

Infection Prevention and Control Workbook



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Introduction

The role of the Australian Commission on Safety and Quality in Health Care (the Commission) is to lead and coordinate national improvements in the safety and quality of health care. Infection prevention and control is a key area in which the Commission works to improve care standards and patient outcomes through the implementation of evidence-based health care. This Workbook and the accompanying online modules have been developed to support this work and develop healthcare worker's knowledge, understanding and implementation of the principles of infection prevention and control in the Australian healthcare setting.

The workbook supports the online learning module content with the provision of additional information to support the learning experience.

The workbook includes:

- A glossary of terms
- Examples
- Forms
- Bibliographical information, and
- More detailed information for some topics.

The material in the online module refers to the workbook where relevant.

This workbook is not a substitute for national, state, territory or local guidelines, and policies. These documents should always be referred to when implementing any infection prevention and control programs.

The key resource for the online learning modules and the workbook is the *Australian Guidelines for the Prevention and Control of Infection in Healthcare (current edition)* <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>.

Module 1 Principles of infection prevention and control

The online module provides:

- An understanding of how healthcare-associated infections occur
- An understanding of the difference between infection and colonisation
- An outline of what standard precautions include
- An outline of when transmission-based precautions should be implemented
- An overview of state and national organisations that provide membership, information and support on infection control issues.

Standard precautions

Standard precautions are work practices that provide a first-line approach to infection prevention in the healthcare environment. They should be adopted by all healthcare workers.

These precautions apply to all patients, regardless of suspected or confirmed infection status, in any healthcare setting. They are used to reduce or prevent the transmission of infectious agents and to render and maintain objects and healthcare areas as free as possible from infectious agents.

Standard precautions include:

- Hand hygiene
- Personal protective equipment (PPE)
- Sharps handling and disposal
- Cleaning of shared patient equipment
- Use of aseptic technique.
- Respiratory hygiene and cough etiquette
- Routine environmental cleaning
- Safe handling and disposal of waste and used linen safely

Hand hygiene

Prevention of healthcare-associated infections (HAIs) is a priority for the Commission. Healthcare-associated infections are one of the most common preventable complications affecting patients. Improved healthcare worker hand hygiene is an important priority to reduce the risk of HAIs. The National Hand Hygiene Initiative (NHHI) is based on the World Health Organization's (WHO) Clean Care is Safer Care program.

Reliable indicators of hand hygiene compliance are important components of the national hand hygiene initiative, as are mechanisms for effective implementation and monitoring of continued improvements against benchmarks. [The National Safety and Quality Health Service \(NSQHS\) Standards: Preventing and Controlling Healthcare Associated Infection](#) Standard aims to reduce the risk of patients acquiring these infections. This Standard includes a number of actions to promote effective infection prevention and control, including a hand hygiene program that is consistent with the NHHI and jurisdictional requirements. Hand hygiene is a key infection prevention and control measure discussed throughout this module.

The National Hand Hygiene Initiative (NHHI)

The Commission works closely with state and territory hand hygiene programs to achieve overall improvements in hand hygiene.

5 Moments for Hand Hygiene are the 5 critical points in the provision of health care where compliance with hand hygiene is required for the safety of the patient and/or the healthcare worker.



Image1: 5 Moments for Hand Hygiene: Source: Hand Hygiene Australia (accessed June 2019)

To learn more about the NHHI, click [here](#) to the NHHI website, which also has more information on:

- The 5 Moments for Hand Hygiene
- Hand hygiene auditing manual
- Alcohol-based hand rubs (ABHR) – including the characteristics for ABHR and placement of product
- Hand care issues
- Resources for healthcare workers
- Data entry tools
- Hand hygiene data
- Audit information, and
- Online learning packages

Examples of evidence supporting practice:

- World Health Organization (2012). Hand Hygiene in Outpatient and Home-based Care and Long-term Care Facilities: A Guide to the Application of the WHO Multimodal Hand Hygiene Improvement Strategy and the "My Five Moments for Hand Hygiene" Approach. Geneva, World Health Organization. Access [here](#)
- World Health Organisation (2009). WHO Guidelines on Hand Hygiene in Health Care. First Global Patient Safety Challenge Clean Care is Safer Care. World Alliance for Patient Safety. Geneva, World Health Organisation Press. Access [here](#)
- Centers for Disease Control and Prevention, Hand Hygiene in Healthcare Settings, a suite of resources, last updated 3 May 2018.

- Access [here](#)
- Boyce JM & Pittet D, Guideline for hand hygiene in health-care settings: Recommendations for the healthcare infection control practices advisory committee and the HICPAC/SHEA/IDSA hand hygiene taskforce, *Infection Control and Hospital Epidemiology*, Volume 23, No 12 (suppl), December 2002. Access [here](#)

Personal protective equipment

Putting on and removing personal protective equipment (PPE)

Healthcare workers should follow the sequence for putting on and removing PPE (see Tables 1 and 3). Take care to perform hand hygiene before putting on PPE and between each step when removing PPE, especially before touching the face.

For the details of putting on and removing PPE, refer to the following resources

- *NHMRC Australian Guidelines for the Prevention and Control of Infection in Healthcare* (current edition) –<https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>
- Tasmanian Government infection prevention and control [PPE demonstration videos](#) for additional information on how to put on and remove PPE for standard and transmission-based precautions. Access [here](#)

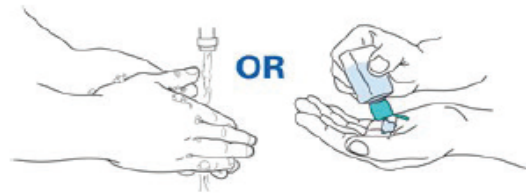
Clinical and laboratory coats or jackets worn over personal clothing for comfort and/or purposes of identity of the person or position are not considered to be PPE. These items of clothing need to be changed dependent on activity and the extent of exposure to potential pathogens.

SEQUENCE FOR PUTTING ON PPE

Put on PPE before patient contact and generally before entering the patient room

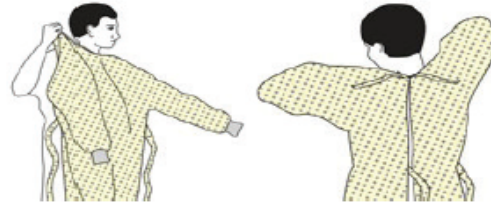
HAND HYGIENE

- Wash hands or use an alcohol based hand rub.



GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back.
- Fasten at the back of neck and waist.



MASK

- Secure ties or elastic bands at middle of head and neck.



PROTECTIVE EYEWEAR OR FACE SHIELD

- Place over face and eyes and adjust to fit.



GLOVES

- Extend to cover wrist of isolation gown.

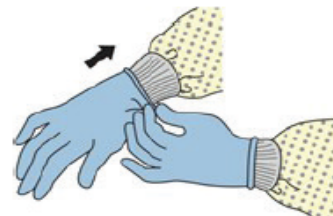


Table 1: Sequence of putting on PPE. Source: Australian Guidelines for the Prevention and Control of Infection in Healthcare, Section 3.3 PPE (2019) <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Removing aprons and gowns

Apron and gowns should be removed in a manner which avoids contaminating clothes or skin. This can be done by pulling from shoulders and turning gown inward, rolling it into a bundle for disposal or, if reusable, laundering.

Type	Recommended use	Characteristics
Plastic apron	Worn for general use when there is the possibility of sprays or spills or exposure to blood or body substances during low-risk procedures ^{[57][208]} . Worn during contact precautions when patient contact is likely.	<ul style="list-style-type: none"> • Fluid impervious • Single-use, for one procedure or episode of patient care • Disposable
Gown	Worn to protect the healthcare worker's exposed body areas and prevent contamination of clothing with blood, body substances, and other potentially infectious material ^{[176][186][191][211]} .	<ul style="list-style-type: none"> • Fluid impervious • Single-use • Disposable • Choice of sleeve length depends on the procedure being undertaken, the extent of risk of exposure of the healthcare worker's arms, the volume of body substances likely to be encountered, and the probable time and route of transmission of infectious agents
Full body gown	Worn when there is a risk of contact of the healthcare worker's skin with a patient's broken skin, extensive skin to skin contact (e.g. lifting a patient with scabies), or a risk of contact with bloody and body substances which are not contained (e.g. vomiting). Worn when there is the possibility of extensive splashing of bloody and body substances or there is a risk of exposure to large amounts of body substances (e.g. in some operative procedures).	<ul style="list-style-type: none"> • Fluid impervious • Single-use • Long sleeved so clothing and exposed upper body areas are protected • Always worn in combination with gloves and other PPE where indicated
Sterile gown	Worn for procedures that require an aseptic field	<ul style="list-style-type: none"> • Pre-packaged

Table 2: Characteristics of aprons and gowns that will assist with risk assessing use and application in clinical settings. Source: Australian Guidelines for the Prevention and Control of Infection in Healthcare, Section 3.2.2 (2019) <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Note: Some types of gowns are designed to be re-used. When used, these gowns should be used for one procedure or patient care episode. These gowns need to be laundered or reprocessed according to **AS/NZS4146 (2000)** — Laundry Practice.

Removing and cleaning reusable face and eye protection

Only touch the back of the mask, goggles or face shield when removing. The front is considered contaminated and, if reusable, should not be touched with bare hands prior to cleaning.

Changing and removing gloves

Gloves should be used when there is anticipated contact with blood and body substances as a key part of standard precautions. Gloves should be changed when performing multiple tasks with the same patient as part of standard and contact precautions. To minimise transmission of contamination or infectious agents, multiple tasks with the same patient should (where possible) progress from clean to dirty with **gloves being changed between each task and hand hygiene performed at each glove change**.

Gloves can also be used by healthcare workers when handling surfaces that may be environmentally contaminated but **when the gloves are removed, hand hygiene must be performed prior to moving on to another task or patient**. When removing gloves, care should be taken not to contaminate the hands.

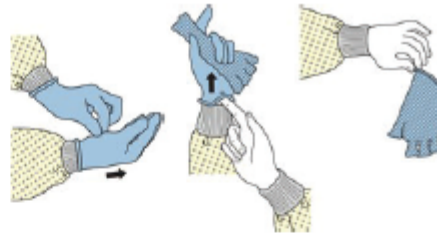
Hand hygiene must be performed immediately after the removal and disposal of gloves, in case infectious agents have penetrated through unrecognised holes, or have contaminated the hands during glove removal.

SEQUENCE FOR REMOVING PPE

Remove PPE at doorway or in anteroom

GLOVES

- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off.
- Hold removed glove in gloved hand.
- Slide fingers of ungloved hand under remaining glove at wrist.
- Peel glove off over first glove.
- Discard gloves in waste container.



HAND HYGIENE

- Wash hands or use an alcohol based hand rub.



PROTECTIVE EYEWEAR OR FACE SHIELD

- Outside of eye protection or face shield is contaminated!
- To remove, handle by head band or ear pieces.
- Place in designated receptacle for reprocessing or in waste container.



GOWN

- Gown front and sleeves are contaminated!
- Unfasten ties.
- Pull away from neck and shoulders, touching inside of gown only.
- Turn gown inside out.
- Fold or roll into a bundle and discard.



MASK

- Front of mask is contaminated—DO NOT TOUCH!
- Grasp bottom, then top ties or elastics and remove.
- Discard in waste container.



HAND HYGIENE

- Wash hands or use an alcohol based hand rub immediately after removing all PPE.



Table 3: Sequence for removal on PPE. Source: Australian Guidelines for the Prevention and Control of Infection in Healthcare, Section 3.3 PPE (2019) <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Cleaning

The *Australian Guidelines for the Prevention and Control of Infection in Healthcare* (2019) classify a range of risks and include detailed guidance on specific items and settings. Refer to the risk based table on cleaning frequencies in Appendix 2, section 6.1, Recommended routine cleaning frequencies <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Appropriate selection and use of chemical agents for environmental cleaning

Appropriate selection and use of chemical agents for environmental cleaning and disinfection should be risk assessed for:

- Correct and safe use
- PPE, especially the use of gloves that are removed immediately once activity has been completed and changed between cleaning and disinfection activities
- Compatibility
- Contact time
- Dilution, and
- Scope of activity.

If using a combined cleaner/disinfectant product – follow manufacturer's instructions once the risk assessment has been completed. If using separate cleaning agents and disinfectants, cleaning must be completed prior to use of disinfectants. Follow manufacturer's instructions for use.

The selection of a disinfectant must include confirmation that its characteristics will ensure it is effective against infectious agent(s) involved.

Disinfectants to be used in healthcare settings may vary according to national/state/territory recommendations and also between acute and non-acute patient care areas. A risk assessment should be completed to ensure the product to be used is compliant and appropriate.

Disinfection and sterilisation

Information on the Spaulding classification of items (critical, semi-critical and non-critical) and comprehensive information on cleaning, disinfection and sterilisation is included in the 'Cleaning, disinfection and sterilisation' module (module 4).

***If it cannot be cleaned, then it cannot be adequately
disinfected or sterilized***

Principles of aseptic technique

Aseptic technique aims to prevent infectious agents from being introduced to susceptible sites by hands, surfaces and equipment in sufficient quantity to cause infection.

Aseptic technique is used to prevent contamination by infectious agents that could cause infection. Asepsis is ensured by appropriately utilising hand hygiene, non-touch technique,

PPE, and using sterilised equipment.

Aseptic technique protects patients during invasive clinical procedures by employing infection prevention and control measures that minimise, as far as practically possible, the presence of pathogenic microorganisms. [Australian Guidelines for the Prevention and Control of Infection in Healthcare, section 3.1.6 Aseptic technique \(2019\)](#) for further information

Aseptic technique involves undertaking a risk assessment for procedures and this will assist in determining what equipment or PPE is required for the activity, e.g. selection of sterile or non-sterile gloves for a specific procedure.

Aseptic technique also requires consideration of sequencing within the activity or procedure to ensure that there is a safe, efficient and logical order to the procedure.

The basic principles of aseptic technique include:

- Hand hygiene immediately before and after procedures
- Using barriers, such as a sterile gown, gloves and drapes
- Using masks and eye protection
- Skin antisepsis
- Using sterile equipment
- Maintenance of a sterile field
- Correct technique, and
- Methodology that minimises the risk of contamination of the sterile field.

Minimising the risk of contamination with infectious agents remains the same for all procedures. Aseptic technique allows for clean and dirty environments, addressing how the aseptic field will be maintained based on the risk assessment for being able to maintain asepsis during the procedure.

For example, in a high risk procedure like inserting a central venous catheter, a surgical scrub, sterile gloves and sterile gown would be utilised.

In a lower risk procedure, like inserting a peripheral venous catheter sterile equipment, hand hygiene and non-sterile gloves would be utilised.

Standardised signage for infection prevention and control precautions

Standardised signage for standard and transmission based precautions has been developed with input from each jurisdiction and is available for download on the Commission's website. The signage is available in several formats with images or symbols and there are also versions that have been co-badged with many of the jurisdictions. Access standardised signage [here](#).

Transmission-based precautions

Transmission-based precautions are additional practices that should be used where standard precautions alone may be insufficient to prevent transmission. Transmission-based precautions should be tailored to the particular infectious agent involved and its mode of transmission and a combination of measures may be used. Examples of transmission-based precautions are contact precautions, droplet precautions and airborne precautions.

In the acute care setting transmission-based precautions includes a combination of the

following measures:

- Continued implementation of standard precautions
- Appropriate use of PPE (including gloves, apron or gowns, surgical masks or P2 respirators, and protective eyewear)
- Patient-dedicated equipment
- Allocation of single rooms or cohorting of patients
- Appropriate air handling requirements
- Enhanced cleaning and disinfecting of the patient environment
- Restricted transfer of patients within and between facilities

Contact precautions

Contact precautions including patient placement, increased use of appropriate PPE and environmental cleaning enhance the use of standard precautions when there is clear evidence that certain infectious agents are transmitted by direct or indirect contact during patient care.

- Direct transmission occurs when infectious agents are transferred from one person to another person without a contaminated intermediate object or person. For example blood or other body substances from an infectious person may come into contact with a mucous membrane or breaks in the skin of another person.
- Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object (fomite) or person.

Contaminated hands of healthcare workers have been shown to be important contributors to indirect contact transmission. Other opportunities for indirect contact transmission include:

- When clothing becomes contaminated after care of a patient colonised or infected with an infectious agent, which can then be transmitted to subsequent patients
- When contaminated patient-care devices are shared between patients without cleaning and disinfection between patients
- When environmental surfaces become contaminated

Hand hygiene and personal protective equipment

To reduce the risk of transmission of infectious agents, healthcare workers should follow these steps:

- Perform hand hygiene
- Put on gloves and gown upon entry into the room or cubicle
- Before leaving the patient care environment, remove gloves, perform hand hygiene and remove gown, and
- Ensure that clothing and skin do not contact potentially contaminated environmental surfaces before leaving the patient care environment.

Contact precautions should be used for diseases such as:

- *Clostridioides difficile* (previously known as *Clostridium difficile*)
- Gastroenteritis – bacterial
- Viral gastroenteritis, such as norovirus and rotavirus
- Hepatitis A
- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin Resistant Enterococcus (VRE)

- Multi-resistant Gram-negative (MRGN) organisms including Carbapenemase-Producing Enterobacteriaceae (CPE)
- Highly contagious skin infections, such as impetigo, and
- Infestations, such as scabies.

Droplet precautions

Droplet precautions including patient placement, increased use of appropriate PPE and environmental cleaning enhance the use of standard precautions when there is risk of an infectious agent being transmitted by the droplet route. A number of infectious agents are transmitted through respiratory droplets (i.e. large-particle droplets >5 microns in size) that are generated by a patient who is coughing, sneezing or talking. Transmission via large droplets requires close contact as the droplets do not remain suspended in the air and generally only travel short distances. There is also the potential for infectious agents transmitted by the droplet route to be transmitted by contact. Droplet precautions are based on evidence that shows that:

- Hand hygiene is effective in preventing transmission of viruses and reducing the incidence of respiratory infections both within and outside healthcare settings
- Physical interventions are highly effective against the spread of a broad range of respiratory viruses
- Surgical masks protect the wearer from droplet contamination of the nasal or oral mucosa
- Physical proximity of less than one meter has long been associated with an increased risk for transmission of infections via the droplet route (e.g. *Neisseria meningitidis* and group A *streptococcus*)
- Placing masks on coughing patients can also prevent infected patients from dispersing respiratory secretions into the air

Infection and conditions which require droplet precautions include:

- Seasonal influenza virus (by direct or indirect transmission)
- Meningococcal infection
- Whooping cough (Pertussis)
- Rubella (German measles)
- Adenovirus
- Rhinovirus
- Respiratory syncytial virus, and
- Streptococcal infection (Group A) respiratory infection.

Airborne precautions

Airborne precautions including patient placement, use of appropriate and specialised PPE and environmental cleaning enhance the use of standard precautions when there is risk of an infectious agent being transmitted by the airborne route.

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

Airborne precautions are based on evidence that shows that:

- The use of P2 or N95 respirators (masks) prevents the inhalation by healthcare workers of small particles that may contain infectious agents transmitted via the

- airborne route
- The use of negative pressure rooms may also reduce the transmission of infection
- Wearing of correctly-fitted surgical masks by coughing patients prevents dispersal of respiratory secretions into the air

Some common infections which require airborne precautions include:

- Rubella virus (Measles)
- Varicella zoster virus (Chickenpox)
- Active pulmonary *Mycobacterium tuberculosis*, and
- Disseminated herpes zoster (shingles).

Personal protective equipment to prevent airborne transmission

To minimise the risk of exposure to suspected or confirmed airborne infectious agents or particles, all healthcare workers who enter a patient care area where airborne precautions are in place must wear a correctly fitted P2 or N95 respirator (mask).

The Tasmanian Government Infection Prevention and Control Unit have produced a series of demonstration videos for standard and transmission based precautions, the [link](#) provided here is for airborne precautions and covers putting on and removing P2 or N95 respirators (masks).

The filtration efficiency of P2 or N95 respirators (masks) protects the wearer from inhaling small respiratory particles, but to be effective they must fit so that inhaled and exhaled air travels through the filter medium. For additional information on the differences between P2 and N95 respirators (masks), refer to Australian Guidelines for the Prevention and Control of Infection in Healthcare (2019), section 3.2.4 Airborne Precautions, Practice Point 30, Table 14 <https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Considerations when using P2 or N95 respirators (masks) include:

- If a good facial seal cannot be achieved, e.g. if the intended wearer has a beard or long moustache, an alternative respirator such as a powered air-purifying respirator (PAPR) should be used
- Masks should be changed when they become moist
- Masks should never be reapplied after they have been removed
- Masks should not be left hanging around the neck, and
- Hand hygiene should be performed upon touching or discarding a used mask.

Module 2 Risk management systems for infectious agents and infectious diseases

The online module provides:

- Information on the different types of infections and infectious diseases that impact upon infection control in healthcare environments
- Descriptions of how risk management strategies will assist in reducing the transmission of these infections and diseases
- Descriptions of the modes of transmission and how they link into the transmission based precautions required for patient safety, and
- Information on the importance of infection control measures required for the management of hospitalised patients with these conditions.

Information on risk assessment can be found in the *Australian Guidelines for the Prevention and Control of Infection in Healthcare (current edition)*

<https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>.

The following pages provide guidance for infection prevention and control precautions and clinical placement for a series of infectious agents that aligns with the content in the online module.

The content of the following tables has been collated from:

Australian Guidelines for the Prevention and Control of Infection in Healthcare (current edition).

Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, *2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings*

<https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html>

(last updated September 2018).

2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, [Appendix A](#) Type and duration of precautions recommended for selected infections and conditions (last updated September 2018).

Group A Beta-Haemolytic Streptococcus (GAS)

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Bacterial infection transmitted by respiratory secretions or in exudate from lesions</p> <p>Carriers of this infectious agent can also transmit the infection.</p> <p>Scarlet fever, streptococcal pharyngitis, pneumonia, skin infections like erysipelas, impetigo and cellulitis.</p> <p>Puerperal and neonatal infections require immediate antibiotic treatment.</p> <p>In severe cases necrotizing fasciitis, acute rheumatic fever, post-streptococcal glomerulonephritis and toxic shock can occur.</p> <p>(Streptococcus pyogenes)</p>	<p>Yes, if the patient has respiratory infection or extensive lesions or draining wounds.</p> <p>Also consider risks for burns patients OR patients with poor hygiene</p>	<p>For respiratory GAS infections – standard precautions with the addition of droplet precautions</p> <p>For skin and non-respiratory GAS infections – standard precautions with the addition of contact precautions</p>	<p>Cease droplet/contact precautions 24 hours after commencing effective antibiotic treatment and maintain standard precautions for duration of admission.</p>	<p>HCW with GAS respiratory infections should take precautions to limit possible transmission to others and not work until 24 hours after commencing effective antibiotic treatment.</p> <p>HCW with GAS lesions must have lesions covered and be on effective antibiotic treatment for at least 24hrs before direct patient care or food preparation</p> <p>This infectious agent has been associated with high morbidity and mortality unless treated early. Consultation with Infectious Diseases is recommended if puerperal sepsis is suspected.</p>

Meningococcal disease

Disease or Infectious agent (<i>causative organism</i>)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Bacterial infection transmitted by respiratory droplets.</p> <p>This infectious agent can be carried asymptotically in the throat of healthy individuals and be transmitted to others causing disease</p> <p>Severe fulminant disease can present as meningitis and/ or septicaemia and result in death within hours of the onset of symptoms.</p> <p>It can also be identified as a bacteraemia, septic arthritis (especially weight bearing joints) and conjunctivitis</p> <p>(<i>Neisseria meningitidis</i>)</p>	<p>Yes or cohort if multiple cases</p>	<p>Standard precautions with the addition of droplet precautions</p>	<p>Cease droplet precautions 24 hours after commencing effective antibiotic treatment and maintain standard precautions for duration of admission.</p>	<p>Immunisation as part of employment should be considered with some HCW groups e.g. laboratory staff. However, it is more commonly used in the community during outbreaks but immunisation will not cover all possible serotypes associated with this infectious agent.</p> <p>Post-exposure prophylaxis for staff who have had significant contact with the patient's naso/oropharyngeal secretions prior to droplet precautions being implemented.</p> <p>Colonised individuals are usually not treated with antibiotics.</p>

This disease is most significant during Australian autumn and winter, however, epidemiologically it has been identified as occurring throughout the year. This is a rare but significant disease that is often difficult to diagnose and it can cause significant morbidity and mortality if not managed effectively in a timely manner. Often these patients require complex prolonged inpatient care. However, if identified and treated early patients may avoid many complications.

Tuberculosis (TB)

Disease or Infectious agent <i>(causative organism)</i>	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Bacterial infection caused by an organism that is identified as an acid fast bacilli (AFB) when stained in the laboratory.</p> <p>Pulmonary tuberculosis</p> <p>Tuberculosis can present in any organ/tissue of the body (extra-pulmonary disease). However, lungs (pulmonary disease) are the most common presenting organ.</p> <p>The infectious agent is usually found in respiratory secretions or sputum where it is capable of being infectious to others but can occasionally also be identified in other body tissues, exudate or pus if extra pulmonary tuberculosis infection.</p> <p><i>(Mycobacterium tuberculosis)</i></p>	<p>Yes – Negative pressure room with the door closed at all times if available.</p> <p>If negative pressure air handling is not operational or not available - a single room with the door closed at all times.</p> <p>No</p>	<p>Standard precautions with the addition of airborne precautions should be implemented on clinical suspicion of pulmonary TB.</p> <p>HCW who have not received training or been assessed for competence in putting on and removing P2 or N95 respirators (masks) should not access the patients room whilst airborne precautions are in place, e.g. food service staff.</p> <p>Standard precautions with the addition of contact precautions for extra-pulmonary tuberculosis infection where there is exudate or pus</p> <p>NOTE - No aerosol generating procedures to be performed on the site of the extra-pulmonary TB without airborne precautions being implemented</p>	<p>Airborne precautions must not be ceased before 3 consecutive negative sputum smears have been collected</p> <p>OR</p> <p>1-2 weeks after initiation of effective treatment.</p> <p>AND</p> <p>In consultation with an Infectious Diseases or Respiratory Physician and infection control professional prior to ceasing precautions.</p>	<p>HCW should all be assessed by specialist clinicians as part of the employment process for risk factors for exposure to TB or infection due to ethnographic, travel or past exposure risks. Vaccination with Bacillus Calmette-Guérin (BCG) vaccines are generally not given to HCWs as it affects some screening tests (tuberculin skin tests – TST) but is sometimes used for children to protect against meningial TB or miliary TB.</p> <p>HCW who work in identified high risk areas (e.g. bronchoscopy units, Chest Clinics) should undertake follow-up screening as required by local policy in relevant State/Territory.</p> <p>HCW requiring treatment or management should be managed by Infectious Diseases or Respiratory physicians or in a Chest Clinic.</p> <p>Immunocompromised HCW or patients should not have contact with suspected cases of pulmonary TB.</p> <p>Other Mycobacterium sp. can also cause infection but are not usually transmitted person to person and need to be eliminated during diagnostic phase.</p> <p>Once infection has occurred many years can pass before the disease presents with signs and symptoms. Onset of symptoms is usually slow and insidious, often going unnoticed by patient or others.</p>

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Legionella

Disease or Infectious agent <i>(causative organism)</i>	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Legionnaires' Disease</p> <p>Bacterial infection affecting the lungs causing pneumonia (often associated with community acquisition however can be healthcare associated disease).</p> <p>Organisms are inhaled from aerosols generated from contaminated water, e.g. cooling towers or drinking fountains, or soil/potting mix</p> <p><i>(Legionella pneumophila)</i> most commonly associated with water from water supply (hot, warm or cold) or from cooling towers for air-conditioning units.</p> <p><i>(Legionella longbeachiae)</i> is most commonly associated with potting mixes or soil.</p>	No	Standard Precautions	For the duration of the admission	<p>Nil</p> <p>Legionnaires' disease is not transmitted from person to person.</p>

Clostridioides difficile (previously known as *Clostridium difficile*)

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Bacterial infection or colonisation.</p> <p>Antibiotic associated pseudomembranous colitis</p> <p>Recent emergence of an international hyper-virulent strain has been identified.</p> <p>Toxin and spore producing infectious agent.</p> <p>Newborns often carry this organism without having disease.</p> <p>Associated with use of antimicrobial agents. Especially cephalosporins (second and third generation), ampicillin/amoxicillin and clindamycin</p> <p>Transmitted in faeces and often associated with diarrhoea.</p> <p><i>(Clostridium difficile</i> also known as <i>Clostridioides difficile</i> or <i>C. difficile</i>)</p>	<p>Yes or cohort if multiple cases</p>	<p>Standard precautions with the addition of contact precautions</p>	<p>For the duration of symptomatic illness or for at least 48 hours after the cessation of symptoms (diarrhoea) and normal bowel function has returned.</p> <p>Toxin may be present after diarrhoea has resolved.</p>	<p>Alcohol-based hand rub is effective in destroying the vegetative forms of <i>C. difficile</i>, but not effective at removing spores. Handwashing with soap and water is preferred because of the absence of sporicidal activity of alcohol in waterless antiseptic hand rubs</p> <p>Review antibiotic use and discontinue antibiotics if appropriate All patients receiving antibiotic therapy should be considered at-risk of <i>C. difficile</i> and monitored accordingly as symptoms of disease. <i>C. difficile</i> can vary from no symptoms to severe diarrhoea and systemic toxic syndrome.</p> <p>In patients with identified <i>C. difficile</i> antibiotic review of current antimicrobial agents is required and administration of effective agents to control <i>C. difficile</i> need to be used, e.g. either oral metronidazole or oral vancomycin).</p> <p>HCWs with <i>C. difficile</i> infection should be excluded from clinical areas whilst symptomatic and for 48 hrs after symptoms have resolved.</p>

Clostridioides difficile or other gastroenteritis diseases

Additional information to be considered when cleaning and disinfecting patient care areas

Appropriate selection and use of chemical agents for environmental cleaning and disinfection should be risk assessed for:

- Scope of activity
- Correct and safe use
- Required PPE to meet work health and safety requirements. Ensure PPE is changed between cleaning activities and disposed of at completion of cleaning.
- Compatibility with item or surface
- Contact time
- dilution

Disinfectants to be used in healthcare settings for environmental cleaning may vary according to National/ State/ Territory recommendations and also vary between acute and non-acute patient care areas. A risk assessment should be completed.

If using separate cleaning agents and disinfectants, surfaces should be cleaned first with a detergent solution, then an appropriate disinfectant is used in accordance with the manufacturer's instructions for use. This is a two-step process, cleaning and then disinfection

If using a combined detergent /disinfectant product for environmental cleaning and follow the manufacturer's instructions for use.

When using disinfectants, ensure staff, patients and items are not harmed by exposure to the disinfectant agents. Follow manufacturer's instructions for use.

The selection of a disinfectant must include confirmation that its characteristics will ensure it is effective against infectious agent(s) involved.

Pertussis

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Whooping Cough or Pertussis</p> <p>Bacterial infection of the respiratory airways.</p> <p>Respiratory secretions are the infective material transmitted during paroxysmal coughing.</p> <p>This disease is highly infectious.</p> <p>Most at risk population is babies < 6months of age who are not fully vaccinated. In this population death can result from Pertussis or its complications.</p> <p>Any age group can contract this infection and transmit it to others if exposed to a case and not protected by vaccination or immunity has waned</p> <p><i>(Bordetella pertussis)</i></p>	<p>Yes – if available. If not, then risk assess the placement of the patient.</p>	<p>Standard precautions with the addition of droplet precautions</p>	<p>For acute infection - maintain droplet precautions until 5 days after the commencement of effective antibiotic therapy.</p> <p>If symptomatic for greater than 3 weeks precautions may not be required.</p> <p>Consultation with clinician and/or Infection Control recommended prior to ceasing precautions.</p>	<p>Pre-employment vaccination assessment required for health care workers in direct patient care. Refer to State/Territory requirements.</p> <p>HCW with Pertussis must be excluded from work for at least 5 days after starting effective antibiotic therapy or for 3 weeks after the onset of symptoms if no receiving antibiotic therapy.</p> <p>This disease can affect adults, however, it is often a milder disease. The duration of coughing will be the same as in babies and can last for extended periods of about 4 months</p> <p>Post exposure prophylaxis may be required for HCW if exposed especially if pregnant.</p>

Hepatitis A

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Hepatitis A</p> <p>Hepatitis A is non-enveloped RNA virus classified as a picornavirus.</p> <p>Acute viral infection (sometimes asymptomatic) that is transmitted by the faecal-oral route, either by person-to-person contact or ingestion of contaminated food/water.</p> <p>(Hepatitis A virus)</p>	<p>Yes, if patient is incontinent then single room and dedicated bathroom facilities should be utilised.</p> <p>Yes, if patient requires hospitalisation and contact precautions are implemented.</p>	<p>Standard precautions with the addition of contact precautions especially important with children and incontinent patients.</p>	<p>For children – maintain contact precautions for duration of admission.</p> <p>For adults - maintain contact precautions for one week (7 days) after the onset of jaundice.</p>	<p>Infection is usually self-limiting but it can last for several weeks and confers life-long immunity to further infection with this virus.</p> <p>This disease has a long incubation period (15-50 days) so determining the source of infection is often difficult.</p> <p>Infected food handlers must not prepare food for others for at least 7 days after the onset of jaundice or 14 days after the onset of symptoms.</p> <p>Vaccination of high risk HCW, e.g. paediatric staff, plumbers, laboratory staff, HCW working in rural and remote indigenous communities.</p> <p>Occurs where there is incidence of the disease combined with poor food handling or sanitation.</p> <p>Often associated with community outbreaks, e.g. child care centres, refugee camps.</p>

Hepatitis B

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Hepatitis B</p> <p>Hepatitis B virus is an enveloped DNA virus belonging to the family Hepadnaviridae</p> <p>Viral infection that can be seen as acute, asymptomatic, or chronic. Complications of Hepatitis B can include cirrhosis of liver or hepatocellular carcinoma.</p> <p>Blood and body substances are the infective material. However, blood has the highest viral load.</p> <p>(Hepatitis B virus)</p>	<p>No</p>	<p>Standard precautions</p>	<p>Duration of admission</p>	<p>Pre-employment assessment to include past infection and natural immunity or carrier status as well as vaccination assessment and confirmation of an adequate antibody response required for health care workers in direct patient care or those who handle human tissue or body fluids. Refer to National/ State/ Territory requirements.</p> <p>This disease has a long incubation period (40-180 days) and is often insidious and asymptomatic in clinical presentation.</p> <p>HCWs infected with Hepatitis B need to be risk assessed and managed according to infection risks. This should be undertaken by specialist clinicians and scope of practice must be considered especially for exposure prone procedures (EPP).</p> <p>Transmission occurs occupationally by percutaneous injuries, mucosal exposure to blood or body substances from an infected person. Transmission can also occur perinatally.</p> <p>Internationally, it has been reported to have been transmitted from contaminated blood products or organ donation.</p>

Hepatitis C

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Hepatitis C</p> <p>Hepatitis C virus is an enveloped RNA virus of the Flaviviridae family</p> <p>Viral infection that can be seen as acute, asymptomatic, or chronic. Complications of Hepatitis C can include cirrhosis of liver or hepatocellular carcinoma.</p> <p>Blood and body substances are the infective material. However, blood has the highest viral load.</p> <p>Transmission occurs occupationally by percutaneous injuries, mucosal exposure to blood or body substances from an infected person. Transmission can also occur in people who have substantial or repeated percutaneous exposures to blood including injecting drug users and persons with haemophilia. Internationally, it has been reported to have been transmitted from contaminated blood products.</p> <p>(Hepatitis C virus)</p>	<p>No</p>	<p>Standard precautions</p>	<p>Duration of admission</p>	<p>This disease has a long incubation period (2-24 weeks) and is often insidious and asymptomatic in clinical presentation.</p> <p>HCW infected with Hepatitis C need to be risk assessed and managed according to infection risks. This should be undertaken by specialist clinicians and scope of practice must be considered especially for exposure prone procedures (EPP).</p>

Measles

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Measles or rubeola</p> <p>Acute viral illness transmitted by airborne respiratory secretions that are aerosoled as droplet nuclei and can stay suspended in the atmosphere and survive for several hours. Direct contact with the infected respiratory secretions can also allow for transmission.</p> <p>The measles virus is highly transmissible and non-immune individuals are at high risk of contracting the infectious agent if exposed.</p> <p>Usually presents as a mild disease characterised by a generalised maculopapular rash, fever and conjunctivitis. However, complications of otitis media, pneumonia or measles encephalitis can occur and can lead to death.</p> <p>(Measles is an enveloped, single stranded RNA virus of the Paramyxovirus family)</p>	<p>Yes – with negative pressure ventilation if possible and the door closed at all times</p>	<p>Standard precautions with the addition of airborne precautions</p>	<p>Maintain airborne precautions until 4 days after the rash appears.</p> <p>Any room used by a patient with measles whilst precautions are in place must be left vacant for a minimum period of 30 minutes after the patient has left it.</p>	<p>Pre-employment vaccination assessment is required for health care workers in direct patient care. Refer to NHMRC/State/Territory requirements.</p> <p>Immunity to measles is obtained by vaccination or natural infection.</p> <p>Incubation period is usually 10-12 days.</p> <p>Only HCW with demonstrated immunity should care for a patient with measles infection.</p> <p>Healthcare workers who are not immune and have not received training or been assessed for competence putting on and removing P2 respirator (masks) should not access the patients room whilst airborne precautions are in place, e.g. food service staff</p>

Rubella

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Rubella or German Measles</p> <p>Acute viral illness transmitted in saliva and respiratory secretions and acquired by direct contact with infected droplets, saliva or contaminated fomites.</p> <p>Rubella is usually a mild, self-limiting illness and many infections are subclinical. However, if the disease is contracted whilst pregnant, the virus can cause significant birth defects if disease occurs early in foetal life.</p> <p>(the Rubella virus is an enveloped virus and a member of the Togavirus family)</p>	<p>Yes – or cohort of multiple cases.</p>	<p>Standard precautions with the addition of droplet and contact precautions</p>	<p>Maintain contact precautions until 7 days after the onset of the rash.</p>	<p>Pre- employment vaccination assessment is required for health care workers in direct patient care. Refer to NHMRC/State/Territory requirements.</p> <p>Immunity to Rubella is obtained by vaccination or natural infection.</p> <p>Incubation period is usually 10-17 days.</p> <p>Only HCW with demonstrated immunity should care for a patient with Rubella infection.</p> <p>Any pregnant healthcare workers (clinical or non-clinical) should not have contact with patient if immune status is unknown or negative.</p>

Mumps

Disease or Infectious agent (causative organism)	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Mumps or Infectious Parotitis</p> <p>Acute viral infection transmitted in saliva and respiratory secretions and acquired by direct contact with infected droplets, saliva or contaminated fomites.</p> <p>In children, Mumps is generally a mild, self-limited illness, but may be debilitating and severe complications of meningitis and encephalitis have been reported. In post pubertal individuals can have complications including epididymo-orchitis (males), mastitis and/or oophoritis (females).</p> <p>(The mumps virus is an enveloped virus and is a member of the Paramyxovirus family)</p>	<p>Yes – or cohort if multiple cases</p>	<p>Standard precautions with the addition of contact and droplet precautions</p>	<p>Maintain contact and droplet precautions until 9 days after the onset of swelling (parotitis).</p>	<p>Pre-employment vaccination assessment is required for health care workers in direct patient care. Refer to NHMRC/State/Territory requirements.</p> <p>Immunity to Mumps is obtained by vaccination or natural infection.</p> <p>Incubation period is usually 12-25 days.</p> <p>Only HCW with demonstrated immunity should care for a patient with Mumps infection.</p> <p>Non-immune people exposed to Mumps should be considered infectious from the 12th -25th day after exposure (with or without symptoms).</p> <p>People may be infectious from 7 days before parotid swelling until 9 days after with a maximum period of infectiousness between 2 days before onset of illness and 5 days afterwards.</p>

Varicella

Disease or Infectious agent	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Varicella or Chicken Pox also includes Shingles</p> <p>Acute viral infection is transmitted by direct contact with the exudate from lesions or by droplets from respiratory secretions. It can also be airborne as droplet nuclei in the prodromal phase of infection.</p> <p>Shingles can occur in some individuals who have had previous infection with VZV. It presents as a painful rash along a dermatome that is a reactivation of the VZV that has been dormant in the nerve dorsal ganglia since primary infection occurred. Shingles is able to transmit the VZV and can cause primary Varicella infection (Chicken pox) in someone exposed who has no immunity to the virus.</p> <p>The disease is more severe in adults than children and is characterised by fever, headache, a rash that crops and develops into vesicles that then crust. Complications include secondary bacterial infection of lesions, pneumonia, encephalitis and death.</p> <p>(the Varicella Zoster Virus is an enveloped virus and is a member of the herpes virus family)</p> <p>(Varicella Zoster Virus – VZV)</p>	<p>Yes – with the door closed at all times.</p>	<p>Standard precautions with the addition of contact and airborne precautions</p> <p>For shingles if hospitalised, standard precautions with the addition of contact precautions until all lesions are dry and crusted the addition of airborne precautions maybe required depending on the location of or if the shingles are disseminated</p>	<p>Maintain contact and airborne precautions during prodromal phase and until all lesions have dried and crusted over</p>	<p>Pre-employment history of infection or vaccination is required for health care workers in direct patient care. Refer to NHMRC/ State/ Territory requirements.</p> <p>Immunity to Varicella is obtained by vaccination or natural infection.</p> <p>Incubation period is usually 13-17 days.</p> <p>Only HCW with a personal memory of disease, evidence of complete, appropriate age related vaccination or serology for an IgG response to show demonstrated immunity should care for a patient with Varicella infection.</p> <p>Shingles should be treated with antiviral agents if diagnosed early to help reduce the severity of infection and the severity of post herpetic neuralgia.</p> <p>HCW who develop shingles should be excluded from work if the lesions cannot be covered. If the lesions can be covered they can work but should be excluded from caring for pregnant women, neonates, immunocompromised patients or patients with extensive eczema.</p> <p>Non-immune people exposed to varicella should be considered infectious from the day 10–21 post contact.</p> <p>Healthcare workers who have not received training or been assessed for competence in putting on and removing a P2 or N95 respirator (mask) should not access the patients room whilst airborne precautions are in place.</p>

Influenza

Disease or Infectious agent	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Seasonal human influenza</p> <p>New/novel/pandemic influenza strains</p> <p>Acute abrupt onset viral infection associated with outbreaks.</p> <p>Influenza is usually a self-limiting systemic disease characterised by fever, malaise, cough, sore throat, joint pain.</p> <p>Complications include pneumonia, otitis media, encephalitis and death.</p> <p>(Influenza is an enveloped virus)</p> <p>(Influenza A or Influenza B)</p>	<p>Yes – or cohort if there are multiple confirmed cases</p>	<p>Standard precautions with the addition of contact and droplet precautions</p> <p>Airborne, droplet and contact precautions for novel and pandemic strains of influenza (e.g. H1N1, H5N1) and influenza like disease (sudden acute respiratory syndrome - SARS) that can cause epidemics or pandemics.</p>	<p>Maintain contact and droplet precautions until 7 days from the onset of symptoms (3 days if treated with anti-viral agents).</p> <p>Children will require longer and this should be assessed by an Infectious Disease Physician or specialist clinician.</p>	<p>Annual vaccination is recommended for at-risk groups including HCW. Pre-employment assessment may be required for health care workers in direct patient care. Refer to NHMRC/State/Territory requirements.</p> <p>HCW with influenza should be excluded until the resolution of symptoms.</p> <p>Influenza incubation period is usually between 1-4 days with symptomatic disease lasting 2-5 days and recovery can take several weeks.</p> <p>Anti-viral medications should be considered for treatment if identified early.</p> <p>Novel and pandemic strains of influenza and influenza–line illness require outbreak and disaster risk planning for each facility and health care providers. Refer to national/State/Territory guidelines for further information relating to this.</p> <p>The influenza virus changes its antigenic makeup frequently (often annually) and increase susceptibility of the population to outbreaks if exposed as the levels of immunity will be inadequate to the changed viral antigens with attack rates of 10-20% of the population.</p> <p>Transmission occurs by droplets of respiratory secretions from an infected person being inhaled by susceptible individuals. Direct contact with contaminated surfaces is also responsible for transmission.</p>

Respiratory Syncytial Virus (RSV), Parainfluenza and Adenovirus

Disease or Infectious agent	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Respiratory Syncytial Virus (RSV) Parainfluenza and Adenovirus</p> <p>Viral infection causing acute respiratory infections most problematic in infants and children but can affect all ages.</p> <p>Infections can be minor but more severe complications include pneumonia, bronchiolitis, conjunctivitis, and croup.</p>	<p>Yes – or cohort of multiple cases.</p>	<p>Standard precautions with the addition of contact and droplet precautions</p>	<p>Maintain contact and droplet precautions whilst symptomatic.</p>	<p>Outbreaks are often associated with these infectious agents and community outbreaks can impact upon healthcare services with an influx of admissions.</p> <p>Outbreaks are usually seasonal.</p> <p>Infected HCW should be excluded from contact with susceptible patients until all symptoms have resolved.</p> <p>These viral infections are transmitted by direct contact with oral or respiratory secretions or exudate from eyes, droplet transmission. Contact with contaminated surfaces or equipment can also allow spread of these infectious agents.</p>

Gastroenteritis

Disease or Infectious agent	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
Gastroenteritis (viral) e.g. rotavirus, norovirus, adenovirus Occasionally transmission can occur through aerosolisation of droplets of vomitus or diarrhoea	Yes or Cohort if multiple cases.	Standard precautions with the addition of contact precautions plus droplet precautions whilst patient is symptomatic and HCW are in close (< 1metre) from patient.	Maintain contact precautions for the duration of the illness and for 48hrs after symptoms have ceased. If droplet precautions are used, maintain whilst patient is symptomatic.	<p>The diagnosis of gastroenteritis requires either:</p> <ul style="list-style-type: none"> • Two or more loose/watery stools more than what is normal for a patient in a 24 hour period • Two or more episodes of vomiting in a 24 hour period • A stool positive for an infectious agent PLUS at least one symptom of nausea, vomiting, abdominal pain, diarrhoea <p>Incubation period is usually 1-4 days but can be as short as several hours or as long as several weeks after exposure.</p> <p>HCW who have symptoms of gastroenteritis should be excluded from work for at least 48hrs after all symptoms have resolved.</p> <p>Gastrointestinal infectious agents are capable of transmission for up to 48hrs after symptoms have ceased.</p>
Gastroenteritis (bacterial) e.g. <i>Salmonella sp.</i> , <i>Campylobacter</i> , <i>Shigella</i> , <i>Cholera</i> , <i>Clostridioides difficile</i>	Yes or Cohort if multiple cases.	Standard precautions with the addition of contact precautions		
Gastroenteritis Other e.g. Protozoa e.g. <i>Giardia lamblia</i> , <i>Entamoeba histolytica</i> , <i>Cryptosporidium parvum</i>	Yes or Cohort if multiple cases.	Standard precautions with the addition of contact precautions		
Gastrointestinal infectious agents are transmitted by the faecal-oral route from contaminated food, fluid or hands and contaminated surfaces.				

Creutzfeldt Jacob Disease

Disease or Infectious agent	Single Room Needed	Infection Control Precautions To Be Applied on Clinical Suspicion	Duration of Precautions	Requirements for HCW and additional comments
<p>Creutzfeldt Jacob Disease (CJD)</p> <p>Protein based transmissible agents cause rare chronic encephalopathy and associated dementia leading to death.</p> <p>They accumulate in brain and neural cells. They cannot be cultured and do not trigger an immune response.</p> <p>There is no evidence that CJD can be transmitted through normal social or sexual contact or mother to child transmission</p> <p>This disease is not infective but it is transmissible.</p> <p>(Prion – altered host protein)</p>	<p>No</p>	<p>Standard precautions</p> <p>Risk assessment of all patients undergoing identified higher risk procedures will assist healthcare facilities to potentially prevent transmission. This can be achieved by using a screening tool to identify risk factors if known.</p> <p>Patients with risk factors for the disease and undergoing higher risk surgery require transmission based precautions to be implemented to manage instrumentation and equipment. This includes disposable instrumentation, PPE, drapes, etc.</p> <p>If non-disposable instrumentation or equipment is used on high risk tissue and the patient is subsequently identified as a case, risk management procedures must be implemented and a look-back may be Required</p>	<p>Duration of admission</p>	<p>CJD has a very long incubation period and the protein is resistant to heat, chemicals and irradiation. However, once signs appear these lead to rapid progressive deterioration characterised by dementia and myoclonus. Death usually occurs within 1 year of onset of symptoms.</p> <p>Presentation of this disease can be sporadic (most common), familial, iatrogenic (health care associated with dura- mater grafts and human growth hormone or gonadotrophin administration, corneal grafts, use of contaminated surgical instrumentation – neurological instruments or equipment). These forms of the disease are also referred to as classical (cCJD).</p> <p>Variant (vCJD) is another form of the disease with different transmission risk factors that are associated with contact/consumption of animal product that is affected by this abnormal protein.</p>

Module 3 Basic microbiology and multi-resistant organisms (MRO)

The online module provides:

- Description of the normal flora and where they are found
- An understanding of environmental contaminants
- Understanding of how a virus differs from bacteria
- Understand the principles of basic bacterial staining, and
- Information on multi-resistant organisms (MROs), specifically Gram-positive bacteria: including MRSA, VRE and *C.difficile*, and Gram-negative bacteria: including ESBL and carbapenem-producing bacteria.

Basic microbiology

Terminology

The following table provides explanation of terms utilised in this module and terms that an ICP should be aware of to ensure they have an understanding of this topic.

Carrier	Person that harbours and has the ability to continuously shed or transmit an infection without showing any symptoms of the disease, e.g. Methicillin Resistant <i>Staphylococcus aureus</i> (MRSA) and Hepatitis B
Colonisation	Microorganisms which normally inhabit and reproduce in or on the human body without causing disease. Some of these organisms are also identified as pathogens, such as <i>S.aureus</i> , which can be carried on the skin without causing disease, but if it is provided with an entry point or suitable environment can be pathogenic (disease/infection producing). There are many health factors that can provide protection against infection by these colonising pathogens.
Disease	Harmful alteration in the physiological or metabolic state of the host, e.g. pulmonary tuberculosis
Endemic	Always present in a given population, e.g. <i>Streptococcus sp.</i>
Endogenous infection	Infection caused by organisms from the hosts own body, e.g. <i>Streptococcus sp.</i>
Epidemic	A sudden rapid rise in a disease in a given population or area, e.g. H1N1 influenza
Erythema	Reddened skin, usually due to inflammation
Exogenous infection	Infection caused by organisms external to the host, e.g. <i>Pseudomonas aeruginosa</i>
Host	Human, or other providing a home for the organism
Iatrogenic infection	Infection resulting from medical treatment or procedure, e.g. post-operative wound infection
Immunisation	Exposure to an antigen in order to create an immune response which then develops antibodies to that particular disease
Incubation period	Time between exposure to organism and appearance of symptoms, e.g. food poisoning – 4-24 hrs; tetanus –3-21 days; chicken pox – 2-3 weeks; Hepatitis B – 1-3 months
Infective dose	The number of organisms which must gain entry in order to cause infection, e.g. Shigella - <100 organisms Salmonella - >10 ⁶ organisms
Pathogenic	The ability for microorganisms to cause disease
Pathogens	These are microorganisms that are capable of causing disease in a susceptible host. The intact skin and mucous membranes lining the respiratory, gastrointestinal and genitourinary tract provide a protective barrier against these organisms. If this barrier is damaged or penetrated, the organisms can potentially gain entry to the body, e.g. <i>Escherichia coli</i> is normally found as normal flora of the gastrointestinal tract where it usually causes no evidence of disease and offers benefits to the host. However, it can also cause bacteraemia, septicaemia and urinary tract infections when it is allowed to enter other body areas/systems, thereby becoming an opportunistic pathogen.

Prodromal (period)	The period that precedes the onset of specific signs or symptoms that indicate the onset of a disease
Resident (normal) flora	Organisms that live on the host without causing disease
Serotypes	Different antigenic strains of a microorganism
Signs	Measurable changes in the patient as a result of infection, e.g. temperature and vomiting
Subclinical infection	No recognisable signs or symptoms but an immune response occurs, e.g. Infectious mononucleosis (glandular fever).
Symptom	Changes felt by the patient, e.g. hot flushes, nausea
Syndrome	Combination of signs and symptoms, e.g. inflammation
Sepsis	Poisoning due to infection by microorganisms
Transient flora	Organisms found on the host for a short time, not causing disease
Virulence	Degree of pathogenicity of an organism. This varies between microorganisms in the same species, e.g. <i>Streptococcus sp.</i>

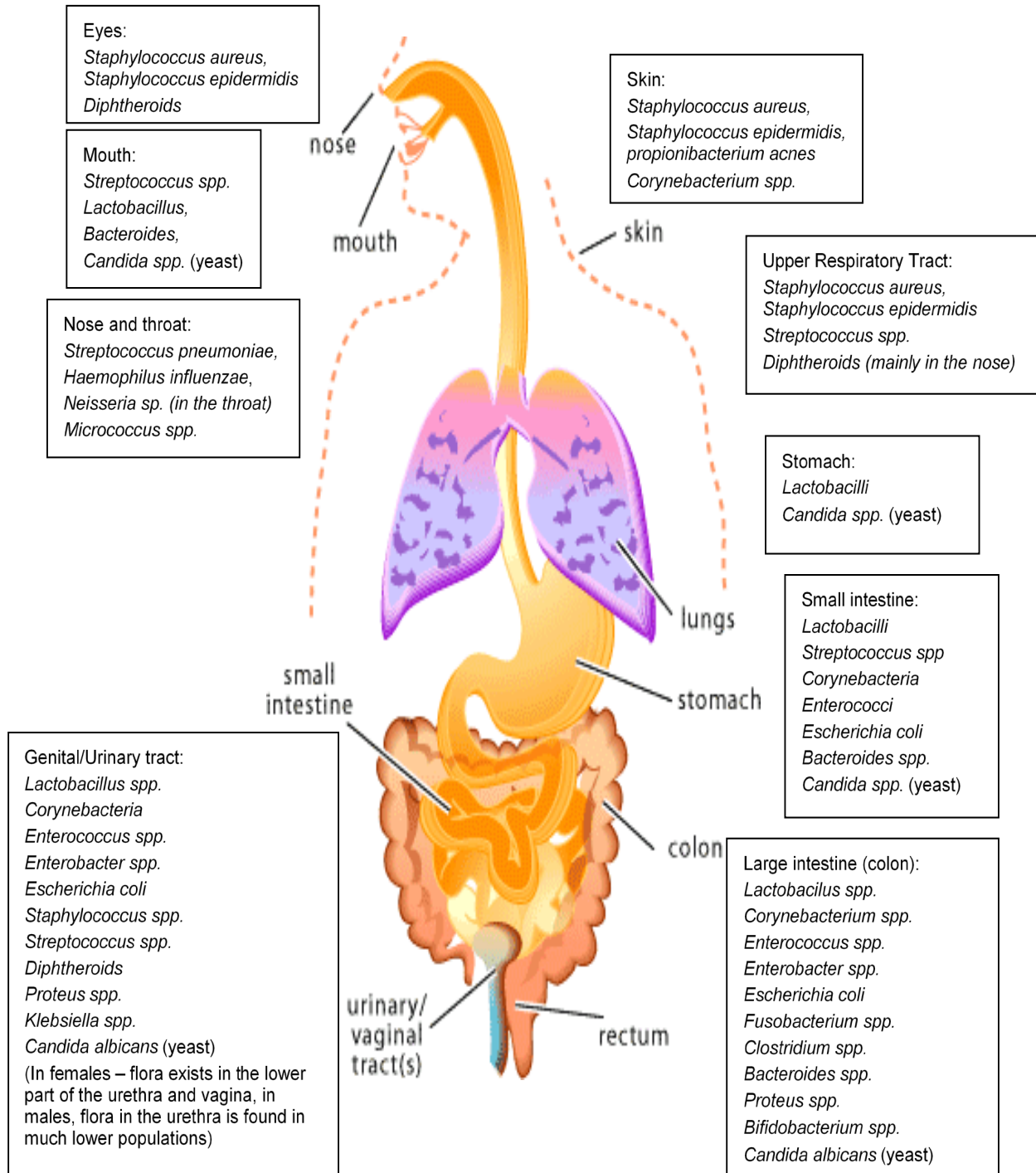


Image 2: Normal body flora. Source: <https://www.scq.ubc.ca/microbes-and-you-normal-flora/> (accessed 25 June 2019)

Normal flora of the skin

The normal flora of the skin includes:

- *Staphylococcus epidermidis*, a type of coagulase negative staphylococcus (CoNS). Other examples include *Staphylococcus capitis* and *Staphylococcus hominis*.
- *Staphylococcus aureus*, found in moist areas, that is, axillae, groin, perineum
- *Propionibacterium acnes*, found in hair follicles and sebaceous glands
- *Corynebacterium* spp, found on the skin surface, and
- *Candida* spp, found in the female genital tract.

Normal flora of the respiratory tract

Normal flora of the respiratory tract includes:

- *Streptococcus* spp, including *S. mutans*, *S. mitis* and *S. salivarius*
- *Neisseria* spp, including *N. sicca* and *N. pharyngitidis*
- *Staphylococcus* spp, including *S. epidermidis*, and
- *Haemophilus* spp, including *H. parainfluenzae*.

Normal human flora also includes some Gram-negative bacilli, such as *E.coli*, *Klebsiella* spp in low numbers in the elderly, and some anaerobic bacteria, such as *Peptostreptococcus* spp.

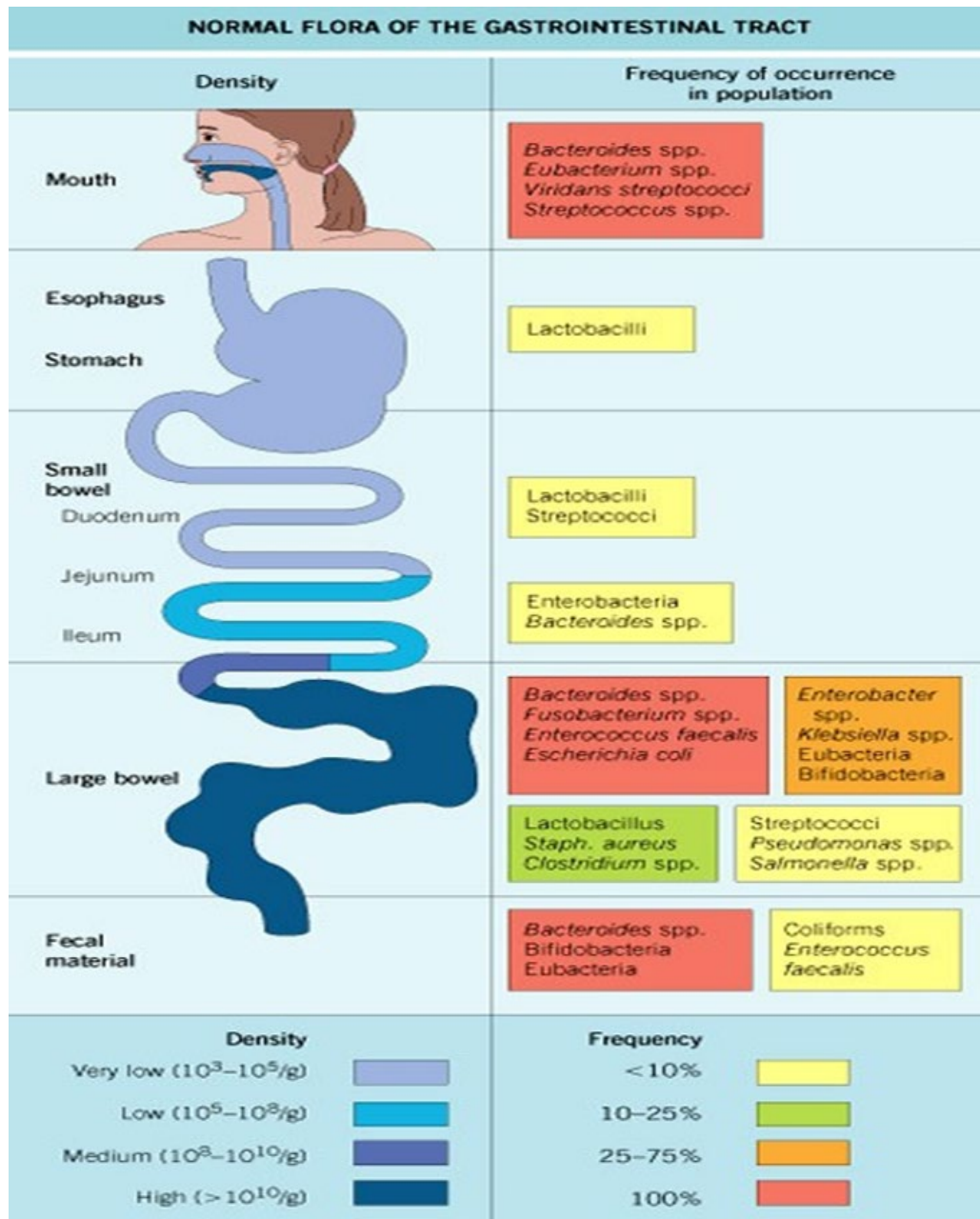


Image 3: The normal flora of the gastrointestinal tract. Source: D. Armstrong and J Cohen. Eds. (1999). Infectious Diseases. Hartcourt International.

Normal flora of the gastrointestinal tract

The normal flora of the gastrointestinal tract includes:

- *Enterococcus* spp, such as *E. faecium* and *E. faecalis*
- Some anaerobic bacteria, such as *Bacteroides* spp
- The anaerobic Gram-positive bacillus *Clostridium perfringens*, and
- Gram-negative bacilli, including *E.coli*, *Serratia* spp, *Klebsiella* spp and *Pseudomonas* spp.

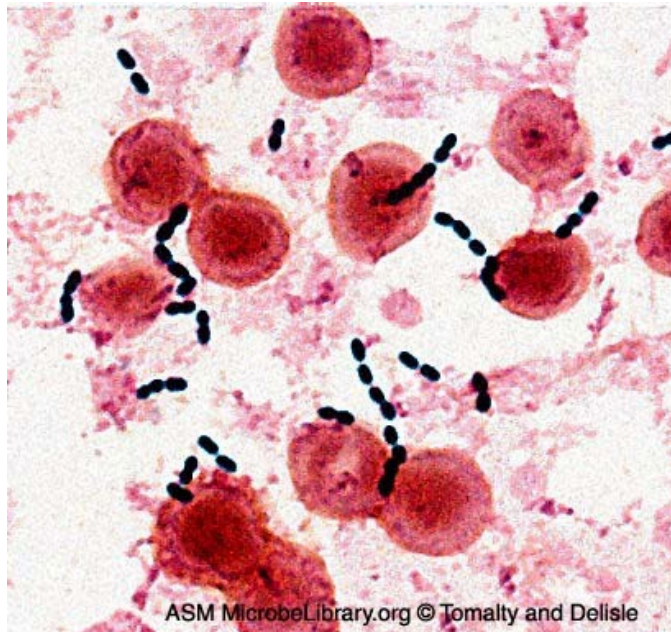


Image 4: Gram-positive cocci: *Enterococcus faecalis*. Source: ASM Microbe Library
<http://chiefmedicalresident.blogspot.com/2009/05/day-299-enterococcal-prosthetic-valve.html>
(Accessed 25 June 2019)

Environmental organisms

There are several significant microorganisms that are linked to transient flora and environmental origins, including:

- Animals
- Soil
- Buildings and air conditioning units
- Vegetation
- Foods, and
- Water.

Healthcare facility areas that pose a risk of being contaminated by environmental microorganisms include:

- Food preparation areas
- Air handling systems
- Warm water systems
- Inanimate surfaces and objects, like curtains, shelving or storage units
- Equipment, like ventilators and humidifiers, and
- Wet areas.

Examples of common environmental microorganisms are: *S. aureus*, *P. aeruginosa*, *L. longbeachiae*, *L. pneumophila*, *L. monocytogenes*, *Pasteurella* spp., and *Enterococcus* spp. *Aspergillus fumigatus*.

Fungi

Aspergillus is a fungal organism found on plants and in soil, dust and building materials. They have also been linked to air-conditioning ducts. While *A. fumigatus* is the most common species of *Aspergillus*, others include *A. flavus*, *A. niger* and *A. terreus*.

Aspergillus spp causes a disease known as Aspergillosis. This is a disease that has been linked to redevelopment and renovations especially in healthcare facilities. For additional information refer to the Renovation, Repairs and Redevelopment Risk Management on-line module.

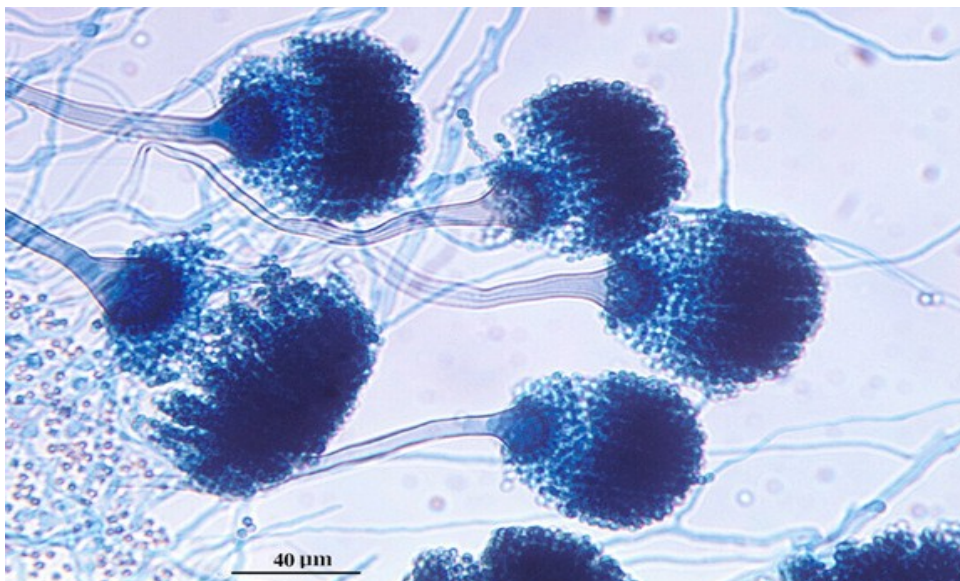


Image 5: *Aspergillus fumigatus*. Source: http://bioweb.uwlax.edu/bio203/s2008/miller_melo/ (accessed 25 June 2019).

Aspergillosis symptoms and transmission

Aspergillosis symptoms range from allergic reactions, like wheezing and coughing, to invasive symptoms resulting from infected bodily organs and compromised immune systems. The disease commonly affects the lungs, and can spread throughout the body,

including the brain.

Aspergillus is transmitted via spores which are breathed in from the environment. There is no harm for healthy people as the immune system can get rid of the spores. However, inhalation by compromised people from a dusty environment can lead to infection.

This means the risk is greatest for immunocompromised patients, including bone marrow or solid organ transplant patients, leukemia patients, or cystic fibrosis patients.

Invasive aspergillosis is very serious and requires early treatment with antifungals. Risk factors associated with aspergillosis include:

- Transplantation
- Corticosteroids, and
- Chemotherapy.

Viruses

Viruses are small obligate intracellular parasites, which by definition contain either a RNA or DNA genome surrounded by a protective, virus-coded protein coat. The main purpose of a virus is to deliver its genome into the host cell to allow its expression by the host cell. Some examples of important viruses include:

- Respiratory viruses, such as respiratory syncytial virus (RSV), influenza A and B, measles, rubella, herpes, and varicella zoster
- Faecal viruses, such as rotavirus or norovirus, and
- Blood borne viruses, such as hepatitis B and C, and HIV.

Bacteria

Gram-positive bacteria

Gram-positive organisms are characterised by having a thick cell wall made of peptidoglycan, and stain blue when challenged with the Gram stain technique.

Examples of Gram-positive bacteria include *Staphylococcus aureus*, *S. epidermidis*, *Enterococcus* spp, *Streptococcus pyogenes*, *S. pneumoniae*, *Clostridioides difficile*, *Lactobacillus* spp and *Listeria* spp.

Gram-negative bacteria

Gram-negative organisms have a thinner cell wall and an additional outer layer made up of polysaccharides that stain red when challenged with the Gram stain.

Examples of Gram-negative organisms include *Neisseria meningitidis*, *N.gonorrhoeae*, *E. coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter* spp, *Serratia* spp and *Bacteroides* spp.

Staphylococcus aureus treatment:

Treatment depends on the type of *S. aureus*.

Terminology used for the types of *S. aureus* will vary between laboratories and clinicians.

It includes:

- Penicillin sensitive *S. aureus* (PSSA)
- Methicillin (flucloxacillin) sensitive *S. aureus* (MSSA)
- Methicillin (flucloxacillin) resistant *S. aureus* (MRSA)
- Healthcare associated (HA-MRSA)
- Community associated (CA-MRSA)
- Vancomycin-intermediate/resistant *S. aureus* (VISA/ VRSA)
- Epidemic methicillin-resistant *S. aureus* (EMRSA)
- Multi-resistant methicillin-resistant *S. aureus* (mMRSA/ mrMRSA),
- Non multi-resistant methicillin-resistant *S. aureus* (nmrMRSA), and
- Heterogeneous vancomycin-intermediate *S. aureus* (hVISA)

Examples of *S. aureus* susceptibility patterns

	PSSA	MSSA	CA-MRSA	HA-MRSA	VISA/VRSA
Penicillin	S	R	R	R	R
Methicillin	S	S	R	R	R
Gentamicin	S	S	S	R	R
Cephazolin	S	S	R	R	R
Erythromycin	S	S	S	R	R
Clindamycin	S	S	S	R	R
Ciprofloxacin	S	S	S	R	R
Vancomycin	S	S	S	S	I/R
Rifampicin	S	S	S	S	S
Fusidic acid	S	S	S	S	S

S=Susceptible, I=Intermediate, R=Resistant

Please note that if recommended, rifampicin and fusidic acid should **always** be used in combination therapy for the treatment of MROs. This reduces the risk of resistance to one or both of these agents

Clostridioides difficile

The *Clostridioides difficile* organism grows anaerobically and is capable of causing:

- Diarrhoea, referred to as *Clostridioides difficile*-associated diarrhoea (CDAD)
- Pseudo membranous colitis

- Toxic megacolon
- Colonic perforation
- Peritonitis, and
- Death.

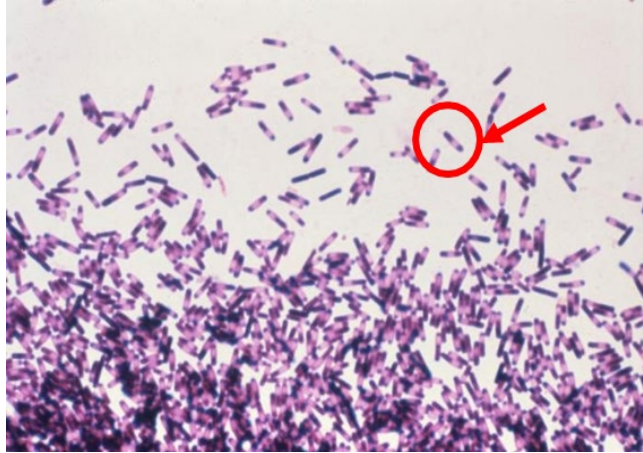


Image 6: *Clostridium difficile* and spores. Source: CDC/Dr. Gilda Jones
<https://www.forbes.com/sites/judystone/2015/07/23/stool-transplants-save-lives-why-dont-we-use-them-early-for-deadly-c-diff/#64361d6d3bf0> (accessed 25 June 2019)

Multi-resistant Gram-negative bacteria (MRGN)

Many of the common Gram-negative bacteria can develop resistance. Examples that have developed multi-drug resistance include:

- *Pseudomonas* spp,
- *Acinetobacter* spp
- *Escherichia coli*
- *Proteus mirabilis*
- *Klebsiella* spp
- *Serratia* spp
- *Enterobacter* spp, and
- *Burkholderia* spp.

Extended spectrum beta-lactamases (ESBL)

The major classes hydrolysed by these enzymes are:

- Penicillins, including benzyl penicillin, cloxacillin, flucloxacillin, amoxicillin and piperacillin, and
- Cephalosporins, including cephalexin, cefaclor, cefazolin, cefotaxime, ceftazidime and ceftriaxone.

Beta lactam antibiotics

Beta lactam groups	Examples
Penicillins	<i>Penicillinase sensitive:</i> penicillin G, penicillin
	<i>Penicillinase resistant:</i> methicillin, oxacillin, cloxacillin
	ampicillin, amoxicillin
	ticarcillin
	piperacillin
Cephalosporins	<i>First generation:</i> cefazolin, cephalothin, cephalexin
	<i>Second generation:</i> cefaclor, cefamycin, cefotetan, cefoxitin
	<i>Third generation:</i> cefotaxime, ceftriaxone, ceftazidime
	<i>Fourth generation:</i> cefepime, cefpirome
Carbapenems	imipenem, meropenem, ertapenem
Monobactams	aztreonam

Module 4 Cleaning, Disinfection and Sterilisation

The online module provides:

- Information to differentiate between methods of cleaning, disinfection and sterilisation
- Information on the quality management processes for reprocessing reusable medical equipment
- Information on the general principles for storing and handling of processed items,
- Overview of education that personnel responsible for the delivery of health care are educated about the safe use of medical equipment and associated products to minimise the risk of disease transmission.

Spaulding classification

The Spaulding classification is a system that provides a general framework for healthcare workers to classify the level of reprocessing required for individual items.

This classification system should be risk based and consistent with relevant national and international standards for reprocessing reusable medical devices, instruments and equipment (Rutala, & Weber, 2008).

Classification	Item use	Goal	Appropriate Process
Critical items	Items entering sterile tissue, the body cavity, the vascular system and non-intact mucous membranes, e.g. surgical instruments.	Clean as soon as possible after use Objects will be sterile (free of all microorganisms including bacterial spores)	Sterilisation (or use of single use sterile product) • steam sterilisation • low temperature methods (ethylene oxide, peracetic acid, hydrogen peroxide plasma) Store appropriately to maintain sterility and prevent environmental contamination
Semi-critical items	Items that make contact, directly or indirectly, with intact mucous membranes or non-intact skin, e.g. endoscopes, diagnostic probes (vaginal/rectal), anaesthetic equipment	Clean as soon as possible after use Objects will be free of all microorganisms, with the exception of high numbers of bacterial spores	High level disinfection • thermal disinfection • chemical disinfection (glutaraldehyde, OPA) • Store to prevent environmental contamination in a designed storage environment. NOTE: It is always preferable to sterilise semi-critical items whenever they are compatible with available sterilisation processes
Non-critical items	Objects that come into contact with intact skin but not mucous membranes, e.g. crutches, BP cuffs and bench tops.	Clean as necessary with detergent solution Objects will be clean	Low level disinfection • cleaning (manual or mechanical) • store clean and dry to minimise environmental contamination

Cleaning and reprocessing of reusable medical devices

Cleaning is the removal of soil and reduction of the number of microorganisms acquired during use and is accomplished using water with detergents and mechanical action or enzymatic products.

Cleaning agents

Agents suitable for instrument cleaning must be:

- Biodegradable
- Mild alkaline or neutral pH
- Low foaming
- Non toxic
- Non corrosive
- Free rinsing and not leave any residue, and
- Compatible with the instrument.

Respiratory equipment

An example of reprocessing reusable medical equipment is the cleaning and disinfection of anaesthetic and respiratory equipment. This equipment does not need to be sterilised as it

classified as a semi-critical item as described by the Spaulding classification. The process required to clean and disinfect this equipment is shown in the table below.

Cycle temperatures required	
Rinsing	40° C to 50° C
Washing	50° C to 60° C
Disinfecting	70° C to 95° C
Final rinsing	80° C to 90° C

Disinfection

Disinfection is the process that inactivates non-spore forming infectious agents, using either thermal or chemical means. Disinfection is not a sterilisation process and must not be used on critical items as described by the Spaulding classification.

Thermal disinfection

High level disinfection is achieved when surfaces are in contact with hot water in an automated thermal washer/disinfector by choosing a cycle that achieves the appropriate time and temperature relationships as listed in the table below

Surface Temperature	Min. Disinfection Time
≥ 90° C	1 minute
80° C	10 minutes
75° C	30 minutes
70° C	100 minutes

Chemical disinfection

High-level disinfection is achieved from the application of a liquid chemical agent and is dependent on the biocidal action to ensure the disinfection process eliminates pathogenic microorganisms

An example of Chemical disinfection is ortho-phthalaldehyde (OPA)

Ortho-phthalaldehyde:

- Demonstrates excellent broad spectrum microbiocidal activity
- Is non corrosive
- Is stable over a wide pH range
- Has a relatively short acting cycle time

- Does not require activation
- Does not fix proteinaceous material to instruments
- Is compatible with a wide range of endoscopic instrument models
- Personnel using OPA must use appropriate PPE when handling this chemical
- Be used in a room fit for purpose and should
- Refer to the Material Safety Data [Sheet](#)

Endoscopes

Endoscopes are another example of semi-critical items that require high-level disinfection. Significantly different processes are used for the disinfection of flexible and rigid scopes, and accessories used for invasive endoscopic procedures must be treated separately as critical items as described in the Spaulding classification.

Further information on endoscopes

For more detailed information on care and reprocessing of endoscopes you can refer to the following as helpful sources of information:

- State or territory guidelines
- [Australian and New Zealand Standards](#)
- The Gastroenterological Society of Australia ([GESA](#)), and
- The Gastroenterological Nurses College of Australia ([GENCA](#)).

Sterilisation

Sterilisation is a process used to render an item free from all forms of viable microorganisms. Critical items require preparation prior to sterilisation including cleaning and drying, a visual inspection for damage, an inspection to ensure the item is functioning correctly and prepackaging.

The most widely used methods of sterilisation used in healthcare facilities are steam sterilisation, dry heat sterilisation and peracetic acid.

Monitoring

Physical monitoring of any method of sterilisation requires certain parameters are met as per the following table.

Steam porous loads	134° C	203-206 KPa	3-3 ½ mins
Steam flash	134° C	203 KPa	3 ½ minutes
Ethylene oxide	45-60° C	78-168.9 KPa	3-4 hrs
Dry heat	160-180° C	Ambient	½ -1r
Gamma radiation	Ambient	Ambient	Dose – 25 kGy
Peracetic acid	50 – 56° C	Concentration	12 minutes
Low temperature gas plasma (hydrogen peroxide)	50 -55°C	Varies according to cycle stage	35-40 or 55-75 minutes Varies according to machine type

Bowie Dick type test

The Bowie Dick type test is done daily at 134°C for 3-3 ½ min. It detects air entrapment and evaluates the removal of residual air from the chamber and load.

Using biological/enzymatic monitoring indicators

The table shown here is a guide showing test organisms appropriate to the method of sterilisation.

Type of test organism	Methods of sterilisation
<i>Geobacillus stearothermophilus</i> (<i>Bacillus stearothermophilus</i>)	Steam under pressure peracetic acid Hydrogen peroxide plasma
<i>Bacillus atrophaeus</i> (<i>Bacillus subtilis</i>)	Ethylene oxide Dry heat

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Module 5 Infectious agent screening and immunisation of healthcare workers

The online module provides:

- An understanding of the steps involved with providing an occupational screening and immunisation program for healthcare workers
- An overview of the organisation's responsibilities for health screening and immunisation of healthcare workers
- Employee responsibilities in relation to certain infectious agents and preventative actions
- An outline of safe work practices to be considered if exposed to these infectious agents
- The requirement for accurate and confidential record keeping in relation to HCW healthcare records.

Some organisational and jurisdictional policies and procedures determine a healthcare worker's risk based on a classification or category that is determined by their occupational risk of exposure to patients, blood and body substances or infectious agents. In addition, some jurisdictions and organisations have included an additional sub-category to reflect a high risk for certain vaccine preventable infections i.e. seasonal influenza may be referred to as Category A mandatory.

The following example gives two category examples.

Category A – direct contact with patients or blood/body substances or infectious agents

Category B – no direct contact with patients, no greater risk of exposure to infectious agents than a member of the general public.

There are clinical areas where an organisation may determine that the risk is considered too high to allow HCWs to work clinically without this evidence of immunisation until all evidence is complete. These include:

- Emergency department
- Operating theatres and post anaesthetic care units
- Paediatrics
- Maternity
- Adult and neonatal ICU and special care units
- Respiratory wards/units
- Transplant and oncology units with immunocompromised patients

Recommend vaccinations for healthcare workers

Occupation	Vaccine
Healthcare workers (HCW)	
All HCW Includes all workers and students directly involved in patient care or the handling of human tissues	Hepatitis B Influenza MMR (if non-immune) ² Pertussis (dTpa) Varicella (if non-immune)
HCW who work in remote Indigenous communities or with Indigenous children in NT, Qld, SA and WA, and other specified healthcare workers in some jurisdictions	Vaccines listed for 'All HCW', plus hepatitis A
HCW who may be at high risk of exposure to drug-resistant cases of tuberculosis (dependent on state or territory guidelines)	Vaccines listed for 'All HCW', plus consider BCG
Persons who work with children	
All persons working with children, including: <ul style="list-style-type: none"> • staff and students working in early childhood education and care • correctional staff working where infants/children cohabit with mothers • school teachers (including student teachers) • outside school hours carers • child counselling services workers • youth services workers 	Influenza MMR (if non-immune) ² Pertussis (dTpa) Varicella (if non-immune)
Staff working in early childhood education and care	Vaccines listed for 'Persons who work with children', plus hepatitis A
Carers	
Carers of persons with developmental disabilities ³	Hepatitis A Hepatitis B Influenza
Staff of nursing homes and long-term care facilities for persons of any age ³	Influenza MMR (if non-immune) ² Varicella (if non-immune)
Providers of home care to persons at risk of high influenza morbidity	Influenza
Emergency and essential service workers	
Police and emergency workers	Hepatitis B Influenza Tetanus (dT or dTpa)
Armed forces personnel	Hepatitis B Influenza MMR (if non-immune) ² Tetanus (dT or dTpa) Other vaccines relevant to deployment

Table 4: Recommended vaccinations for persons at increased risk of certain occupationally acquired vaccine-preventable diseases. Source: Australian Technical Advisory Group on Immunisation: The Australian Immunisation handbook. 10th.ed. Canberra: Australian Government Department of Health and Ageing: 2013

Risk assessment and health screening for healthcare workers

An example of risk assessment table for health screening and immunisation of HCWs is presented below.

Infectious agent or disease	HCW category A	HCW category B	Examples of evidence that may be required as part of the recruitment process for new staff
Diphtheria, Tetanus and Pertussis (Adult dTpa)	Yes	Recommended	One documented dose of adult dTpa vaccine This dose must identify that the vaccine contained a Pertussis component in addition to Diphtheria and Tetanus. Note: This is not the same as a ‘Tet Tox’ or ADT vaccine.
Tuberculosis (TB)	Yes	No	Assessment of status within 4 weeks of commencement of employment
Hepatitis A	Selected	Selected	Offer to selected staff only, for example: <ul style="list-style-type: none"> laboratory services plumbers, and community, primary and mental healthcare workers working with developmentally disabled or indigenous people.
Hepatitis B	Yes	No	Documented evidence* of completed, age appropriate, course of vaccine AND documented evidence of antiHBs>10mIU/ml' OR documented evidence of past infection (HBcAb)
Measles, Mumps, Rubella (MMR)	Yes	Recommended	Born before 1966; OR documented evidence of 2doses of MMR at least 1 month apart; OR documented evidence of immune response (IgG) to Measles, Mumps, Rubella.
Chickenpox	Yes	Recommended	Personal history of chicken pox; OR physician diagnosis of shingles; OR documented evidence of IgG varicella serology; OR documented evidence of age appropriate vaccination for Varicella.
Influenza	Recommended for most HCWs but mandatory for identified high risk HCW	Recommended	Offer annually in autumn Identified high risk HCWs are HCWs who work in emergency departments, ICU (adult, paediatric and NICU), haematology/oncology units, transplant units or other high risk areas as identified by the organisation or jurisdiction

Hepatitis B immunity

If documented evidence is not available but the HCW has serological evidence of >10mU/L Hepatitis B surface antibody serology (antiHBs or HBs Ab) then the following items will assist in determining risk for the HCW:

1. The assessor should document the person's reported hepatitis B vaccination history and determine the validity of the information, taking into consideration:
 - Who provided the vaccines, the number of doses and the timing of the doses
 - The person's age at the time each dose was received (NB. two adult doses of hepatitis B vaccine administered 4-6 months apart are adequate when given to persons aged 11-15 years)
 - The time between the last vaccine dose course and serology provided, and
 - The reasons stated for the inability to provide documented evidence of hepatitis B vaccination.
2. Review a recent serology result (antiHBs).
3. Assess the risk to both the person and clients based on the type of clinical area/procedures involved.
4. Advise the person of the importance of a completed age-appropriate course of immunisation to establish long-term protection and the risks associated with incomplete vaccination, even though sufficient antiHBs levels have been documented.
5. The person should be offered an additional dose(s) of vaccine if the person believes that the antiHBs levels could have resulted from an incomplete course.

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Module 6 Outbreak management

The online module provides:

- Information on how to define the steps of an outbreak
- Increased awareness of the need to have effective management and notification systems in place to address relevant state and territory notifiable infectious agents and conditions
- Improved understanding of the role of the state and territory health authorities in outbreak management
- Awareness of the requirements relating to data collection and reporting systems
- Awareness of the main stakeholders required to form an Outbreak Control Team, and
- The ability to recognise the importance of investigating outbreaks as early as possible to utilise the maximum effect of the risk management principles, for example, identification, control and containment, and acquiring and utilising the best epidemiological data and microbiological results to minimise impact upon the population.

An outbreak can be defined as: **"when there are more cases of infection with the same organism than would normally be expected in one area or period of time".**

<https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>

Factors that can affect the response to an outbreak include

- The virulence of the infectious agent, and
- The vulnerability of the population

Key steps in responding to an outbreak:

Many steps are taken more or less simultaneously, while the results of investigations and implementation of strategies to contain and control will vary with the availability and timeliness of information and the seriousness of the outbreak

1. Implement and reinforce infection control strategies to contain/ prevent further cases
2. Investigate and identify epidemiological links,
3. Communication to key stakeholders and the development of an outbreak control team
4. Develop a case definition
5. Identify and monitor existing and new cases, contact tracing and data collection
6. Possible treatment and prophylaxis
7. Develop and test the hypothesis (source, type and mode of transmission)

Chemical agents for environmental cleaning during an outbreak situation

A major factor in the control of an outbreak involves enhanced environmental cleaning. Appropriate selection and use of chemical agents for environmental cleaning and disinfection should be risk assessed for correct and safe use. PPE, especially gloves are to be changed between and on completion of any cleaning and disinfection activities. Ensure that solutions used for environmental cleaning are compatible with items or surfaces, receive adequate contact time with surfaces and are prepared correctly.

Disinfectants to be used in healthcare settings for environmental cleaning may vary according to national/state/territory recommendations and also between acute and non-acute patient care areas. A risk assessment should be completed.

If using separate cleaning agents and disinfectants, surfaces should be cleaned first with a detergent solution, then a disinfectant is used in accordance with the manufacturer's instructions for use. This is a two-step process, cleaning and then disinfection

If using a combined detergent /disinfectant product for environmental cleaning and follow the manufacturer's instructions for use.

When using disinfectants, ensure staff, patients and items are not harmed by exposure to the disinfectant agents. Follow manufacturer's instructions for use.

The selection of a disinfectant must include confirmation that its characteristics will ensure it is effective against infectious agent(s) involved.

When using disinfectants, ensure staff, patients and items are not harmed by exposure to the disinfectant agents.

Monitoring of cases and the resolution of the outbreak

The development of surveillance lists, case lists, checklists and reporting formats should include appropriate data required by the outbreak management team and state/territory health authorities. Most public health authorities will have protocols to utilise.

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Sample organisational gastro outbreak case list

Name	Patient MRN/ UR number	DOB	Symptom duration		Symptom description (tick & describe)						Room No.	Ward/ Floor
			Onset date & time	End date	Abdominal Pain	Fever	Diarrhoea	Vomiting	Nausea	Hospitalised		

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Module 7 Management of occupational exposures

The online module provides:

- An understanding of the types of occupational exposures likely to be encountered in the healthcare setting
- An understanding of the ways to prevent occupational exposures in the healthcare setting
- Information on the body fluids that pose a risk for blood borne viruses transmission
- Awareness of the estimated transmission risks of the blood borne viruses hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV)
- The ability to outline the management of an occupational exposure, including first aid, informed consent, pre and post-test counselling, risk stratification and assessment, blood tests required and follow up
- An understanding of the processes involved in managing an occupational exposure within a healthcare facility.

Transmission risk

Type of Exposure	Estimated Risk of HIV Transmission	Estimated Risk of HBV Transmission	Estimated Risk of HCV Transmission
Use of contaminated injecting equipment	0.8%		
Needlestick injury of HCW	0.3 – 0.8 % If source is HIV positive and/or not receiving antiretroviral treatment	1-6% if source is HBeAg negative and health care worker is non-immune or unvaccinated 22-31% if source is HbeAg positive or HBV DNA positive and health care worker is non-immune or unvaccinated	Approx 1.8% if the source is HCVab positive but PCR negative 10% if the exposure is a result of a deep needlestick injury with a hollow bore needle from a HCV –RNA positive source (tested using Polymerase Chain Reaction PCR)
Mucous membrane exposure	0.09%		

Table 5: Risk of transmission following exposure to HIV, HBV, HCV infected person who is NOT on antiretroviral treatment. Source: NSW Health Policy Directive 2017-101 HIV, Hepatitis B and Hepatitis C – Management of Health Care Workers Potentially Exposed, Health Protection NSW, NSW Health, May 2017

Factors affecting transmission risk

The following factors may increase the risk of transmission of blood borne viruses following an occupational exposure.

- If first aid is delayed
- The nature of the injury such as:
 1. Hollow bore needles verses solid sharp
 2. Penetrating injury verses mucosal splash
 3. Deep versus superficial
 4. Visible blood on instrument/ body fluid verses no visible blood or body fluid
 5. No gloves verses wearing gloves
- Hepatitis B immune status of the recipient
- Types and stages of viral infection of the source
 1. High viral load in the source
 2. Early post exposure prophylaxis (PEP) may significantly reduce the risk of transmission of blood born viruses

Factors to consider in assessing the need for follow-up of occupational exposures

Type of Exposure

- Percutaneous injury
- Mucous membrane exposure
- Non-intact skin exposure
- Bites resulting in blood exposure to either person involved
- Other – environmental, zoonotic

Type and Amount of Fluid/Tissue

- Blood
- Fluids containing blood
- Potentially infectious fluid or tissue (semen, vaginal secretions, and cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids or wound exudate)
- Direct contact with concentrated virus or bacteria

Infectious Status of Source

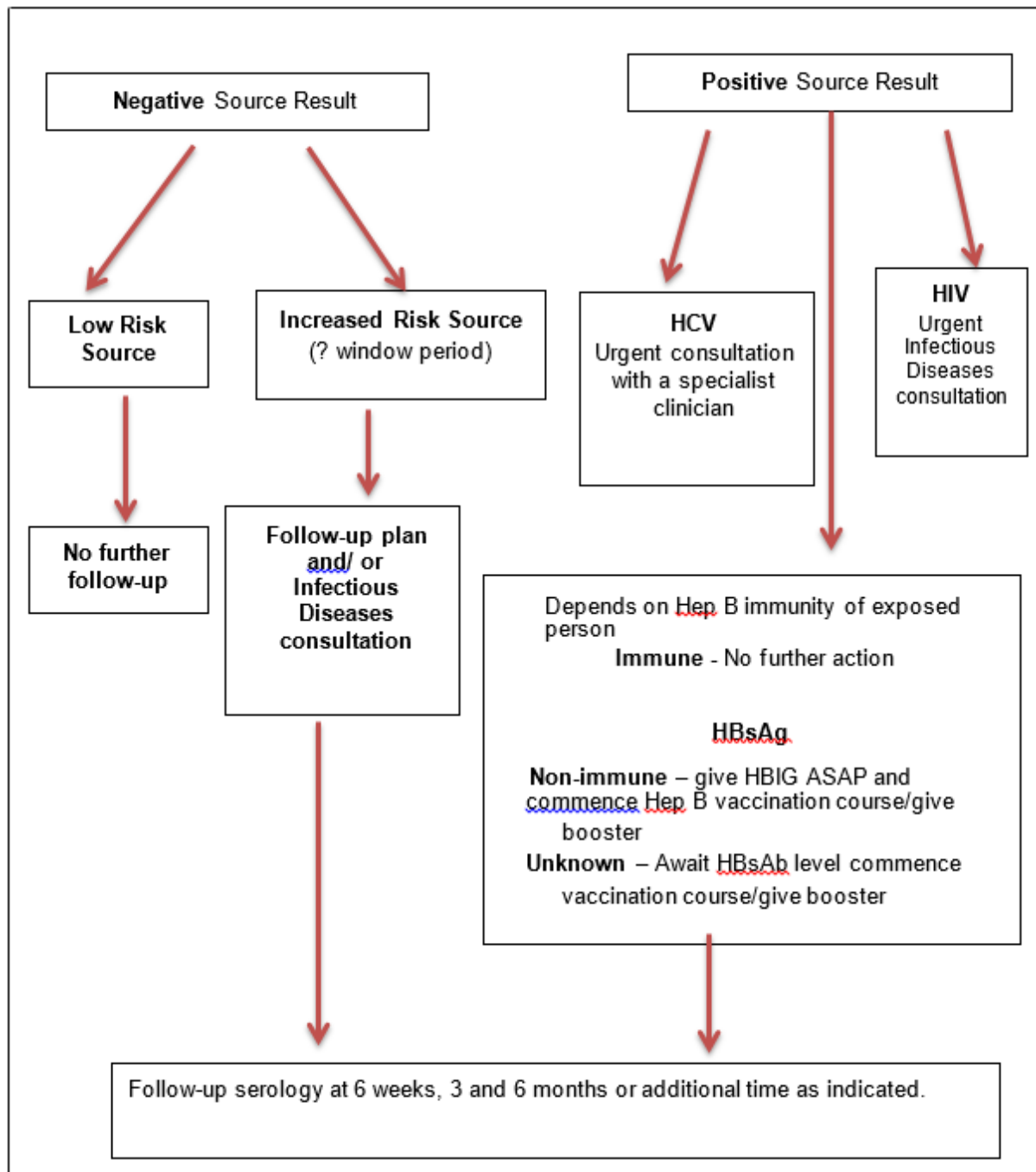
- Can source be identified
- Presence of HBsAg
- Presence of HCV antibody
- Presence of HIV antibody

Source status	Serological tests for HCWs			
	Baseline	6 weeks	3 months	6 months
HIV+ve or in a window period	HIVab	HIVab	HIVab	HIVab (if PEP is used)
HB+ve or in a window period	HBsAb HBsAg HBeAg HBV DNA	HBsAb HbsAg HBeAg HBV DNA	HbsAg	HBsAg
HC+ve or in a window period	LFT's HCVab	*HCV PCR at 3 weeks	HCVab HCV – PCR LFT's	HCVab HCV – PCR LFT's

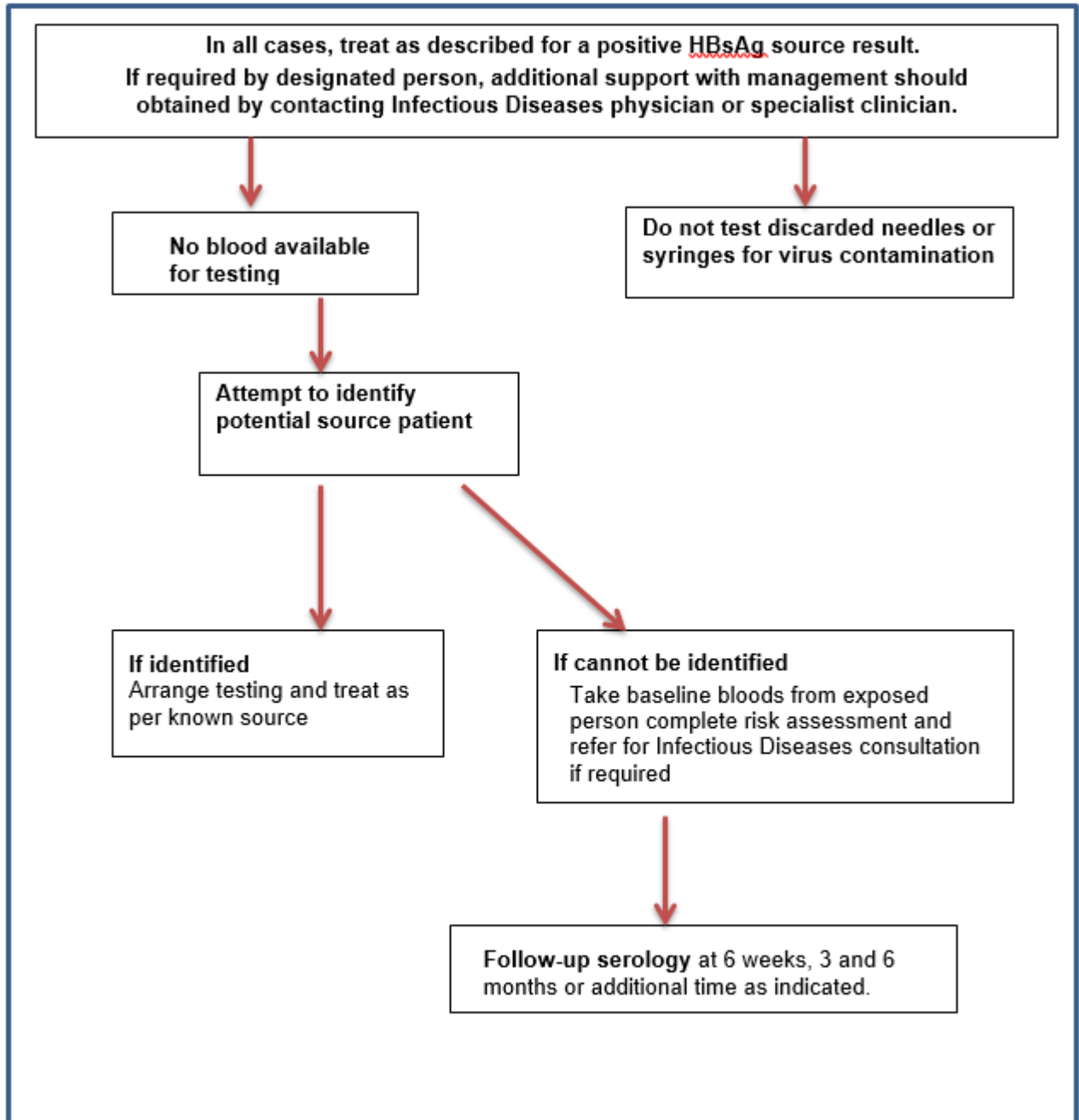
Table 6: Serological testing timeframe for healthcare workers. Source: NSW Health Policy Directive 2017-101 HIV, Hepatitis B and Hepatitis C – Management of Health Care Workers Potentially Exposed, Health Protection NSW, NSW Health, May 2017.

Note: In high risk exposures consideration should be given to checking Hep C PCR at 3 weeks post exposure if earlier diagnosis is desired.

Immediate management flow chart – source identity known – SAMPLE ONLY



Immediate management flow chart – source identity unknown - SAMPLE ONLY



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Module 8 Renovation, repairs and redevelopment risk management

The online module provides:

- An overview of basic risk minimisation strategies
- An example of how to demonstrate the method of risk assessment
- Methods to recognise the appropriate infection prevention measures for each classification
- Methods to demonstrate an understanding of monitoring options to be used during projects in the healthcare setting, and
- A description of significant infectious agents that are associated with renovation and redevelopment in healthcare facilities.

Etiologic agent	Underlying medical condition	Number of patients infected or colonised	Number of patients who died	Circumstances	Year
<i>Scedosporium sp.</i> , <i>Rhizopus sp.</i> , <i>Phoma sp.</i> , <i>Exosporohilum sp.</i> , <i>Bipolaris sp.</i> , <i>Fusarium sp.</i> , <i>Aspergillus sp.</i> , <i>Candida sp</i>	Children with acute leukaemia	50	10	Major renovation with excavation of grounds for construction of a tower connecting buildings	Pokala, et al., 2014
<i>A. fumigatus</i> <i>A. flavus</i> <i>A. terreus</i>	Acute leukaemia	25	6	Construction and renovation work	Charbrol et al., 2010
<i>A. fumigatus</i>	Haematology unit/acute leukaemia	4	0	Renovation work	Pini, et al., 2008
<i>A. fumigatus</i>	Haematology patients	6	2	Major hospital construction work	Chang et al., 2008
<i>A. fumigatus</i> <i>A. flavus</i> <i>A. terreus</i>	Lung transplant recipients	8	1	Building construction work	Raviv et al., 2007
<i>A. ustus</i>	Ophthalmology patients	3	0 (3 enucleations)	Renovations ophthalmology dept and operating suite	Saracli et al., 2007

Table 7: Summary of documented significant outbreaks of construction related infection

Etiologic agent	Underlying medical condition	Number of patients infected or colonised	Number of patients who died	Circumstances	Year
<i>A. fumigatus</i>	Renal transplant patients	4	4	Building construction work	Panackal et al., 2003
<i>A. fumigatus</i> <i>A. flavus</i>	Surgical inpatients	6	2	Deterioration of insulating material in airflow units	Lutz et al., 2003
Aspergillus	Oncology patients (Bone Marrow Transplant, Acute Myeloid Leukaemia, Acute and Chronic Lymphatic Leukaemia)	36 (over 69 months)	17	28 cases occurred during construction and 4 cases after control measures initiated	Loo et al., 1996
<i>A. fumigatus</i>	Respiratory failure, Crohns disease, chronic bronchitis	6	3 (related to underlying disease)	Spores in fibrous insulation above perforated ceiling were dispersed during minor building in adjacent offices and stores areas	Humphreys et al., 1991
<i>A. fumigatus</i>	Renal disease – chronic renal failure	3	2	Outbreak coincided with hospital renovation in an area near the renal unit where the patients were being accommodated.	Sessa et al., 1996
Aspergillus	Patients on haematology unit	5	5	Large-scale evacuation work while hospital being rebuilt. The isolation rooms that housed the patients overlooked the building site.	Shields et al., 1990

Outbreak papers are included in further resources at the end of the section.

Risk rating	Area/Department
Lowest risk	Office areas Public areas Workshops Unoccupied wards areas not accommodating patients
Potential risk	Nuclear medicine Non-invasive radiology including Magnetic Resonance Imaging (MRI) and Computerised Tomography (CT) Preadmission units and discharge clinics Research laboratories General outpatient areas except surgery and oncology Psychiatric services Allied health, e.g. physiotherapy, occupational therapy, social work, dietetics and so on General wards All other patient care areas unless stated in moderate or highest risk
Moderate risk	Emergency Department Pharmacy Pathology laboratory Respiratory units Physiotherapy respiratory function units Coronary care unit Cardiology clinics Outpatients unit (surgery and oncology) Invasive radiology Paediatrics wards Obstetrics wards including labour ward and delivery suites Surgical wards Geriatric and long term care wards
Highest risk	Units accommodating immunocompromised patients (e.g. HIV/ AIDS units) Intensive care units and high dependency units Sterilising services unit Sterile stock store rooms All operating suites Day surgery units Haematology/oncology inpatient and day units Solid organ transplant units (e.g. renal transplant unit) Bone marrow transplant units Neonatal intensive care/special care units Cardiac catheterisation/angiography units Haemodialysis unit Endoscopy units Anaesthesia and pump areas Recovery units Pharmacy clean rooms/aseptic areas/admixture rooms

Table 8: Patient and geographic risk areas in a health service organisation for redevelopment
adapted from: [Australasian Health Facility Guidelines: Part D- Infection Prevention and Control](#),
Accessed June 2019.

This table describes the level of risk for the transmission of pathogens relating to the level of construction activity.

Classification	Type of activity
Type 1 – insignificant	<p>Inspection and non-invasive activities. These include but are not limited to:</p> <ul style="list-style-type: none"> • Activities that require lifting or removal of ceiling tiles for visual inspection only • Painting (not sanding) • Electrical trim work • Minor plumbing (in a localised area, e.g. patient bathroom), and • Maintenance activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
Type 2 - Minor	<p>Small scale short duration, maintenance or renovation activities that create minimal dust. These include but are not limited to:</p> <ul style="list-style-type: none"> • Access to duct spaces • Cutting of walls or ceilings where dust migration can be controlled for the installation of minor electrical work or cables • Sanding to repair small patches • Minor plumbing work in one patient care area (1 patient room), e.g. disruption to water supply.
Type 3 - Moderate/major	<p>Work that generates a moderate to high level of dust or work that cannot be completed in a single work shift. This includes but is not limited to:</p> <ul style="list-style-type: none"> • Sanding of walls for painting or wall covering • Removal of floor coverings and ceiling tiles • Plasterwork, duct work or electrical work above ceilings • Major plumbing work, e.g. interruption of sewerage pipes, and • Removal of fixed building items, e.g. countertops, sinks.
Type 4 - Major	<p>Major maintenance, demolition/ excavation/ construction projects that require consecutive work shifts to complete. These include but are not limited to:</p> <ul style="list-style-type: none"> • Removal of ceiling tiles and/or ceilings • Major plumbing work in clinical common areas or affecting more than 2 patient rooms • Removal of plaster walls, block works, bricks, or mortar, and • New construction involving large areas of open soil.

Table 9: Activities and classification for risk rating. **Adapted from:** [Australasian Health Facility Guidelines: Part D- Infection Prevention and Control](#), Accessed June 2019

AREAS OF VULNERABILITY	PROBABILITY OF CONTAMINATION			
	Insignificant	Minor	Moderate	Major
<i>Lowest risk</i>	Class I	Class II	Class II	Class III
<i>Potential risk</i>	Class I	Class II	Class III	Class IV
<i>Moderate risk</i>	Class I	Class II	Class III	Class IV
<i>Highest risk</i>	Class II	Class III	Class IV	Class IV

Table 10: Risk rating matrix. **Adapted from:** [Australasian Health Facility Guidelines: Part D- Infection Prevention and Control](#), Accessed June 2019

Baseline air sampling should be considered prior to the commencement of any activities, especially where there is a disruption of possible contaminants. There are several methods used to determine baseline levels of dust and microorganisms.

Further information can be obtained from the [Australian Institute of Occupational Hygienists](#).

Description of activities and classification by class

This table describes the level infection prevention and control intervention required to minimise the risk of transmission of organisms that could be harmful to patients and others during the project works.

Class	Activity conducted during project
Class 1	<ul style="list-style-type: none"> • Minimise raising or disturbing dust during activity • Vacuum ceiling as tile is being displaced or removed for inspection • Immediately replace ceiling tiles displaced for visual inspection • Vacuum work areas • Minimize patient's exposure to construction/renovation area, and • Ensure construction zone is thoroughly cleaned when work is complete.
Class 2	<ul style="list-style-type: none"> • Restrict access to the work area to essential staff undertaking the activity • Wet mop and/or vacuum to remove visible dust during activity • Use drop sheets to control dust and airborne infectious agents • Water mist work surfaces while cutting or sawing • Seal windows and unused doors with duct tape • Seal air vents in construction/renovation area • Disable ventilation system until the project is complete • Place dust mat at entrance and exit to work areas • Contain debris in covered containers before transporting for disposal • Wipe horizontal surfaces to keep dust free • Identify high risk patients who may need to be temporarily kept away from construction area • Ensure that patient care equipment and supplies are free from dust exposure, and • Ensure construction zone is thoroughly cleaned when work is complete with wet mop with hot water and detergent and /or vacuum with HEPA filtered vacuum.

<p>Class 3</p>	<p>In addition to measures introduced in Class 1 and 2:</p> <ul style="list-style-type: none"> • Ensure that IPC consultation has been completed and infection prevention measures approved • Erect impermeable dust barrier from true ceiling to floor (e.g. 2 layers of 6mm plastic sheeting) • Ensure windows, doors, plumbing penetrations, electrical outlets and intake and exhaust vents are sealed with plastic and duct taped • Clean and vacuum air ducts and spaces above ceiling as far as accessible, if necessary • Ensure construction workers wear protective clothing that is removed before entering patient areas • Remove dust barrier carefully to minimise spreading dust and other debris associated with construction • Remove debris at the end of each working day • Increase frequency of cleaning in areas adjacent to construction zone, and <p>Design traffic pattern for construction workers that avoid patient care areas and a traffic pattern for clean or sterile supplies and equipment that avoids the construction area.</p>
<p>Class 4</p>	<p>In addition to measures introduced in Class 1, 2 and 3:</p> <ul style="list-style-type: none"> • Erect an impermeable dust barrier and anteroom with walk off mat into patient care area • Check integrity of barriers daily and repair any damage as soon as identified • Seal holes, pipes, conduits, and punctures appropriately • Ensure negative pressure ventilation systems in construction area is separate to patient care areas by sealing off or redirecting directly to outside. Consider HEPA filtration to redirected air • Regularly visit the patient care areas adjacent to the construction zone to ensure preventative measures are effective, and • Utilise dust monitors in adjacent areas that have been calibrated to the environment.

Table 11: Description of activities and classification by class. Adapted from: **Adapted from:** [Australasian Health Facility Guidelines: Part D- Infection Prevention and Control](#), Accessed June 2019

Construction Survey Tool

Below is an example of a construction/ project survey tool. This type of tool maybe used for documentation of daily inspection of construction area by Infection Control or delegate.

Barriers			
Patient doors adjacent to area closed	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Dust proof plastic sheeting barriers in place and sealed at ceiling height	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Dust proof rigid barrier walls in place and sealed at ceiling height	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Ceiling space sealed within the work area (between the ceiling tiles and the next slab or roof)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Project Area			
Debris removed in covered container	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Rubbish in appropriate container	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Entry and exit points clearly identified	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Traffic Control			
Restricted to construction workers and necessary staff only	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
All doors and exits free of debris	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
General public and patient access diverted	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
COMMENTS			

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Roles and responsibilities for planning, consultation, implementation and monitoring of infection prevention activities

This table is an example of the infection prevention roles and responsibilities that need to be considered during construction and renovation, responsibilities may vary in different facilities.

Planning and consultation	Responsibility
<p>Infection prevention staff must be consulted and involvement should be sought at the planning stage to assist with:</p> <ul style="list-style-type: none"> • Education • Design of the project to maximise the safety of staff and patients, and • Review of the schematic design to ensure all preventative measures to maximise dust control are in place. 	<p>Architects/ builders Engineering services Infection prevention and control</p>
Project design	Responsibility
<p>The ICP in collaboration with facility administration and nursing staff must identify patient population(s) that may be at risk and the appropriate preventative measures to ensure their safety. This include providing construction/ renovation workers sole access to ensure they avoid patient care areas</p>	<p>Infection prevention and control Facility administration</p>
<p>Patients who are at increased risk or immunocompromised should be moved to an area away from the work area/ construction zone if the air quality cannot be assured during construction.</p>	<p>Infection prevention and control Facility administration</p>
<p>Traffic patterns for construction workers should be established that avoid patient care areas and traffic areas for patient services, e.g. food delivery.</p>	<p>Architects/ builders Engineering services Infection prevention and control</p>
<p>Management must identify whose responsibility it is to stop construction projects if breaches in preventative measures arise.</p>	<p>Facility administration</p>
Education	Responsibility
<p>All personnel involved in the construction/renovation activity should be educated and trained in the infection prevention measures, methods for dust containment and removal of construction debris should be outlined.</p>	<p>Architects/ builders Engineering services</p>

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Dust control	Responsibility
Isolation/ventilation	
A dust barrier should be created from the floor to the true ceiling and edges sealed. Plastic sheeting can be used for short term dust barriers.	Architects/ builders Engineering services
All potential sources of air leak should be sealed in the work area/ construction zone. Traffic patterns for construction workers should be established that avoid patient care areas.	Architects/ builders Engineering services
If possible, an elevator or staircase should be designated for the sole use of construction workers. The ventilation of the elevator or shaft should not be re-circulated in the facility	Architects/ builders Engineering services
When major demolition or excavation is undertaken, damping down to limit dust should be considered.	Architects/ builders Engineering services
Open ends of exhaust vents should be capped to prevent air exhausted from the work area/ construction zone from being drawn back into patient care areas or released to outdoor streets around the healthcare facility.	Architects/ builders Engineering services
All windows, doors, vents and other sources of potential air leak should be sealed in the work area/ construction zone.	Architects/ builders Engineering services
The work area/ construction zone should be under negative pressure and all exhausted air should be to the outside of the facility. The exhaust location must not be a risk to other air intakes or external services/ people. Consideration should be given to HEPA filtration for exhausted air from work area.	Architects/ builders Engineering services
Environmental cleaning	Responsibility
Areas adjacent to patient areas should be vacuumed with a vacuum fitted with a HEPA filter and damp dusted daily or more frequently if needed.	Environmental services

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Waste containment	Responsibility
If a dedicated lift/ corridor is not available then dedicated times should be allocated and cleaning should be completed following these times.	Architects/ builders Engineering services
All waste containers should be covered and all debris removed daily via a dedicated work area/ construction zone access corridor and/ or lift.	Architects/ builders Engineering services
Monitoring	Responsibility
Daily inspection	
The ICP should conduct daily inspections of the adjacent patient care areas for breaches in infection prevention measures. The need for additional cleaning of adjacent patient areas should be assessed and confirmation of adequate dust control can be made by air sampling during the highest level of demolition work or during periods of high dust generation.	Infection prevention and control
Laboratory surveillance	Responsibility
A baseline rate of clinical isolates of <i>Aspergillus spp.</i> and other significant infectious agents should be established prior to the commencement of construction/ renovation work. Throughout the project the rate of clinical isolates should be monitored. An increase in the rate should be investigated to determine if associated with the construction/renovation works. All preventative infection measures should be reviewed to ensure that a breach has not occurred and corrective action should be undertaken immediately.	Infection prevention and control
Air sampling	Responsibility
Air sampling aims to detect <i>Aspergillus spp.</i> colonies in association with the building works. Sabouraud's Dextrose Agar (SABG). Sabouraud's agar, a selective inhibitory mold agar (IMA) media for fungi is used for this test to monitor for <i>Aspergillus spp.</i>	Infection prevention and control

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Module 9 Basic epidemiology and statistics

The online module provides:

- Information on the occurrence of infection transmission
- How bias and confounding affect results
- The common units of measurement; mean, median and percentiles
- The measure of variability; range and standard deviation,
- The different statistical analysis that can be performed; p value, confidence intervals, odds ratio and risk ratio
- How infection is measured and describe the different epidemiology investigations that are conducted
- The scales of measurement in statistics

Incidence

A measure of the frequency with which new cases of illness, injury, or other health condition occurs among a population during a specified period ([CDC](#)).

5 newly colonised patients with MRSA were detected on a weekly screening in Ward C. A total of 30 patients were screened on this day:

- 23 did not have MRSA
- 2 were known to have MRSA from last week's screening, and
- 5 were the newly detected cases.

Therefore: Incidence ratio = $5/30 = 0.17$
Incidence percentage = 17%

Incidence rate

A measure of the frequency with which new cases of illness, injury, or other health condition occur, expressed explicitly per a time frame. Incidence rate is calculated as the number of new cases over a specified period divided either by the average population (usually mid-period) or by the cumulative person-time the population was at risk ([CDC](#)).

In the following example, 5 patients were identified with *S.aureus* bloodstream infections from Ward A in a 30 day period. Ward A had another 16 patients coming in and out of the ward during these 30 days with a total of 257 patient-days of bed occupation in the ward.

Therefore: Incidence ratio = $5/257 = 0.019$
Incidence rate = 19 per 1,000 patient-days
The incidence rate was 19 patients with *S.aureus* bloodstream infections per 1,000

patient-days.

This rate can then be compared to the rates:

- In other wards within the same hospital
- In other similar sized hospitals for the same specialty units, and
- Before and after infection control intervention.

When comparing rates, consideration should be given to *variable risk* as patients may have different risk factors or be undergoing procedures that change their risk factors. The risk affecting the rates can be used to identify higher or lower rates and how they impact upon patient safety.

Prevalence

The number or proportion of cases or events or attributes among a given population ([CDC](#)).

In the following example, 5 newly colonised patients with MRSA were detected on screening in Ward B on one day. A total of 30 patients were screened on this day:

- 23 patients did not have MRSA
- 2 were known to have MRSA from last week's screening, and
- 5 were the newly detected cases.

Therefore: Prevalence ratio = $7/30 = 0.23$
Prevalence percentage = 23%

Types of studies used in epidemiology

Various studies can be conducted on a [sample population](#) by collecting data over a defined time period. Epidemiological data can be used to record disease or infections, to identify modes of [transmission](#) and identify [risk factors](#). There are two types of studies used in epidemiology; observational and experimental studies.

Examples of observational studies

Ecological study

An example of an ecological study would be a comparison of hospital-wide use of vancomycin with prevalence of VRE in the hospital. Additional studies would be required to further explore the data.

Cross sectional study

A cross-sectional study is a study in which a sample of persons from a population are enrolled and their exposures and health outcomes are measured simultaneously. This type of study can be either prospective or retrospective ([CDC](#)).

An example of a cross sectional study would be an investigation of all patients

currently in hospital with VRE and whether they have received vancomycin. This study then can lead to analysis of the population as either a case control or cohort study.

Case control study

A case-controlled study is a retrospective observational analytic study that enrolls one group of persons with a certain disease, chronic condition, or type of injury (cases) and a group of persons without the health problem (controls) and compares differences in exposures, behaviors, and other characteristics to identify and quantify associations, test hypotheses, and identify causes ([CDC](#)). An example of a case control study would be an investigation of patients with central venous catheters who had BSI (cases) and those that did not (controls) in the intensive care unit over the same time period to identify the risk factors relating to central venous catheters and acquisition of BSI.

Cohort study

A cohort study is a prospective observational analytic study in which enrollment is based on status of exposure to a certain factor or membership in a certain group. Populations are followed, and disease, death, or other health-related outcomes are documented and compared. Cohort studies can be either prospective or retrospective.

A cohort is a well-defined group of persons who have had a common experience or exposure and are then followed up, as in a cohort study or prospective study, to determine the incidence of new diseases or health events ([CDC](#)).

An example of a cohort study would be an investigation of risk factors in patients with central venous catheters who had BSI and those that did not in the intensive care unit over the same time period.

	Cohort studies	Case control studies
Suited for rare diseases	No	Yes since starting with a set of cases
Suited for rare exposures	Yes since starting with exposure status	No
Allows for studying several exposures	Difficult but examples exists (Framingham study)	Yes
Allows for studying several outcomes	Yes	No
Disease status easy to ascertain	Sometimes difficult	Easier since starting point of the study
Exposure status easier to ascertain	Yes since starting point of the study. Except for retrospective cohorts	Sometimes difficult. Information biases.
Allows computation of risk and rates	Yes	No
Allows computation of effect	Computation of risk ratio and rate ratio	Estimation of risk ratio, rate ratio from odds ratio
Allows studying natural history of disease	Yes Easier to show that cause precedes effect.	More difficult Temporality between cause and effect difficult to establish
Based on existing data sources	Difficult	Yes but access to information sometimes difficult
Easiness to find a reference group	Usually not difficult to identify an unexposed population	No Major potential biases when selecting a control group
Sample size	Large	Small
Cost	Elevated except if retrospective cohorts	Smaller
Time required	Long, sometimes very long except if retrospective cohorts	Shorter
Follow up	Difficult, loss to follow up	No follow up
Logistics	Heavy Many staff, large data sets Long duration	Easier
Concept	Easy to understand	Difficult to understand particularly if case cohort or density case control study
Ethical issues	Major if studying risk factors. Interruption of study if exposure shown to be harmful. Need for intermediate analysis.	None since outcome already happened.

Table 12: Advantages and disadvantages of cohort and case control studies. Source: European Centre for Disease Prevention and Control (ECDC) Field Epidemiology Manual, Access June 2019, access [here](#)

Examples of experimental studies

An experimental study is a study in which the investigator specifies the type of exposure for each person (clinical trial) or community (community trial) then follows the person's or community's health status to determine the effects of the exposure ([CDC](#)). An experimental study may look at the effectiveness of an antibiotic by which a group of people are given the new antibiotic while the others receive the current treatment. All other factors are kept constant while the antibiotic is the only experimental factor (variable) that will or will not show an effect.

Randomised controlled trials (RCT)

An RCT is a study in which a number of similar people are randomly assigned to two (or more) groups to test a specific drug, treatment or other intervention. One group (the experimental group) has the intervention being tested, the other (the comparison or control group) has an alternative intervention, a dummy intervention (placebo) or no intervention at all. The groups are followed up to see how effective the experimental intervention was. Outcomes are measured at specific times and any difference in response between the groups is assessed statistically. This method is also used to reduce bias ([NICE](#)).

An example of a randomised controlled trial would be where patients in the intensive care unit are randomly assigned to either a new antibiotic or the current antibiotic treatment for MRSA bacteraemia and then compared for mortality and length of hospital stay outcomes.

Bias

Bias is defined as any systematic error in the design, conduct or analysis of a study that results in a mistake of the estimate between the exposure and risk of infection.

Bias examples

Selection bias

Selection bias is a systematic difference in the enrollment of participants in a study that leads to an incorrect result (e.g., risk ratio or odds ratio) or inference ([CDC](#)).

Selection bias occurs where volunteers may not be representative of a true population as these are patients who want free treatment and they may differ to non-volunteers.

Information bias

Information bias is a systematic difference in the collection of data regarding the participants in a study (e.g., about exposures in a case-control study, or about health outcomes in a cohort study) that leads to an incorrect result (e.g., risk ratio or odds ratio) or inference ([CDC](#)).

Information bias can occur if patients are aware of their infection status as they may try to identify possible reasons for obtaining a resistant infection. This group would be more likely to remember recent antibiotics that they have been given

Confounding

Confounding is the distortion of the association between an exposure and a health outcome by a third variable ('confounder') that is related to both ([CDC](#)).

For example, in assessing the association between VRE infection and mortality in a gastro-surgical unit, we need to consider complexity of surgery as a potential confounder. Complex surgical patients are more likely to be on vancomycin and develop VRE but these patients are also more likely to die. As complexity of surgery is associated with both exposure and outcome it is a potential confounder.

Basic statistics

Statistics allow clinicians to have an understanding of the significance of the epidemiological data and to determine if it is statistically significant or not in the applied setting. An understanding of the terminology and how it is applied in research will also assist with the interpretation of scientific journal articles and research findings.

Mean (μ)

Mean is the measure of central location, commonly called the average, calculated by adding all the values in a group of measurements and dividing by the number of values in the group ([CDC](#)).

To calculate the mean for the set of 10 numbers displayed here:

10.5, 10.8, 10.9, 11.9, 12.4, 12.8, 15.2, 11.1, 11.7, 10.1

Total sum $X = 117.4$ and number of observations $n = 10$.

Therefore: $117.4/10 = \text{mean } 11.7$.

Median

Median is the measure of central location that divides a set of data into two equal parts ([CDC](#)).

To calculate the median for the following set of numbers: 10.5, 10.8, 10.9, 11.9, 12.4, 12.8, 15.2, 11.1, 11.7, 10.1

Arrange them in numerical order:

10.1, 10.5, 10.8, 10.9, 11.1, 11.7, 11.9, 12.4, 12.8, 15.2

The median is between 11.1 and 11.7. The median is the middle number. If there is two middle numbers, the median is halfway between the two middle numbers.

Median = **11.4**

Percentiles

Percentiles are a set of cut points used to divide a distribution or a set of ranked data into 100 parts of equal area with each interval between the points containing 1/100 or 1% of the observations ([CDC](#)).

If we use our previous set of numbers:

10.5, 10.8, 10.9, 11.9, 12.4, 12.8, 15.2, 11.1, 11.7, 10.1

10.1, 10.5, 10.8, 10.9, 11.1, 11.7, 11.9, 12.4, 12.8, 15.2

Therefore:

- 25th percentile = (10.5, 10.8) = **10.6**
- 50th percentile = (11.1-11.7) = **11.4**
- 75th percentile = (12.4-12.8) = **12.6**.

Normal distribution

Normal distribution is a distribution represented as a bell shape, symmetrical on both sides of the peak, which is simultaneously the mean, median, and mode, and with both tails extending to infinity ([CDC](#)).

The height of adults in Australia follows a normal distribution with a mean (μ) of 174 cm and a standard deviation (σ) of 6 cm.

Therefore:

- 68.2% of observations will be between ± 1 standard deviation (168-180cm)
- 95.4% of observations will be between ± 2 standard deviations (162-186cm), and
- 99.6% of observations will be between ± 3 standard deviations (156-192cm).

Range

Range is the difference between the largest and smallest values in a distribution; in common use, the span of values from smallest to largest ([CDC](#)).

Using the set of numbers from our previous

sample: 10.5, 10.8, 10.9, 11.9, 12.4, 12.8, 15.2,

11.1, 11.7, 10.1

We would rearrange them in numerical order:

10.1, 10.5, 10.8, 10.9, 11.1, 11.7, 11.9, 12.4, 12.8, 15.2

Therefore, the **range** is (**10.1 – 15.2**).

Standard Deviation (σ)

Standard deviation is a statistical summary of how dispersed the values of a variable are around its mean, calculated as the square root of the variance ([CDC](#)).

To use the set of numbers from our previous

example: 10.5, 10.8, 10.9, 11.9, 12.4, 12.8, 15.2,

11.1, 11.7, 10.1

We would again arrange them into numerical

order. 10.1, 10.5, 10.8, 10.9, 11.1, 11.7, 11.9,

12.4, 12.8, 15.2

Therefore:

- Mean = 11.7, and
- Calculated SD = **1.5**.

This means that 95% of results will be between (11.7-1.5) to (11.7+1.5), that is, 10.2 to 13.2.

If the distribution is "normal", 95% of all observed results will be located between the mean +/- 1.96 SD.

Confidence intervals

Confidence intervals are a way of expressing how certain we are about the findings from a study, using statistics. It gives a range of results that is likely to include the 'true' value for the population. A wide confidence interval indicates a lack of certainty about the true effect of the test or treatment - often because a small group of patients has been studied. A narrow confidence interval indicates a more precise estimate (for example, if a large number of patients have been studied). The confidence interval is usually stated as '95% CI', which means that the range of values has a 95 in a 100 chance of including the 'true' value ([NICE](#)).

Confidence intervals are a range of values for a measure (e.g. rate or odds ratio) constructed so that the range has a specified probability (often, but not necessarily, 95%) of including the true value of the measure ([CDC](#)).

p value

The p value is a statistical measure that indicates whether or not an effect is statistically significant. For example, if a study comparing two treatments found that one seems to be more effective than the other, the p value is the probability of obtaining these results by chance.

By convention, if the p value is below 0.05 (that is, there is less than a 5% probability that the results occurred by chance) it is considered that there probably is a real difference between treatments. If the p value is less than 0.001 (less than a 1% probability that the results occurred by chance), the result is seen as highly significant. However, a statistically significant difference is not necessarily clinically significant. The following provides an example of the difference between statistical significance and clinical significance.

Example, drug A might relieve pain and stiffness statistically significantly more than drug B. But, if the difference in average time taken is only a few minutes, it may not be clinically significant (adapted from [NICE](#)).

The incidence rate for acquiring VRE from another patient in a four bed room has a Relative Risk of 2.9 [95% CI, 1.3-4.4], $p = 0.01$.

This means that the risk of acquiring VRE from another patient sharing the four bed room is 2.9 times increased with the true value 95% of the time being as low as 1.3 or as high as 4.4. As it does not cross 1, the p value of 0.01 is supported as significant.

Other common statistical tests

Anova: Tests for statistical significance between means of several subgroups (multiple testing).

Chi-square: Tests the relationship between the frequencies of two factors.

Correlation coefficient: A measure of association that indicates the degree to which two variables have a linear relationship. Results can be between -1 and +1.

Fisher's exact: Used to test association of 2X2 frequency table for sparse data or small numbers (<20).

Kruskall-Wallis: Extension of Wilcoxon for comparing more than 2 groups

Mann-Whitney: Used when sample data are not normally distributed. Test compares two independent groups of ordinal scores.

McNemar's Test: A form of Chi- square test for matched pair's data.

Multivariate Analysis: Involves the observation and analysis of more than one statistical variable at a time.

Pearson Correlation: Used to determine if the values of two normally distributed variables are linearly associated.

Regression: Determines the relationship between one dependent (response) variable and one or more independent variables.

T-test: Used to test the hypothesis involving numerical data that is normally distributed. It determines whether the mean observations differ significantly from a test value.

Univariate Analysis: Explores each variable in a dataset separately.

Wilcoxon: Used instead of the T-Test, when sample data are not normally distributed. It is

similar to a Mann-Whitney test but used for dependent data, for example, matched or repeated samples.

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Module 10 Surveillance and quality improvement

The online module provides:

- An introduction to the principles of surveillance and quality improvement,
- An overview of why surveillance and quality improvement is important to patient safety and quality of care
- Examples of the Plan-Do-Study-Act (PDSA) cycle
- An understanding of the different types of surveillance
- Information on the importance of regular evaluation of all programs
- Information on available resources to support facilities and individuals undertaking surveillance activities, and
- Information on surveillance principles and how to improve quality and safety in healthcare.

AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE

Resources for further information on Infection prevention and control, surveillance definitions and activities

<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>For NSQHS Standards 2nd edition use the microsite link available here</p>	<p>The National Safety and Quality Health Service (NSQHS) Standards were developed by the Commission with the Australian Government, state and territory partners, consumers and the private sector. The primary aim of the NSQHS Standards is to protect the public from harm and improve the quality of health care. They describe the level of care that should be provided by health service organisations and the systems that are needed to deliver such care.</p> <p>The second edition of the NSQHS Standards was released in November 2017. Health service organisations will be assessed to the second edition from January 2019.</p>
<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>Antimicrobial Use and Resistance in Australia (AURA)</p> <p>National Alert System for Critical Antimicrobial Resistances - CARAlert</p>	<p>Comprehensive, coordinated and effective surveillance of antimicrobial resistance and antimicrobial use is a national priority and a critical component of the <i>Australia's First National Antimicrobial Resistance Strategy 2015–2019</i>. The Commission has developed the AURA Surveillance System to support strategies to prevent and contain AMR.</p> <p>AURA coordinates data from a range of sources to provide a comprehensive and integrated picture of patterns and trends of AMR and antimicrobial use across Australia.</p> <p>The National Alert System for Critical Antimicrobial Resistances (CARAlert) was established by the Australian Commission on Safety and Quality in Health Care (the Commission) in March 2016 as part of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System. CARAlert collects surveillance data on nationally agreed priority organisms with critical resistance to last-line antimicrobial agents.</p>

<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>Hospital-acquired complications (HACs)</p>	<p>A hospital-acquired complication (HAC) refers to a complication for which clinical risk mitigation strategies may reduce (but not necessarily eliminate) the risk of that complication occurring.</p> <p>The national list of 16 HACs that includes healthcare associated infections was developed through a comprehensive process that included reviews of the literature, clinical engagement and testing of the concept with public and private hospitals.</p>
<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>Australian Atlas of Healthcare Variation Series. Link accessed here</p>	<p>The Commission has led development of the Atlas series. The first Atlas was developed in collaboration with the National Health Performance Authority and the second Atlas with the Australian Institute of Health and Welfare.</p> <p>The Commission has consulted widely with the Australian government, state and territory governments, colleges and specialist societies, clinicians and consumer representatives to develop each Atlas. Over 150 stakeholders were consulted in the development of the second Atlas; this consultation addressed the topic selection, data specification development, data interpretation and development of the clinical commentary.</p> <p>Enhancements made to the second Atlas have included:</p> <ul style="list-style-type: none"> • Greater involvement of clinicians during all stages of development • Analysis of data by Aboriginal and Torres Strait Islander status • Analysis of data by patient funding status (public or private).

<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>Clinical Care Standards. Link accessed here</p>	<p>The Commission established the Clinical Care Standards program to develop Clinical Care Standards on health conditions that would benefit from a national coordinated approach.</p>
<p>Australian Commission on Safety and Quality in Health Care (ACSQHC)</p> <p>National Hand hygiene Initiative (NHHI). Link accessed here.</p>	<p>The National Hand Hygiene Initiative was established to develop a national hand hygiene culture-change program that standardised hand hygiene practice and placement of alcohol-based hand rub in every Australian hospital.</p> <p>Hand hygiene is a high priority for the prevention of healthcare associated infection (HAI) worldwide, as it is the single most effective intervention for preventing HAI.</p>
<p>Queensland Health</p>	<p>Resources for infection prevention and control in Queensland Health. Provides policies, procedures, guidance and support for Queensland healthcare facilities in communicable diseases, surveillance activities aggregating and analysing data.</p>
<p>New South Wales Health, Clinical Excellence Commission (CEC)</p>	<p>Incorporates knowledge and resources for NSW Health, including quality improvement, patient safety, and infection prevention and control.</p>
<p>South Australia - SA Health - Healthcare Associated Infections</p>	<p>Provides resource information, publications and data on infection prevention and control activities including HAI and surveillance activities, reprocessing of reusable medical devices and AMS</p>
<p>Tasmanian Government – Infection Prevention and Control Service</p>	<p>Provides resource information and education resources, publications and data on infection prevention and control activities including HAI and surveillance activities</p>
<p>Victoria Health – Infection Control guidelines</p>	<p>Infection prevention and control resources in Victoria</p>

AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE

<u>Safer Care Victoria</u>	Victoria's quality and safety improvement agency. Work to monitor and improve the quality and safety of care
<u>Department of Health and Human Services</u>	Manages health data collections by supplying standards, specifications and quality processes and analysing data to assist health services develop services, policies and procedures.
Victorian Hospital Acquired Infection Surveillance System (<u>VICNISS</u>) https://www.vicniss.org.au/	Resources for surveillance activities in Victoria that collects and analyses data from acute care facilities. Provides data on results and resources for these activities.
<u>Western Australia – Department of Health – Infection Prevention and Control policies</u>	Provides links to WA health policies and resources on infection prevention and control.
<u>Western Australia – Department of Health – Infectious Disease Guidelines</u>	Provides generic and specific advice for specific diseases and outbreak settings.
Australian Council for Healthcare Standards (<u>ACHS</u>)	Provides member organisations with risk management tools and clinical indicators.
Australian Aged Care Quality Agency http://www.accreditation.org.au/ <u>Department of Health, Aging in Aged Care</u> https://agedcare.health.gov.au/ensuring-quality	Provides aged care information relating to accreditation and regulatory requirements. Revised Aged Care Standards will be implemented in 2019. Aging in Aged Care is linked to the Australian Aged Care Quality Agency and provides information on quality and reporting of quality activities in aged care. This includes risk management and infection prevention control in this specialised area of healthcare.

<p>Australasian College for Infection Prevention and Control (ACIPC)</p>	<p>The College is the peak body for infection prevention and control professionals in the Australasian region with the vision of the prevention and control of infection in our communities. The College commenced in January 2012 bringing together the various State and Territory infection control associations to support and encourage collaboration across Australasia.</p>
<p>Gastroenterological Society of Australia (GESA)</p>	<p>GESA is the peak membership organization for healthcare professionals and researchers working in gastroenterology and hepatology. GESA sets and promotes clinical practice standards, training and research. Infection Control in endoscopy resources can be located on their website.</p>
<p>Gastroenterological Nurses College of Australia (GENCA)</p>	<p>Professional organisation for nurses working in endoscopy. GENCA provide</p> <ul style="list-style-type: none"> • The development of national standards and guidelines • Providing educational courses and supporting the COGEN credentialing program • Providing representation at state, national and international forums.
<p>Healthcare Infection Control Special Interest Group (HICSIG) https://www.asid.net.au/groups/hicsig</p>	<p>HICSIG provides resources and education on infection prevention and control and antimicrobial stewardship</p>
<p>Institute of Healthcare Improvement</p>	<p>An independent resource centre that provides information and resources on improvement of health care world-wide.</p>

Surveillance is the ongoing and systematic collection, analysis, interpretation and dissemination of data regarding a healthcare-related event. Surveillance can be used to measure performance in key areas such as:

- Assessing patient safety
- Measuring the effectiveness of an intervention strategy
- Benchmarking, and
- Contribution to other programs.

The surveillance of HAIs assists in identifying:

- Whether there is an infection problem
- The magnitude of the problem, and
- The factors that contribute to the infections

Surveillance programs should incorporate the principles of quality improvement. In order to achieve this one approach would be to use **Plan - Do - Study - Act (PDSA)**. This method enables early identification of issues and opportunities for improvement through careful planning of what is going to be measured, ongoing analysis of data and action on results received as part of the broader facility quality improvement program.

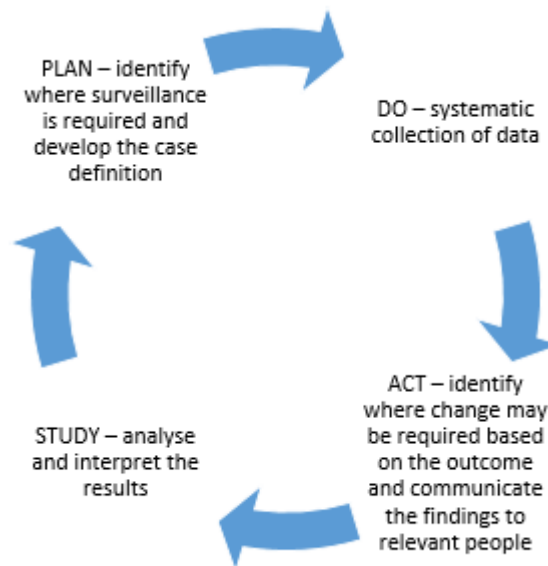
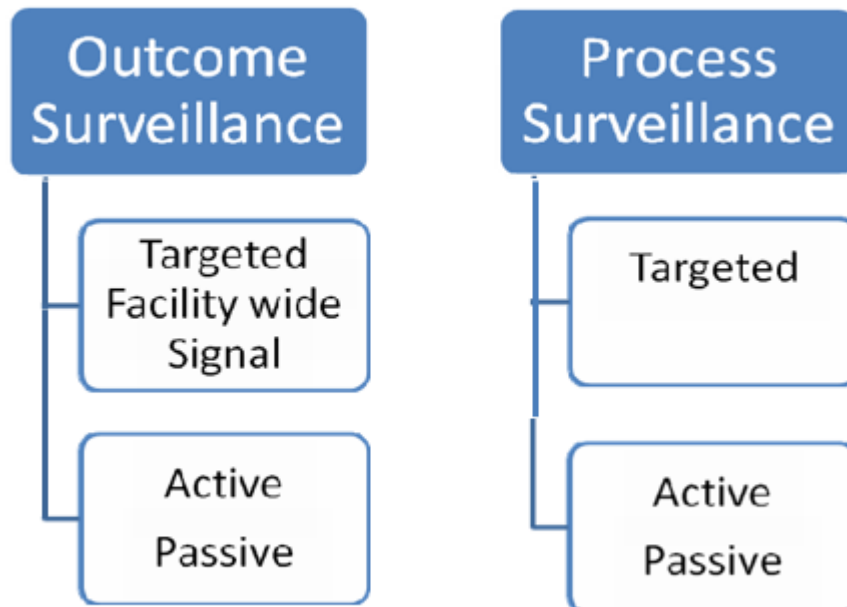


Image 7: An example of a PDSA cycle for surveillance. Source: NSW Health, Plan, Do, Study, Act Cycle <https://www.health.nsw.gov.au/pfs/Pages/pdsa.aspx>

Types of surveillance are outlined in the following diagram.



Specific high risk clinical areas such as Intensive Care Units (ICU) and High Dependency Units, including neonatal and pediatric intensive care units, may perform routine HAI surveillance. Both process and outcome surveillance methods are used for surveillance in these areas and focus on identified risk areas or sites. Examples of HAIs surveillance include:

- Central line associated blood stream infections, which account for approximately 87% of primary blood stream infections
- Ventilator associated pneumonia, which accounts for up to 86% of pneumonia cases associated with mechanical ventilation
- Catheter related urinary tract infections, which account for up to 97% of ICU cases of urinary tract infections associated with indwelling urinary catheters
- Antimicrobial use and antimicrobial resistance in infectious agents, which create morbidity and mortality issues, especially in ICU [refer to module 4], and
- Surgical site infections (SSI) following an invasive surgical procedure, which are associated with significant morbidity, mortality and cost to the organisation and patient.

The following examples are scenarios that have been developed as additional material to assist with understanding surveillance activities.

Facility-wide ongoing surveillance

Scenario 1: The Infection Control Preventionist (ICP) at a rural aged care facility decided to undertake targeted facility-wide surveillance to monitor the incidence of urinary tract infections associated with indwelling urinary catheters. This is an example of outcome

surveillance as the ICP is measuring the rate of infection. The ICP is able to perform this surveillance because the facility has only 12 residents and all are cared for by the local GP. Close liaison with the GP allows the capture all infections and identify possible trends. After twelve months of data collection and analysis, the data indicates that patients with indwelling urinary catheters have a higher infection rate than those patients without an indwelling urinary catheter. The ICP consulted similar facilities that collect data and confirms that the presence of an indwelling urinary catheter is a higher risk for infection. A reassessment of the surveillance plan and available time for the activity indicated that surveillance needed to be refined to concentrate on reducing urinary catheter related infections. The facility's surveillance program now focuses on clinical practices such as reviewing need for urinary catheters, hand hygiene, aseptic technique, and urinary catheter maintenance until infection rates have decreased significantly. The findings from the surveillance program are reported monthly to the facility management, medical officer, and clinical staff.

Point prevalence surveillance:

Scenario 2: The ICP at a small rural hospital undertakes a point prevalence survey of patients colonised with MRSA because several patients have had MRSA isolated from infected surgical wounds over the last month. Nose and groin swabs were collected from every patient on a particular day, but MRSA was not detected in any specimens.

To conclude that MRSA was no longer a problem based only on these results, may not be an accurate assessment. In this case, it would be more beneficial to undertake surgical site infection surveillance for a period of time (e.g. 3 to 6 months) to determine if a link between the infections was identifiable, e.g. all patients with MRSA infected wounds had the same surgeon or were operated on in the same theatre etc.

How long should surgical site infection (SSI) surveillance continue?

The following examples provide some suggestions you may want to consider for surveillance activities and effective use of resources.

Example 1: Hospital A has conducted SSI surveillance on elective coronary artery bypass (CABG) surgery for twelve months. Eighty procedures were performed and the infection rate was 1 or less cases of SSI per 100 patient bed days each month. Based on these data the ICP decides that CABG surgery in this facility may not be a high risk for SSI and decides to focus surveillance resources on another surgical specialty for the next 12 months.

Example 2: Hospital B has conducted surveillance on Lower Segment Caesarean Section (LSCS) for the last 12 months. LSCS procedures were the most commonly performed surgical procedure at this facility. The hospital also performed about 10 hip replacements (arthroplasty) per year. The LSCS infection rate after twelve months was 6%, half of which were deep wound infections (non-risk adjusted). The ICP contacted several similar sized facilities in other regions to compare rates and communicated the findings of the surveillance program to the surgical teams, clinical staff and quality manager of the facility. The ICP did not want to cease surveillance of LSCS due to the deep wound infection rate but also wanted to conduct sentinel surveillance on a second surgical

specialty such as hip arthroplasty (replacements), and in particular, adherence to the surgical antibiotic prophylaxis protocol. The ICP continued to monitor the SSI rate for LSCS surgery, reviewed contributing factors that lead to the development of deep wound infections for these patients and introduced interventions to reduce the risk of SSI for future LSCS patients for 12 months. After 12 months the ICP reviewed and evaluated the outcomes of the interventions and the SSI rate. The need for surveillance of hip arthroplasty (replacements) could be assessed by reviewing readmission rates of patients with SSI for the facility over a specific time frame and identifying if and how many patients were readmitted with SSI post hip arthroplasty (replacements).

Example 3: SSI surveillance has been conducted at Hospital C, a regional hospital, for the last three years. Data has been collected on three different procedures which are most commonly performed. One procedure was targeted each year. After three years, the infection rate for all procedures remained less than the jurisdiction's benchmark. The surgical procedures performed did not require the patients to remain in hospital for longer than a few days, so detecting infections unless readmitted to the hospital was not possible. The ICP considers the jurisdictional requirements for surveillance in the organisation and decides that sentinel events will be targeted for SSI surveillance and added aseptic technique, hand hygiene activities and staff education to the quality monitoring and surveillance activities undertaken. A three month surveillance snapshot of one of the surgical procedures each year for the next three years would also be undertaken. If infection rates increased in any of these procedure groups, the ICP would adjust the surveillance program accordingly.

Process surveillance

Monitoring

In the ICU of a large hospital, the ICP has been providing feedback on high infection rates for central line associated bacteraemia to the clinical staff and quality and safety manager. The rate has not decreased, despite introducing a “bundle” of interventions to prevent infection. The ICP decides to monitor/audit adherence to the “bundle protocol” by staff and provide feedback on these results. In this case, the monitoring of the bundle protocol has a twofold effect. The staff are aware that they are being observed and they usually correct bad habits, or if they are unaware of the correct protocol they can be advised accordingly. Providing feedback on the results of the bundle protocol can assist in highlighting the bundle approach, correcting suboptimal practices or technique, or the need for additional resources in the ICU.

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Centers for Disease Control and Prevention Healthcare-associated Infections
<https://www.cdc.gov/hai/data/index.html>

NSW Health, Plan, Do, Study, Act Cycle
<https://www.health.nsw.gov.au/pfs/Pages/pdsa.aspx>

Glossary

Acid fast stain: A differential stain use to identify Mycobacteria.

Aerobe: An organism that requires oxygen to grow.

Airborne precautions: Utilised to prevent transmission of aerosoled infectious agents (small airborne droplets less than 5 microns in size) that can remain infective over time and distance.

Anaerobe: An organism that does not requires oxygen to grow.

Aseptic technique: Method used to protect patients during an invasive procedure which employs infection control measures that minimise, as far as practicably possible, the presence of pathogenic organisms. (<https://www.nhmrc.gov.au/health-advice/public-health/preventing-infection>)

Association: In statistics, this refers to any dependence between two or more events, characteristics or other variables.

Bacilli: Bacteria with a rod-like shape.

Beta lactamase: An enzyme produced by bacteria that are resistant to antibiotics containing a Beta (β) -lactam ring such as penicillin and cephalosporins.

Bias: Any trend in the collection, analysis, interpretation, publication, or review of data that can lead to conclusions that are systematically different from the truth.

Bioburden: The number and the types of microorganisms present on an item prior to sterilisation.

Box plot: A graphical method of presenting the distribution of a variable measured on a numerical scale. Values are divided into quartiles.

Case: In epidemiology, a person in the population or study group identified as having a particular disease, health disorder, or condition under investigation.

Case control studies: An observational study of people with the disease (or other outcome variable) of interest and a suitable control (comparison, reference) group of persons without the disease.

Cell wall: Outer layer of bacteria, plant and fungal cells that provides shape and structural support for the cell.

Cocci: Bacteria with a spherical or oval shape.

Cohort studies: Observation of a large number of people over a long period of time (commonly years) who have been or in the future may be exposed to factors hypothesised and the occurrence of a given disease or outcome.

Colonising: Microorganisms which normally inhabit and reproduce in or on the human body without causing disease.

Contact precautions: Utilised to prevent transmission of blood, body substances or infectious agents by hand or via direct or indirect contact with contaminated surfaces or items.

Confidence interval: The probability, e.g. 95%, that the true value of a variable such as mean, proportion, or rate is contained within the interval.

Confounding: A situation which distorts the effect of an exposure on risk due to its association with other factors that can influence the outcome.

Control: In epidemiology, these are subjects with whom comparison is made in case control studies and Random Control Trials (RCTs).

Cross-sectional studies: Examines the relationship between disease and other variables of interest as they exist in a defined population at one particular time.

Cytotoxin: A toxin that kills mammalian cells.

Denominator: In a fraction, it is the number below the line that indicates the number of equal parts into which one whole is divided, e.g., $2/3$ - 3 is the denominator.

Dependent variable: Variable of interest which should change in response to intervention.

Disinfectant: A chemical agent used on inanimate objects and surfaces (e.g. floors, walls and sinks) to destroy most recognised pathogenic infectious agents but not necessarily all (e.g. bacterial spores).

Disinfection: Destruction of pathogenic and other kinds of infectious agents by physical and chemical means.

Droplet precautions: Utilised to prevent direct transmission of infectious agents (larger than 5 microns in size) from the respiratory tract of the infected person to susceptible mucosal surfaces of another person. Transmission requires close contact as the droplets do not remain suspended in the air and generally only travel short distances, usually one metre or less.

Ecological studies: Studies where the unit of analysis are populations or groups of people, rather than individuals.

Endemic: Sporadic infections that occur at a background rate.

Enzymatic cleaner: Enzymatic cleaning solutions contain enzymes which are capable of breaking down biological soils (containing proteins, lipids, carbohydrates and

mucopolysaccharides).

Epidemic: Occurrence of infection at a higher rate than the background rate.

Exposure Prone Procedure (EPP): EPPs are invasive procedures where there is the potential for direct contact between skin, usually a finger or thumb of the healthcare worker, and sharp surgical instruments, needles, sharp tissues (e.g. fractured bones) spicules of bone or teeth in body cavities or in poorly visualised or confined body sites, including the mouth of the patient.

HAI: Healthcare-associated infection.

Hepatitis B surface antibody (anti-HBs/HBsAb): Indicates previous exposure or vaccination to Hepatitis B virus. The antibody protects the body from future Hepatitis B virus infection.

Hepatitis B surface antigen (HBsAg): Is a protein antigen produced by Hepatitis B virus. This antigen is the earliest indicator of acute hepatitis B and frequently identifies infected people before symptoms appear.

Hepatitis C PCR: Detects the genetic material (RNA) of the virus in the blood using a special molecular technique. The amount of RNA can help determine how severe the infection is and how easily hepatitis C infection can be spread.

Incidence: Number of new cases of infection during a specified period of time.

Independent variable: Variable in the intervention which is being manipulated.

Interquartile range (IQR): a measure of spread representing the middle 50% of the observations, calculated as the difference between the third quartile (75th percentile) and the first quartile (25th percentile) [CDC](#).

Liver function tests (LFTs or IQR): LFTS detect abnormal levels of enzyme production in the liver, and the enzyme most commonly monitored using this test is alanine aminotransferase (ALT). When elevated above normal values, the ALT and aspartate aminotransferase (AST) tests indicate liver damage.

Mean: A measure of central tendency calculated by adding all individual values in the group and dividing by the number of values in the group.

Median: A measure of central tendency calculated by dividing the lower and upper half of the measurements. The point on the scale that divides the group in this way is called the median.

Mould: A type of fungus, in contrast to a yeast, that forms multicellular hyphae that grows on various kinds of damp or decaying matter.

MRSA: A strain of *S.aureus* that is resistant to methicillin as well as a number of other antibiotics.

Normal distribution: A graph of continuous measurement whose properties include

continuous symmetrical distribution with both ends extending to infinity, identical arithmetic mean, median and mode and whose shape is determined by mean and standard deviation.

Normal flora: A collection of microorganisms that live on or in a normal healthy individual without causing infection or disease.

Normal body flora: A collection of microorganisms that live on or in a normal healthy individual without causing infection or disease.

Numerator: In a fraction, it is the number above the line that indicates the number of parts of a whole, e.g., $\frac{2}{3}$ - 2 is the numerator.

Odds Ratio: The ratio of two odds used to compare two groups in case control studies.

Occurrence: In epidemiology, this describes the frequency of a disease in a population without distinguishing between incidence and prevalence.

Opportunistic: An organism capable of infecting only when host defenses are compromised.

Organelle: A structure bound by a membrane and found in eukaryotic cells.

P value: A statistical measure calculated from various statistical tests ranging from 0-1 that assesses the degree of belief in a hypothesis or statement.

P2 or N95 particulate masks: Also called respirators, are PPE worn by HCW to protect them from inhalation exposure to airborne infectious agents that are <5 microns in size.

Pandemic: An epidemic occurring over a very wide area, crossing international boundaries and affecting a large number of people.

Percentage: Proportion multiplied by 100.

Percentiles: The set of divisions that produce exactly 100 equal parts in a series of continuous variables.

Plasmid: A small, circular, double extra-chromosomal DNA molecule which replicates independently of chromosomal DNA and can carry several genes that control plasmid or parent cell activity.

Population: In statistics, this refers to all inhabitants of a given country or area considered together.

Prevalence: The number of new and existing cases with infection over a given period of time.

Prodromal Period: The period that precedes the onset of specific signs or symptoms that indicate the onset of a disease

Proportion: The number of patients with a given disease divided by the total number of patients included in the study.

Prospective: Studies that collect data by looking forward in time.

Quartiles: Division of a distribution into equal quarters.

Randomised controlled trials: An epidemiological experiment in which subjects in a population are randomly allocated into groups called *study* and *control* groups.

Range: The difference between the largest and smallest values in a distribution.

Rates: Rates are based on the number of infections that have occurred divided by the number of patients at risk over a fixed period of time. Similar to proportion but a multiplier is used (for example 1000, 10000 and 100000)

Ratio: The number of patients in a given group with a given disease divided by the number of patients without the disease.

Relative Risk: The ratio of the risk of disease among the exposed to the risk among the unexposed and used in cohort and randomized controlled trials.

Retrospective: Studies that collect data by looking back in time.

Risk factor: Any aspect of behaviour, environment, or inherited characteristic, which on the basis of epidemiological evidence is known to be associated with health related conditions considered important to prevent.

Sample population: These are measurements made on a subset of the population. The sample is intended to give results that are representative of the whole population.

Sensitivity: The proportion of individuals in a population that will be correctly identified when tested to detect a particular disease/ infection, calculated as the number of true positive results divided by the number of true positive and false negative results.

Single use item: Single use means the medical device or item is intended to be used on an individual patient during a single procedure and then discarded. It is not intended to be reprocessed and used on another patient. If a single use devices or item is marketed as non-sterile, then it will require processing to make it sterile and ready for use. The manufacturer of the device or item will include appropriate processing instructions to make it ready for use.

Specificity: The statistical probability that an individual who does not have the particular disease/ infection will be correctly identified as negative, expressed as the proportion of true negative results to the total of true negative and false positive results.

Spores: A reproductive structure formed by some Gram positive bacteria and fungi which are highly resistant to heat and chemicals.

Standard deviation: A measure of dispersion or variation of values around the centre of a frequency distribution.

Standard precautions: Work practices to ensure basic infection prevention and control

apply to everyone regardless of perceived or confirmed infectious status. They are a first line approach to reduce risk relating to potential transmission of infectious agents.

Transmissibility: Infectious microorganisms capable of being transmitted to another patient or host.

Transmission: Any mechanism by which an infectious agent is spread from a source or reservoir to another person.

Variable: Any quantity that varies and can have different values.

Virulence: The degree of pathogenicity of a microorganism.

Virus: An infectious particle consisting of nucleic acid and a protein coat.

Window period: The time from infection to development of detectable antibodies.

Yeast: A unicellular fungus

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