS/ANZ 4815\(^2\)) and running costs. For smaller practices, such ongoing expenditure could make the use of an external service (other office practice, hospital or commercial facility) or the use of disposable single-use items a practical and cost-effective alternative.

Sterilisers must be used in accordance with the manufacturer’s instructions. It may be necessary to contact relevant State/Territory occupational health and safety authorities regarding registration and inspection of steam sterilisers.

Items must be thoroughly cleaned before sterilising. If the steriliser has a built-in drying unit, the items should also be packaged or wrapped (see Section 16.5 for details of these procedures).

For group practices, the greater volume of instruments required might justify the use of larger, more sophisticated steam sterilisers. These should conform to AS 1410 and/or AS 2192.\(^3\)

### 34.2.1 Cryotherapy, electrocautery and related devices

Instruments and devices that are used in the treatment of skin and mucosal lesions such as warts and that come into direct contact with the lesions must be single use, disposable or cleaned and resterilised after each patient. This applies to cryotherapy and electrocautery tips and other devices, which should be processed as for other surgical instruments according to the manufacturer’s recommendations, either by steam or by gas sterilisation.

### 34.3 Special precautions for CJD

Information on disposal, quarantine and reprocessing of instruments potentially contaminated with the Creutzfeldt–Jakob disease agent is given in Section 31.

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1. AS 2487 (1981) *Dry heat sterilizers (hot air type).*
35 Dental practice

**Key points**

+ All instruments and equipment (including dental burs, reamers and files) used in the mouths of patients should either be disposable (single use) or sterilised between cases.¹

+ Health care workers should wear personal protective equipment, including eye and face protection, where aerosols are likely to be generated. Patients should be provided with protective eye equipment.

+ The integrity of the operating field should be maintained during each case. The formation of droplets, splatter and aerosols should be minimised during treatment. Barrier draping, using either plastic wrap, sterile drape or preformed plastic covers, should be used where appropriate. Sterile drapes should be used for surgical procedures.

+ All articles within the operating field should be considered contaminated by the case in progress and must be removed for reprocessing before the next case begins.

+ Materials, equipment and instruments must be kept bagged, covered with an impermeable material in closed drawers, or in dedicated covered containers until use, to protect them from contamination by aerosols created in the dental environment. Instruments that penetrate normally sterile tissue must be sterile at the time of use and must be kept bagged until use. Bagging should be checked for damage before the equipment is used, and instruments stored in bags found to be damaged should be resterilised before use.

+ All environmental surfaces outside of the operating field should be maintained in a clean and hygienic condition at all times.

+ Dental lasers and air abrasion devices create particular bioaerosol hazards and extra control measures are required during their use.

+ All materials transported to and from dental laboratories should first be cleaned, disinfected as appropriate and placed in a sealed container. Standard precautions should apply when receiving, handling and working on dental materials.

In addition to the general requirements for office practice (see Section 34), some special considerations and requirements for dental practice should be carefully followed.

¹ In this section, the term ‘case’ means the treatment provided by a dental HCW to a patient during one session.
35.1 Liability

Nonregistered practice owners have obligations to provide facilities, health care workers (HCWs) and equipment necessary to ensure that the practice and its employee HCWs can comply with current infection control guidelines. While liability for adequate infection control procedures lies with the registered HCW, in some States/Territories the nonregistered owner shares this liability.

35.2 Personal protective equipment

Adequate eye and face protection should be worn where aerosols are likely to be generated.

Gloves should be worn by dental HCWs for all procedures where contact with patient secretions or tissue is possible. Gloves do not need to be sterile for most general dental procedures. However, gloves should be sterile when invasive procedures (eg incision into soft tissue or surgical procedures) are carried out. In dental practice, gloves should be worn for most procedures; in these circumstances, allergy or sensitivity can become a significant issue.

Patients should be provided with protective eye equipment.

35.3 Operating field

The integrity of the operating field should be maintained during dental procedures. Appropriate use of dental dams, high-volume evacuation and proper patient positioning should minimise the formation of droplets, splatter and aerosols during treatment.

The following equipment should be cleaned or barrier protected after each patient use:

- any hand-operated control in the operating field, the operating light handle, the X-ray head, the suction tubing and the cradles they rest in;
- any intraoral light source (eg fibreoptic illuminators, intraoral cameras, the polymerising light and the handle of its light shield); and
- the bracket table and its handle.

Protective coverings (plastic wraps, sterile drapes or preformed plastic covers) may be applied to surfaces that have been cleaned at the beginning of each day. Protective coverings should be disposed of after each case.
Materials should routinely be predispensed. However, if additional instruments and materials have to be retrieved from outside the operating field, the following procedures should be followed:

- Gloves must be removed and hands washed to dispense materials from their containers into the field (alternatively, overgloves can be used).
- Drawers must be opened by elbow touch, degloving or a suitable no-touch technique (eg use of transfer tweezers or single-use barriers on handles).
- Retrieval of instruments or materials from drawers must be by transfer tweezers that are kept separate from the other instruments.
- Transfer tweezers may be handled with gloved or ungloved hands during a case and should be sterilised at the end of each case.
- Precut supplies of some materials (eg floss, cellulose acetate strips, gingival retraction cord and articulating paper) can be stored in drawers and predispensed before procedures or retrieved with transfer tweezers.

All articles within the operating field should be deemed contaminated by the case in progress, and must be removed, cleaned and disinfected or sterilised before the next case can begin (CDC 1991).

All instruments and equipment used in the mouth must be sterilised after each case.

### 35.4 Intraoral dental handpieces

All dental handpieces should be cleaned according to the manufacturer’s instructions and sterilised after each case.

The manufacturer’s instructions regarding the choice of lubricants should be followed, and care taken to choose a lubricant that does not compromise the sterilisation process. If the handpiece is relubricated after sterilising, then that lubricant system should be for post-sterilisation use only. It is strongly recommended that automatic flush-through and lubricant systems be used for cleaning and lubricating dental handpieces.

### 35.5 Management of water quality and aspiration

A hierarchy of water quality is required for dentistry. Water used for surgical procedures should be sterile; water used for mouth rinsing should be of potable standard. Water required for irrigation for tooth preparation and ultrasonic scaling should be of no less than potable standard.
Biofilm in dental unit waterlines is an unknown hazard. It is prudent to treat immunocompromised patients using water in which the number of colony forming units (CFU) per mL is less than 200. CFU levels can be measured using commercially available test strips.

Air and water lines should be flushed for a minimum of two minutes at the start of the day and for 30 seconds between patients. For dental units equipped with an independent water supply, the manufacturer’s instructions must be closely followed for disinfection procedures.

All dental equipment that supplies water to the oral cavity must be fitted with nonreturn valves. Routine maintenance of nonreturn valves is necessary to ensure their effectiveness. Manufacturers should be consulted to establish an appropriate maintenance routine.

### 35.6 Aerosols

Materials, equipment and instruments must be kept bagged, covered with an impermeable material or in closed drawers until use, to protect them from contamination by aerosols created in the dental environment. Instruments penetrating tissue are required to be sterile at the time of use and must be kept bagged. All environmental surfaces, apart from those contaminated in the operating field, must be cleaned at least weekly.

Dental lasers and air abrasion devices create particular bioaerosol hazards. Extra control measures for these aerosols, such as purpose-built ventilators and high-velocity suction devices, are required. Some pathogenic viruses such as human papilloma virus are not inactivated by laser or electrosurgery procedures, and appropriate filtration masks and suction are necessary to prevent inhalation. Air abrasion devices create alumina dust, which can become a respiratory irritant for both HCWs and patients. In such instances, high-efficiency particle arrest (HEPA) filtration and vapour filtration are indicated.

### 35.7 Dental prostheses, impressions and materials

Although the efficacy of disinfection of dental materials is still undetermined, standard precautions should be applied whenever people handle dental material. Implantable items must be sterile (see Section 17.12).

The most important step is the thorough cleaning of material that has contacted oral tissue (eg impressions). Thorough rinsing with cold running water, followed by the application of a diluted detergent and further rinsing, should continue until all visible contamination is removed.
Prosthetic work area in the clinic

- Prostheses or appliances that have already been inserted into the mouth require special attention. Any instruments, attachments and materials that contact these prostheses should be cleaned and disinfected between cases.

- A small amount of pumice should be dispensed for individual use. When the treatment is complete the remainder should be discarded and the container cleaned with a detergent solution and rinsed for dispensing pumice for the next case.

- All burs and rubber wheels should be steam sterilised and arbor bands disposed of. Polishing buff and ragwheels must be cleaned, dried and thermally disinfected or sterilised after each case. Splash guards should be cleaned between cases.

- People working on such appliances should wear a clean uniform or laboratory coat, single-use gloves, protective eyewear or face-shield, and a mask if necessary. An exhaust fan is recommended. Vacuum exhaust at benches and a fume cupboard should be available for use when required.

35.8 Dental laboratories

All materials transported to and from dental laboratories should first be cleaned or disinfected, and placed in sealed containers. In each case, the method of disinfection should be noted on the laboratory form. Laboratory staff should be aware that laboratory items present a biological hazard; for their own safety, they should practice the necessary precautions in handling biological material. Standard precautions should be applied when handling dental materials.

All prostheses should be cleaned before being polished in the lathe working area.

Receiving area

- An area should be set aside to receive incoming cases. The laboratory request form should be checked for details about which cleaning procedures are required before the items are stored.

- Appropriate personal protective equipment (eg disposable gloves, apron, eye protection or a face-shield) should be worn when the container is opened. A mask should be worn where there is a risk of aerosolisation or airborne transmission of infection.

- Sometimes items are sent to the laboratory without having been cleaned. When this occurs, items should be rinsed in cold running water, cleaned in a mild detergent solution until all traces of blood, debris and body fluids are removed, and then rinsed.
• All packing materials and waste should be disposed of according to the waste regulations of State/Territory health and environmental authorities. Reusable containers should be cleaned with detergent and then disinfected.

• The receiving area should be cleaned with detergent between cases. Placing a single-use impenetrable barrier (ie plastic or plastic-backed paper) on the surface is recommended.

Work area

• Hands should always be washed before leaving the work area.

• Food or drink should not be allowed in the work area.

Outgoing prostheses/appliances

On completion of the laboratory work, items should be cleaned or disinfected, dried and placed in a sealed container for dispatch.

35.9 Special precautions for CJD

Information on disposal, quarantine and reprocessing of instruments potentially contaminated with the infectious agent for Creutzfeldt–Jakob disease is given in Section 31.
It is important that midwifery and obstetric health care workers (HCWs) are trained in infection control procedures and have access to professional counselling services. This training should enable them to anticipate and manage situations in which they may be exposed to infectious organisms. Situations in which infectious agents may be encountered are listed below.

36.1 Antenatal care

Procedures and physical examinations, performed during the antenatal period, that may expose HCWs to blood or body fluids include:

- management of antepartum haemorrhage (APH);
- cervical smears;
- treatment of a threatened miscarriage and premature labour;
- chorionic villus sampling (CVS);
- amniocentesis;
- foetal blood sampling (FBS);
- intrauterine foetal blood transfusions;
- other intrauterine foetal therapy and procedures (eg cystic drainage);
- foetoscopy (to gain foetal blood);
All vaginal loss or secretions should be treated as being potentially infectious (i.e., regarded as a ‘body fluid’ that is subject to standard precautions).

### 36.2 Labour and birth

The following procedures performed during labour and birth may expose HCWs to blood and other body fluids:

- insertion of intravenous lines;
- lumbar epidural, where contact with cerebrospinal fluid may occur;
- rupturing of the membranes;
- spontaneous rupture of the membranes;
- vaginal examination;
- attachment of foetal scalp electrode or scalp pH meter;
- birth process, either vaginally or by caesarian section; and
- delivery of the placenta or retrieval of a retained placenta.

Used needles and other disposable sharp instruments should be discarded immediately after use into an approved sharps container (see Section 14.2). Gross soiling should be rinsed from instruments in the delivery room and cleaning should proceed as described in Section 16.3.

Personal protective equipment (long gloves, at least elbow length where available) should be worn when attending labouring/birthing women in baths containing water contaminated by amniotic fluid, blood and/or faeces.

#### Cutting the umbilical cord

When cutting the umbilical cord, two clamps should be used to clamp the proximal and distal ends of the cord. Once clamps are in place, absorbent material should be placed over the site and the cutting instrument to prevent spurting of blood during cutting.

If practicable, the umbilical cord should be cut when pulsation has ceased. Active management of third-stage labour decreases overall exposure of the HCW to maternal/foetal blood. Cord blood should be taken before the delivery of the placenta by releasing the cord clamp and allowing blood to drain when pressure on the cord is less. Collection of cord blood for banking purposes, which requires handling and drainage, should be undertaken by a person wearing facial protection (mask and protective eyewear).
Disposal of the placenta

The placenta should be carefully examined with gloved hands and discarded into a plastic bag for incineration. Sink disposal units should not be used for the disposal of placentae because of the risk of generating droplets and aerosols.

36.3 Postnatal care

- Personal protective equipment should be worn to protect HCWs from contact with colostrum and/or breast milk, or blood from traumatised nipples.
- When conducting postnatal checks, HCWs must wear personal protective equipment.
- Used needles and other disposable sharp instruments should be discarded immediately after use into an approved sharps container (see Section 14.2).
- Gross soiling should be rinsed from instruments in the operating room and cleaning should proceed as described in Section 16.3.
- Gloves should be worn when handling newborns until after all blood contamination has been removed (ie after the first bath).
- Bloodstained/soiled bedding and used pads should be placed into approved leak-proof bags and disposed of in accordance with waste management procedures (see Section 15).
- Mothers should be taught about hygiene practices associated with vaginal loss in the shower. All vaginal losses should be treated as ‘spills’ and cleaned appropriately (see Section 18.2).
- Gloves should be worn when changing wet or soiled napkins.
37 Home and community

Key points

+ Health care workers (HCWs) working in informal health care settings should carry personal protective equipment, including waterproof gowns, gloves, masks and goggles, to protect them from hazards they might encounter.

+ HCWs should wash their hands before and after contact with community-based clients. If soap and water are not available, single-use towelettes (with detergent) may be used before an alcoholic hand rub. Hands should then be washed with skin disinfectant and running water at the first opportunity.

+ The work case and all the items carried in it should be cleaned regularly or if they become soiled. Care must be taken to wash hands before removing items from, or returning clean items to, the work case.

+ Waste generated in informal health care settings must be disposed of according to local and State/Territory regulations.

+ Medical supplies and client equipment should be stored in a safe place in the home. Where possible, equipment should be dismantled to allow physical removal of all particulate and biological matter, cleaned with detergent and water, and dried thoroughly before moving it into or out of the home.

37.1 Introduction

The home is an unregulated, informal setting in which to provide health care, without the infrastructure or regulations of a hospital setting or office-based practice. Basic requirements such as hot or running water may not be available, and the client has control over the environment. Care providers can include family, friends or volunteers, personal care attendants and home help.

Employers have a responsibility to provide their employees with the personal protective equipment required to protect them from hazards they might be expected to encounter.

Standard precautions should be applied in all situations in both remote and urban areas.

Further information on infection control in the home care setting can be found in Thomas (1997), Anon (1998), Davis and Madigan (1999) and Friedman and Rhinehart (1999).
37.2 Handwashing

Community health care workers (HCWs) should wash their hands before and after contact with community-based clients. In situations where access to clean running water is difficult, clean water may be transported in a canister. Canisters may be fitted with a tap. If water is not accessible, single-use towelettes (with detergent) may be used before an alcoholic hand rub. Hands should then be washed with liquid handwash and running water at the first opportunity.

Community HCWs may use a clean, dry towel provided by the client or employer, provided a fresh area of the towel is used each time hands are dried. Paper towels can be used in cases where clients are unable to provide a clean, dry towel for HCWs to use.

37.3 Personal protective equipment

The employer is responsible for providing personal protective equipment, and community HCWs should carry it in anticipation of exposure to blood and body substances. These basic requirements can be carried into the home in a work case and should include waterproof gown, gloves, masks and goggles. Care must be taken to wash hands before removing items from or returning clean items to the work case or bag. The work case or bag and other items carried in it (eg stethoscopes, sphygmomanometers and scales) should be cleaned regularly or if they become soiled.

37.4 Waste disposal

Waste disposal must be carried out in accordance with local and State/Territory regulations. The Australian and New Zealand standard for clinical and related wastes (AS/NZS 3816) does not cover general domestic waste. Attempts should be made to segregate wastes at the point of generation.

Hazards arise when handling, storing, transporting and disposing of waste. Blood and body substances should be disposed of directly into the sewer system where possible. Heavily exuding wound dressings should be contained in a leak-proof bag and double-bagged before disposal. Care must be taken in the handling and disposal of sharps (see Section 14). Sharps and other clinical wastes must be disposed of according to State/Territory guidelines.

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37.5 Equipment and supplies

Medical supplies and client equipment should be stored in a dry area out of reach of children and pets and away from the high-traffic areas of the home. All parts of any equipment should be dismantled, where possible, to allow physical removal of all particulate and biological matter. Equipment should be cleaned with detergent and water and dried thoroughly before it is transported into or out of the home.
38 Long-term care establishments

Key points

- Infections in long-term care establishments (LTCEs) may be community acquired, health care associated or endemic. Residents are both susceptible to, and a potential source of, infection.

- LTCEs should have an established infection control relationship with any associated acute care and other health care establishments/providers for their residents.

- Each LTCE must have an infection control program coordinated by a designated infection control practitioner. In the United States, one full-time equivalent infection control practitioner per 250 to 300 LTCE beds has been recommended.

- The home-like atmosphere of LTCEs presents some specific issues for infection control (e.g., visiting hairdressers, podiatrists and companion animals). Companion animals require care programs, including vaccination and hygiene programs.

- Surveillance should be part of the infection control program and trained personnel should be used for data collection. Published definitions for infection surveillance in an LTCE should be used.

- The infection control program should also address the prescription of antimicrobial agents. LTCEs should liaise with other health care establishments to which they regularly refer patients for care, about the ongoing surveillance and management of patients colonised or infected with antimicrobial-resistant bacteria.

- The risks of infection can be reduced through patient health programs, including immunisation, tuberculosis screening, and prevention and control from time of admission.

38.1 Introduction

A long-term care establishment (LTCE) is a home-like environment that potentially facilitates infection. Residents are often susceptible to infection and may themselves be a source of infection (Smith and Rusnak 1997). The spread of infection in LTCEs reflects a mixture of aetiologies, including community-acquired, health care associated and endemic infections (Strausbaugh and Joseph 2000).
Transferring residents/patients between different health care settings has the potential for transmission of infection from one setting to another. There should therefore be an established infection control relationship between an LTCE and associated acute care facilities and other health care establishments/providers for its residents. Appropriate infection control measures are required to prevent transmission of infection from one person to another, and between health care establishments (Strausbaugh and Joseph 2000).

All LTCEs must have an appropriate infection control program (see Section 8) that reflects infection control principles, including standard precautions (see Section 2.2) and additional precautions (see Section 2.3). For Commonwealth-funded residential aged care services, the Aged Care Act 1997 requires that services meet the Accreditation Standards, including Standard 4: Physical Environment and Safe Systems. In particular:

- **Outcome 4.2: Regulatory compliance** — requires aged care services to have systems in place to identify and ensure compliance with all relevant legislation, regulatory requirements, professional standards and guidelines about physical environment and safety systems.
- **Outcome 4.7: Infection control** — requires services to have an effective infection control program and to have policies and practices supporting it.

As in other health care settings, a designated infection control practitioner (ICP) should be responsible for the coordination of the infection control program. The ICP can be either a staff member within the LTCE or an external consultant. They should meet the requirements for an ICP listed in Section 8.4. Depending on the size of the LTCE, a full-time ICP may be required. In the United States, one full-time equivalent ICP per 250 to 300 LTCE beds has been recommended (Smith and Rusnak 1997).

Providing a home-like environment poses specific issues for LTCEs (eg visiting hairdressers, podiatrists and companion animals). These issues require an individual establishment approach within the principles of infection control. Companion animals, for example, require the involvement of a veterinary surgeon to develop a plan of care, including vaccination and hygiene programs (Duncan and APIC 2000). Under food safety legislation, animals are not permitted in kitchen areas.

### 38.2 Surveillance

An important element of an LTCE infection control program is surveillance of any infections in residents and staff. For residential aged care, Outcome 4.7 of the Accreditation Standards requires that policies and practices implemented in each aged care home provide surveillance programs for infection control (Aged Care Principles). To ensure that the data collected are of high quality and useful, surveillance activities should involve:

- a written plan to outline objectives and key elements of the process;
• consistency in surveillance methodology and standardised written definitions for collection of data;

• a process for data analysis and review.

Variability in data between establishments may arise from differences in the type of facility and the patient population. This must be considered before rates are compared or benchmarks considered.

38.2.1 Methodology

Case-finding methods vary according to resources available, which can include:

• ancillary reports, such as laboratory, pharmacy or radiology reports;

• resident charts; and

• reporting by staff.

The data collection tool must be developed to fit the given surveillance objective, be user friendly and provide accurate information. Personnel responsible for data collection should be trained in the use of the tool and recognition of signs of infection (APIC 1999).

Data should be analysed regularly. The most common and meaningful way to express infection incidence is the number of infections per 1000 resident days (Strausbaugh and Joseph 2000).

38.2.2 Diagnosis and criteria for infection

Published definitions for infection surveillance in an LTCE should be followed (McGeer et al 1991). It may be appropriate to survey for the following infections in residents of LTCEs:

• skin and soft tissue infections

• respiratory tract infections

• urinary tract infections

• primary bloodstream infections

• gastroenteritis

• unexplained febrile episodes.

38.3 Antibiotic-resistant bacteria

Residents of LTCEs may be colonised or infected with multidrug-resistant organisms when they are admitted, or may develop these infections through antibiotic medication during their stay (Nicolle et al 1996).
The infection control program should include a component specifically addressing prescription of antimicrobial agents. Using a multidisciplinary approach, recommendations should include clinical guidelines for empiric antimicrobial prescription, review of antibiotic usage and restricted formulary (Nicolle et al 1996).

LTCEs should liaise with other health care establishments to which they regularly refer patients for care about the ongoing surveillance and management of patients colonised or infected with antimicrobial-resistant bacteria.

### 38.4 Resident health programs

Health programs for residents are desirable to ensure administration of appropriate vaccines and, where possible, reduce risk of infection in this patient group (Strausbaugh and Joseph 2000). Programs should include the following elements:

- immunisation as recommended in the most recent edition of the *NHMRC Immunisation Handbook* (currently NHMRC 2003);
- tuberculosis screening in conjunction with State/Territory public health authorities; and
- prevention and control (from the time of admission) and monitoring of physical and historical information, to provide a framework for assessing and addressing each resident’s specific infection risks, including:
  - previous hospitalisation;
  - past infections (eg tuberculosis);
  - immunisation history;
  - skin integrity;
  - bladder and bowel function;
  - baseline chest X-ray; and
  - baseline microbiology from invasive devices.
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Appendix 1  Consensus numerator definitions

Surgical site infection

Infections following surgery cause considerable morbidity and economic cost within the health care system. A proportion of such infections is preventable and the appropriate point of intervention can be identified if useful surveillance data are available.

The National Nosocomial Infections Surveillance (NNIS) System, begun in 1970 by the United States Centers for Disease Control and Prevention (CDC), includes definitions for surgical site infection (SSI) that fulfil both clinical and epidemiological requirements to provide useful objective surveillance data (Gaynes and Horan 1996). These definitions have been extensively validated in the United States and are already widely used in Australia.

It is acknowledged that the exclusion of subjective criteria for the diagnosis of SSI may underestimate the infection rate. However, the objectivity of the definitional criteria increases the level of reliability of surveillance data collected by multiple contributors and allows reliable intrahospital comparison. Caution, however, must be exercised with interhospital, State or national comparisons of SSI rates based on standardised definitions, until adjustment can be made for the many factors contributing to the risk of infection.

General notes and reporting instructions

The SSI definitions are identical to those defined by the CDC’s NNIS System. The intent is to follow exactly the NNIS approach to SSI surveillance. Where the chosen wording differs in the consensus group definition from NNIS, it is solely to improve clarity.

For SSIs that become apparent after discharge, a medical officer’s diagnosis is not accepted unless another criterion for infection is also present, except when the diagnosis is made by the operating surgeon or registrar.

Rates of infection determined by postdischarge surveillance should be reported separately as ‘postdischarge’ (as the combined rates will often be substantially higher than if only ‘in-hospital’ surveillance is reported).
Definitions and reporting instructions for SSIs

There are three types of SSI, which are described in detail below:
1. Superficial incisional
2. Deep incisional
3. Organ/space.

1. **Superficial incisional**

A superficial incisional SSI must meet the following three criteria:
1. Infection involves only skin and subcutaneous tissue of the incision.
2. Infection occurs within 30 days after the operative procedure.
3. Patient has at least one of the following:
   a. purulent drainage from the superficial incision; or
   b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision (note that a positive wound swab, as opposed to wound aspirate, is not adequate for diagnosis of superficial SSI without other significant evidence of infection); or
   c. at least one of the following signs or symptoms of infection:
      - pain or tenderness or localised swelling or redness or heat; or
      - superficial incision is deliberately explored by surgeon, and is culture-positive or not cultured (a culture-negative finding does not meet this criterion unless the patient was on antibiotics immediately prior to the wound being explored and/or the culture being taken); or
      - diagnosis or antimicrobial treatment of superficial incisional SSI by the operating surgeon or registrar.

**Reporting instructions**

1. Do not report a stitch abscess (minimal inflammation and discharge confined to the points of suture penetration) as an infection.
2. If the incisional site infection involves or extends into the fascial and muscle layers, report as a deep incisional SSI.
3. Classify infection that involves both superficial and deep incision sites as deep incisional SSI.
4. Note that for coronary bypass graft operations, infections related to graft and chest sites must be clearly distinguished.

2. **Deep incisional**

A deep incisional SSI must meet the following three criteria:
1. Infection involves deep soft tissues (eg fascial and muscle layers) of the incision.
2. Infection occurs within 30 days after the operative procedure, unless an implant is left in place (if an implant is in place, a deep SSI is any infection that appears to be related to the operative procedure and occurs within one year of the operation).

3. Patient has at least one of the following:
   - purulent drainage from the deep incision but not from the organ/space component of the surgical site; or
   - a deep incision spontaneously dehisces or is deliberately explored by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38°C), or localised pain or tenderness, and is culture positive or not cultured (a culture-negative finding does not meet this criterion unless the patient was on antibiotics immediately prior to the wound being explored and/or the culture being taken); or
   - an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination; or
   - diagnosis or antimicrobial treatment of a deep incisional SSI by the operating surgeon or registrar.

**Reporting instructions**

Classify infection that involves both superficial and deep incision sites as deep incisional SSI.

3. **Organ/space**

An organ/space SSI must meet the following three criteria:

1. Infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure (e.g., appendicectomy with subsequent subdiaphragmatic abscess).

2. Infection occurs within 30 days after the operative procedure if no implant is left in place, or within one year if an implant is in place and the infection appears to be related to the operative procedure.

3. Patient has at least one of the following:
   - purulent drainage from a drain that is placed through a stab wound into the organ/space; or
   - organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space; or
   - an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination; or

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1 A nonhuman-derived implantable foreign body (e.g., prosthetic heart valve, nonhuman vascular graft, mechanical heart or hip prosthesis) that is permanently placed in a patient during surgery.
- diagnosis or antimicrobial treatment of an organ/space SSI by the operating surgeon or registrar.

**Reporting instructions**

Occasionally, an organ/space infection drains through the incision. Such infection generally does not involve reoperation and is considered a complication of the incision. Therefore, classify it as a deep incisional SSI unless other criteria (e.g., radiological examination) for diagnosis of organ/space SSI infection are satisfied.

The following are specific sites of an organ or space SSI:
- osteomyelitis
- breast abscess or mastitis
- myocarditis or pericarditis
- disc space
- ear, mastoid
- endometritis
- endocarditis
- eye, other than conjunctivitis
- gastrointestinal tract
- intra-abdominal, not specified elsewhere
- intracranial, brain abscess or dura
- joint or bursa
- other infections of the lower respiratory tract
- mediastinitis
- meningitis or ventriculitis
- oral cavity (mouth, tongue or gums)
- other male or female reproductive
- other infections of the urinary tract
- spinal abscess without meningitis
- sinusitis
- upper respiratory tract
- arterial or venous infection
- vaginal cuff.
Bloodstream infection

Bloodstream infections (BSIs) or bacteraemias have a high morbidity and mortality. Many factors can lead to the development of a bloodstream infection. Some of these, a proportion of which may be preventable, are related to health care. Surveillance of BSIs has proven to be a useful tool in identifying significant breakdowns in infection control procedures. With ever increasing moves to provide ever more complex forms of health care in the community setting, it has become imperative to include surveillance of BSIs arising in that setting. This will ensure that some of the more severe forms of health care associated infection are recognised and appropriately included in prevention strategies.

The CDC’s NNIS System includes a valid and reliable definition for intravascular device associated bloodstream infection (Gaynes and Horan 1996). This has been modified by the Public Health Laboratory Services’ Nosocomial Infection National Surveillance Scheme in the United Kingdom to provide useful surveillance data on a broader group of BSIs (Glynn et al 1997).

Modifications to these definitions were made by the Australian Infection Control Association Expert Working Group to include the focus and place of acquisition of infection, the intention being to extend the reach of health care associated infection surveillance beyond hospitals.

These databases can now be used in conjunction with other microbiological databases to examine the impact of antibiotic resistance. Caution must be used with interhospital, State or national comparisons of bloodstream infection rates based on the standardised definition without adjustment for the many factors contributing to the risk of infection.

For line-associated BSIs, the definition is identical to the NNIS laboratory confirmed (primary) bloodstream infection (LCBI).

The Australian Infection Control Association Expert Working Group recognises that these definitions may often require some clinical assessment of patients. The working group believes that laboratory surveillance without clinical correlation is often too inaccurate to maintain the validity of this indicator. This view is incorporated into the recommended definitions, which cover diagnosis, place of acquisition, focus of infection, and device or procedure associated infections.

Definitions and reporting instructions for BSIs

There are four reporting categories for BSIs, which are described in detail below:

1. Diagnosis of bloodstream infection
2. Place of acquisition (health care associated/community associated/maternally acquired)
3. Focus of infection
4. Device or procedure-associated infections.

1. Diagnosis of bloodstream infection

**Criterion 1 (recognised pathogens)**

Isolation of one or more recognised bacterial or fungal pathogens from one or more blood cultures (eg *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli*, *Klebsiella* spp, *Proteus* spp, *Salmonella* spp, *Candida albicans*).

Note: Where mixed isolates are obtained with one being an accepted pathogen, the potential contaminant² organism is to be disregarded.

**Criterion 2 (potential contaminants in patients aged >1 year)**

The patient has at least one of the following signs and symptoms within 24 hours of a positive blood culture being collected:
1. fever (>38°C); or
2. chills, rigors; or
3. hypotension;

and at least one of the following:
• there is isolation of a potential contaminant from two or more blood cultures drawn on separate occasions within a 48-hour period (isolates identified by suitable microbiological techniques); or
• there is isolation of a potential contaminant from a single blood culture drawn from a patient with an intravascular line (within 48 hours of the episode) and appropriate antimicrobial therapy is commenced.

**Criterion 3 (potential contaminants in patients aged <1 year)**

The patient has at least one of the following signs and symptoms within 24 hours of a positive blood culture being collected:
1. fever (>38°C rectal); or
2. hypothermia (<37°C rectal); or
3. apnoea or bradycardia;

and at least one of the following:
• there is isolation of a potential contaminant from two or more blood cultures drawn on separate occasions within a 48-hour period; and

² Potential contaminant organisms include diphtheroids (*Corynebacterium* spp etc), coagulase-negative staphylococci, *Micrococcus* spp, *Propionibacterium* spp, *Bacillus* spp, alpha haemolytic streptococci, environmental gram-negative rods, non-pathogenic *Neisseria* spp.
Consensus numerator definitions

There is isolation of a potential contaminant from a single blood culture drawn from a patient with an intravascular line (within 48 hours of the episode) and appropriate antimicrobial therapy is commenced.

Reporting instructions

Bloodstream infection due to the same organism(s) that recurs within 14 days of the original event is disregarded.

2. Place of acquisition

Each bloodstream infection event is categorised by place of probable acquisition as follows:

A. Health care associated
B. Community associated
C. Maternally acquired.

A. Health care associated infection

Each infection event satisfies at least one of the following criteria:

- acquired during hospitalisation and not present or incubating on admission (in inpatient neonates >48 hours after delivery); or
- is a complication of the presence of an indwelling medical device (eg IV catheter, urinary catheter); or
- occurs within 30 days of a surgical procedure, where the bloodstream infection is related to the SSI; or
- an invasive instrumentation or incision related to the bloodstream infection was performed within 48 hours before onset of the infection (if the time interval was longer than 48 hours, there must be compelling evidence that the infection was related to the invasive device or procedure); or
- associated with neutropenia (fewer than 1000 neutrophils \( \times 10^6/L \) [1000 per \( \text{mm}^3 \)]) contributed to by cytotoxic therapy.

Health care associated events are subcategorised as being:

- non-inpatient associated; or
- inpatient associated.

Inpatient events are those that occur more than 48 hours after hospital admission or within 48 hours of discharge.

B. Community associated infection

These events are defined as:

- not health care associated; and
• not manifesting more than 48 hours after admission, unless an organism with a long incubation period (e.g., Salmonella Typhi) is isolated.

C. Maternally acquired infection

This type of infection is defined as an infection, in a neonate, that is acquired from the mother during delivery. Unless strong evidence suggests otherwise, an infection that appears less than 48 hours after birth is considered to be acquired from the mother.

Note: The maternally acquired infection classification may indicate either community or health care associated events. Where a neonate is born in the hospital and admitted to a neonatal intensive care unit, maternally acquired events as defined above would then be termed health care associated, consistent with the NNIS System.

3. Focus of infection

Three categories of site are recommended:

1. unknown focus, including disseminated infections;
2. line-associated bloodstream infection (refer to diagnosis of bloodstream infection, criterion 1, 2 or 3); and
3. intravascular line present within 48 hours before the event.

The organism(s) must not be related to an infection at another site.

Other suggested categories of organ site focus are:

• urinary tract
• respiratory tract
• surgical site
• intra-abdominal
• bone and joint
• hepatobiliary
• skin and soft tissue
• genital tract
• central nervous system
• head and neck
• cardiovascular
• other (specify).

Criteria for diagnosis of infection related to each site are not defined at this point. The published NNIS definitions from CDC may be used.
4. Device or procedure-associated infections

For each health care associated event where an organ site focus is identified, it may be recorded whether the occurrence of an invasive medical procedure (e.g., ERCP, arthroscopy) or presence of an indwelling medical device (e.g., CSF shunt) within 48 hours of the event was potentially significant. If the time interval was longer than 48 hours, there must be compelling evidence that infection was related to the procedure or device.
Appendix 2  Australian notifiable diseases

Nationally consistent notification of infectious diseases provides data across all Australian States and Territories. These data provide a basis for the development of public health policy, a mechanism for the development of response to communicable disease outbreaks of national significance, and basic information relating to the development and implementation of a communicable disease control policy. The following list of communicable diseases to be notified nationally was endorsed by Communicable Diseases Network Australia (CDNA) in September 2003. States and Territories will now work towards harmonisation with the national notifiable disease list. CDNA will regularly review the list, the current version of which is available at the Communicable Diseases Australia website:


Australian nationally notifiable diseases

Acquired immunodeficiency syndrome (AIDS)
Anthrax
Arbovirus infections:
- Barmah Forest virus
- Dengue virus
- Japanese encephalitis virus
- Murray Valley encephalitis virus (notified as Australian arbo-encephalitis in Victoria)
- Ross River virus
- Kunjin virus
- Flavivirus infection, unspecified or not otherwise classified
Botulism
Brucellosis
Campylobacteriosis (not notified in New South Wales)
Chlamydia
Cholera
Creutzfeldt–Jakob disease (CJD)
Cryptosporidiosis
Diphtheria
Donovanosis
Gonococcal infection
Haemolytic uraemic syndrome (HUS)
*Haemophilus influenzae* serotype b (Hib) (invasive only)
Hepatitis A
Hepatitis B:
- newly acquired
- unspecified
Hepatitis C:
- newly acquired
- unspecified
Hepatitis D
Hepatitis E
Hepatitis, not otherwise specified (not notified in Western Australia)
Human immunodeficiency virus (HIV) infection:
- newly acquired
- unspecified individuals over 18 months of age
- individuals less than 18 months of age
Influenza
Legionellosis
Leprosy (Hansens disease)
Leptospirosis
Listeriosis
Lyssavirus:
- Australian bat lyssavirus
- Rabies
- Lyssavirus unspecified
Malaria
Measles
Meningococcal disease (invasive)
Mumps
Pertussis (whooping cough)
Plague
Poliomyelitis – wild type and vaccine-associated
Pneumococcal disease (invasive)
Psittacosis (ornithosis)
Q fever
Rubella and congenital rubella syndrome
Salmonellosis
Severe acute respiratory syndrome (SARS)
Shigellosis
Shiga toxin- and verocytotoxin-producing Escherichia coli (STEC/VTEC)
Smallpox
Syphilis:
- infectious (primary, secondary and early latent) less than 2 years duration
- more than 2 years or unknown duration
- congenital syphilis
Tetanus
Tuberculosis
Tularaemia
Typhoid
Viral haemorrhagic fevers (quarantinable)
Yellow fever
Australian State/Territory notifiable communicable diseases

In addition to the list of nationally notifiable diseases, each State and Territory in Australia has its own list of notifiable diseases. The communicable diseases that are additional to those on the national register are listed below for each State/Territory. This information was current in September 2003. Please contact your local State or Territory health authority for the current list relevant to your particular State/Territory.

**Australian Capital Territory**

- Chancroid
- Hendra virus (equine morbillivirus) infection
- Food poisoning
- Giardiasis
- Lymphogranuloma venereum
- Yersiniosis

**New South Wales**

- Acute viral hepatitis
- Adverse event following immunisation
- Arbovirus infections (including alphavirus, flavivirus and bunyavirus infections)
- Acute rheumatic fever
- Chancroid
- Foodborne illness in two or more related cases
- Gastroenteritis among people of any age, in an institution (eg among persons in an educational or residential institution)
- Lymphogranuloma venereum
- Meningococcal infection (conjunctivitis)
- Typhus (epidemic)

**Northern Territory**

- Acute post-streptococcal glomerulonephritis
- Acute rheumatic fever
- Adverse event following immunisation
- Amoebiasis
- Arbovirus infections not otherwise classified
- Atypical mycobacterial disease or non-tuberculosis mycobacteria
- Chancroid
- Chlamydial conjunctivitis
- Echinococcosis (hydatid disease)
- Foodborne or waterborne disease in two or more related cases
- Gastroenteritis (with potential for an outbreak)
- Gonococcal infection (genital, neonatal and conjunctivitis)
- Hepatitis (acute viral)
Human T-cell lymphotropic virus
Lymphogranuloma venereum
Meliodosis
Rotavirus infection
Trichomoniasis
Thrombotic thrombocytopenic purpura
Typhus (all forms)
Vibrio food poisoning
Yersiniosis

Queensland
Acute flaccid paralysis
Acute rheumatic fever
Adverse event following immunisation
Alphavirus infections (all alphavirus infections, including all on national list plus getah and sindbis virus)
Atypical mycobacterial disease
Bunyavirus infections (gan gan, mapputta virus, termeil and truanaman etc)
Chancroid
Ciguatera poisoning
Cryptococcosis
Echinococcosis (hydatid disease)
Hendra virus (equine morbillivirus) infection
Flavivirus infections (including alfuy, Edge Hill, kokobera, Stratford, unspecified flavivirus etc)
Foodborne or waterborne disease in two or more related cases
Lymphogranuloma venereum
Meliodosis
Yersiniosis

South Australia
Echinococcosis (hydatid disease)
Food poisoning
Haemophilus influenzae (invasive)
Non-tuberculosis mycobacteria
Varicella–zoster infection (chickenpox and shingles)
Yersiniosis

Tasmania
Chancroid
Echinococcosis (hydatid disease)
Gastroenteritis in an institution (ie residential, educational or child care facility)
Giardiasis
Hydatid infection
Lymphogranuloma venereum
Mycobacterial infection (including atypical Mycobacterium spp)
Rickettsial infection (including Flinders Island spotted fever and others)
Suspected cases of foodborne or waterborne illness
Taeniasis
Typhus (*Rickettsia prowazekii*)
Vancomycin-resistant enterococci (VRE)
Vibrio infection
Yersiniosis

**Victoria**

Foodborne and waterborne illness (two or more cases)
Giardiasis
Paratyphoid (included as salmonellosis in the national list)

**Western Australia**

Amoebiasis
Amoebic meningitis
Chancroid
Giardiasis
Echinococcosis (hydatid disease)
Melioidosis
Methicillin-resistant *Staphylococcus aureus* (MRSA) infection
Relapsing fever
Scarlet fever
Schistosomiasis (bilharzia)
Typhus (rickettsial infection)
Yersiniosis
### Appendix 3  Australian/New Zealand Standards

Australian/New Zealand Standards™ (AS/NZS) is a registered trademark. AS/NZS are published in Australia by:

Standards Australia  
1 The Crescent  
Homebush NSW 2140  


#### Australian/New Zealand Standards

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<tr>
<td>AS 2192 (1991)</td>
<td>Sterilisers — Steam — Downward displacement</td>
</tr>
<tr>
<td>Australian /New Zealand Standard number and year</td>
<td>Title</td>
</tr>
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<td>------------------------------------------------</td>
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<tr>
<td>AS 2437 (1987) and Amendment 1 (1988)</td>
<td>Flusher/sanitisers for bed pans and urine bottles</td>
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<tr>
<td>AS 2487 (1981)</td>
<td>Dry heat sterilisers (hot air type)</td>
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<tr>
<td>AS 2610.1 (1993)</td>
<td>Spa pools — Public spas</td>
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<tr>
<td>AS 2610.2 (1993)</td>
<td>Spa pools — Private spas</td>
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<tr>
<td>AS 2773 (1998)</td>
<td>Ultrasonic cleaners for health care facilities</td>
</tr>
<tr>
<td>AS 2945 (1998)</td>
<td>Batch-type washer/disinfectors for health care facilities</td>
</tr>
<tr>
<td>AS/NZS 3666 (1995)</td>
<td>Air-handling and water systems of buildings — Microbial control</td>
</tr>
<tr>
<td>AS 3789.2 (1991) and Amendment 1 (1992)</td>
<td>Textiles for health care facilities and institutions — Theatre linen and pre-packs</td>
</tr>
<tr>
<td>AS 3789.3 (1994)</td>
<td>Textiles for health care facilities and institutions — Apparel for operating theatre staff</td>
</tr>
<tr>
<td>AS 3864 (1997) and Amendment 1 (1998)</td>
<td>Medical refrigeration equipment — For the storage of blood and blood products</td>
</tr>
<tr>
<td>AS 4031 (1992) and Amendment 1 (1996)</td>
<td>Non-reusable containers for the collection of sharp medical items used in health care areas</td>
</tr>
<tr>
<td>AS/NZS 4146 (2000)</td>
<td>Laundry practice</td>
</tr>
<tr>
<td>AS/NZS 4187 (2003)</td>
<td>Cleaning, disinfecting and sterilizing reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities</td>
</tr>
<tr>
<td>AS/NZS 4261 (1994) and Amendment 1 (1997)</td>
<td>Reusable containers for the collection of sharp items used in human and animal medical applications</td>
</tr>
<tr>
<td>AS 4381 (1996) and Amendment 1 (1997)</td>
<td>Surgical face masks</td>
</tr>
<tr>
<td>AS 4480.1 (1998)</td>
<td>Textiles for health care facilities and institutions — Medical sheepskins — Product specification and testing</td>
</tr>
<tr>
<td>AS/NZS 4815 (2001)</td>
<td>Office-based health care facilities not involved in complex patient procedures and processes — Cleaning, disinfecting and sterilising reusable and surgical instruments and equipment</td>
</tr>
</tbody>
</table>
Other standards


## Appendix 4  State and Territory chief health and medical officer contacts

<table>
<thead>
<tr>
<th>Role and Location</th>
<th>Tel</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief Medical Officer — Commonwealth of Australia</td>
<td>02 6289 8408</td>
<td>02 6289 1994</td>
</tr>
<tr>
<td>Department of Health and Ageing</td>
<td>GPO Box 9848, MDP 84</td>
<td>Canberra ACT 2600</td>
</tr>
<tr>
<td>Chief Medical Officer — New Zealand</td>
<td>0011 64 4 496 2336</td>
<td>0015 64 4 496 2340</td>
</tr>
<tr>
<td>New Zealand Ministry of Health</td>
<td>PO Box 5013 Wellington</td>
<td>NEW ZEALAND</td>
</tr>
<tr>
<td>Chief Health Officer — Australian Capital Territory</td>
<td>02 6205 5111</td>
<td>02 6205 1884</td>
</tr>
<tr>
<td>ACT Department of Health and Community Care</td>
<td>Locked Bag No 5</td>
<td>Weston Creek ACT 2601</td>
</tr>
<tr>
<td>Chief Health Officer — New South Wales</td>
<td>02 9391 9181</td>
<td>02 9391 9029</td>
</tr>
<tr>
<td>NSW Health Department</td>
<td>Locked Mail Bag 961</td>
<td>North Sydney NSW 2059</td>
</tr>
<tr>
<td>Chief Health Officer — Northern Territory</td>
<td>08 8999 2768</td>
<td>08 8999 2600</td>
</tr>
<tr>
<td>Territory Health Services</td>
<td>PO Box 40596</td>
<td>Casuarina NT 0810</td>
</tr>
<tr>
<td>Chief Health Officer — Queensland</td>
<td>07 3234 1137</td>
<td>07 3221 7535</td>
</tr>
<tr>
<td>Queensland Health Department</td>
<td>GPO Box 48</td>
<td>Brisbane QLD 4001</td>
</tr>
<tr>
<td>Chief Health Officer — South Australia</td>
<td>08 8226 6315</td>
<td>08 8226 6316</td>
</tr>
<tr>
<td>Department of Human Services</td>
<td>PO Box 6 Rundle Mall</td>
<td>Adelaide SA 5000</td>
</tr>
<tr>
<td>Chief Health Officer — Tasmania</td>
<td>03 6233 3297</td>
<td>03 6233 9392</td>
</tr>
<tr>
<td>Department of Health and Human Services</td>
<td>PO Box 125B</td>
<td>Hobart TAS 7001</td>
</tr>
<tr>
<td>Chief Health Officer — Victoria</td>
<td>03 9637 4200</td>
<td>03 9637 4250</td>
</tr>
<tr>
<td>Department of Human Services</td>
<td>GPO Box 1670N</td>
<td>Melbourne VIC 3000</td>
</tr>
<tr>
<td>Chief Health Officer — Western Australia</td>
<td>08 9222 4080</td>
<td>08 9222 4014</td>
</tr>
<tr>
<td>Health Department of Western Australia</td>
<td>189 Royal Street</td>
<td>East Perth WA 6000</td>
</tr>
</tbody>
</table>
Appendix 5  Reviewers of previous edition

Organisations

Australasian Society for Ultrasound in Medicine
The Australasian College of Sexual Health Physicians
Australian College of Midwives Incorporated
Australian Confederation of Operating Room Nurses
Australian Dental Association
Australian Health Ethics Committee
Australian Infection Control Association
Australian Medical Association Limited
Australian National Council on AIDS and Related Diseases
Australian Nursing Federation
Australian Private Hospitals Association Limited
Australian Red Cross Blood Service
Australian Society of Anaesthetists
Communicable Diseases Network Australia New Zealand (CDNANZ)
CDNANZ Nosocomial Infection Advisory Group
Consumers’ Health Forum of Australia
Dental Hygienists Association
Department of Employment, Training and Industrial Relations, Division of Workplace Healthcare and Safety
Food Science Australia
Gastroenterological Nurses Society of Australia
Gastroenterological Society of Australia
Health Department of Western Australia
Infection Control Guidelines Review Project Team, National Centre for Disease Control
Infection Control Guidelines Steering Committee
Institute of Ambulance Officers
National Association of Specialist Obstetricians and Gynaecologists
National Centre for Disease Control, Department of Health and Ageing
National Centre for Epidemiology and Population Health, Department of Health and Ageing

Pituitary Hormones Section, National Centre for Disease Control, Department of Health and Ageing
Respiratory Nurses Group
Royal Australasian College of Surgeons
The Royal Australian College of General Practitioners
Royal District Nursing Service
Royal Hospital for Women
St Johns Ambulance Australia
Standards Australia
The Transplant Society of Australia and New Zealand Inc.
Therapeutic Goods Administration Laboratories — Microbiology Section, Department of Health and Ageing
Therapeutic Goods Administration Laboratories — Blood Products Section, Department of Health and Ageing
The Thoracic Society

Individuals

Anil Patel (Queensland Health)
Colin Masters (University of Melbourne)
David Isaacs (New Children’s Hospital)
Gary Lum (Northern Territory Health)
Henry Kilham (New Children’s Hospital)
John Turnidge (Department of Microbiology, Women’s and Children’s Hospital)
Margaret Burgess (National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, The University of Sydney)
Maria Kokkinakos (Food Service Nutrition, Royal Prince Alfred Hospital, Sydney)
Peter Collignon (Canberra Hospital)
Tom Riley (Department of Microbiology, The University of Western Australia)
Yvonne Cossart (The University of Sydney)
Appendix 6  Respondents to public consultation

First public consultation (July 2000)

Organisations

ACT Department of Health, Housing and Community Care
Dr Shirley Bowen, Chief Health Officer

Aged Care Queensland Incorporated
Michael Isaac

Asthma Foundation of Victoria
Robin L. Ould, CEO

Australia and New Zealand Clinical Waste Management Industry Group Network
Pam Keating

Australian and New Zealand College of Anaesthetists
A/Professor G Knoblanche

Australian and New Zealand Society of Respiratory Science Incorporated
Maureen Swanney, President

Australian Chemical Specialties Manufacturers Association
Bronwyn Capanna, Executive Director

Australian Chemical Specialties Manufacturers Association
Geoff Harris, Technical Manager

Australian Dental Association
Robert Butler, Executive Director

Australian Dental Industry Association
Geoff Robinson, Chief Executive Officer

Australian Divisions of General Practice Limited
Dr Steve Clark, Chief Executive Officer

Australian Federation of AIDS Organisations
Robin Gorna, Executive Director

Australian General Practice Accreditation Ltd
Anne Cramer, CQI Coordinator

Australian Government Department of Health and Ageing
Dr Hector Maclean

Australian Government Department of Health and Ageing
Blood and Organ Donation Taskforce
Chris Woodgate

Australian Government Department of Health and Ageing
Australian Council for Healthcare Standards
Dr Marjorie Pawsey, Executive Manager

Australian Government Department of Health and Ageing
Therapeutic Goods Administration
Vivienne Christ and microbiology staff

Australian Government Department of Health and Ageing
Australian Drug Evaluation Committee
Helen Brown, Secretary

Australian Government Department of Health and Ageing
Public Health Laboratory Network
Professor Lyn Gilbert, Chair

Australian Government Department of Health and Ageing
Australian Health Ethics Committee
Dr Kerry Breen, Chair

Australian Infection Control Association
Ms Dolly Olesen, President

Australian Medical Association Limited
AMA Public Health and Aged Care Committee
Dr Bill Pring, Chair

Australian National Council on AIDS, Hepatitis C and Related Diseases (ANCAHRD)
Hepatitis C Committee
Professor Robert Batsey, Chair

Australian Nursing Federation (Victorian Branch)
Jeanette Sdrinis, OHS Officer

Australian Nursing Homes and Extended Care Association (NSW)
Sue Macri, Executive Director

Australian Nursing Homes and Extended Care Association Ltd
Rod Young, Chief Executive Officer

Australian Podiatry Association (NSW)
Judy Hopwood JP, Executive Director

Australian Red Cross Blood Service
Dr Joanne Pink, Director

Australian Self-Medication Industry
Juliet Seifert, Chief Executive Officer

Australian Self-Medication Industry
Zephanie Jordan, Scientific Director

Australian Society for Ultrasound in Medicine
Dr Cheryl Bass and Dr Andrew Ngu

Australian Society of Anaesthetists
Dr Rod Westhorpe, President

Centre for Eye Research Australia Limited
Dr Hector Maclean
Infection control in the health care setting

Chiropody Board of South Australia
Geraldine Treloar, Chairperson
CJD Support Group Network
Sue Byrne
Dental Practice Board of Victoria
Vincent Amerena, Registrar
Department of Human Services, Victoria
The Royal Melbourne Hospital
Professor Len Gray
Department of Human Services, Victoria
Disease Control and Research
Dr John Carnie, A/g Assistant Director
Department of Human Services, Victoria
The Alfred Hospital, Infectious Diseases Unit
Professor Steve Wesselingh, Director
Department of Infectious Diseases
The University of Sydney
Professor Yvonne Cossart
Department of Microbiology and Immunology
The University of Melbourne
Mark Veitch
Federation of Sterilising Research and Advisory Councils of Australia
Jenny Bourne, President
Gastroenterological Nurses College of Australia
Bronwyn King, President
Gastroenterological Nurses College of Australia
Di Jones, Director of Education
Health Department of Western Australia
Bunbury Health Service
Teressa Normington
Health Department of Western Australia
Philip Robins, Technical Services
Infection Control Association of South Australia Incorporated
Jude Bail, President
Michael Wishart, Vice President
Infection Control Association of Western Australia Inc
Helen Cadwallader, President
Infection Control Practitioners Association of Queensland
Alanna Geary, Chairperson
M.E.D.I.S. Chemicals
Peter Popp, Manager
Microbiological Diagnostic Unit
The University of Melbourne
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NSW Health
Central Sydney Area Health Service
Royal Prince Alfred Hospital, Food Services Department
Suzanne Kennewell and Maria Kokkinakos
NSW Health
Sydney Hospital and Sydney Eye Hospital
Sue Greig CNC, Infection Control Consultant
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David Fowler, A/g Director
NSW Health
AIDS and Infectious Diseases Unit
Sue Campbell Lloyd, A/g Director
NSW Health
Hunter Public Health Unit
Malcolm Rea
NSW Infection Control Resource Centre
The Albion Street Centre
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Pathology Department
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Podiatrists Board of Queensland
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Queensland Ambulance Service
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Division of Workplace Health and Safety
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Queensland Health
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Queensland Health
Specialised Health Services
Terry O’Brien CNC
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Communicable Diseases Unit
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Royal Australasian College of Physicians
Australasian Faculty of Public Health Medicine
Professor Charles Watson
Royal Australian and New Zealand College of Obstetricians and Gynaecologists
Dr Di Tibbits, Deputy CEO
Royal Australian College of General Practitioners
Dr Nicholas Demediuk
Royal Australasian College of Surgeons
Professor Richard West
Chair of Infection Control Advisory Committee
Royal Children’s Hospital, Melbourne
Raylee Pandur, Infection Control Consultant
Respondents to public consultation

Royal College of Nursing, Australia
Rosemary Bryant, Executive Director

Royal College of Pathologists of Australasia
Colin MacLeod, Honorary Secretary

Royal College of Pathologists of Australasia
Dr Colin MacLeod

Royal District Nursing Service
Valene Houghton CNC, Infection Control

South Australian Department of Human Services
Public and Environmental Health Service
Communicable Disease Control Branch
Dr Robert Hall, Director

South Australian Department of Human Services
Royal Adelaide Hospital
Judith Berry, Nursing Director, Operating Room Services

South Australian Department of Human Services
Daw Park Repatriation General Hospital
David Schembri

South Australian Department of Human Services
Flinders Medical Centre
A/Professor Alan Crockett

St Johns Ambulance Australia
Operations Branch Canberra
Franklin H G Bridgewater

Standards Australia
Rupert Ferdinands

Sterilising Research Advisory Council of Australia Qld Inc
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Territory Health Services
Pathology Department
Dr Gary Lum

Territory Health Services
Alice Springs Hospital
Linda Zerna CNC

Thoracic Society of Australia and New Zealand
Jo Douglass, Chair Clinical Care and Resources Subcommittee

Victorian AIDS Council
Gay Men’s Health Centre
Mark Riley, President

Whiteley Industries
Greg Whiteley, Manager

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Infection Control Consultant, Perth

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Second consultation (October 2001)

3M Australia Pty Limited
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ACT Department of Health, Housing and Community Care
Dr Shirley Bowen

The Alfred Hospital, Monash University
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Alistair Cowan

Australasian College of Dermatologists
Stephen Lee

Australasian Society for HIV Medicine
Ms Levinia Crooks

Australasian Society for Ultrasound in Medicine
Dr Caroline Hong BDS CDHA ACHSE CHE MHA FADI

Australasian Society for Ultrasound in Medicine
Dr Cheryl Bass, Chair

Australasian Society of Infectious Diseases
Robyn Middleton

Australian and New Zealand Clinical Waste Management Industry Group
Pam Keating

Australian College of Operating Room Nurses
Judith Berry

Australian Consumer and Speciality Products Association
Mr Geoff Harris

Australian Council on Healthcare Standards
Dr Majorie Pawsey

Australian Dental Association
Dr Gerard Condon, Liz Coates

Australian Dental Association
Robert J F Butler

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Dr Steve Clark

Australian Federation of AIDS Organisations
Don Baxter

Australian Infection Control Association
Ms Dolly Olesen

Australian Medical Association Limited
Dr Bill Pring

Australian National Council on AIDS, Hepatitis C and Related Diseases
Professor Robert Batey

Australian Nursing Federation
Victoria Gilmore

Australian Self-Medication Industry
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Australian Society for HIV Medicine
Larissa Trompf

The Canberra Hospital
A/Professor Peter Collignon

CJD Support Group Network
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Department of Community Services
Dr Avner Misrachi

Department of Health and Ageing
Dr Lance Sanders

Department of Health and Ageing
Lorraine Breust

Department of Health and Ageing
Louise Butkus and Alma Quick

Department of Health and Ageing
Ms Fiona Brooke

Department of Human Services
Dr Anne Mijch

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Glasgow Dental Hospital and School
Dr Andrew J Smith BDS FDS RCS PhD MRCPath

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Infection Control Association of South Australia
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Alana Geary

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Jayne Saul

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NSW Health Department
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NSW Health Department
Deborah Best

NSW Health Department
Dr Jeremy McAnulty
NSW Health Department
Dr Michael Hills

NSW Health Department
Dr Peter Hornby

NSW Health Department
Maggy Tomkins

NSW Health Department
Sue Campbell Lloyd

NSW Health Department, John Hunter Hospital
Beth Bint

NSW Health Department, Renal Medicine, Westmead Hospital
Dr Jeremy Chapman

Optometrists Association Australia
Mr Joe Chakman

Queensland Health Department
Dr Anil Patel

Queensland Health Department
Ms Ruth Hood

Queensland Health Department
Patricia Howard, Senior Inspector

Royal Australian College of General Practitioners
Dr Nicholas Demediuk

Royal Australian and New Zealand College of Obstetricians and Gynaecologists
Dr Di Tibbits

Royal Australian and New Zealand College of Obstetricians and Gynaecologists
Ann Robertson and Dr John Campbell

Territory Health Services
Dr Gary Lum

United Dental Hospital
Dr Ian Jacobi

United Dental Hospital
Joy Borgert

The University of Melbourne
Dr Andrew Daley

The University of Melbourne
Dr C W Chow

The University of New South Wales
Dr Mary-Louise McLaws

The University of New South Wales
Phyllis Heggie

The University of Queensland
Peter Brooks

The University of Sydney
Prof Michael Kidd

Whiteley Industries
Greg Whiteley

Workcover NSW
Bill Sullivan
Appendix 7  National contact information

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apodc@apodc.com.au
http://www.apodc.com.au

Australasian Society for Infectious Diseases
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Fax: 02 9252 3310
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Australasian Society for HIV Medicine
LMB 5057
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clairek@ashm.org.au
http://www.ashm.org.au

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http://www.asum.com.au

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West End QLD 4101
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Fax: 07 3846 5276
Freecall: 1300 725 334
aacma@acupuncture.org.au
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Australian Association of Neurologists
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Australian Consumer and Specialty Products Association
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Ultimo NSW 2007
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Fax: 02 9281 0366
acspa@acspa.asn.au
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Turner ACT 2612
Tel: 02 6230 7333
Fax: 02 6230 6033
acmi@acmi.org.au
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Australian Council on Healthcare Standards
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Australian Dental Association
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Australian Drug Evaluation Committee
c/- Therapeutic Goods Administration
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Fax: 02 6232 8103
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Australian Federation of AIDS Organisations
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Newtown NSW 2042
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Fax: 02 955 79867
afao@afao.org.au
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Australian Nursing Homes and Extended Care Association Ltd (NSW)
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Australian Physiotherapy Association
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national.office@physiotherapy.asn.au
http://www.physiotherapy.asn.au

Australian Podiatry Association (NSW)
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Tel: 02 9698 3751
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apoda@podiatry.asn.au
http://www.podiatry.asn.au

Australian Private Hospitals Association Ltd
PO Box 60
Deakin West ACT 2600
Tel: 02 6285 2716
Fax: 02 6285 2243
info@apha.org.au
http://www.apha.org.au

Australian Red Cross Blood Service
PO Box 10325 Adelaide Street
Brisbane QLD 4000
Tel: 07 3835 1225
Fax: 07 3835 1304
http://www.arcbs.redcross.org.au

Australian Self-Medication Industry
Private Bag 938
North Sydney NSW 2059
Tel: 02 9922 5111
Fax: 02 9959 3693
http://www.asmi.com.au

Australian Society of Anaesthetists
PO Box 600
Edgecliff NSW 2027
Tel: 02 9327 4022
Fax: 02 9327 7666
asasec@ozemail.com.au
http://www.asa.org.au

Australian Society for Microbiology
Unit 23, 20 Commercial Road
Melbourne VIC 3004
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Fax: 03 9867 8722
admin@theasm.com.au
http://www.theasm.com.au

National Blood Authority
19–23 Moore St
Turner ACT 2600
Freecall 1800 35 1000
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Fax: 02 6211 8330
nationalbloodauthority@nba.gov.au
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Centre for Eye Research Australia Limited
Locked Bag 8
East Melbourne VIC 3002
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hmaclean@ceri.unimelb.edu.au

The Chapter of Sexual Health Medicine
GPO Box 1614
Sydney NSW 2001
Tel: 02 9382 7457
Fax: 02 9382 7475
secretariat@acshp.org.au
http://www.acshp.org.au

CJD Reference Group
GPO Box 9848, MDP 14
Woden ACT 2601
Tel: Freecall 1800 802 306

Commonwealth Interdepartmental JETACAR Implementation Group (CIJIG)
GPO Box 9848, MDP 14
Canberra ACT 2601
Ph: 02 6289 8847
Fax: 02 6289 3677

Communicable Diseases Network Australia (CDNA)
previously known as CDNANZ
c/- CDNA Secretariat
GPO Box 9848, MDP 14
Canberra ACT 2601
Tel: 02 6289 7983 Fax: 02 6289 3677
cdna@health.gov.au

Consumers Health Forum of Australia
PO Box 3099
Manuka ACT 2603
Tel: 02 6273 5444
Fax: 02 6273 5888
info@chf.org.au
http://www.chf.org.au

Dental Hygienists Association of Australia Inc
GPO Box 296
Adelaide SA 5000
Tel: 0409 011 516
Federation of Sterilizing Research and Advisory Councils of Australia
PO Box 5004
Mt Gravatt East QLD
Tel: 07 3840 1063

Gastroenterological Nurses College of Australia
PO Box 483
Boronia Vic 3155
Tel: 1300 788 155
http://www.genca.org

Gastroenterological Society of Australia
145 Macquarie Street
Sydney NSW 2000
Tel: 02 9256 5454
Fax: 02 9241 4586
gesa@gesa.org.au
http://www.gesa.org.au

Inter-Govermental Committee on AIDS/HIV Hepatitis C and Related Diseases
c/– IGCAHRD Secretariat
GPO Box 9848, MDP 14
Canberra ACT 2601
Tel: 02 6289 7200
Fax: 02 6289 3677
igcahrd@health.gov.au

Medical Industry Association of Australia
PO Box 299
St Leonards NSW 1590
Tel: 02 9437 1151
Fax: 02 9437 3177
pdavis@miaa.org.au
http://www.miaa.org.au

Ministerial Advisory Committee on AIDS, Sexual Health and Hepatitis
(formerly Australian National Council on AIDS, Hepatitis C and Related Diseases [ANCAHRD])
GPO Box 9848, MDP 13
Canberra ACT 2601
Tel: 02 6289 8512
Fax: 02 6289 8098

National Centre for Immunisation Research and Surveillance
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Westmead NSW 2145
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National Centre in HIV Epidemiology and Clinical Research
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recept@ncer.unsw.edu.au
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National Health and Medical Research Council, Australian Health Ethics Committee
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National Occupational Health & Safety Commission
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liz@nrl.gov.au
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National Tuberculosis Advisory Committee
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Appendix 8  ANCAHRD Bulletin No 29

Management of exposure to blood and/or body fluids in the health care setting
MANAGEMENT OF EXPOSURE TO BLOOD/BODY FLUIDS IN A HEALTH CARE SETTING

Needlestick and Blood Accidents - This bulletin is about the management of exposure to blood or body fluids contaminated with blood, including needlestick or sharps injuries with a potential for BBV infections.

DEFINITIONS AND ABBREVIATIONS

BBV
Blood-borne viruses. In general the management of occupational exposures aims to prevent infection with HIV, HBV or HCV. However, in rare circumstances, other infections may be transmitted by occupational exposure.1

Exposed person
The person who has been exposed to blood and/or body fluids. This is assumed to be the health care worker in this document, but patients and visitors may also be exposed in health care settings.

Exposure
Contact between blood or body fluids (except sweat) from the source and non-intact skin or mucous membranes of the exposed person.

HBV  Hepatitis B Virus
HCV  Hepatitis C Virus
HCW  Health Care Worker(s)
HIV  Human Immunodeficiency Virus

Source
The person whose blood or body fluids were inoculated or splashed onto the exposed person. The source may not always be identifiable.

GUIDELINES FOR MANAGING EXPOSURES

The purpose of these guidelines is to inform policy development and clinical management of occupational exposures.

The potential for exposures should be minimised by the adoption of Standard Precautions and safe sharps handling practices. However, even where there is safe practice, some exposures may still occur, for example, through accidents, faulty equipment, or aggression.

For this reason, all health care settings should have policies and protocols in place for the management of exposures. The aim of protocols is to reduce the potential for transmission of BBV by first aid and post exposure prophylaxis (PEP) where indicated. Even where there are comprehensive national or state guidelines, local health settings need to develop local protocols to address the local situation and resources.

Policies and protocols should primarily aim to meet the needs of the exposed person, rather than the employer or health facility. Protocols should be non-punitive and simple to implement so as to encourage reporting and compliance. The immediate management including risk assessment and consideration of PEP should be considered a medical emergency in terms of timeliness and resource allocation. Protocols should ensure that the confidentiality of the exposed person is maintained.

RECOMMENDED STEPS FOLLOWING EXPOSURE

IMMEDIATE

First aid
The aim of first aid is to minimise contact with any BBV after an exposure. The exposed person should be advised to complete the following.

1. Clean the wound/site with soap and water.
2. Flush mucous membranes/conjunctiva with normal saline or water. If contact lenses are worn, remove after flushing eye and clean as usual.
3. Further management of wound dependant on nature of injury (for example, suturing, application of dressing).

There is no advantage to the use of a stronger solution than soap and water for cleaning, as some disinfectants may inhibit wound healing.

Risk assessment
After first aid, the most important step in the management process is an assessment of the severity of the exposure to determine the risk of BBV transmission. The risk assessment will determine if PEP is warranted. The risk assessment is urgent as initiation of PEP may potentially prevent a life-threatening disease. On the other hand PEP is also expensive and may have significant side effects, so an accurate risk assessment is also important.
ensuring PEP is only recommended when warranted.

Because this step is crucial to the management process, the exposed person must be immediately relieved from duty to be assessed. Supervisors must be aware of how to access a person who is able to assess risk 24 hours a day. (The initial risk assessment may be by telephone.)

In assessing whether an exposure has the potential to transmit a BBV, the following would be considered:

- type of exposure
- type of body substance
- volume of blood or body fluids
- length of time in contact with blood or body fluids
- time elapsed since exposure.

In addition, after a sharps injury:

- presence of visible blood or body substance on the device causing the injury
- type of device involved
- whether a hollow bore needle or solid sharp object
- procedure for which the device was used (for example, into a vein or artery)
- gauge of the needle or device
- time elapsed since use of device
- whether the injury was through a glove or clothing.

Risk of HIV transmission

The overall risk from a needlestick injury from a known HIV positive source has been estimated at 0.3%.

A six year retrospective study of HCW exposed to known HIV-infected blood identified the following factors as being associated with HIV transmission: deep injury, a device visibly contaminated with blood, procedures involving a needle placed directly in a vein or artery and terminal illness in the source.

Reviews of the literature show that most cases of HIV seroconversion after occupational exposure occur after percutaneous injury from a hollow bore needle (very few are related to mucocutaneous exposures) — often after venepuncture.

There have been five documented cases of occupational transmission of HIV in Australia, of which four have been in health care workers.

Risk of HBV transmission

It is important to remember that while much of the documentation on risk relates to HIV, the risk of HBV transmission to a non-immune person is much greater than for HIV. While all HCW are encouraged to take up vaccination, not all have done so and some remain non-responders to vaccination.

The risk of HBV transmission to a non-immune person from a single needlestick is more than 30% if the source is hepatitis B ‘e’ antigen positive, and less than 6% if the source is surface antigen positive, but ‘e’ antigen negative.

Risk of HCV transmission

The risk of HCV transmission from a single needlestick injury from a confirmed HCV positive source is about 1.8%, but this rose to 10% in a study where the source patients had HCV RNA in their blood (tested by PCR).

International studies of occupational transmission of HCV, suggest that the risk factors are similar to HIV – predominantly from needlestick injury with a large bore needle used for drawing blood.

Post exposure prophylaxis (PEP)

If the exposure is considered significant (i.e. able to transmit a BBV if the source were infectious) then PEP for HBV, HIV and Tetanus should be considered immediately.

HIV PEP

There is some evidence that taking Zidovudine reduces the risk of transmission of HIV after an occupational exposure. There are also documented cases of seroconversion, despite early use of Zidovudine.

Since combination therapy is now the standard of treatment for HIV, two or three antiretroviral medications should always be prescribed for PEP.

For significant exposures where the source is positive or at high risk, three antiretroviral medications, including one protease inhibitor will usually be prescribed. Which medications are used in combination will depend on current information and local protocols. If the source is known to be on anti HIV medications, the treatment history will influence the medications prescribed.

In general, HIV antiretroviral medications can only be prescribed by S100 prescribers or specialised services. This does not apply to starter packs of medications after occupational exposure. However, anyone who is commenced on HIV PEP should be referred as soon as possible to an S100 prescriber, or a physician specialising in HIV or infectious diseases.

If the exposed person elects to take PEP, it should be commenced as soon as possible. PEP may be commenced within 72 hours of exposure, but while there is no research evidence for the optimal time, it is recommended that it should be commenced within a few hours if possible.

In some settings, there may not be immediate access to all antiretroviral drugs. In this case Zidovudine or Combivir should be commenced immediately (as this should be available as a starter pack in all health facilities.) Other antiretrovirals can then be accessed as soon as possible.
The following should be discussed with the exposed person before commencing PEP:

- A detailed assessment of their risk
- HIV PEP is an experimental, not a proven, therapy
- It is a 4 week course of oral therapy
- There can be difficulties taking PEP (especially if working)
- Side effects - 30 - 40% in several studies do not complete the course due to side effects. It is important that the exposed person knows the difference between PEP side effects and seroconversion symptoms.
- It is the exposed individual's choice whether to take PEP and they can stop at any time
- The possibility of pregnancy.

It is advisable to have the exposed person sign a consent form to indicate that these factors have been discussed with them prior to commencing PEP.

If the exposed person is pregnant and the exposure is significant, the use of PEP would be strongly encouraged. If a woman seroconverts to HIV during pregnancy there is an increased risk of the child becoming infected. There is a large body of evidence demonstrating reduction in transmission from mother to child with the use of HIV prophylaxis. Many antiretroviral medications can be safely used in pregnancy. An experienced HIV physician should be consulted about the appropriate regime.

HBV PEP

If the exposed person has ever had a blood test which demonstrates HBV immunity - whether from infection or vaccination - there is no necessity for further boosters or hepatitis B immunoglobulin after a potential exposure to hepatitis B.

If the exposure is significant and the exposed person has not had demonstrated immunity to HBV, hepatitis B immunoglobulin can be given within 72 hours of exposure.

After any exposure (whether significant or not) to a non-immune person who has not been vaccinated, it is advisable to commence a course of HBV vaccination. For a full discussion on the use and doses of HBV immunoglobulin and vaccination, refer to the Australian Immunisation Handbook.7

Tetanus PEP

If the exposure involves an injury from an object which may be contaminated with soil or dust, tetanus prophylaxis should also be considered. For a full discussion on the use, types and doses of tetanus prophylaxis refer to the Australian Immunisation Handbook.7

Bites and clenched fist injuries

Human bites, clenched fist injuries (which microbiologically are equivalent to human bites) and animal bites often become infected. There is no risk of HIV, hepatitis B or hepatitis C transmission from an animal bite.

The risk of HIV infection following a human bite is minimal as the saliva in HIV-infected people has been demonstrated to contain insufficient quantities for transmission to occur. While there is the potential that other infectious diseases such as HBV, tetanus and to a lesser extent, HCV may be spread following a human bite, instances of this happening have rarely been documented.

The recommended management for bites and clenched fist injuries is thorough cleaning, debridement, elevation, immobilisation and prophylactic antibiotics. If obviously infected, a wound swab should be taken. In all cases, a patient's tetanus immunisation status must be assessed. For recommended antibiotics refer to the current edition of the Therapeutic Guidelines: Antibiotic (Australia).8

AS SOON AS POSSIBLE
(same day)

Source assessment

After a significant exposure, if information is readily available about the HIV, HBV, or HCV status of the source, this should be used to inform the decision about whether to commence PEP. However, in practice, this is rarely the case and assessing the source should not delay the commencement of PEP if the exposure warrants it.

If the source is known, but they are not known to have HIV, HBV, or HCV, and they have not had a recent negative test, they may be asked to undergo testing (with the consent of their health care provider if they are a patient). If the source is tested, they must first give informed consent after receiving pre-test counselling according to accepted guidelines. The source must also give consent as to who may be informed of the test results.

If the source refuses or is reluctant to be tested, it must be remembered that if the exposure is not significant, or if the exposed person has elected not to take PEP, knowing the status of the source – while providing epidemiological data – will not affect the immediate management of the exposed person.

Source unknown

If the source of the exposure is unidentifiable (for example, an exposure from a discarded needle), what is known about the local prevalence of BBV should be taken into account when considering PEP. This may vary by service, institution, and geographical area.9

Source HIV positive

If the source is known or found to be HIV positive, PEP is still only indicated if there has been a significant exposure. A person who is HIV positive is deemed to be infectious throughout the course of the disease, however, infectivity will be
greater if the source is terminally ill, has a high viral load or positive HIV antigen, or if they are seroconverting after recent infection with HIV.

If the source is taking or has previously taken antiretroviral medication, PEP medications for the exposed person will be adjusted so that different medications will be prescribed. This is because the virus exposed to may have some resistance to medications the source has taken.

Source HBV antigen positive

If the source is known or found to have a positive HBV antigen, and the exposed person does not have demonstrated immunity to HBV, hepatitis B immunoglobulin should be administered after a significant exposure to blood or blood-contaminated fluids. A source who is hepatitis B ‘e’ antigen positive is significantly more infectious than someone who is surface antigen positive.

Source HCV antibody positive

Although at present there are no specific PEP indicated for HCV, a paper by Jaeckel et al (2001) provides evidence that treatment with antiviral agents during the acute phase of the disease may prevent establishment of the carrier state. At the time of writing there are insufficient data on which to base specific recommendations on the place of antivirals in PEP or management of acute hepatitis C. However, if the source is known or likely to be HCV positive, regular liver function tests and the monitoring of clinical signs and symptoms should be undertaken by an infectious diseases physician or gastroenterologist, and specific therapy considered if appropriate.

Source with negative serology results

If the source has negative serology results, this does not automatically mean that they do not have a BBV. The possibility that they may be in the window period must be considered. In Australia, the window period is considered to be three months for HIV and six months for HBV and HCV. If the injury is significant, a detailed risk history should be taken from the source to determine if infection could have been acquired during that time. It must be realised that the source may be reluctant to disclose all lifestyle-related risk factors to a health care provider. It should also be remembered that if the source is in a window period, they may be at a particularly infectious stage of their disease process, even though test results are negative. If no risk can be determined it is for the exposed person to decide whether to discontinue PEP if it has been commenced.

Documentation of incident

The exposure should be documented on a standard incident or accident reporting form and reported to the employer. This documentation ensures a record for the employer and the insurer, should there be a later claim and also provides evidence for infection control or Occupational Health and Safety personnel about potentially unsafe practices, environments, or equipment.

Prevention of transmission and crisis counselling

If the exposure is considered significant, the exposed person should be advised on ways to prevent transmission of BBVs to others. This will include advice about safe sex, safe needle use, breastfeeding, blood donation and safe work practices. As this may be a stressful time for the exposed person, it is recommended that information is also provided in writing and revisited at the next appointment - for instance with test results or occupational health and safety review. Sexual partners of exposed persons should also be offered counselling on the necessity for safe sex practices until the results of follow up tests are known.

Some people find the experience of an occupational exposure very distressing and they should be given the opportunity for immediate counselling to address anxieties.

AS SOON AS POSSIBLE (within 1 week)

Baseline blood testing

Blood testing should be offered to the exposed person to provide a baseline result against which to measure future test results. If baseline testing is to include a test for HIV, standard pre-test counselling must be provided as per local guidelines before blood is drawn.

The baseline test is measuring any past exposures. Because any infection resulting from the current exposure will not be evident by routine blood testing for some time, this testing may be performed up to two weeks after the exposure. Therefore urgency is not a reason to do baseline testing without pre test counselling.

While it is preferable to do baseline testing soon after the exposure, there are reasons why this may not always be appropriate (outlined in the following section.)

Pre HIV test counselling

Because baseline testing is concerned with risks before the current exposure, questions must be asked in pre test counselling about lifestyle as well as occupational risks. It should not be assumed that HCWs are either well informed about HIV Transmission, or that they are without lifestyle risks of infection. The majority of HCW in Australia with HIV did not acquire it through their occupation. There is evidence to show that adequacy of pre-test counselling affects adjustment to being HIV positive.

Therefore it is important that someone who has the appropriate knowledge and skills provides pre test counselling for the exposed person. Testing should always be delayed until such a person is available.

It may also be argued that if the exposed person is anxious about the exposure, they
may not be able to give true informed consent immediately after the exposure. The exposed person should be given options as to where they are tested. In a small institution, it is not appropriate to discuss lifestyle risks (such as sexual and drug taking behaviours) with a colleague and testing off-site may be the preferred option. Health care facilities should explore links with local facilities to provide this service when developing policy.

Referral to specialist physician

If the exposed person commenced HIV PEP they should be referred to an HIV specialist physician – this may be a general practitioner who is an S100 prescriber, a doctor in a sexual health centre, or a specialised service in a hospital.

Support for significant others

As information about BBV exposures and transmission risks is complex, it can be difficult for the partner or family members of the exposed person to understand. This may result in pressure on a HCW to change their area of work. It may therefore be necessary to offer support and education for a partner or family member, as well as the exposed person.

FOLLOW UP

Post test counselling

Results of baseline testing must be given in person with standard post test counselling.

Occupational health and safety review

The exposure should be assessed and followed up by infection control or occupational health and safety staff. This may lead to specific training for the exposed person, or a general review of workplace practices, staffing levels, environmental safety, training requirements, equipment, etc.

Follow up blood tests

Local protocols should be followed for ongoing blood testing. The minimum requirement is to test for HIV antibodies at three months and hepatitis B and C at six months. If HIV PEP has been commenced. HIV antibodies should also be tested at six months.

There have been a few cases where seroconversion has been recorded outside this timeframe, but it is not considered necessary to adopt a more stringent testing regime than is advised for the community as a whole. Nevertheless, the treating doctor should advise the patient of this remote possibility.

Follow up testing for the source is often logistically difficult and is not necessary unless the exposed person is positive at follow up testing, or the source was thought likely to have been in the window period at the time of exposure.

OTHER PUBLISHED GUIDELINES FOR EXPOSURE MANAGEMENT

United States Guidelines


Australian State Guidelines

ACT Department of Health; Canberra Sexual Health Centre; AIDS Action Council. ACT Division of General Practice (October 2000) Post Exposure Management Guidelines

Health Department of Western Australia (September 2001) Operational Instruction 1333/00: Sharps Injury and Blood and Body Substance Exposure Protocol


Communicable Disease Unit. Public Health Services, Queensland Health (October 2001) Guidelines for the Management of Occupational and Non-Occupational Exposures to Blood and Body Fluids

REFERENCES


6. National Centre in HIV Epidemiology and Clinical Research (2001) Number of new diagnoses of HIV Infection for which exposure category was reported by sex and exposure category cumulative to December 2000. Australian HIV Surveillance Report 17(2) April: 12


MANAGEMENT OF EXPOSURE TO BLOOD/BODY FLUIDS IN A HEALTH CARE SETTING

<table>
<thead>
<tr>
<th>WHEN</th>
<th>WHAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediately after exposure</td>
<td>First aid&lt;br&gt;Relief from duty&lt;br&gt;Risk assessment&lt;br&gt;Post exposure prophylaxis (PEP)&lt;br&gt;– if significant injury</td>
</tr>
<tr>
<td>As soon as possible (same day)</td>
<td>Source assessment&lt;br&gt;Documentation of exposure&lt;br&gt;Prevention of transmission and crisis counselling</td>
</tr>
<tr>
<td>As soon as possible (within 1 week)</td>
<td>Pre HIV test counselling&lt;br&gt;Baseline serology&lt;br&gt;Referral to specialist physician&lt;br&gt;– if PEP commenced&lt;br&gt;Support of significant others</td>
</tr>
<tr>
<td>1-3 weeks</td>
<td>Post test counselling with results of baseline serology&lt;br&gt;Occupational health and safety review</td>
</tr>
<tr>
<td>3 months</td>
<td>Pre HIV test counselling&lt;br&gt;Follow up serology – HIV, HBV, HCV</td>
</tr>
<tr>
<td>6 months</td>
<td>Follow up serology – HBV, HCV&lt;br&gt;– HIV (if PEP taken)</td>
</tr>
</tbody>
</table>
Appendix 9 Variant Creutzfeldt–Jakob disease

Infection control issues regarding patients with suspected or confirmed vCJD will be incorporated into Part 6, Appendix 9 once vCJD is reported in Australia and will be available on the Department of Health and Ageing website (www.health.gov.au). If you suspect a case of vCJD, contact your local State or Territory Health Department immediately.
<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-helices</td>
<td>One of the basic shapes of a protein, like a corkscrew.</td>
</tr>
<tr>
<td>β-sheets</td>
<td>One of the basic shapes of a protein, like a ribbon.</td>
</tr>
<tr>
<td>14-3-3 protein</td>
<td>A protein released from degenerating nerve cells, used as a non-specific marker for CJD.</td>
</tr>
<tr>
<td>Additional precautions</td>
<td>Precautions required when standard precautions might not be sufficient to prevent transmission of infection. These are used for patients known or suspected to be infected or colonised by highly transmissible pathogens that can be transmitted by airborne, droplet or contact transmission, or for those patients suspected of being infectious for CJD. Additional precautions are designed to prevent transmission of infection by these agents and should be used in addition to standard precautions when transmission of infection might not be contained by using standard precautions alone (see Section 2.3). See also Airborne transmission, Droplet transmission, Contact transmission, Creutzfeldt–Jakob disease.</td>
</tr>
<tr>
<td>Airborne transmission</td>
<td>Transmission by air of infectious agents from respiratory secretions. See also Droplet transmission.</td>
</tr>
<tr>
<td>Akinetic</td>
<td>Unmoving; having lost all voluntary movement.</td>
</tr>
<tr>
<td>Allele</td>
<td>The basic unit of gene expression.</td>
</tr>
<tr>
<td>Amyloid plaques</td>
<td>Microscopic aggregates of the prion protein.</td>
</tr>
<tr>
<td>Amyloid-related diseases</td>
<td>Disorders associated with amyloid deposition.</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>A subset of antimicrobial agents that includes antibacterial agents.</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td>A chemical agent that, on application to living tissue or by systemic administration, will selectively kill or prevent growth of susceptible organisms. This definition includes antibacterials, antiprotozoals, antifungals, antiseptics and disinfectants.</td>
</tr>
<tr>
<td>Antisepsis</td>
<td>The prevention of infection by topical application of bacteriostatic agents to tissues.</td>
</tr>
<tr>
<td>Antiseptic</td>
<td>A substance that is recommended by its manufacturer for dermal application to kill microorganisms or to prevent the growth of microorganisms to a level that may cause clinical infection, and that is not represented to be suitable for internal use. [Ref: Therapeutic Goods Order 54, based on Therapeutic Goods Act and Regulations 1989]</td>
</tr>
<tr>
<td>Asepsis</td>
<td>The prevention of microbial contamination of living tissues or sterile materials by removal, exclusion or destruction of microorganisms.</td>
</tr>
<tr>
<td>Aseptic technique</td>
<td>One in which the instruments, the drapes and the gloved hands of the surgical team are sterile.</td>
</tr>
<tr>
<td>Astrocytes</td>
<td>Cells that support nerve cells.</td>
</tr>
<tr>
<td>Asymptomatic infection</td>
<td>Infection that does not display any clinical symptoms, but may still be capable of transmitting disease.</td>
</tr>
<tr>
<td>Ataxia</td>
<td>Uncoordinated movements of muscles normally under voluntary control.</td>
</tr>
</tbody>
</table>
Autonomic nervous system
Part of the peripheral nervous system controlling blood vessels and viscera; not normally under voluntary control.

Autosome
Any chromosome other than a sex chromosome; autosomes normally occur in pairs in somatic cells and singly in gametes.

Bacteriuria
The presence of bacteria in the urine with or without consequent urinary tract infection.

Beneficence
Beneficence is the obligation to maximise possible benefits and minimise possible harms. The obligation to do no harm is referred to separately as non-maleficence.

Biological indicator
A preparation of standardised bacterial spores on, or in, a carrier packaged so that the integrity of the inoculated carrier is maintained, and which is used to monitor a sterilising process.

Body substance
Includes any human bodily secretion, excluding sweat, or substance other than blood.

Bovine spongiform encephalopathy (BSE)
Also known as 'mad cow disease', a new form of TSE that emerged in the United Kingdom in 1986.

C-terminus
The carboxyl end of the amino acid chain of a protein.

Chemical indicator
Dye that can be impregnated into materials or contained within a device, and which changes colour when subjected to a sterilising process.

Cleaning
The physical removal of foreign material, for example, dust, soil, organic material such as blood, secretions, excretions and microorganisms. Cleaning physically removes rather than inactivates microorganisms. Cleaning is accomplished with water, detergents and mechanical action, and must precede disinfection and sterilisation.

Clinical contact HCWs
Health care workers who have contact with patients.

Clinical pathways
Predefined sets of provider interventions that should be achieved in a certain timeframe and address a particular diagnosis, patient problem, or procedure.

Clinical waste
Includes discarded sharps, laboratory and associated waste directly associated with specimen processing, human tissues (including material or solutions containing free-flowing blood), and animal tissue or carcases used in research. See also Related waste, General waste.

Codon
A basic unit of the gene (three-nucleotide base sequence) of DNA, which encodes a particular amino acid.

Cohort management
Management of a group of individuals infected with the same infectious agent in the same place (eg MRSA-infected patients managed in one ward).

Contact transmission
Transmission of infectious agents by person-to-person contact.

Contamination
The introduction of microorganisms or foreign matter (or both) to sterile or nonsterile materials or living tissue [Reference: AS 4187].

Creutzfeldt–Jakob disease (CJD)
A progressive neurologic disorder, one of the subacute TSEs caused by prions. Clinical features of CJD include a progressive cerebellar syndrome, including ataxia, abnormalities of gait and speech, and dementia.

Critical site
Entry or penetrations into sterile tissue, cavity or bloodstream. The instruments used must be sterile.

Decontamination
The removal of microorganisms or foreign matter (or both) from contaminated materials or living tissue.
<table>
<thead>
<tr>
<th><strong>Glossary</strong></th>
<th><strong>INFECTION CONTROL IN THE HEALTH CARE SETTING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Directed therapy</strong></td>
<td>Antimicrobial therapy selected on the basis of culture and susceptibility testing (laboratory culture or other molecular tests) of the infectious agent. Often, a narrow-spectrum agent specific for the organism can be used.</td>
</tr>
<tr>
<td><strong>Disinfectant</strong></td>
<td>A substance that is recommended by its manufacturer for application to an inanimate object to kill a range of microorganisms; and that is not represented by the manufacturer to be suitable for internal use.</td>
</tr>
<tr>
<td><strong>Disinfection</strong></td>
<td>The inactivation of nonsporing microorganisms using either thermal (heat alone, or heat and water) or chemical means. See High-level disinfection, Thermal disinfection, High-level disinfectant, Intermediate-level disinfectant and Low-level disinfectant.</td>
</tr>
<tr>
<td><strong>Dominant gene mutation</strong></td>
<td>Expressed even when the other allele is ‘normal’.</td>
</tr>
<tr>
<td><strong>DNA</strong></td>
<td>Deoxyribonucleic acid.</td>
</tr>
<tr>
<td><strong>Droplet transmission</strong></td>
<td>Transmission of infectious agents in droplets from respiratory secretions. See also Airborne transmission.</td>
</tr>
<tr>
<td><strong>Dysaesthesia</strong></td>
<td>Abnormal sensations, such as ‘pins and needles’ in fingers.</td>
</tr>
<tr>
<td><strong>Endocrine</strong></td>
<td>The hormonal system of cellular communication.</td>
</tr>
<tr>
<td><strong>Eosinophilic</strong></td>
<td>Red colour in tissue sections stained with eosin dye.</td>
</tr>
<tr>
<td><strong>Exposure-prone procedures</strong></td>
<td>A subset of ‘invasive procedures’ characterised by the potential for direct contact between the skin (usually finger or thumb) of the health care worker (HCW) and sharp surgical instruments, needles, or sharp tissues (spicules of bone or teeth) in body cavities or in poorly visualised or confined body sites (including the mouth). In the broader sense, and for the purpose of these guidelines, an exposure-prone procedure is considered to be any situation where there is a potentially high risk of transmission of bloodborne disease from HCW to patient during medical or dental procedures. See also Invasive procedures.</td>
</tr>
<tr>
<td><strong>Fatal familial insomnia (FFI)</strong></td>
<td>Fatal familial insomnia is a rapidly progressive TSE characterised by refractory insomnia, with autonomic and endocrine dysfunction. It is a genetic disorder with an autosomal dominant pattern of inheritance.</td>
</tr>
<tr>
<td><strong>General waste</strong></td>
<td>Includes other wastes that do not fall into the categories of clinical or related waste. This forms the bulk of waste generated by health care establishments and is not more of a public health risk than domestic or household waste. See also Clinical waste.</td>
</tr>
<tr>
<td><strong>Gerstmann–Sträussler–Scheinker disease (GSS)</strong></td>
<td>GSS is a TSE characterised by ataxia in the early stages and which has a much longer clinical course than CJD. Dementia and myoclonus may be absent or minimal. It is a genetic disorder with an autosomal dominant pattern of inheritance.</td>
</tr>
<tr>
<td><strong>Gliosis</strong></td>
<td>Proliferation of astrocytes in response to brain injury.</td>
</tr>
<tr>
<td><strong>Gravity displacement steam sterilisers</strong></td>
<td>Steam sterilisers designed for general decontamination and sterilisation of solutions and instruments. They function by displacing air with steam, via a port in the bottom of the chamber. See also Porous load steam sterilisers.</td>
</tr>
<tr>
<td><strong>Haemovigilance</strong></td>
<td>A surveillance system for monitoring and analysing transfusion hazards of blood and plasma products in order to improve the safety of the transfusion process.</td>
</tr>
<tr>
<td><strong>Hazard</strong></td>
<td>An agent (biological, chemical or physical) that has the potential to cause harm.</td>
</tr>
<tr>
<td><strong>Health care associated infection</strong></td>
<td>Infection contracted as a result of health care. Includes iatrogenic infections resulting from medical procedures and nosocomial infections resulting from the patient’s presence in a health care establishment.</td>
</tr>
</tbody>
</table>
Health care environment  Includes all environmental surfaces, including furnishings and fittings, and supplied services such as air and water. Other fixed services such as piped gases should also be considered part of the environment.

Health care establishments  The centres that deliver health care services on a commercial or public health basis (eg hospitals, general practice, dentistry, community-based office practices, day-surgery centres, domiciliary nursing services, alternative health providers, and other community services such as needle exchanges).

Health care setting  The setting within which health care is provided (eg acute care, long-term care, office practice, community care). See Health care establishments and Office practice.

Health care workers  Refers to all health care professionals, including students and trainees, and employees of health care establishments, who have contact with patients or with blood or body substances from patients.

High infectivity  Relates to the predicted infectivity of human tissues and fluids for CJD. High-infectivity sites are those sites demonstrated to be consistently infectious.

High-level disinfectant  A disinfectant that kills all microbial pathogens, except large numbers of bacterial endospores, when used as recommended by its manufacturer. The specified exposure time is generally shorter than the time required to achieve sterilisation with the same formulation. High-level disinfectants used in Australia must comply with Therapeutic Goods Order 54 — Standard for composition, packaging, labelling and performance of disinfectants and sterilants.

High-level disinfection  The minimum treatment recommended for reprocessing a device or item of equipment for use in a semicritical site, if it cannot be sterilised.

Holding time  For sterilisation by steam under pressure or by dry heat, the holding time is the minimum time for which the load must be held at the selected sterilising temperature.

Homozygosity  Having identical genes at one or more loci.

Hydrolyse  Chemical or enzymatic cleavage of proteins into amino acids.

Iatrogenic infection  See Health care associated infection.

Immunoassays  Immunologic techniques used to measure proteins.

Immunocompromised patients  People whose immune system is not functioning normally because of an immunodeficiency disorder or other disease, or as the result of the administration of immunosuppressive drugs or radiation.

Incubation period  The time that elapses between infection and the appearance of symptoms of a disease.

Indwelling devices  Medical devices that remain in the body, such as intravascular catheters or urethral catheters.

Information Privacy Principles  Standards established under the Privacy Act 1988, for the handling of personal information collected by Australian Government and ACT public sector agencies.

Informed and voluntary consent  A voluntary decision is one made without undue pressure, and without coercion, force, or persuasion against one’s will.

Intermediate-level disinfectant  A disinfectant that kills all microbial pathogens except bacterial endospores when used as recommended by the manufacturer. It is bactericidal, tuberculocidal, fungicidal against asexual spores (but not necessarily dried chlamydospores or sexual spores), and virucidal.
<table>
<thead>
<tr>
<th><strong>Invasive procedure</strong></th>
<th>Any procedure that pierces skin or mucous membrane or enters a body cavity or organ. This includes surgical entry into tissues, cavities or organs, or repair of traumatic injuries. See also Exposure-prone procedures.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Isoforms</strong></td>
<td>Identical or closely related forms of proteins.</td>
</tr>
<tr>
<td><strong>Kuru</strong></td>
<td>A TSE that occurred as an epidemic among the Fore people of the Eastern Highlands of Papua New Guinea.</td>
</tr>
<tr>
<td><strong>Latent infection</strong></td>
<td>Infection that is not clinically apparent or is hidden. See also Asymptomatic infection.</td>
</tr>
<tr>
<td><strong>Lookback investigation</strong></td>
<td>The process of identifying, tracing, recalling, counselling and testing patients or HCWs who may have been exposed to an infection, usually a bloodborne virus, due to a breakdown in infection control procedure or protocols.</td>
</tr>
<tr>
<td><strong>Low infectivity</strong></td>
<td>Relates to the predicted infectivity of human tissues and fluids for CJD. Low-infectivity sites are those sites demonstrated to be infectious, but not consistently.</td>
</tr>
<tr>
<td><strong>Low-level disinfectant</strong></td>
<td>A disinfectant that rapidly kills most vegetative bacteria, as well as medium-sized lipid-containing viruses, when used according to labelling. It cannot be relied upon to destroy, within a practical period, bacterial endospores, mycobacteria, fungi or all small nonlipid viruses.</td>
</tr>
<tr>
<td><strong>Medical device</strong></td>
<td>Any instrument, apparatus, appliance, material or other article, whether used alone or in combination (including the software necessary for its proper application), intended by the manufacturer to be used for human beings for the purposes of: * diagnosis, prevention, monitoring, treatment or alleviation of disease; * diagnosis, prevention, monitoring, treatment or alleviation of or compensation for an injury or handicap; * investigation, replacement or modification of the anatomy or of a physiological process; or * control of conception and which does not achieve its primary intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means.</td>
</tr>
<tr>
<td><strong>Microglia</strong></td>
<td>Brain cells that react to injury.</td>
</tr>
<tr>
<td><strong>Mutism</strong></td>
<td>Speechlessness; inability to speak voluntarily.</td>
</tr>
<tr>
<td><strong>Myoclonus</strong></td>
<td>Abnormal jerking movements of muscles.</td>
</tr>
<tr>
<td><strong>NaOH</strong></td>
<td>Sodium hydroxide, caustic soda.</td>
</tr>
<tr>
<td><strong>National Privacy Principles</strong></td>
<td>Standards established under the Privacy Act 1988, for the handling of personal information collected by private sector organisations.</td>
</tr>
<tr>
<td><strong>Needle exchange</strong></td>
<td>Program for the exchange of syringes to reduce the risk of bloodborne virus infection associated with sharing them, most often community-based.</td>
</tr>
<tr>
<td><strong>Needlestick injury</strong></td>
<td>Percutaneous injury with any sharps designed for use in health care that may potentially transmit infectious agents, and particularly bloodborne viruses. Sharps may or may not have been used on a patient. See also Sharps.</td>
</tr>
<tr>
<td><strong>Negative pressure</strong></td>
<td>Used to denote airflow that is negative in relation to surrounding air pressure; that is, air flows in from the surrounding area. Usually created by mechanical airflow devices (eg exhaust fans).</td>
</tr>
<tr>
<td><strong>Neuronal dendrites</strong></td>
<td>Fine branches of nerve cells that receive incoming signals.</td>
</tr>
<tr>
<td><strong>Neutropenic patient</strong></td>
<td>A patient who has a very low neutrophil (white cell) count in the blood and is at high risk of bacterial infection.</td>
</tr>
</tbody>
</table>
**Non-maleficence**
See Beneficence.

**Nonclinical contact HCWs**
HCWs who do not have clinical contact with patients.

**Noncritical site**
Body site with intact skin. Instruments should be cleaned and disinfected if necessary.

**Nosocomial infection**
See Health care associated infection.

**Notifiable disease**
Disease or condition that, by law, must be notified to State/Territory health department.

**Nucleic acids**
The building blocks of genes.

**Occupationally-acquired infection**
Infection acquired as a result of a work-related injury or exposure.

**Office practice**
The provision of health care services in sites outside routine hospital inpatient and operating theatre settings; such sites include private consulting rooms, health clinics (including mobile health clinics), ambulatory day-care centres and outpatient departments. See also Health care establishments.

**Pasteurisation**
In the context of this guideline, a thermal disinfection process using hot water at a temperature of 75°C for a contact time of at least 30 minutes.

**Patient**
Includes (but is not limited to) a person who is accessing medical or health services, or who is undergoing any medical or health care procedure.

**Pedigree**
Used in genetics to analyse inheritance.

**Penetration time**
For sterilisation by steam under pressure or by dry heat, the time required for every part of a load to reach the selected sterilising temperature after that temperature has been reached in the sterilising chamber.

**Percutaneous**
Through the skin, as in an injection or piercing.

**Porous load steam sterilisers**
Steam sterilisers optimised for sterilisation of clean instruments, gowns, drapes, towelling and other dry materials required for surgery. In such sterilisers, air is exhausted by a mechanical pump, which creates a vacuum that is replaced by steam. They are not suitable for liquid sterilisation. See also Gravity displacement steam sterilisers.

**Prion**
The small proteinaceous infectious unit that appears to cause TSEs.

**Privacy Principles**
See Information Privacy Principles and National Privacy Principles.

**PrPC**
The normal isoform of the prion protein.

**PrPSc**
The abnormal isoform of the prion protein; infectious agent in TSEs.

**Pyramidal/extrapyramidal dysfunction**
Disease of motor tracts in brain and spinal cord leading to defective or abnormal movements.

**Recessive genetic mutation**
Mutation expressed only when present on both loci in the same individual.

**Related waste**
Related waste includes cytotoxic waste, pharmaceutical waste, chemical waste and radioactive waste. See also Clinical waste, General waste.

**Reprocessing**
All steps necessary to make a contaminated reusable medical device ready for its intended use. These steps may include cleaning, functional testing, packaging, labelling, disinfection and sterilisation. [References: AS/ANZ 4815 and AS 4187].

**Respiratory isolation room**
A single room with an ensuite, engineered such that the interior of the room can be made to be at a negative pressure with respect to the corridor, so that air from the room is not recirculated into other areas within the facility.
Reusable item
An item designated or intended by the manufacturer to be suitable for reprocessing and reuse.

Risk analysis
A process for assessing the risk posed by an identified hazard, managing (minimising) the risk and communicating risk information to all stakeholders (includes risk assessment, risk management and risk communication).

Semicritical site
Contact with intact mucosa or nonintact skin. Instruments should be sterilised where possible, or high-level disinfected.

Sharps
Any objects capable of inflicting penetrating injury, including needles, scalpel blades, wires, trocars, auto lancets, stitch cutters and broken glassware.

Single room
Room for accommodation of one patient only. May or may not have adjacent ensuite bathroom.

Single-use equipment
Equipment designated by the manufacturer for single use or single-patient use only.

Skin disinfectant
An antiseptic that is intended for application to intact, healthy skin to prevent the transmission of transient or resident skin bacteria from person to person or from a surgical operation site to underlying tissue. Skin disinfectants include antimicrobial and antiseptic soaps, hygienic handwashes, hygienic hand rubs, surgical hand rubs and surgical handwashes.

Soil
Visible dirt or debris that may protect, harbour or assist the growth of microorganisms. Includes organic matter, organic substances, residual soil, inorganic matter, blood and body substances.

Standard precautions
Work practices required for the basic level of infection control. Standard precautions are recommended for the treatment and care of all patients, and apply to all body fluids, secretions and excretions (excluding sweat), regardless of whether they contain visible blood (and including dried body substances such as dried blood or saliva), nonintact skin and mucous membranes. Standard precautions include good hygiene practices, particularly washing and drying hands before and after patient contact; use of protective barriers (including gloves, gowns, plastic aprons, masks, eye shields or goggles), appropriate handling and disposal of sharps and other contaminated or infectious waste, and the use of aseptic technique. See also Additional precautions.

Sterilant
A chemical agent, other than a gas, which is used to sterilise critical medical devices.

Sterile operating field
An area specifically designed to be free from microorganisms, as used for performing invasive procedures. See also Asepsis, Aseptic technique.

Sterilisation
Complete destruction of all microorganisms, including spores.

Sterilisation time
The total time of the sterilisation stage after the sterilising chamber has reached the sterilising temperature (penetration time plus holding time).

Sterility assurance level
The acceptable sterility assurance level for a terminally sterilised product is one in one million. This means that of a million products being sterilised by the same method, you may statistically expect one to be unsterile.

Therapeutic devices
Medical devices used for the purpose of treatment or medical therapy; specifically, for the purpose of this document, devices that may be left indwelling and may provide an infection hazard.

Thermal disinfection
Disinfection achieved by the action of moist or dry heat. [Reference: prEN ISO 15883-1:1999].

Transmissible spongiform encephalopathies (TSEs)
TSEs are rare, fatal neurodegenerative disorders that occur in a wide variety of animals, including humans.

Triphasic
Characteristic shape of brain waves in CJD.
**Universal precautions**  Term previously applied to work practices that required everyone to assume that all blood and body substances are potential sources of infection, independent of perceived risk. The terms ‘standard precautions’ and ‘additional precautions’ are used in these guidelines, replacing the term ‘universal precautions’. See *Standard precautions*.

**Vacuoles**  Microscopic spaces or holes among nerve cells; characteristic features of TSEs.

**Validation**  Documented procedure for obtaining, recording and interpreting the results required to establish that a process will consistently yield a product complying with predetermined specifications. Validation broadly encompasses three activities — commissioning, verification of a process specification and performance qualification. [Reference: AS 4187 and AS/ANZ 4815].

**Window period**  The period immediately after a person is infected with an agent, during which the infection is not detectable by laboratory tests, although the person may be infectious. See also *Asymptomatic infection*. 

Recinded
### Abbreviations and acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADEC</td>
<td>Australian Drug Evaluation Committee</td>
</tr>
<tr>
<td>AHMAC</td>
<td>Australian Health Ministers’ Advisory Council</td>
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<tr>
<td>AICA</td>
<td>Australian Infection Control Association</td>
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<tr>
<td>AIDS</td>
<td>acquired immune deficiency syndrome</td>
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<tr>
<td>AMA</td>
<td>Australian Medical Association</td>
</tr>
<tr>
<td>ANCA</td>
<td>Australian National Council on AIDS</td>
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<tr>
<td>ANCAHRD</td>
<td>Australian National Council on AIDS, Hepatitis C and Related Diseases</td>
</tr>
<tr>
<td>ANZFA</td>
<td>Australia New Zealand Food Authority</td>
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<td>AQIS</td>
<td>Australian Quarantine and Inspection Service</td>
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<tr>
<td>ARCBS</td>
<td>Australian Red Cross Blood Service</td>
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<tr>
<td>ARTG</td>
<td>Australian Register of Therapeutic Goods</td>
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<tr>
<td>AS</td>
<td>Australian Standard</td>
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<tr>
<td>AS/NZS</td>
<td>Australian Standard/New Zealand Standard</td>
</tr>
<tr>
<td>AUST L</td>
<td>medicines or devices listed on the ARTG</td>
</tr>
<tr>
<td>AUST R</td>
<td>medicines or devices registered on the ARTG</td>
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<tr>
<td>AZT</td>
<td>azidothymidine</td>
</tr>
<tr>
<td>BCG</td>
<td>Bacille Calmette–Guerin (vaccine)</td>
</tr>
<tr>
<td>BSE</td>
<td>bovine spongiform encephalopathy</td>
</tr>
<tr>
<td>BSI</td>
<td>bloodstream infection</td>
</tr>
<tr>
<td>CAUTI</td>
<td>catheter-associated urinary tract infection</td>
</tr>
<tr>
<td>cCJD</td>
<td>classical Creutzfeldt–Jakob disease</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention (United States)</td>
</tr>
<tr>
<td>CDNA</td>
<td>Communicable Diseases Network Australia</td>
</tr>
<tr>
<td>CDNANZ</td>
<td>Communicable Diseases Network Australia New Zealand (now known as CDNA)</td>
</tr>
<tr>
<td>CFU</td>
<td>colony forming unit</td>
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<tr>
<td>CJD</td>
<td>Creutzfeldt–Jakob disease</td>
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<tr>
<td>CMV</td>
<td>cytomegalovirus</td>
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<tr>
<td>CNS</td>
<td>central nervous system</td>
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<tr>
<td>CQO</td>
<td>chief quarantine officer</td>
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<tr>
<td>CSF</td>
<td>cerebrospinal fluid</td>
</tr>
<tr>
<td>CT</td>
<td>computerised tomography</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>CVC</td>
<td>central venous catheter</td>
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<tr>
<td>ddC</td>
<td>dideoxycytidine</td>
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<tr>
<td>ddl</td>
<td>dideoxyinosine</td>
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<tr>
<td>DHA</td>
<td>Department of Health and Ageing</td>
</tr>
<tr>
<td>DNA</td>
<td>deoxyribonucleic acid</td>
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<tr>
<td>EBV</td>
<td>Epstein–Barr virus</td>
</tr>
<tr>
<td>EEG</td>
<td>electroencephalograph</td>
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<tr>
<td>ELISA</td>
<td>enzyme-linked immunosorbent assay</td>
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<tr>
<td>EMEA</td>
<td>European Medicines Evaluation Agency</td>
</tr>
<tr>
<td>EMG</td>
<td>electromyography</td>
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<tr>
<td>EO</td>
<td>ethylene oxide</td>
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<tr>
<td>ERCP</td>
<td>endoscopic retrograde cholangiopancreatography</td>
</tr>
<tr>
<td>ESBL</td>
<td>extended spectrum beta-lactamase producing bacteria</td>
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<tr>
<td>FDA</td>
<td>Food and Drug Administration (United States)</td>
</tr>
<tr>
<td>FFI</td>
<td>fatal familial insomnia</td>
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<tr>
<td>FSE</td>
<td>feline spongiform encephalopathy</td>
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<tr>
<td>GENCA</td>
<td>Gastroenterological Nurses College of Australia</td>
</tr>
<tr>
<td>GESA</td>
<td>Gastroenterological Society of Australia</td>
</tr>
<tr>
<td>GMP</td>
<td>good manufacturing practice</td>
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<tr>
<td>GSS</td>
<td>Gerstmann–Sträussler–Scheinker disease</td>
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<tr>
<td>HACCP</td>
<td>hazard analysis critical control point</td>
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<tr>
<td>HAV</td>
<td>hepatitis A virus</td>
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<tr>
<td>HBcAb</td>
<td>HBV core antibody</td>
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<tr>
<td>HBeAg</td>
<td>HBV ‘e’ antigen</td>
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<tr>
<td>HBIG</td>
<td>HBV immunoglobulin</td>
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<tr>
<td>HBsAg</td>
<td>HBV surface antigen</td>
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<tr>
<td>HBV</td>
<td>hepatitis B virus</td>
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<tr>
<td>HCV</td>
<td>hepatitis C virus</td>
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<tr>
<td>HCVAb</td>
<td>hepatitis C virus antibody</td>
</tr>
<tr>
<td>HCWs</td>
<td>health care workers</td>
</tr>
<tr>
<td>HEPA</td>
<td>high-efficiency particle arrest</td>
</tr>
<tr>
<td>HICPAC</td>
<td>Hospital Infection Control Practices Advisory Committee (United States)</td>
</tr>
<tr>
<td>HIV</td>
<td>human immunodeficiency virus</td>
</tr>
<tr>
<td>HPP</td>
<td>hydrogen peroxide plasma</td>
</tr>
<tr>
<td>HSV</td>
<td>herpes simplex virus (HSV1 and HSV2)</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>ICG</td>
<td>Infection Control Guidelines for the Prevention of Transmission of Infectious Diseases in the Health Care Setting (this publication)</td>
</tr>
<tr>
<td>ICGSC</td>
<td>Infection Control Guidelines Steering Committee</td>
</tr>
<tr>
<td>ICP</td>
<td>infection control practitioner</td>
</tr>
<tr>
<td>IgG/IgM</td>
<td>immunoglobulins</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>IV</td>
<td>intravenous</td>
</tr>
<tr>
<td>JETACAR</td>
<td>Joint Expert Technical Advisory Committee on Antibiotic Resistance</td>
</tr>
<tr>
<td>LCBI</td>
<td>laboratory confirmed bloodstream infection</td>
</tr>
<tr>
<td>LTCE</td>
<td>long-term care establishment</td>
</tr>
<tr>
<td>MB</td>
<td>methylene blue</td>
</tr>
<tr>
<td>MDI</td>
<td>metered-dose inhaler</td>
</tr>
<tr>
<td>MDR-TB</td>
<td>multidrug-resistant tuberculosis</td>
</tr>
<tr>
<td>MMR</td>
<td>measles–mumps–rubella (vaccine)</td>
</tr>
<tr>
<td>MRI</td>
<td>magnetic resonance imaging</td>
</tr>
<tr>
<td>MRSA</td>
<td>methicillin-resistant <em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td>NAT</td>
<td>nucleic acid amplification testing</td>
</tr>
<tr>
<td>NCDC</td>
<td>National Centre for Disease Control (Australia)</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NIGH</td>
<td>normal immunoglobulin (human)</td>
</tr>
<tr>
<td>NNIS</td>
<td>National Nosocomial Infections Surveillance (system)</td>
</tr>
<tr>
<td>OHS</td>
<td>occupational health and safety</td>
</tr>
<tr>
<td>PAA</td>
<td>peracetic acid</td>
</tr>
<tr>
<td>PCR</td>
<td>polymerase chain reaction</td>
</tr>
<tr>
<td>PEP</td>
<td>postexposure prophylaxis</td>
</tr>
<tr>
<td>PICC</td>
<td>peripherally inserted central catheter</td>
</tr>
<tr>
<td>PPE</td>
<td>personal protective equipment.</td>
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<tr>
<td>PRNP</td>
<td>prion protein gene</td>
</tr>
<tr>
<td>PrP</td>
<td>prion protein</td>
</tr>
<tr>
<td>RSV</td>
<td>respiratory syncytial virus</td>
</tr>
<tr>
<td>SAL</td>
<td>sterility assurance level</td>
</tr>
<tr>
<td>SARS</td>
<td>severe acute respiratory syndrome</td>
</tr>
<tr>
<td>SD</td>
<td>solvent–detergent</td>
</tr>
<tr>
<td>SECTSE</td>
<td>Special Expert Committee on Transmissible Spongiform Encephalopathies (NHMRC)</td>
</tr>
<tr>
<td>SSI</td>
<td>surgical site infection</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>SSU</td>
<td>sterilisation service/supply unit</td>
</tr>
<tr>
<td>TB</td>
<td>tuberculosis</td>
</tr>
<tr>
<td>Td</td>
<td>adsorbed diphtheria tetanus vaccine — adult formulation</td>
</tr>
<tr>
<td>TGA</td>
<td>Therapeutic Goods Administration (Australia)</td>
</tr>
<tr>
<td>TIG</td>
<td>tetanus immunoglobulin</td>
</tr>
<tr>
<td>TSE</td>
<td>transmissible spongiform encephalopathy</td>
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<tr>
<td>TSEAC</td>
<td>Transmissible Spongiform Encephalopathies Advisory Committee (United States)</td>
</tr>
<tr>
<td>vCJD</td>
<td>variant Creutzfeldt–Jakob disease</td>
</tr>
<tr>
<td>VHF</td>
<td>viral haemorrhagic fever</td>
</tr>
<tr>
<td>VRE</td>
<td>vancomycin-resistant enterococci</td>
</tr>
<tr>
<td>VZV</td>
<td>varicella–zoster virus (chickenpox and shingles)</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>ZDV</td>
<td>zidovudine</td>
</tr>
<tr>
<td>ZIG</td>
<td>varicella–zoster immunoglobulin</td>
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