



Pacific Public Health Surveillance Network Infection Prevention and Control Guidelines



2021



PACIFIC PUBLIC HEALTH SURVEILLANCE NETWORK (PPHSN)

INFECTION PREVENTION AND CONTROL GUIDELINES

2021



Prepared by the Surveillance, Preparedness and Response Programme,
Public Health Division,
Pacific Community



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ABBREVIATIONS

ABHR	alcohol-based handrub
AGP	aerosol generating procedures
AMR	antimicrobial resistance
BCG	Bacille Calmette–Guerin
BSI	blood stream infection
BVM	bag-valve-mask
CAIPC	collaborative for the advancement of infection prevention and control
COVID-19	SARS-coV-2
CDC	Centers for Disease Control and Prevention
EVD	Ebola virus disease
ESBL	extended spectrum beta lactamases
HBV	hepatitis B virus
HBsAB	hepatitis B surface antibody
HBsAg	hepatitis B surface antigen
HBeAg	hepatitis B “e” antigen
HBIG	hepatitis B immunoglobulin
HAIs	healthcare associated infections
HCF	healthcare facility
HCV	hepatitis C virus
HCW	healthcare worker
IPC	infection prevention and control
HIV	human immunodeficiency virus
HLD	high-level disinfection
MDR-TB	multi drug resistance tuberculosis
MROs	multi resistant organisms
MRSA	multi resistant staphylococcus aureus
MERS CoV	middle eastern respiratory syndrome virus
P2/KN95/FFP2 mask	particulate respirator that filters more than 94% of airborne particle
OMC	outbreak management team
OT	operating theatre
PEP	post-exposure prophylaxis
PPE	personal protective equipment
PPHSN	Pacific Public Health Surveillance Network
SARS	severe acute respiratory syndrome
SOP	standard operating procedure
SPC	Pacific Community
SVM	spiritus vini methylatus (methylated spirits, denatured alcohol)
TB	tuberculosis
WHO	World Health Organization



GLOSSARY

Airborne transmission	The spread of an infectious agent caused by the dissemination of droplet nuclei that remain infectious when suspended in air over long distances and time
Alcohol hand rub	A waterless alcohol-based product appropriate for rapid hand decontamination between patient contacts. It is recommended for use when hands are not visibly soiled or contaminated with blood and body fluids
Avian influenza	Avian influenza is an infectious disease of birds and is caused by type A strains of the influenza virus
Contact transmission	<p>The transmission of infectious agents can be divided into two subgroups: direct contact transmission and indirect contact transmission</p> <p>Direct contact transmission involves direct physical transfer of micro-organisms from an infected or colonised person to a susceptible host</p> <p>Indirect contact transmission involves a susceptible person coming in contact with a contaminated (usually inanimate) object, such as a contaminated instrument or piece of equipment</p>
Coronavirus disease 2019	COVID-19 disease caused by SARS-CoV 2, a novel coronavirus first detected in Wuhan City, Hubei Province, China in December 2019 [1] [2]
Decontamination	Cleaning an object by either chemical or physical means to reduce the number of micro-organisms on it
Droplet transmission	Transfer of infectious agents in the droplets that are generated during coughing, sneezing or talking, and during the performance of certain clinical procedures such as suctioning and bronchoscopy. These droplets contaminate inanimate surfaces as a method of transmission
Disinfection	A process that kills or destroys most disease-producing organisms, but rarely kills spores. Disinfectants are used on inanimate objects as opposed to antiseptics, which are used on living tissue
Hand hygiene	Refers to hand washing with soap and water, use of alcohol hand rub and antiseptic solutions
P2/KN95/FFP2 mask	<p>A disposable filter mask designed specifically to protect the wearer from exposure to airborne (small particle) infectious diseases such as TB by sealing tightly to the face.</p> <p>The N95 respirator has a filter efficiency level of 95% or more against particulate aerosols free of oil, when tested against</p>

	<p>0.3 \timesm particles. The “N” denotes that the respirator is not resistant to oil, and the “95” refers to a 95% filter efficiency</p> <p>The FFP2 respirator has a filter efficiency level of 94% or more against 0.4 \timesm solid particles, and is tested against both an oil and a non-oil aerosol [3]</p>
Nosocomial infection	(Also known as healthcare-associated infection.) An infection that is acquired during hospital admission as a result of health care interventions.
Occupational exposure	<p>An incident that occurs during the course of a person’s employment and involves contact with blood or body substances. Occupational exposure includes:</p> <ul style="list-style-type: none"> • percutaneous injuries or cuts caused by used instruments, such as needles or scalpel blades, and involving blood or other body substances • contamination of fresh cuts or abrasions with blood or other body substances • contamination of the eyes or other mucous surfaces with blood or other body substances
Personal protective equipment (PPE)	Gloves, masks, eye protection, gown, caps and aprons worn to protect the wearer from contact with infectious agents
Surgical mask	A disposable mask designed to protect the wearer against splashes of bodily fluids, and sprays and droplets generated by coughing and sneezing and to prevent transmission of pathogens from the wearer
Sterilisation	A process that destroys all forms of microbial life, including bacteria, viruses, spores and fungi. This method is used for all items that contact normally sterile areas of the body. Items must be cleaned first of organic matter to be successfully sterilised
Standard precautions	Precautionary measures designed to reduce the risk of transmission of micro-organisms from both recognised and unrecognised sources of infection in healthcare settings. Standard precautions involve safe work practices and include, but are not limited to the following: hand hygiene, respiratory hygiene/cough etiquette, personal protective equipment, appropriate handling of laundry and appropriate handling of used patient equipment.
Sharps	Needles, intravenous spikes, lancets, broken ampoules, scalpel blades and any other sharp object that is capable of causing an injury
Transmission-based precautions	Precautions designed for use with patients who are diagnosed with, or are suspected to have, a specific infectious pathogen whose transmission cannot be prevented through standard precautions alone. There are three types of transmission-based precautions: airborne precautions, droplet precautions and contact precautions. Some pathogens require the use of a combination of these.



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The 2010 *Pacific Public Health Surveillance Network Infection Prevention and Control Guidelines* has been updated to provide and support regional guidance on IPC standards for adaptation and implementation by all Pacific Island countries and territories.

The guidelines have been kept simple for adaptation in every healthcare facility in the region. However, as with any generic guidelines, these must be adapted to suit the local situation, whether at a national or local healthcare facility.

My sincere appreciation is extended to the following colleagues for reviewing the *Infection Prevention and Control Guidelines*:

- The Collaborative for the Advancement of Infection Prevention and Control (CAIPC), Dr Peta-Anne Zimmerman (Griffith University) for her valuable support in writing chapters 3 and 7, and colleagues Vanessa Sparke (James Cook University) and Matt Mason (University of the Sunshine Coast);
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FOREWORD

I am pleased to present this updated version of the PPHSN *Infection Prevention and Control Guidelines*, which will guide the initiatives, developments and actions in healthcare settings across the Pacific region.

COVID-19, declared by the World Health Organization a pandemic on 11 March 2020, affected thousands of Pacific Islanders. The crisis demonstrated the importance of patient safety and good quality care at every healthcare interaction.

Through the Pacific Infection Control Network, one of the six support services of the Pacific Public Health Surveillance Network (PPHSN), and under the auspices of the Surveillance, Preparedness and Response Programme of the Pacific Community, these updated guidelines will enhance the capacity of PPHSN member countries to develop and implement effective interventions to prevent current and future threats from infectious diseases such as COVID-19, build resilient health services, help fight antimicrobial resistance (AMR) and improve the overall quality of health care delivery for patients, health care workers and the larger community.

To meet the standards of good IPC is challenging and cannot be achieved overnight. Co-operation and compliance to standards and internationally accepted practices are required from all the cadres of health service providers and institutions, including policy makers, facility managers and those who access health services. A structured and rational introduction and enhancement of the IPC practices and standards laid out in these guidelines are particularly important in the Pacific Island countries and territories where health care delivery and medical hygiene standards can be negatively compromised by secondary infections.

With the support and collaboration of PPHSN members and partners, we look forward to implementing these guidelines and help ensure that we truly realise a quality health care delivery for our *Blue Pacific* continent in the future.

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1 INTRODUCTION

1.1 Background

Infection prevention and control (IPC) is integral to the provision of a safe healthcare environment for both patients and healthcare workers (HCWs) across the continuum of care. Lack of adherence to safe practices or inadvertent exposure to pathogens in the healthcare environment can lead to significant morbidity and mortality in patients and HCWs alike. A safe working environment includes the provision of a safe physical environment, the use of safe clinical practices, the availability of adequate resources, the provision of safe equipment and consumable items, and a culture of safety for all. Safety in healthcare also includes mechanisms for reporting events that result from an unsafe environment or practice [4].

Infection prevention and control, particularly in healthcare facilities, is a critical element in interrupting the transmission of priority infectious diseases in the region. Communication, accessibility of expertise, and technical advice are recognised as areas in need of improvement in facilitating infection control response to infectious disease threats.

1.2 Purpose

The purpose of the IPC guideline is to provide regional guidance on IPC standards for adaptation and implementation by all Pacific Island countries and territories. The update of the 2010 PPHSN IPC guidelines is based on the World Health Organization core components of infection prevention and control.

1.3 Objective

The overall objective of these guidelines is to provide guidance on IPC standards for Pacific countries to use as a framework to develop their own national and institutional guidelines.

More specifically, these guidelines cover the following:

- management of the IPC programme
- healthcare associated infections and IPC
- the application of standard and transmission-based precautions
- hand hygiene
- principles of personal protective equipment
- safe handling and disposal of sharps
- environmental cleaning
- safe reprocessing of reusable medical equipment
- safe handling of laundry
- airborne precautions
- droplet precautions
- contact precautions
- IPC in special care areas

- guidelines for the management of occupational exposure
- vaccine preventable diseases for staff health
- surveillance for IPC
- environmental management practices
- food safety
- outbreak management situations
- infections by selected diseases.

1.4 Guidelines use

These guidelines are generic and should be used in every healthcare facility in the region. As with any generic guidelines, they must be adapted to suit national and local healthcare facilities. To aid adaptation of the guidelines into practice, the seven conditions below are important for ministry of health policy leaders.

1. There must be strong national commitment for development and enforcement of IPC policy.
2. Development of national and facility level IPC guidelines and programme recommendations to help foster, develop and reinforce a culture of patient and health care worker safety and IPC.
3. Infrastructure/system: ensure availability of human resources for IPC at national and facility level, access to the necessary equipment and supplies, and an environment that is designed and planned to facilitate the guideline recommendations.
4. Promote accountability for IPC by incorporating IPC indicators into the ministry of health's strategic and operational plans.
5. Training and education: a programme of routine training, education, and periodic annual training for ALL personnel responsible for IPC.
6. Monitoring, evaluation and feedback: a programme of regular supervision and feedback is in place in relation to the guideline recommendations, including a surveillance programme.
7. Safety culture: managers and leaders AT EVERY LEVEL of healthcare service delivery demonstrate commitment and accountability for implementation of the national IPC guidelines.

Below are the minimum requirements recommended by the World Health Organization core components of infection prevention and control programmes at the national and health care facility level [5].

Table 1.1. World Health Organization core components of infection prevention and control programmes

Category	Component
IPC programmes	<p>An IPC programme with a dedicated, trained team should be in place in each acute health care facility for the purpose of preventing healthcare associated infections (HAIs) and combating anti-microbial resistance (AMR) through IPC good practices.</p> <ul style="list-style-type: none"> • One full-time focal point trained in IPC • A dedicated budget for implementing IPC • Strategies/plans • Stand-alone, active national IPC programmes with clearly defined objectives, functions and activities for the purpose of preventing HAI and combating AMR through IPC good practices should be established. National IPC programmes should be linked to other relevant national programmes and professional organisations.
Evidence-based guidelines	<p>Evidence-based guidelines should be developed and implemented for the purpose of reducing HAI and AMR. Education and training of the relevant health care workers on guideline recommendations and monitoring of adherence to guideline recommendations should be undertaken to achieve successful implementation.</p>
Education and training	<p>At the facility level, IPC education should be in place for all health care workers by utilising team and task-based strategies that are participatory and include bedside and simulation training to reduce the risk of HAI and AMR. The national IPC programme should support education and training of the health workforce as one of its core functions.</p>
Surveillance	<p>Facility-based HAI surveillance, including AMR surveillance, should be performed to guide IPC interventions and detect outbreaks, with timely feedback of results to health care workers and stakeholders and through national networks.</p> <p>National HAI surveillance programmes and networks that include mechanisms for timely data feedback and with the potential to be used for benchmarking purposes should be established to reduce HAI and AMR.</p>
Multimodal strategies	<p>At the facility level, IPC activities should be implemented using multimodal strategies to improve practices and reduce HAI and AMR.</p> <p>National IPC programmes should coordinate and facilitate the implementation of IPC activities through multimodal strategies at the national or sub-national level.</p>
Monitoring, audit and feedback	<p>Regular monitoring/audit and timely feedback of health care practices should be undertaken according to IPC standards to prevent and control HAIs and AMR at the health care facility level. Feedback should be provided to all audited persons and relevant staff.</p> <p>A national IPC monitoring and evaluation programme should be established to assess the extent to which standards are being met and activities are being performed according to the programme's goals and objectives. Hand hygiene monitoring with feedback should be considered as a key performance indicator at the national level.</p>
Workload, staffing and bed occupancy	<p>In order to reduce the risk of HAI and the spread of AMR, the following should be addressed: (i) bed occupancy should not exceed the standard capacity of the facility; (ii) health care worker staffing levels should be adequately assigned according to patient workload.</p>
Built environment, material and equipment	<p>At the facility level, patient care activities should be undertaken in a clean and/or hygienic environment that facilitates practices related to the prevention and control of HAI, as well as AMR, including all elements around the WASH infrastructure and services and the availability of appropriate IPC materials and equipment.</p> <p>At the facility level, materials and equipment to perform appropriate hand hygiene should be readily available at the point of care.</p>

2 INFECTION PREVENTION AND CONTROL PROGRAMME

2.1 Introduction

An infection prevention and control programme is a set of organised activities designed for the prevention and control of infectious diseases and healthcare associated infections (HAIs) in the healthcare environment.

IPC programmes have proven to be successful in lowering the incidence and spread of infectious diseases, provided the programmes are comprehensive and include surveillance and prevention activities and staff training [4]. It is, however, imperative that a governance structure at national level is established to regulate national standards and to promote and effectively implement standards for infection prevention and control (IPC).

The purposes of an IPC programme in healthcare are:

- to prevent the transmission of HAIs between patients, healthcare workers and visitors;
- to prepare healthcare facilities to detect early outbreaks of HAIs, respond promptly and effectively manage such situations;
- to be prepared to manage and respond to epidemics of emerging infectious diseases in the community and healthcare facilities;
- to maximise coordination and response with community health colleagues to better coordinate and respond to large-scale epidemics; and
- to prevent the transmission of antimicrobial resistant organisms (AMR).

The minimum requirements of an IPC programme are:

- to develop IPC standards, processes and practices to prevent the transmission of HAIs and AMR in healthcare facilities;
- to manage epidemics according to expected outcomes;
- to detect and manage outbreaks of HAIs with expected outcomes and implement lessons learned;
- to have good compliance with processes and work practices based on IPC standards;
- to have ongoing targeted surveillance with a desired aim to reduce the incidence and risk of preventable HAIs;
- to prevent infection transmission within healthcare facilities and the community; and
- have mandatory training of all staff on IPC standards.

2.2 Responsibility and authority for infection prevention and control [4, 5, 6]

It is the responsibility of the ministry of health in every country to ensure that the healthcare workforce, patients and the community are protected from HAIs and public health disease threats through the strategies below.



- Develop a national IPC programme with clear objectives, functions and activities.
- Ensure national and facility level implementation of IPC policy and guidelines.
- Ensure that IPC education and training is part of every health-care facility orientation programme for new employees and that there is an ongoing education programme for all existing staff, regardless of level and position.
- Ensure that HAI and AMR surveillance is standardised and performed to guide IPC interventions and detect outbreaks, with timely feedback of results to health care workers through local networks and the IPC committee.
- Ensure that regular monitoring and audits of IPC practices, with feedback, are performed to provide data to improve the quality of services and reduce the spread of HAIs and AMR.
- Ensure that IPC officers are adequately resourced through appropriate provision of a work space, computer and internet access.
- Ensure that there is microbiology laboratory support for the IPC nurse and use microbiology data for IPC surveillance and early detection of HAIs.
- Ensure that responsibility for IPC is incorporated into job descriptions of all HCWs.
- Ensure there is a multidisciplinary IPC committee, supported by senior medical practitioners' participation in the IPC programme and IPC committee meetings.
- Ensure that IPC key performance indicators are incorporated into the healthcare facility business plan.

2.3 *Monitoring and evaluating an infection prevention and control programme*

Routine monitoring and evaluation of the infection prevention programme is important for measuring the programme's effectiveness. Monitoring should be done to address the questions below.

- Are recommended standards and practices being followed?
- Are essential equipment and supplies readily available and accessible to staff in the hospital or clinic?
- If equipment is available, is it being used correctly?
- Does the staff training programme meet training objectives?
- Is there an increase in HAI rates?

Providing monitoring (audit) feedback to staff and recommendations for improvement is critical for improving IPC compliance, patient safety and strengthening a culture of continuous improvement in the organisation. Feedback should follow the Positive-Negative-Positive rule: provide positive aspects first, followed by identified deficits, and lastly recommendations for improvement, underpinned by the importance of adherence to IPC standards and guidelines. Staff must be active participants and contribute to identifying solutions and recommendations that will work in their local context, supported by the local IPC committee and hospital management.

Monitoring and evaluation should be performed regularly via internal audits and reviews of antibiotic resistance reports, reports of nosocomial (hospital-derived) infections, and other reports. Report findings should be presented to national and local infection control committees.

2.4 IPC Committee

An IPC committee should be formalised at the national level and at healthcare facility level to champion, monitor and evaluate the IPC programme. Committee membership should comprise representatives from clinical departments, including the laboratory and pharmacy, and facility management supervisors, such as waste and/or cleaning services.

The purposes of an IPC committee are:

- to provide a strategy to management for the implementation (including unplanned events, such as outbreaks) and improvement of the IPC programme;
- to ensure monitoring and evaluation of IPC policies;
- to develop and implement policies, guidelines and procedures relating to IPC and ensuring their currency and accessibility to staff;
- to review IPC reports and problems that may cause infections and identify areas for intervention by using surveillance and other data;
- to decide how IPC practices can be applied, based on the amount of available equipment, ensuring that decisions are practical and standard;
- to assess and promote improved IPC practices at all levels of the healthcare facility;
- to ensure and monitor appropriate staff training in IPC and safety management,
- to ensure provision of safety materials, such as personal protective equipment and products;
- to ensure that there is a defined programme for HAI surveillance that includes collection, analysis and reporting back of data to departments and clinicians;
- to ensure that reports on the occurrence of HAIs are received and that actions resulting from these reports are determined and monitored;
- to provide guidance, advice and support to the IPC officer/team;
- to ensure that resources and equipment are consistently available, used efficiently and are cost effective;
- to ensure implementation of multimodal strategies to achieve IPC practice improvement; and
- to draw up a work plan for the IPC programme, identifying key priorities for three months, six months, nine months and 12 months of the programme – such as:
 - priorities for policy development
 - priorities for sop development
 - priorities for training
 - priorities for surveillance
 - systems for documenting and recording
 - systems for monitoring implementation of agreed priorities
 - systems for identifying and addressing obstacles to implementation with a clear action plan for resolution
 - individuals responsible for delivering each aspect of the work programme.

Members of the IPC committee should include staff from a variety of departments. Membership must include, but not be limited to:

- the head of the hospital or healthcare facility or their designate,
- the senior administrative officer who is in a position to allocate necessary resources etc.,
- IPC officer/team,
- one or more senior medical officers,
- midwife or doctor working in obstetrics,



- head of housekeeping,
- operating room staff responsible for sterilisation,
- clinical microbiologist or microbiology technician or laboratory personnel
- pharmacist,
- chair of the AMR committee.

The IPC committee should not have more than ten members or it becomes unmanageable. Specialists from various departments (for example, the laundry manager) can be called to meetings when a problem arises in their department, or when they can offer specialised information.

The IPC committee should meet on a regular basis (at least every two months) to discuss IPC activities and to solve any problems. In the event of a critical incident or outbreak situation, the committee should be able to convene promptly.

The committee should establish and document its terms of reference and have these approved by an appropriate authority, such as a senior healthcare administrator or director of health services.

The committee should appoint a secretary and keep records of its activities. An agenda should be prepared and distributed prior to each meeting. Minutes of the previous meeting should be distributed with the agenda.

The agenda should include:

- a report of monitoring and surveillance activities
- a report on actions taken on problems identified at the last meeting
- a report on training activities and needs
- a list of new problems
- a set of recommendations for change, if needed, and a list of who will be responsible
- any other business.

For each agenda item, a designated person should be responsible for preparing a report and for applying the recommendations for change. At each meeting, the designated person (or people) should report on progress made toward specific goals.

The committee secretary should keep the minutes of the meeting. Minutes should be written as soon as possible after the meeting and kept in a folder. Care is needed when handling folders to ensure that pages are not lost.

Meeting minutes should adopt a consistent format such as the one below

1. Present	List all those present at the meeting.
2. Apologies	List the apologies received.
3. Minutes of previous meeting	Confirm the minutes of the previous meeting as a true and correct record of proceedings. (Once confirmed, the minutes should be signed off by the chairperson.)
4. Matters arising	Discuss any matters arising from previous minutes.
5. Reports	Consider the reports as circulated or presented to the meeting.
6. General business	Discuss new business as listed on the agenda or any other matters raised at the meeting.
7. Date and time of next meeting	Enter the meeting date and time.
8. Meeting closed	Note the time the meeting closed.
9. Signature block	The chairperson signs once the minutes have been confirmed.

Meeting minutes should include the following information:

- a brief summary (a few sentences) of the discussion on each agenda item,
- recommendations of tasks or actions to solve a problem (e.g. training programme, buying equipment, making posters),
- the name of the person to be responsible for implementing the recommended changes, and the date (deadline) by which the person or task group should have carried out the assigned task,
- the results of the actions taken to solve a problem.

Other information to note may include the questions below.

- Was the goal accomplished?
- If there were problems, were they identified and solved?
- How were problems solved (e.g. staff were trained in IPC procedures, supplies were purchased)?

Keeping a record of this information will make it easier to solve a similar problem later.

Good communication and exchange of ideas with staff can improve work habits and attitudes. Staff should be informed about the IPC committee and the purpose of the programme. Healthcare service management should share ideas and materials with staff and be ready to listen to their perspective. Good communication at all staff levels is the key to a successful IPC programme.

2.5 Infection prevention and control officer

Each hospital or healthcare facility should have a designated person responsible for implementing infection prevention policies and activities and developing methods for reviewing practices to minimise the incidence of infection. This person may be a nurse but may also be



any other person with knowledge of infections (e.g. laboratory staff, medical officer). Ideally, this person would have received specialist training in IPC.

The IPC officer must be a member of the IPC committee. The IPC officer's role is to work with all departments in the implementation of the IPC programme. (See sample IPC job description in Appendix 5).

Some of the major responsibilities of an IPC officer are:

- to develop and implement IPC yearly work plan or IPC management plan;
- to coordinate and conduct training activities relevant to IPC;
- to carry out HAI surveillance activities;
- to develop and disseminate IPC standards and procedures;
- to observe IPC practices and make suggestions for improvement;
- to help identify problems and assist in problem-solving;
- to report to the IPC committee at every meeting; and
- to support and participate in research.

It is generally recommended that there be no less than one full-time equivalent infection control officer per 100 hospital beds [5].

2.6 *Education and training of healthcare workers, patients and visitors*

An IPC programme can be successful only when everyone is engaged. Staff are usually willing to change bad habits to good ones when they understand the reasons and the importance of applying theory to clinical practice through guidelines and standard procedures. Each healthcare facility should, therefore, plan frequent in-service education programmes for staff, patients and visitors. In-service training is an ongoing process and should be used to teach good practices, change bad habits, and demonstrate new equipment or procedures.

Every level of health care worker (HCWs) needs to learn the importance of IPC. Even workers who have little contact with patients, such as laundry or kitchen staff, should be included in mandatory annual education and training programmes for current and new staff.

The IPC staff education and training programme objectives should include:

- a sound knowledge of IPC principles
- how these are applied in practice
- challenges and problem solving
- introduction of new equipment
- guidelines and procedures
- updates on IPC activities, including IPC committee reports.

All HCWs have a responsibility in preventing HAIs and AMR in the healthcare facility. They should:

- understand infection transmission in the healthcare facility;
- know the important role each staff member plays in preventing infection; and
- be able to describe or demonstrate various methods of preventing the spread of micro-organisms, such as hand hygiene.

The IPC training programme should be made interactive and stimulating, using problem solving and discussions. Practice audit results should be used as triggers for discussions and problem solving. Additionally, if possible, use audio-visual aids, posters, role playing and games.

The training programmes described below should be established:

2.6.1 Orientation

IPC orientation is a basic programme for all new staff and should include the principles and methods of preventing the spread of infection within each staff member's unit or department. New employees should know their responsibility in the overall infection prevention and control programme.

2.6.2 Mandatory annual IPC in-service education

A programme of in-service education should be planned for all staff, beginning as soon as the IPC guidelines are introduced. Regularly scheduled in-service education workshops can be used to identify and solve problems, introduce new techniques, and provide general reminders about the importance of safe practices to prevent the spread of HAIs and AMR.

2.6.3 Patient teaching

It is the HCW's responsibility to instruct patients via the use of posters, verbal instructions or handouts about their role in the prevention of infection or the spread of infection. For example, a HCW may teach patients with respiratory illnesses to cough into a tissue, or teach patients with enteric disease to thoroughly wash their hands before and after using the toilet, or teach a patient with a wound to keep it clean and dry.

2.6.4 Visitor teaching

Strategically placed visual posters on hand hygiene, respiratory cough etiquette, etc. are excellent reminders for reinforcing IPC behaviour compliance. Visitors should be made aware of the risks they pose by spitting in halls, using toilets improperly and not washing hands, crowding around patients, and handling intravenous sets, catheters and other patient care equipment. Every opportunity should be used to give one-on-one education in order to increase visitors' knowledge about infection prevention. An excellent time to educate visitors is when they are waiting in the hospital or clinic. For example, small classes on infection prevention can be given using a TV screen (if available).

2.6.5 Steps to a successful IPC training programme

Continuing or refresher IPC training programmes for current staff need to be short, simple and interesting and should address the following objectives: (i) reinforce IPC compliance; (ii) communicate and update IPC programme activities; (iii) problem solving; and (iv) introduce new guidelines, procedures, etc.

A training programme should:

- include all staff (e.g. nurses, community health workers, cleaners, laboratory technicians, drivers, etc.);
- be carefully planned; it will be necessary to decide on:
 - **what** will be taught,
 - **how** it will be taught (what teaching aids and supplies are needed),
 - **when** it will be taught (making use of a schedule), and
 - **where** it will be taught (e.g. in a classroom, on the ward).



- describe clearly the learning objectives that staff need to learn at the beginning of the session;
- use 'pre and post-tests' to provide feedback if the training met its overall objectives and recommendations for improvement. Evaluation of the IPC training programme annually from staff and managers should be implemented for quality improvement;
- include practical demonstration of available equipment and resources;
- include necessary information about the reason for certain procedures and identification of adverse outcomes if recommended IPC procedures and practices are compromised or ignored (e.g. infection or even death);
- make learning interesting by:
 - encouraging discussion,
 - linking information about caring for patients and cleanliness in healthcare facilities with local tradition and beliefs, and
 - using teaching aids such as posters, field trips, role playing, and audio-visual aids;
- be appropriate at staff level although training should also be implemented at ward/unit level to include all team members for strengthening team communication, support and cohesion and reinforces each other's role in the team;
- provide information, examples and training skills;
- teach skills using practice session of tasks;
- use case presentations to identify problems, and exchange ideas on how to better handle a given situation;
- give learners feedback on their practice (in a respectful way) so they will know how well they are doing;
- evaluate the training by measuring if the training has met its explicit objectives. This can be in the form of pre and post-tests and a post session evaluation survey; and
- use the results of the evaluation to improve training.

3 INTRODUCTION TO HEALTHCARE ASSOCIATED INFECTIONS AND IPC

3.1 *The chain of infection*

Healthcare associated infections (HAIs) take place when an infectious agent is present and are able to survive in a host and an environment. Hence, it is very important to understand the process of the chain of infection for implementation of effective IPC measures.

In order for an infectious agent to successfully spread from one host to another, several conditions must be met. This is referred to as the chain of infection. If this 'chain' is broken at any stage, the infection cannot spread and becomes contained. We will use the basic human flu (influenza) as an example below to explain the chain of infection [7].

Chain of infection

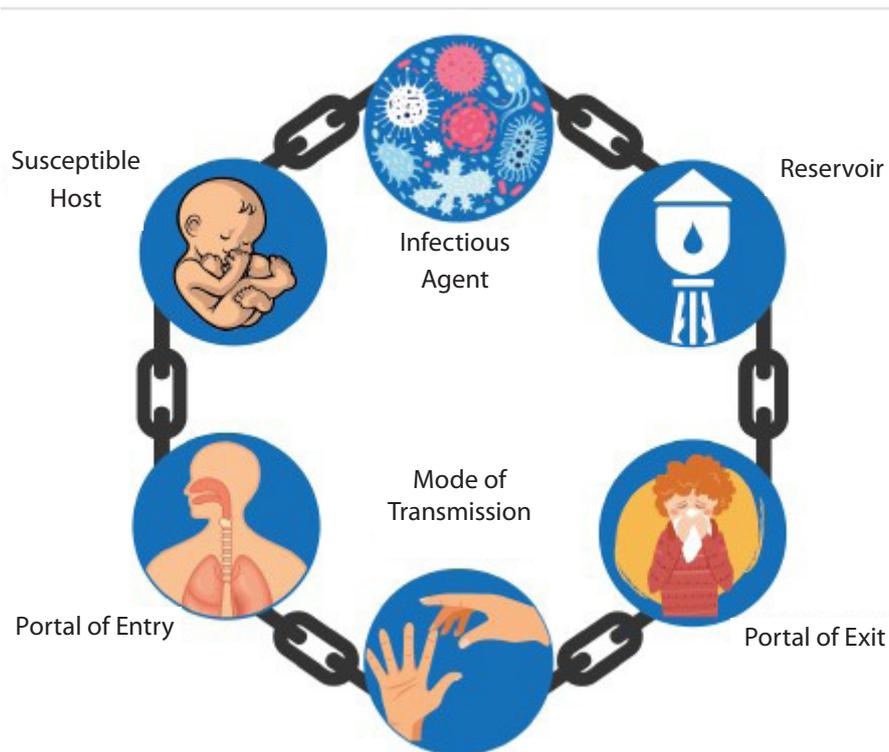


Figure 3.1. Chain of infection

Infectious agent: First there must be something that causes the disease. For example, flu is caused by an influenza virus.

Reservoir: A reservoir is the place the organism is found and sustained. This can be an animal, or it can be something in the environment such as water, food and soil. E.g. humans, birds and pigs serve as reservoirs for the influenza virus.

Portal of exit: The infectious agent must then be able to leave the reservoir. Infected humans shed the virus through respiratory mucus, particularly through sneezing and coughing.

Mode of transmission: Following its exit from the reservoir, the infectious agent must be able to survive the journey and transmit to the host. E.g. the influenza virus can survive in bodily fluids for a limited time, and typically is transmitted via contact, especially inhalation. After sneezing or coughing, infected respiratory fluids can either be directly inhaled by a nearby human (inhalation) or land somewhere which then comes into contact with another person's eyes, nose or mouth, e.g. tissue (contact).

Infectious agents can be spread in five main ways.

1. Contact (direct and indirect)

Direct skin to skin contact with contaminated bodily fluids can lead to transmission and subsequent infection. Contact can also be indirect, when infectious particles are able to survive on a nonliving object (fomite) for a period of time, such as a door handle or a used tissue.

2. Inoculation (bloodborne)

A type of contact transmission, this involves direct or indirect blood to blood contact. Often this occurs through sharing needles, or through cuts and other skin openings.

3. Ingestion

This is a type of contact transmission. Consumption of contaminated food and drink can lead to infection. If the infectious agent survives the digestion process, it can enter the body via the mucous membranes lining the gut. The infectious agent then replicates and exits via the faeces.

4. Inhalation (droplet and airborne)

Infectious agents can cross the mucous membranes lining the respiratory system and are shed from the host through respiratory mucous (a type of bodily fluid) expelled via sneezing, coughing, talking and even simple breathing. Larger infectious agents are transmitted via large, heavy drops of mucous (droplets) and can travel up to three feet (91cm) from the infected person. Smaller infectious agents (<5 microns in size) can attach to dust particles and become airborne, travelling extreme distances via air currents.

5. Trans-placental

Trans-placental infections are those that are transmitted from the mother to her embryo or fetus via the placenta. The mother acts as the reservoir and the embryo is the susceptible host.

Portal of entry – Infectious agents enter the host either through openings in the skin (e.g. cuts), or via mucous membranes lining the wall of the respiratory, gastrointestinal and genitourinary tracts. Infectious agents access the respiratory tract via the eyes, nose and mouth.

Susceptible host – In order to cause disease in the new host, this host must be susceptible to the disease. For example, the host can be naturally immune to the infectious agent or be rendered immune via vaccination.

- Babies are vulnerable to infection because it takes several months for their immune system to fully develop.
- As people age, their immune systems change, so the elderly may fight infection less quickly and less effectively.

3.2 IPC principles

Infection prevention and control strategies within healthcare are designed to break the chain of infection. These interventions are often targeted at specific links of the transmission chain.

The basic set of IPC strategies that should be implemented in healthcare facilities (HCFs) at all times are known as standard precautions. These evidence-based practices are designed to protect HCWs and also prevent transmission of infections among patients and visitors. Standard precautions include hand hygiene, the use of personal protective equipment, practising appropriate respiratory hygiene, safe use and disposal of sharps, appropriate decontamination of medical equipment and laundry, and environment and waste management.

For certain infectious diseases, e.g. those considered highly transmissible and/or caused by epidemiologically important pathogens, an additional set of IPC interventions known as transmission-based precautions are implemented to prevent the spread of the disease. These interventions are specific to the mode of transmission of the disease. Contact precautions are implemented to prevent transmission of diseases that are spread via contact with infectious material. Droplet precautions are used to prevent transmission of diseases that are spread via contaminated respiratory droplets. Airborne precautions are implemented to prevent transmission of diseases that can spread through aerosolised particles.

3.3 Common healthcare associated infections

The healthcare environment includes people, instruments, equipment and surfaces such as floors and furniture. The environment also includes waste disposal and water supply. Cleanliness of this environment can help to make the healthcare facility a safe and comfortable place for the patient. In addition, proper care of the healthcare environment can prevent a healthcare associated infection (HAI).

An HAI is an infection that the patient did not have when he or she was admitted to the healthcare service. It is defined as a localised or systemic infection that results from an adverse reaction to the presence of an infectious agent(s) or its toxin(s), for which there is no evidence of infection on admission to a healthcare facility.

An infection is frequently considered an HAI if it appears $\times 48$ hours after admission [7]. For example, a patient may come to the hospital to have an operation. After the operation, the patient's surgical wound begins to produce pus or other signs and symptoms of infection. This infection is an HAI because there was no infection before the operation. Other types of healthcare associated infections include urinary tract infection, pneumonia, bloodstream infection (septicaemia), gastro-intestinal and skin infections.

Healthcare associated infections also occur in HCW, relatives and visitors who have close contact with patients or with patients' body fluids, such as blood, vaginal secretions, urine and faeces. For example, a patient's blood may be infected with HIV and a HCW may get HIV infection if he or she is injured with a needle that has just been used on an HIV-infected patient.



Preventing HAIs is important because they:

- result in pain, discomfort and even death;
- increase the time the patient has to stay in hospital;
- keep the patient from working; and
- are expensive because money is required for medicines and equipment.

Healthcare associated infections can be classified as either endogenous (also known as self-infection) or exogenous (also known as cross-infection) infections. Infection prevention and control interventions are different for the two categories [7].

Endogenous infection

Many microorganisms that cause HAIs come from the patient's own body (the term normal flora/endogenous flora is used to describe this). For example, bacteria normally present in the colon can gain entry to the urinary tract and cause urinary tract infections. Endogenous infections are difficult to prevent by conventional measures since the microorganism causing the infection comes directly from the patient. They can, however, be controlled by helping to protect the resistance of the person to infection (e.g. mobilising the patient, providing adequate nutrition, avoiding the use of urinary catheters and intravenous catheters if possible, and promoting patient hand hygiene after defecation, before eating and before touching wounds/skin breaks).

Exogenous infection

Exogenous infection is a result of the transfer of microorganisms to the patient or HCW from an external reservoir. For example, microorganisms can be transferred by direct contact with contaminated hands of HCWs and other patients (cross-contamination), or by contaminated instruments and needles or the environment greatly reduces the frequency of cross-contamination between patients and HCWs and thus reduces the incidence of infection. As with endogenous infection, measures to protect a person's natural resistance to infection can also help to reduce the likelihood of infection if cross transmission does occur.

IPC is important in health care facilities (HCFs) because ongoing transmission can result in certain types of microorganisms becoming established (resident) in the HCF with the potential for antimicrobial resistance to occur.

There are four major types of HAI, all related to invasive or surgical procedures [7]:

- urinary tract infection (UTI)
- surgical-site infection (SSI)
- ventilator associated pneumonia (VAP)
- blood stream infection (BSI).

This chapter provides background information and prevention advice on the above four major types of HAI and in addition a number of other significant or common infections that may be transmitted in an HCF.

For all the HAIs discussed in this chapter the following preconditions for prevention should be addressed by HCF leaders and managers, informed by the evidence-based information provided.

- Infrastructure/system change: There is access to the right equipment, supplies and an environment that facilitates the right actions for patient and HCW safety.
- Training and education: A programme of routine training and education for all relevant HCWs in line with the recommendations presented in this chapter is offered.
- Monitoring, evaluation and feedback: A programme of regular monitoring and feedback is in place.
- Awareness raising/promotion: The practices described in the chapter are reinforced through awareness raising, such as the use of posters referenced in the chapter, displayed at the point of care.
- Safety culture: Managers and leaders at every level of the HCF show their visible support for IPC to help develop and reinforce a culture of patient safety.
- Policies and procedures should be developed, reviewed periodically, revised as necessary, and be readily available in the practice setting.

3.3.1 Urinary tract infection

Urinary tract infection (UTI) is one of the most common HAIs. Preventing UTI is a major factor in decreasing the overall incidence of HAIs in HCFs. Healthcare-associated UTIs are frequently related to urinary catheterisation. Many patients with a urinary catheter develop bacteriuria (bacteria in the urine) because the catheter creates a pathway for bacteria to enter the bladder. However, it is important to make the distinction between bacteriuria and an actual urinary tract infection. Patients should not be considered to have a catheter-related urinary tract infection and should not receive antimicrobial treatment solely because the urine is discoloured, has an odour, or because the laboratory has cultured bacteria from the urine. Unless the patient has clinical features of infection (e.g. fever, rigors, other systemic features) they should not be considered to have catheter-related UTI.

Factors that can lead to bacteriuria and may lead to UTIs:

- urinary catheterisation, which creates a pathway that allows for endogenous transfer of microorganisms (e.g. bacteria from the patient's gastrointestinal tract can be transmitted to the urinary tract);
- the passage of organisms from the urine bag to the bladder (retrograde contamination), which can occur in patients with indwelling catheters;
- some microorganisms growing on the outside or inside of the catheter's tubing and in the urine itself; and
- handling of the urinary catheter and urine bag by HCWs.

Reducing healthcare associated UTI can be achieved by:

- limiting the duration of catheterisation as much as possible and introducing an indwelling urinary catheter only when necessary and no other options are effective;
- following appropriate procedures for inserting and removing urinary catheters to reduce the risk of UTI;
- considering other methods for managing urinary tract problems that do not require the use of an indwelling catheter; and
- ensuring that only properly trained persons insert and maintain catheters.



Insertion procedure for urinary catheter

1. Explain the procedure to the patient and get his / her consent.
2. It is recommended that during the procedure an assistant is available.
3. Before inserting a urinary catheter, all of the following materials should be available at the point of care: a sterile indwelling urinary catheter, a sterile drape, a sterile syringe filled with sterile water for blowing up the balloon, clean examination gloves, sterile gloves, antiseptic solution (2% aqueous chlorhexidine gluconate or 10% povidone-iodine), a sterile gauze or sponge-holding forceps, and a sterile single use lubricant.
4. Lubricant is not really necessary, but in case you decide to use it, be sure it is single use
5. Practice aseptic technique. Perform hand hygiene and wear clean examination gloves.
6. Clean the urethral area and external genitals with soap and water and rinse carefully and thoroughly.
7. Separate and hold the labia apart or hold the head of the penis with the non-dominant hand and prepare the urethral area with the antiseptic solution, using a sterile gauze or sponge forceps with sterile gauze.
8. Perform hand hygiene and put on a pair of sterile gloves.
9. Grasp the catheter about five centimetres from the catheter tip with the dominant hand and connect the other end to the urine collection bag.
10. Gently insert the catheter until urine flows then for a further 5 cm. Inflate the balloon. Record the volume required to inflate the balloon, the same volume should be removed when the balloon is deflated for removal.
11. Do not use undue force. In the event of pain, blood or resistance during insertion, stop the procedure.
12. If the catheter is indwelling, pull it out gently to feel resistance, and secure the indwelling catheter properly to the thigh.
13. For in and out catheterisation, allow the urine to slowly drain into the collection bag, then gently remove the catheter.
14. Dispose of waste appropriately.
15. Remove gloves and practise hand hygiene.

Removal procedure for urinary catheter

1. Indwelling urinary catheters should be removed as soon as possible to reduce the risk of UTI.
2. Before removing the catheter, ensure that a new pair of clean examination gloves and a syringe are at the point of care.
3. Practise hand hygiene.
4. Put on clean examination gloves.
5. Empty the catheter balloon using a syringe; compare the volume removed to that inserted – it should be the same.
6. Swab the urethra two times with an antiseptic solution using sponge forceps with sterile gauze.
7. Gently remove the catheter.
8. Dispose of all waste appropriately.
9. Remove gloves and practise hand hygiene.

Catheter maintenance

- Clean the peri-urethral area daily.
- Do not rest the bag on the floor.
- Check the urine flow through the catheter several times a day to ensure that the catheter is not blocked (no dependent loops or kinking of the catheter tubing).
- Avoid raising the collection bag above the level of the bladder. If it becomes necessary to do so during transfer of the patient to a bed or stretcher, clamp the tubing.
- Before the patient stands up, drain all the urine from the tubing into the bag.
- Remove the urine after performing hand hygiene and while wearing clean examination gloves.
- To avoid contamination, empty the collection bag in a clean, fresh vessel; do not permit the tip to touch the urine vessel.
- For samples collection, aspirate the urine from the needleless sampling port with a sterile needle.
- Unless obstruction is anticipated, bladder irrigation is not recommended.
- The catheter collection closed system should always remain closed.
- In an open system, replace bags when needed.
- Clamping catheters prior to removal is not necessary.
- Do a daily review of urinary catheter necessity and remove as soon as indicated, preferably within 24 hours.

3.3.2 Surgical site infections [8]

Surgical site infections (SSIs) are often the result of contamination during a surgical procedure or contamination of the surgical wound after the procedure. SSIs are very common HAIs and often require additional surgical procedures to treat the infection.

The following factors predispose a patient to development of an SSI:

- obesity
- infection at another body site at the time of surgery
- immunosuppression
- malnutrition and anaemia
- old age and chronic diseases such as diabetes and malignancy.

Reducing SSI risk for patients

- Avoid prolonged preoperative hospitalisation and recommend ambulatory surgery as often as possible.
- Avoid preoperative hair removal. If hair must be removed, clip it with scissors or electric clippers just before the surgery. Do not shave using a razor blade (shaving has been attributed to microscopic cuts in the skin that later serve as foci for bacterial multiplication).
- In the surgical room, prepare a wide area around the proposed incision site with antiseptic solution (2% alcohol chlorhexidine is generally appropriate)
- Practice good surgical techniques that minimise tissue trauma, control bleeding, eliminate dead space, use minimal sutures, and maintain adequate blood supply and oxygenation.
- Keep the duration of surgical procedures as short as possible. The rate of infection doubles with each hour of surgery.
- Discharge patients promptly after surgery.



- It is important to note that applying topical antibiotic ointments on closed skin incisions does not decrease the risk of SSI. Additionally, healthy tissue growth is damaged when dry gauze is removed from surgical wounds. Moisten the dry gauze with sterile normal saline solution before removing it.

Antimicrobial prophylaxis to reduce risk of SSI

- The administration of systemic antimicrobial agents immediately before surgery can reduce the incidence of SSI after certain operations. The benefits, however, must be weighed against the risks of toxic and allergic reactions, the emergence of resistant bacteria, drug interactions, super infection, and cost. In general, antimicrobial prophylaxis is recommended for procedures with significant risk of infection (for example, surgery that involves entering the colon). The prophylactic antimicrobial drug(s) should be directed against the most likely infecting organisms.
- To help reduce the development of antimicrobial resistance to drugs used for surgical prophylaxis, it is recommended that:
 - antimicrobial agents with a moderately long half-life be used;
 - antimicrobial agents with an appropriate spectrum of activity be used;
 - the antimicrobial agent(s) used prophylactically differ from any agents used for a period of time just before surgery, as anti-microbial-resistant bacteria may have developed; and
 - selection of antimicrobial agent(s) for surgical prophylaxis take account of local/national data on antimicrobial resistance where this is available.
- Each HCF should have a clear written policy of antimicrobial prophylaxis in surgery that specifies for which types of surgery and which patient categories antimicrobial prophylaxis is required, the agent(s) to be used, the dose, the route of administration, the interval before surgery and an alternative regimen for patients with a history of adverse reaction to the primary regimen.
 - In most instances, a single intravenous (IV) dose of an antimicrobial administered 60 minutes or less before the skin incision provides adequate levels of antimicrobial within the tissues throughout the operation. If surgery is prolonged (more than four hours), if major blood loss occurs, or if an antimicrobial with a short half-life is used, one or more additional doses should be given during the procedure.
 - Use the WHO Surgical Safety Checklist [9] (See Annex 11).

3.3.3 Healthcare associated pneumonia [10]

Healthcare associated pneumonia (HAP) is a common HAI with a significant risk of a fatal outcome. Most of these infections occur by aspiration of bacteria growing in the back of the throat or in the stomach. Pneumonia associated with mechanical ventilation may be referred to as Ventilator Associated Pneumonia (VAP). The range of microorganisms associated with HAP/VAP is much wider than is the case for community acquired pneumonia (CAP) and many of these microorganisms are much more likely to be resistant to antimicrobials. Therefore HAP/VAP may be much harder to treat effectively with antimicrobial agents than CAP.

Intubation and mechanical ventilation greatly increase the risk of pneumonia in the following ways.

- They block the normal body defence mechanisms – coughing, sneezing, and the gag reflex.
- They prevent the washing action of the cilia and mucus-secreting cells that line the upper respiratory system.
- They provide a direct pathway for microorganisms to get into the lungs.

Other procedures that could increase the risk of pneumonia include oxygen therapy, Intermittent Positive Pressure Ventilation (IPPV) treatment, and endotracheal suctioning. The combination of severe illness, the presence of multiple invasive devices (intravenous catheters, urinary catheters, and mechanical ventilators), and frequent contact with the hands of HCWs often leads to cross-contamination and patient infection.

Risk factors for HAP:

- old age
- chronic lung disease
- severe head injuries with loss of consciousness
- severe medical conditions, such as end-stage renal disease and liver cirrhosis
- cigarette smoking
- alcoholism
- obesity
- major cardiovascular or pulmonary surgery
- endotracheal intubation and mechanical ventilation
- prolonged confinement to bed
- immune deficiency states
- diabetes

Reducing the risk of HAP – Preoperative pulmonary care

- Limit the use of narcotics, although not to a degree that will compromise appropriate pain relief.
- Adhere to standard precautions to maximise prevention of cross-transmission of microorganisms.
- Additionally, patients should be educated about the following postoperative practices that can prevent development of HAP:
 - deep breathing,
 - moving in bed,
 - frequent coughing.
- Early ambulation.

Reducing the risk of HAP – Prevention of complications from equipment/devices

To reduce the risk of contamination and possible infection from mechanical respirators and other equipment, follow these guidelines.

- Use mechanical ventilation only when necessary.
- Implement a comprehensive oropharyngeal cleaning. This includes suctioning to avoid draining past the tube. Also consider a decontamination programme for all patients at high risk of VAP.
- If reusable breathing circuits are used for more than one patient, they must be cleaned and appropriately sterilised between patients, according to the manufacturer's guidance. Disposable (single patient use) breathing circuits eliminate this risk of cross-transmission but are expensive.
- Breathing circuits intended for single patient use are not suitable for cleaning, decontamination and reuse.



- Respiratory equipment, such as oxygen tubing, nasal prongs, nebulisers and masks, are intended for single patient use and are not suitable for cleaning, decontamination and reuse.
- Disinfect or sterilise resuscitation devices, such as bag valve mask, promptly according to the manufacturer's guidelines.

To minimise cross-contamination when suctioning patients on ventilators, follow these guidelines.

- A closed suction system is recommended to lessen the risk of cross contamination.
- Practise hand hygiene.
- Wear sterile examination gloves, a mask, and protective eyewear.
- Use only sterile fluid to clear a catheter that you are using to suction secretions from the patient's lower respiratory tract if you are planning to reinsert it into the endotracheal tube (ET).
- Discard waste appropriately.
- Remove gloves immediately after therapy and practise hand hygiene.

Reducing the risk of HAP – Preventing gastric reflux

Follow these practices to reduce the risk of gastric reflux, which can lead to HAP.

- Avoid prolonged use of nasal gastric tubes for feeding.
- Feed small, frequent amounts rather than large amounts at one time.
- Elevate the head (30–45 degrees), if not contraindicated so that the patient is in a semi-sitting position.
- Ensure that patients stop taking solid foods four to six hours prior to a general anaesthetic.

Reducing the risk of HAP – Post-operative management

Surgical units should have effective plans for post-operative management that include the following the guidelines.

- Provide adequate pain control for patient comfort and to facilitate movement.
- Move and exercise patients daily to prevent skin breakdown and pressure sores.
- Encourage deep breathing/coughing in the immediate postoperative period and for the next few days.
- Encourage early mobilisation of patients.
- Ensure adequate nutrition.

3.3.4 Infections related to use of intravascular devices

Intravascular, intraosseous devices inserted into the venous or arterial bloodstream penetrate the normal skin defence mechanism and provide a route for microorganisms to enter the bloodstream from one or more of the following:

- any contamination of the device at the time of insertion,
- subsequent contamination of the device or attachments,
- pathogens on the skin surrounding the insertion site.

Intravascular device-related infection may be localised skin and soft tissue infection at the site of the intravascular device (exit site infection, phlebitis). Localised infection is typically associated with *Staphylococcus aureus*. The infection may extend to cause extensive skin and soft tissue infection of the limb and can progress to bloodstream infection. Intravascular devices may also be associated with bloodstream infection with little or no evidence of infection at

the catheter site. *Staphylococcus aureus* is again the most common associated organism. For these reasons, intravascular catheter-related infection should be considered in any patient who develops a new onset blood stream infection with an intravascular device in situ, particularly if there is no other obvious site of infection (e.g. pneumonia). Where possible, a sample for blood culture should be taken, using appropriate precautions, to aid in diagnosis of patients with suspected severe intravascular catheter-related infection. One of the most important principles of safe management of intravascular catheter-related infection is early removal of the catheter. Antimicrobial treatment is unlikely to be effective if the catheter remains in place.

Risk factors associated with infections related to the use of intravascular catheters:

- inadequate hand hygiene during insertion and care of the device
- immunosuppression
- cracks in infusion bottles and punctures in plastic containers, allowing for contamination of the substance being infused
- contaminated infusion fluid or additives
- leaky intravenous administration sets with multiple connections
- non-sterile preparation of intravenous infusion fluid
- inadequate preparation of skin before inserting the device
- multiple changes of intravenous fluid containers while using the same IV administration set
- multiple injections and irrigations of the system
- Central venous pressure measurement apparatus

Reducing the risk of HAI due to intravascular catheters

The following practices should help reduce the risk of infection. Avoid intravascular catheterisation when possible.

- Practise hand hygiene and put on clean sterile gloves when inserting and handling intravenous catheters.
- If the site for inserting the catheter is dirty, wash it with soap and clean water and dry it before applying the skin antiseptic.
- Apply the skin antiseptic and allow the solution to dry before inserting the intravascular catheter.
- Follow the aseptic technique in insertion and care of intravascular lines.
- Fix the device in place by attachment to the skin. Ideally use transparent, adherent dressings to allow easy inspection of the site later.
- Dressings can be left in place for up to 72 hours if they are kept dry. Change the dressing immediately if it becomes wet, soiled, or loose.
- If dressings are removed to inspect the site. discard the removed dressing appropriately and use a new dressing.
- If there is resistance to withdrawal of blood or injection of drugs through an intravascular catheter, do not use force. The catheter is likely to need replacement.
- Check at least daily if the patient has pain or discomfort at the site of the intravenous line. If palpating the cannula site daily for tenderness be careful to practise hand hygiene, wear sterile gloves and avoid touching the puncture site. Inspect the insertion site if the patient develops tenderness or fever.
- For peripheral IV lines, avoid using the lower limbs if possible, as these are more likely to become infected.



- A routine change of intravascular catheters after 72 hours is not necessary if there is no evidence of infection and there is no resistance to injection or fluid administration.
- Because straight and butterfly needles frequently infiltrate, do not use them with solutions that could cause tissue necrosis.

Inserting central venous catheters

- Avoid the use of a central venous catheter unless it is essential.
- Avoid using the femoral or jugular sites for adults (if possible).
- Central venous catheters should be inserted only by those with substantial experience in the procedure or by those in training under direct supervision of a person with substantial experience. Infection is more likely if inexperienced HCWs insert the catheter.
- Wash the catheter insertion site with soap and clean water and dry it before applying the skin antiseptic.
- Prepare the skin using alcoholic 2% chlorhexidine gluconate or 60% to 90% alcohol and allow to dry.
- Perform hand hygiene and use the aseptic technique/maximum sterile barrier precautions (i.e. surgical mask, cap, gown, sterile gloves) and sterile full body drape on the patient.
- Put on sterile gloves, face shield and gown before inserting the central venous catheter.
- Handle and maintain central lines appropriately.
- Comply with hand hygiene requirements.
- Scrub the access port or hub immediately prior to each use with an appropriate antiseptic (e.g. alcoholic chlorhexidine, povidone iodine, an iodophor, or 70% alcohol).
- Access catheters only with sterile devices.
- Replace dressings that are wet, soiled, or dislodged.
- Perform dressing changes under aseptic technique using clean or sterile gloves.

Changing fluids and infusion sets

Follow these guidelines for changing fluids and infusion sets.

- Change infusion bottles or plastic bags with parenteral solutions every 24 hours.
- Change infusion bottles or plastic bags with lipid emulsion given alone within 12 hours.
- Change infusion sets whenever they are damaged/contaminated and after 96 hours routinely.
- If the tubing becomes disconnected, wipe the hub of the cannula with 60% to 90% alcohol and connect a new infusion set.
- Replace tubing that is used to administer blood products or lipid emulsions within 24 hours.

Inserting and maintaining peripheral IV lines

Follow these practices to reduce the risk of infection when inserting and maintaining peripheral intravascular catheters.

- Avoid the use of intravascular catheters, unless essential.
- Practise hand hygiene and wear sterile single-use examination gloves.
- Cleanse the insertion site with antiseptic solution, using a circular motion outward from the insertion site (or follow the manufacture's recommendation for cleansing the site) and allow the antiseptic solution to dry.

Removal of peripheral IV lines

Follow these practices to reduce the risk of infection when removing peripheral IV lines.

Practise hand hygiene.

- Put on sterile examination gloves.
- Check the patient's hand or wrist for phlebitis or evidence of infection. If phlebitis is associated with other signs of infection, such as fever or pus coming from the exit site, this is classified as a clinical exit-site infection.
- Carefully remove the needle or the plastic catheter with one hand and with the other hand cover the insertion site with sterile gauze.
- Press the insertion site firmly for about a minute and cover it with a sterile bandage.
- Dispose of waste appropriately, remove gloves, and practise hand hygiene.
- If clinical exit site infection is present, assess whether it requires antimicrobial treatment.
- Document clinical observations of the IV site (e.g. intact without signs/symptoms of infection, warm, erythema, pus, etc.) in the patient's record.

3.4 Common pathogens responsible for HAI

3.4.1 Healthcare associated diarrhoea

Diarrhoea is generally defined as passage of three or more liquid stools in 24 hours. In some cases, however, the abrupt onset of illness with passage of a single liquid stool leaves little doubt that the patient will meet the definition of diarrhoea soon afterwards and it is sensible to consider that the patient has diarrhoea. New onset passage of loose stool in patients admitted to HCF is common. It is not always caused by infection, although this should be considered as likely in most cases.

Food- and water-borne infectious diarrhoea (rotavirus, campylobacter, salmonella, cholera) can be introduced into a health care facility by patients and staff, if the water supply is not safe; if food is not properly prepared, stored and served; if infected staff come to work while they have diarrhoea; or if infected people visit relatives. Once introduced to the hospital or health service, diarrhoeal infection may be spread through person-to-person transmission.

Factors that put patients at particular risk of healthcare associated diarrhoea:

- antimicrobial administration (especially for *C. difficile*-associated diarrhoea),
- sharing space with a patient who has infectious diarrhoea,
- occupying space previously occupied by a patient with infectious diarrhoea,
- immunosuppression,
- decreased gastric acidity (for example in patients taking drugs to suppress gastric acid),
- unhygienic shared toilet facilities,
- inadequate hand hygiene by patients and staff.

Prevention of healthcare associated diarrhoea

- Ensure compliance with the five moments for hand hygiene.
- Single room isolation, cohorting in a separate space or keeping distance between patients should be practised for all patients with diarrhoea, even if the diarrhoea is considered to be non-infectious. This is because patients with diarrhoea are highly likely to contaminate their environment with their colonic bacteria. These bacteria may include antimicrobial resistant bacteria that could cause infection in other vulnerable patients.



- Ensure that all patients admitted with diarrhoea or who develop diarrhoea in the HCF are kept in a separate space and use separate washing and toilet facilities if possible (i.e. isolation).
- If a separate space is not possible, consider how to help the patients with diarrhoea to keep some distance from other patients.
- Immediately clean and then disinfect all soiled articles and environment.
- Ensure that bedpans and bathroom equipment that are regularly handled by patients and staff are clean at all times and disinfected when appropriate.
- Wear utility or heavy-duty gloves before sorting out linen and bundle soiled linen to prevent leakage.
- Ensure that staff with diarrhoea are not engaged in patient care or food preparation and serving until at least 24 hours after the diarrhoea has been resolved.

3.4.2 Blood-borne pathogens

Blood-borne transmission of viral infection is a recognised risk to both HCWs and patients in their care. In health care, transmission of blood-borne viruses may occur by injection, infusion, transplantation, unsterile equipment, or other accidental injury/penetration. The risk of transmission of infections can be reduced by eliminating hazards, providing and using engineering controls, avoiding unsafe practices, using personal protective equipment, immunisation, and post-exposure prophylaxis.

Hepatitis B virus (HBV), hepatitis C virus (HCV) and HIV are important blood-borne pathogens that can be transmitted in the health care setting through administration of blood and blood products, the use of contaminated needles/surgical equipment or sharps injuries.

3.4.3 Tuberculosis

Tuberculosis (TB) is a bacterial infection caused mainly by the species *Mycobacterium tuberculosis* [3]. Transmission is through the airborne route when someone with active disease (untreated smear-positive) coughs, talks, sneezes, or spits. The bacteria can be inhaled into the lung by people nearby. Only patients who develop lung disease generate the aerosols that allow for the airborne spread of TB. Patients with TB at sites other than the lung (e.g. bone or kidney) generally do not transmit infection. Tuberculosis is usually identified by laboratory examination of a sputum sample.

Procedures for patients who are suspected of having TB

1. Initial evaluation and testing is best done on an outpatient basis if possible.
2. Collect a sample of sputum for smear examination as a matter of urgency. Where available, rapid molecular testing may be preferred.
3. Disposable, non-transparent sputum cups with lids should be used for sample collection.
4. Perform a chest X-ray, when available, to aid diagnosis.
5. Initiation of effective treatment rapidly reduces the risk of infection from infected patients.
6. All HCFs should be assessed to identify areas where TB transmission can occur.
7. Adequacy of airflow/ventilation and natural light should be determined.
8. In areas where airflow by cross-ventilation is inadequate, extractor fans should be installed.
9. Natural light should be increased where necessary.
10. Patients who are coughing in the outpatient clinic or emergency department should wait outside if possible, or in a well-ventilated area. They should wear a surgical/medical mask for source control. Signs reminding patients about respiratory hygiene precautions, such as the use of tissues when coughing, should be displayed prominently.

11. Patients suspected of having TB should be examined in a well-ventilated area.
12. The patient should wear a surgical mask if possible.
13. HCWs treating patients with TB should wear a mask, ideally a fitted respiratory protection mask (N95 or equivalent). Work in the patient area should be planned so as to be performed as efficiently as possible to limit time spent there.
14. If a patient who is suspected of having TB is admitted to an inpatient ward, they should be placed in either a separate, well-lit, and well-ventilated room or with other patients suspected of having TB in a cohort area of the ward.
15. Patients with multi-drug resistant (MDR) or extensively drug resistant (XDR) TB should be nursed in isolation.
16. The sputum smear result/molecular test result should be returned to HCWs on the inpatient ward within 24 hours so that the patient can be treated as soon as possible.
17. Supplies of respiratory protection (N95 or equivalent) masks may be limited. If so, they should be conserved for high-risk situations, such as when performing or assisting with bronchoscopy, endotracheal intubation, suctioning, or autopsy of TB cases.
18. When the patient needs to be moved within the hospital, he or she should wear a surgical/medical mask. Inform staff in the area or ward to which the patient is taken or transferred so that they can implement effective IPC measures.
19. For patients on TB treatment, delay any operative procedures until the patient is no longer infectious if it is safe to do so. (TB-infected patients who have received adequate treatment for two or three weeks, have responded to the treatment, and have had three consecutive negative smear examinations from sputum taken on three separate days are no longer infectious.) It will take about two months for most infectious TB patients to become non-infectious. This is more complex, however, in situations where MDR and XDR TB are common, as standard initial therapy is generally ineffective for these patients.
20. If emergency surgery is required, it should be planned to minimise the risk of occupational exposure. The number of HCWs in the operating room should be minimised and respiratory protection masks (N95 or equivalent) should be worn as appropriate.
21. Every patient that is confirmed to have TB via laboratory smear should be informed of their positive result.
22. It is a public health requirement under the National Public Health Act that diagnosed cases of every form of TB should be reported to the Ministry of Health using the relevant TB notification form(s).
23. Contact tracing for screening should be performed and the patient should be monitored to ensure full compliance with treatment.

4 STANDARD PRECAUTIONS AND TRANSMISSION-BASED PRECAUTIONS

Infection prevention and control precautions are divided into two distinct groups: standard precautions and transmission-based precautions. This chapter covers each of the elements of standard precautions and transmission-based precautions.

4.1 *Standard precautions*

The elements of standard precautions are the minimum IPC measures designed to protect patients and HCWs from healthcare associated infections in all settings.

It is essential that all HCWs apply these standard precautions, regardless of diagnosis, known or suspected infectious status of individuals because:

- people may be infectious before they show signs and symptoms or laboratory test confirmation;
- there is an increased risk of transmission of infection with specific procedures; and
- people are at risk of acquiring infectious agents present in the environmental surroundings, including surfaces and equipment.

Standard precautions should be used for all patients, regardless of their diagnosis or presumed infection status. They are used when handling blood, including dried blood; all body fluids, secretions and excretions (excluding sweat), regardless of whether or not they contain visible blood; non-intact skin; and mucous membranes [11,12].

Standard precautions involve safe work practices and include the following elements:

- hand hygiene
- respiratory hygiene/cough etiquette
- personal protective equipment according to the risk
- safe injection practices, sharps management and injury prevention
- environmental cleaning
- safe handling and cleaning of soiled linen
- safe reprocessing of medical equipment and instruments
- waste management.

4.2 *Hand hygiene*

Effective hand hygiene is the cornerstone of standard precautions and is the single most important measure in the prevention of HAIs and anti-microbial resistance.

The most common mode of transmission of any infectious agents is via the hands of staff and patients. Infectious agents are present on the hands most of the time and are categorised into groups.

- *Resident flora* reside on the surface of the skin
- *Transient flora* are acquired from HCWs during contact with patients and contaminated environmental surfaces in the patient's surrounding. The transient organism survives and multiplies on the skin's surface and can easily be removed by frequent hand hygiene. Transient organisms are most often associated with HAIs.

Several studies have stressed that HCWs' hands contaminated with transient organisms have been responsible for outbreaks of methicillin-resistant *Staphylococcus aureus* (MRSA) and other multi-resistant gram-negative organisms in neonatal intensive care units and adult intensive care units. In addition, hands can be contaminated with the influenza virus through contact with secretions and contaminated environmental surfaces and can lead to cross infection.

4.2.1 Indications for hand hygiene

Hand hygiene is mandatory and is the single most important measure to prevent and minimise the spread of HAIs in healthcare environments.

The main purpose of hand hygiene is to mitigate the spread of infection by removing visible soil and micro-organisms (transient microorganisms) carried on the hands of both staff and patients.

Hand hygiene includes both hand washing with soap or antimicrobial soap and water, and the use of alcohol-based hand rub products (gels, rinses, foams) that do not require the use of water.

The five moments for hand hygiene (Figure 4.1) developed by the World Health Organization [13], describes the opportunities or situations when hand hygiene should be performed by healthcare workers in acute and primary healthcare settings. The five moments are designed to protect patients from the risk of microbial transmission from the hands of healthcare workers and also prevents microbial transmission to healthcare workers and patient surroundings from the patient.

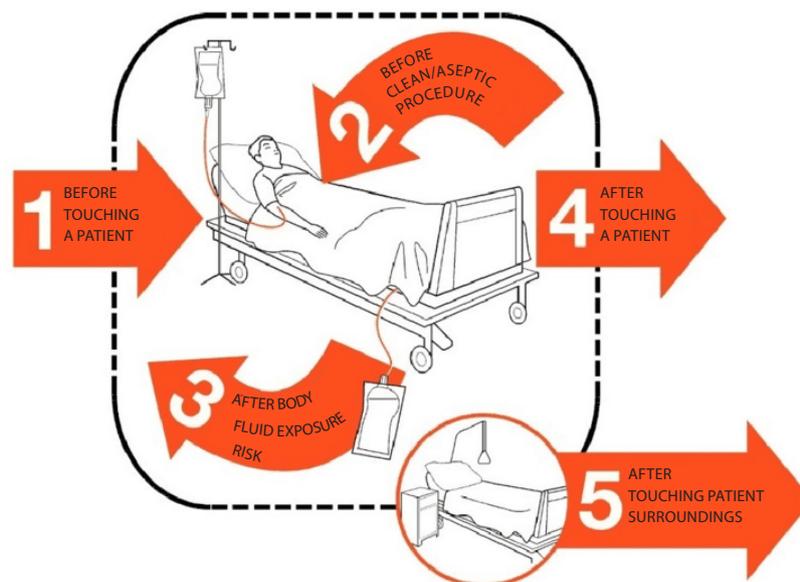


Figure 4.1. The five moments for hand hygiene developed by the World Health Organization.

Hand hygiene must also be performed:

- before and after eating or preparing to serve or handle food;
- when hands become visibly soiled;
- after using the toilet;
- before putting on gloves and after removing gloves;
- before starting work and leaving work;
- before and after using computer keyboards, especially in the clinical environment;
- after wiping mouth and nose secretions;
- when entering and leaving the patient environment, especially during an outbreak of an infectious agent; and
- after handling laundry, waste and equipment.

Access to hand hygiene must also be provided to immobile inpatients after toileting and before meals. Patients and visitors must be encouraged to perform hand hygiene.

4.2.2 Hand hygiene products

Hand hygiene includes both hand washing with liquid soap and water, and the use of alcohol-based hand rub products (gels, rinses, foams) that do not require the use of water. Water alone is not suitable for cleaning soiled hands; soap must be used with water for effective hand washing.

Hand drying is an essential part of hand washing. Ideally, hands should be dried with a single use paper towel or single use cloth towel. The reuse of cloth hand towels should be avoided because of the risk of cross contamination.

Plain soaps

Soaps are commonly available in the form of bar soaps and liquid preparations. Plain soaps aid in the removal of dirt, soil and various certain organisms, such as *C. difficile* and non-enveloped viruses, e.g. noro-virus. Plain soaps have minimal, if any, antimicrobial activity, although handwashing with plain soap can remove loosely adherent transient flora.,

It is not recommended to use bar soaps in clinical settings due to the risk of soap being left sitting in water, hence allowing transient organisms to grow. If bar soaps are used, it is important to ensure that the bar is placed on a well-drained holder and should not be immersed in liquid. It is preferable to use liquid soap preparations. Soap and water can still be used, even where there is no piped water. If piped water is not available, one of the following methods can be used:

- a bucket with a tap at the base
- a pitcher or a jug to pour water over the hands with the help of an assistant.

Alcohol-based hand rubs [13]

According to WHO, alcohol-based hand rub preparations contain either ethanol, isopropanol or a combination of these products. (60% v/v n-propanol is approximately equivalent to 70% v/v isopropanol and to 80% v/v ethanol).

Most studies have indicated that an alcohol-based hand rub preparation of at least 70% isopropanol, 0.5% chlorohexidine and a skin emollient is effective against HAs.

An alcohol-based hand rub (ABHR) is highly effective and inactivates a wide range of harmful microorganisms on the hands. It is effective at removing vegetative forms of *C. difficile* but are not effective at removing spores [13].

The efficacy of an alcohol-based hand rub depends on appropriate usage. This includes:

- the type of alcohol used;
- hands should be dry before use of ABHR;
- the volume of alcohol used – the ideal volume is unknown, but if hands dry less than 20 seconds after being rubbed, it is likely that insufficient alcohol was used;
- if hands are visibly soiled, they should be washed first with soap and water.

Local production of alcohol-based hand rub [13,14]

Alcohol-based-hand rubs can easily be prepared locally by a hospital pharmacy and are suitable for use in places where there may not be sinks or other hand hygiene needs, such as hand towels, liquid soap and clean running water. (See Annex 6: How to make an alcohol handrub.)

4.2.3 Hand hygiene technique [13]

The steps below should be followed when performing hand hygiene with either soap and water or an alcohol-based hand rub to ensure that all surfaces of the hands are covered (See Figure 4.2).

1. Ensure that jewellery has been removed.
2. Lather the hands with liquid soap and water or, if using ABHR, rub hands palm to palm.
3. Rub as follows:
 - right palm over back of left hand with fingers interlaced and vice versa,
 - palm to palm with fingers interlaced,
 - backs of fingers to opposing palms with fingers interlocked,
 - rotational rubbing of left thumb clasped in right palm and vice versa
 - rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.
4. Rinse under running water if hand washing.
5. Do not touch taps with clean hands – if elbow or foot controls are not available, use paper towel to turn off taps.
6. Pat hands dry using paper towel or single use hand towel





Figure 4.2. Steps for hand washing. Source: SPC 2008

There are three types of hand hygiene techniques:

- social or routine hand hygiene;
- aseptic or clinical hygiene;
- surgical hand antisepsis.

a. Social or routine hand hygiene

Using soap and water

Note: Hands must be washed with liquid soap and water when:

- they are visibly dirty or soiled with blood and bodily fluids; or
- exposure to potential spore-forming pathogens is strongly suspected or proven, including outbreaks of *Clostridium difficile*.

Use the five moments for hand hygiene and Figure 4.2 to follow the steps for hand washing. Hands and wrists should be washed for 40–60 seconds with plain liquid soap to remove dirt, soil and other organic substances. The hands are then dried with a paper towel or, if these are not available, a single-use hand towel. This type of hand hygiene is suitable for all routine procedures.

Using ABHR

Many studies have stated that ABHRs are more effective than hand washing with soap and water. Studies have shown that ABHRs have excellent in-vitro germicidal activity against Gram-positive and Gram-negative vegetative bacteria (including multidrug-resistant pathogens such as methicillin resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE), *M. tuberculosis*, and a variety of fungi. However, hand hygiene must be performed with soap and water when there is *Clostridium difficile* or norovirus suspected or known to be present.

How to use ABHR:

- Use ABHR on clean dry hands.
- Apply about 3 ml of the product to the palm of one hand and rub hands together, covering all surfaces of the hands and fingers until the hands are dry. This should take about 20–30 seconds; if the hands are dry in 10–15 seconds, not enough hand rub was used.
- Hand hygiene with ABHR can be used according to the indications for 5 moments for hand hygiene.

b. Aseptic clinical hand hygiene

Aseptic clinical hand hygiene is undertaken to remove or destroy transient micro-organisms and inhibit the growth of resident microorganisms. It should be carried out prior to any procedures that involve contact with the mucous membrane, non-intact skin or invasive medical device, e.g. insertion of central venous line.

The hand hygiene procedure can be carried out in one of two ways:

- by washing hands and forearms with antimicrobial soap (chlorohexidine gluconate 2% solution) and water, for 40–60 seconds and dried with a hand towel); or



- by using ABHR for 20–30 seconds. This is appropriate for hands that are not soiled with protein matter or fat or are otherwise visibly dirty.

Note: Immersing hands in bowls of antiseptic is not recommended. Follow the same steps for hand washing shown in Figure 4.2.

c. Surgical hand antisepsis

Surgical hand antisepsis removes or destroys transient micro-organisms and reduces the presence of resident flora on the skin of hands and arms.

Principle 2 of *Pacific perioperative practice bundle: Infection prevention* states that the criteria for antimicrobial solution used for scrubbing should:

- be used according to manufacturer’s instructions;
- be broad spectrum;
- be fast acting and persistent;
- have a residual and cumulative effect; and
- be non-irritating and have minimal detrimental effects on the skin.

The five-minute surgical scrub technique (for first scrub)

1. Open and prepare nail cleaner and scrub sponge for use later in the scrub.
2. Turn on the water to a comfortable temperature and even flow.
3. Complete pre scrub wash using antiseptic solution to loosen debris on the skin.
4. Apply antiseptic solution to hands, wash hands before proceeding to wash arms using a circular hand motion, working in one direction from hands to 2.5 cms above the elbow.
5. Leave the solution in contact with the skin whilst nails are cleaned using nail cleaner – dispose of nail cleaner in a safe manner.
6. Rinse hands and arms, keeping hands higher than elbows to allow water to run in one direction only
7. Avoid splashing water onto perioperative attire as this will cause ‘strike through’ when donning a sterile gown, rendering it unsterile.
8. Apply antiseptic solution to scrub sponge (unless it is already impregnated).
9. Wash all surfaces of the hands and fingers, then wash the forearms to elbow level – discard the scrub sponge safely.
10. Rinse hands and arms thoroughly.
11. Apply antiseptic solution to hands and repeat previous step, but stopping at mid forearm.
12. Rinse thoroughly.
13. Apply antiseptic solution to hands and wash hands only.
14. Rinse for the final time – if taps are elbow operated, turn taps off using elbows to avoid contamination of the hands.

Note

- If scrub sponge and nail cleaners are unavailable, greater attention must be paid to the first-hand wash of the procedure to ensure that nail beds are thoroughly cleaned by dipping the fingertips of each hand into the solution.
- If brushes are used, the selection of reusable or disposable brushes or sponges for scrubbing should be based on realistic considerations of effectiveness and economy.
- If a reusable brush is desired, it should be easy to clean and maintain and should be durable enough to withstand repeated sterilization without bristles becoming soft or brittle.

The three minute surgical scrub technique for subsequent scrubs

1. Turn on the water to a comfortable temperature and even flow.
2. Apply antiseptic solution to hands, wash hands before proceeding to wash arms using a circular hand motion, working in one direction from hands to 2.5 cms above the elbow.
3. Leave the solution in contact with the skin.
4. Without rinsing, apply additional solution and wash all surfaces of the hands and then proceed from forearms using a circular motion to the level of the elbow.
5. Rinse hands and arms thoroughly.
6. Apply solution and wash hands and forearms, stopping at mid forearm.
7. Rinse hands and arms thoroughly.
8. Apply solution and wash hands only.
9. Rinse for the final time.

Many studies discourage the use of a surgical hand brush because there is no additional microbial effect. However, use of disposable sponges is recommended.

Steps before starting surgical hand preparation

1. Keep fingernails short.
2. Do not wear nail polish or artificial nails.
3. Remove all jewellery.
4. Wash hands with non-medicated soap before entering the operating room.
5. Clean subungual areas with the nail file

Surgical hand preparation with ABHR [13]

Several long-acting (chlorhexidine gluconate or quaternary compounds) ABHRs are licensed for the commercial market. Surgical hand antisepsis using commercially prepared ABHR requires three minutes contact time. Manufacturer instructions should be followed.

4.3 Respiratory hygiene and cough etiquette

The application of respiratory hygiene and cough etiquette procedures are designed to reduce the spread of respiratory infections such as COVID-19 and other influenza like symptoms. Respiratory hygiene and cough etiquette are elements of standard precautions and should be practised at all times by all patients (and staff and visitors) with respiratory symptoms (e.g. coughing, sneezing) [11,12].

People with respiratory infections/symptoms should be taught to do the following.

- Cover their mouth and nose with a tissue when coughing, sneezing or blowing nose and dispose of used tissue in waste and/or garbage containers. If no tissues are available, cough or sneeze into the inner elbow rather than the hands and perform hand hygiene immediately.
- Spit into tissue if spitting is necessary and dispose of tissue into waste and/or garbage bin and perform hand hygiene.
- Perform hand hygiene (use an alcohol-based hand rub or wash hands with soap and water) each time after contact with respiratory secretions.



- Wear a medical/surgical mask (if available) if you are coughing in order to protect other people in the waiting area.
- Keep contaminated hands away from the mucous membranes of the eyes, nose and mouth.

Healthcare facilities should promote respiratory hygiene and cough etiquette by:

- ensuring that patients with fever and cough are seated away from others in common waiting areas (ideally at least three feet/1 metre from others);
- ensuring that appropriate materials are available for patients to adhere to respiratory hygiene and cough etiquette;
- promoting the use of disposable tissues (if available) as opposed to using handkerchiefs;
- making medical/surgical masks available in waiting areas to reduce the risk of infection transmission;
- making hand hygiene resources (e.g. dispensers of alcohol-based hand rubs) with instructions on how to use them, available in waiting areas during an influenza outbreak;
- educating patients, family members, and visitors on the importance of covering their mouths and noses with a tissue to help prevent the transmission of influenza and other respiratory viruses;
- making appropriate garbage bins (pedal operated) or open bins available in waiting areas for disposal of used tissues;
- posting signs requesting that patients and family members with acute febrile respiratory illness use respiratory hygiene and cough etiquette; and
- ensuring that all staff have access to and are trained in using PPE.

4.4 *Personal protective equipment*

Personal protective equipment (PPE) is an important component in the prevention and control of infectious diseases. PPE is used to protect the mucous membranes (eyes, nose mouth), airway, skin and clothing from exposure to infectious agents.

Depending on circumstances, PPE is part of standard precautions and include medical/surgical masks or NIOSH-certified N95 particulate respirator masks, eye shields or eye goggles, waterproof gowns and coveralls, shoe covers, head covers and rubber boots (gum boots).

PPE on its own is insufficient. It must be used simultaneously with standard and additional precautions. It is important to use PPE effectively and correctly [14,15].

The selection of PPE is based on the assessment of:

- the risk of transmission of the infectious agent/microorganism to the patient and HCW;
- the risk of contamination of the HCW's skin and clothing by the patient's blood and body substances in consideration of the type of patient interaction and procedure;
 - the type of known or possible infectious agent,
 - the risk of exposure and extent of contact with blood, body fluids, respiratory droplets, aerosols or open skin,
 - the local context, current epidemiology,
 - what is happening in the patient's area, city, other countries,
 - an outbreak;
- likely modes of transmission of the infectious agent [16].

The use of comprehensive PPE is mandatory if direct, close contact with patients suffering from highly pathogenic airborne and droplet viruses (e.g. from COVID-19, Filovirus disease [Ebola and Marburg], MERS-CoV, Avian influenza A (H5N1) in humans and SARS) is anticipated [14,15].

Careful removal of PPE is also very important and HCWs must receive training and supervision on how to put on and safely remove PPE. (Follow the steps shown in Figure 4.3 and 4.4).

Additional specialised training should be obtained prior to working with these and other highly pathogenic organisms.

Where to wear PPE

PPE should be worn in a protected environment (e.g. isolation room, operating room, etc.) and should not be worn outside that area. PPE must be removed before leaving the protected area.

4.4.1 Gloves

Gloves can protect staff and patients from infectious agents such as MROs and are an essential component of standard and contact precautions. Gloves are used to protect HCWs' hands against contamination and should be worn by all HCWs when touching blood, body substances secretions, excretions and contaminated equipment or surfaces. Hand hygiene should be performed before and after removal of gloves.

Gloves should be changed:

- between care/treatment of patients (to prevent cross transmission of infection);
- when performing separate procedures on the same patient;
- as soon as they are torn or punctured; and
- before touching non-contaminated items and environmental surfaces.

Table 4.1. Types and indications of use for gloves [17]

Glove Type	Indication	Examples
Non-sterile examination gloves	<ul style="list-style-type: none"> • Risk of exposure to blood, body substances, secretions, excretions • Contact with contaminated equipment or surfaces • Contact with the mucous membranes and non-intact skin • Risk of transmission of infectious agents to the patient. • If the integrity of the skin of the HCW's hands is compromised. 	<ul style="list-style-type: none"> • Venepuncture • Vaginal examination • Nasogastric tube insertion • Rectal examination • Emptying urine bags • Minor dressings (cuts) • Saliva in dental procedures
Sterile gloves	<ul style="list-style-type: none"> • Any invasive procedures where aseptic conditions must be maintained 	<ul style="list-style-type: none"> • Vaginal delivery • Insertion of central line, etc. • Insertion of urinary catheter • Preparation of chemotherapy drugs and total parental nutrition • Radiological procedures etc. • Lumbar puncture

Glove Type	Indication	Examples
Nitrile gloves (resistant to chemicals and disinfectants such as chlorine and glutaraldehyde)	<ul style="list-style-type: none"> • Preferable for clinical procedures requiring more patient contact • Alternative for latex sensitivity or allergy. 	<ul style="list-style-type: none"> • Recommended for clinical care with Filovirus because it is resistant to chemicals and disinfectants such as chlorine and glutaraldehyde
Reusable utility/household gloves	Used in non-clinical activities	<ul style="list-style-type: none"> • Cleaning reprocessing equipment in the central sterile department • Contaminated equipment • Cleaning contaminated surfaces, etc.

4.4.2 Masks, eye protection (face shields/eye goggles)

Masks, eye protection and face shields are worn to protect the mucous membranes of the eyes, nose and mouth which are portals of entry for infectious agents during procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions or excretions.

Face and eye protection are essential components of airborne and droplet precautions.

Table 4.2. Types of mask and indications

Medical/Surgical mask indications	N95 or P2 particulate respirator mask indications
<ul style="list-style-type: none"> • Procedures that generate large droplets of secretions and excretions • Procedures that require aseptic techniques to protect the patient from infectious agents • Droplet infections, e.g. influenza virus 	<ul style="list-style-type: none"> • Airborne precautions e.g. TB • Procedures that generate aerosols of particles of known or suspected infectious agents. <p>Note: Not all N95 particulate respirator masks are fluid resistant. Only N95 respirators labelled surgical respirators are tested for fluid resistance.</p>

Note: Medical/Surgical masks should be provided to patients who are coughing to prevent transmission of infectious agents.

When a mask is worn ensure that:

- it is changed when it becomes wet (it is no longer effective when wet);
- it is not reused once it is removed;
- it is not allowed to hang round the neck;
- it is not touched while in use; and
- the wearer performs hand hygiene after removal of a used mask.

Note: The front of the mask is considered contaminated.

How to perform a user seal check when wearing a respirator mask (N95 or P2) [18]

A user seal check should be performed by the wearer each time the respirator mask is put on. It determines if the respirator mask is properly worn or needs to be adjusted. The user seal check can either be a positive pressure or negative pressure check. Before checking, cover the front of the respirator mask with both hands, being careful not to disturb the position of the respirator.

- Positive seal check
 - Exhale sharply. A positive pressure inside the respirator means there is no leakage. If there is leakage, adjust the position and/or tension straps.
- Negative seal check
 - Inhale deeply. If no leakage, negative pressure will make respirator cling to your face.
 - Leakage will result in loss of negative pressure in the respirator due to air entering through gaps in the seal.

Considerations for eye protection

- According to WHO, face shields and goggles are considered to be equally effective, so either device can be selected on personal preference.
- Fogging can affect eye shields and goggles but is less with eye shields. In hot and humid climates fogging can affect visibility and the ability of the HCW to provide patient care. Therefore, it is advisable to use goggles with some form of ventilation.
- Face shields provide a wider range of view of the patient and enhances more patient interaction.
- Reusable eye shields and goggles should be cleaned with detergent and water or disinfected using the manufacturer's instructions.
- The front of the eye shield/goggle is considered contaminated.

4.4.3 Fluid resistant gowns, coveralls and aprons

- Fluid resistant gowns/coveralls and aprons prevent contamination of infectious agents on clothing and skin during procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions or excretions.
- A clean, non-sterile gown is adequate to protect clothing for procedures that are likely to generate splashes or sprays of blood, body substances.
- A fluid resistant long-sleeved gown and apron or coverall is strongly recommended to mitigate against the risk of infectious blood and body substances, secretions or excretions that could penetrate the underlying clothes or skin with potential to subsequently, unknowingly transmit the infectious agent via the hands to the mucous membranes of the eyes, nose or mouth.
- Aprons are usually worn over a gown or coverall to protect against splashing of blood, body substances excretions or secretions.
- Disposable plastic aprons can be worn for contact precautions to protect against transmission of MROs or other contact infectious agents.
- Removal of gowns/aprons should be done before leaving the patient area to prevent contamination of the environment.

Head cover

A head cover is worn to protect the head, neck and hair from contamination of infectious agents and the possibility of unknowingly transmitting the infectious agent via the hands to the mucous membranes of the eyes, nose or mouth. (A head cover is not normally used for transmission-based precautions.)

Shoe cover and boots are highly recommended when caring for patients with a confirmed or unknown infectious agent that has rapid fatality with a high mortality rate, such as the Ebola



virus. In this situation, boots are preferred because they are easier to clean and disinfect.

Shoe covers are worn over closed shoes to facilitate against decontamination.

Table 4.3. PPE selection based on blood and body fluid exposure

Scenario	Gloves	Gown	Eyewear	Mask
If direct contact with blood and body fluids, secretions, excretions, mucous membranes, non-intact skin	✓			
If there is a risk of splashes to the HCW's body	✓	✓	✓	
If there is a risk of splashes to the HCW's body and face	✓	✓	✓	✓

4.4.4 Sequence for putting on and removal of PPE for highly infectious diseases [19]

Before putting on PPE

Ensure the following measures are taken before putting on PPE. (See Annex 1. Personal protective equipment (PPE) competency checklist – putting on and removing PPE)

- HCWs must be trained and competent in PPE donning and doffing (putting on and taking off) procedures before attending to patients in isolation.
- It is essential to have a trained observer or 'buddy' to supervise the donning and doffing procedure, to ensure that the correct steps are followed during the process.
- Before donning PPE, all jewellery, watch, pen and mobile phone should be removed from the pocket.
- Protocols for donning and doffing PPE should be available in the donning and doffing area and should be strictly followed to prevent missing a step.
- There should be appropriate separate places designated for donning and doffing PPE.
- Ensure that there is a mirror available. This is helpful in adjusting the PPE to check that it is placed and removed correctly.

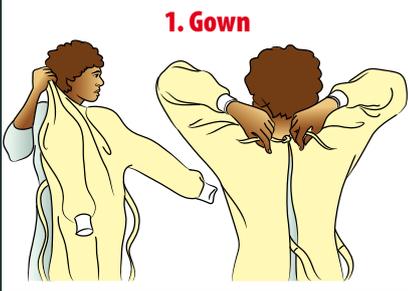
Putting on PPE (donning)

- PPE must be put on using the correct order according to the donning procedure (protocol posted in donning area). (See Figure 4.3.)
- Once the HCW enters the patient zone, the PPE cannot be adjusted.
- The observer or buddy should check the integrity of the PPE to ensure a correct fit.

Sequence for putting on personal protective equipment (PPE)

Gather all PPE supplies, check correct size for fit,
Remove all personal items (jewellery, watches, wedding ring, cell/mobile phone)
Ensure you have a Supervisor/buddy or mirror
Perform hand hygiene using soap and water (40-60 seconds) or alcohol based hand rub (20-30 seconds)

1. Gown



- Long sleeves down to wrist
- Length of gown to knees
- Ties at back of neck and waist

2. Mask or Respirator



2. Mask

a. If wearing a medical mask

- i. Place mask over nose and mouth and below chin

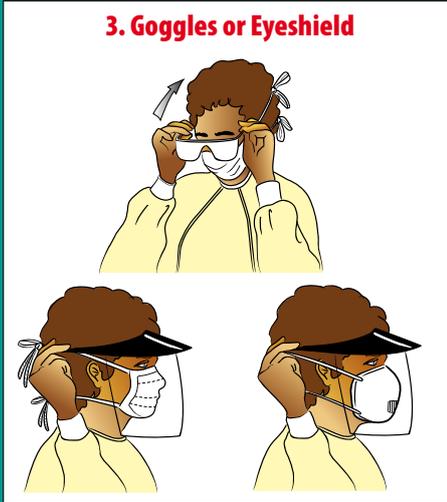


or Respirator

b. If wearing a respirator mask for aerosol generating procedure

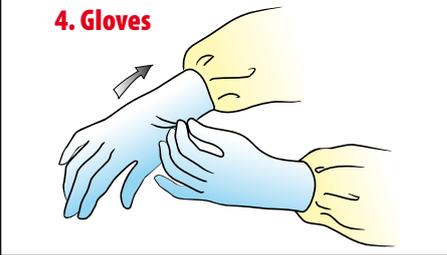
- i. Place mask over nose and mouth
- ii. Pull elastic bands over head – upper band above ear line, lower band below ear line
- iii. Fit check by moulding nose strip over bridge of nose with finger tips of both hands to get a snug fit

3. Goggles or Eshield



- Put on goggles or eyeshield

4. Gloves



- Put gloves on
- Pull over wrist of isolation gown

Safety precautions

- PPE needs to be the appropriate size for the person
- Avoid adjusting PPE once you enter isolation area
- Avoid touching your face
- Minimise contact with environmental surfaces



Developed based upon infection control guidance from the World Health Organization.

Figure 4.3. Sequence for putting on PPE



When wearing PPE during patient care

- Do not touch the eye protection (face shield/goggle) or mask.
- Keep your hands away from your face.
- Limit touching surfaces, no sitting, running or leaning against the wall.
- PPE cannot be adjusted during this time.
- If there is a partial or total breach, e.g. gloves torn, or insect entered the goggles, leave the patient environment immediately and go to the doffing area and remove PPE under the supervision of the trained observer or buddy.

Sequence for removing Personal Protective Equipment (PPE)

IMPORTANT
Remove PPE at doorway or in anteroom
Remove mask after leaving isolation room and closing door



Remove glove



Perform hand hygiene
Alcohol based handrub
Rub hands for 20–30 seconds
or water and soap
Wash hands for 40–60 seconds

If wearing apron

Remove apron:

a. If disposable, lean forward and tear off apron from the neck and roll it forward without touching the front area of the apron

b. If reusable, untie from the waist and lift off apron from the neck away from the body





Perform hand hygiene
Alcohol based handrub
Rub hands for 20–30 seconds
or water and soap
Wash hands for 40–60 seconds



Remove gown



Perform hand hygiene
Alcohol based handrub
Rub hands for 20–30 seconds
or water and soap
Wash hands for 40–60 seconds



Remove eye shields or eye goggles

Remove reusable eye protection from behind the head and place in a container for cleaning before reuse, dispose single use face shield in a bin



Remove surgical or respirator mask

Remove mask from behind and lift away from face
Discard in waste bin
Do not touch the front of mask



Remove surgical or respirator mask

Grasp the top tape and then bottom tape from behind with your hands
Lift carefully over head and remove
Do not touch the front of mask



Perform hand hygiene
Alcohol based handrub
Rub hands for 20–30 seconds
or water and soap
Wash hands for 40–60 seconds

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Developed based upon infection control guidance from the World Health Organization.

Figure 4.4. Sequence for removing PPE (doffing) [19]



Removing PPE (doffing)

- Removing used PPE is a high-risk activity that requires a structured procedure.
- A trained buddy or assistant is vital for removal to ensure protection.
- PPE must be removed slowly and deliberately in the correct sequence to reduce the possibility of self-contamination or other exposure to an infectious agent.
- This must be done in the designated doffing area under the supervision of the observer/buddy.
- Discard PPE in the appropriate designated container.
- Access to hand hygiene must be available.

4.5 Safe handling and disposal of sharps

The most common way in which HCWs are at risk of occupational exposure to HIV, hepatitis C and hepatitis B viruses is through accidental injury with sharp objects. The potential for transmission of bloodborne diseases is greatest when needles and other sharp instruments or devices are used. Special care should be taken to prevent injuries when cleaning reusable sharp instruments and disposal of sharps.

4.5.1 Responsibility for sharps

All HCWs who use sharps are responsible for their safe disposal into “sharps containers”.

Safe practices when handling sharps include the following:

- Sharps should not be passed by hand between a health care worker and any other person; a puncture resistant tray or kidney dish must be used to transfer sharps.
- Needles should never be recapped.
- Do not bend needles, lancets or other sharps after use.
- Sharps should never be forced into a sharps container.

Cleaning staff should not clean up loose sharps. Loose sharps should be notified to the on-duty medical supervisor so that HCWs can dispose of them properly. This will also serve to encourage proper disposal of sharps in the first place.

In situations where sharps are on the ground or floor, use tongs or a similar implement to pick them up. If no implement is available, put on gloves and pick them up carefully.

4.5.2 Sharps containers

Standard sharps containers should be ordered well in advance of their anticipated need in order to prevent shortages. If absolutely necessary, a puncture-proof container can be made from thick plastic or cardboard. Use locally available items such as a heavy plastic bottle or an empty milk tin if there are no special sharps containers available.

- Dispose of all sharp objects in puncture-proof containers.
- Sharps containers must be puncture-resistant and must be labelled SHARPS.
- The container should have an opening that is wide enough to allow the sharps to be dropped into it.
- The container should never be overfilled and should be replaced when it is three-quarters full. When it is three-quarters full, close the lid or cover with tape.



- Sharps containers should be placed as close as practical to the point of use. For example, containers should be placed on the medicine trolley, and in the treatment or immunisation room.
- Sharps containers should not be placed where they are easily accessible to children.
- Sharps containers should be incinerated and then buried. They should not be disposed of in a regular municipal waste facility.

4.6 Environmental cleaning

Infectious agents present in the healthcare environment can be transmitted to patients via the hands of staff when they have contact through contaminated equipment or the environment. Frequent environmental cleaning reduces the number of infectious agents and is a vital component of standard precautions

Cleaning refers to the use of mechanical action, water and detergent, followed by rinsing and drying with the aim of removing organic matter and dirt from the environmental surface.

Routine environmental cleaning prevents infectious agents from multiplying on clean dry surfaces and also enhances the well-being of patients and staff. Housekeeping staff and HCWs have the responsibility to ensure that the environment is clean and safe, not just for patients but for their colleagues and visitors as well; housekeeping staff are an integral part of the healthcare system.

The level of cleaning required in certain areas of a healthcare facility depends on the risk of contamination with infectious agents. For example, the general areas of the hospital will require regular cleaning, while the isolation units and the intensive care units, where there is a risk of AMR transmission, require additional levels of cleaning. Cleaning with neutral detergent, followed by a chemical disinfectant can effectively inactivate most infectious agents [20,21].

4.6.1 Cleaning chemicals

There are two main groups of cleaning chemicals for use in the healthcare facility:

- **Detergents:** A detergent is a surfactant that facilitates the removal of dirt and organic matter. Most hard surfaces can be adequately cleaned with warm water and a neutral detergent as per the manufacturer's instructions. Allowing the cleaned surfaces to dry is an important aspect of cleaning.
- **Disinfectants:** A disinfectant is a chemical agent that rapidly kills or inactivates most infectious agents. Disinfectants are not to be used as routine cleaning agents, unless combined with a detergent as a combination cleaning agent (detergent-disinfectant).

Disinfectants that are used for cleaning purposes in a healthcare setting must be either an approved hospital-grade disinfectant, preferably with label claims against specific organisms, OR a chlorine-based product, such as sodium hypochlorite (at the correct concentration and freshly made) [20,21].

4.6.2 Cleaning schedules (refer to Annex 10 for recommended cleaning schedule) [20]

In healthcare, the recommended cleaning schedules are determined by the risk of transmission of infection in the environment. The recommended schedules for cleaning include frequency and methods and are divided into two main groups.

- Minimal hand contact areas, e.g. floors, walls, ceilings and non-patient areas.
 - These areas require routine cleaning with detergent solution.
 - Damp mopping is recommended over dry mopping.
- Frequent hand contact areas or high-risk surface areas are in-patient areas, e.g. doorknobs, bedrails, bedside tables, wall areas around the toilet and bathroom, etc.
 - These areas require cleaning with detergent solution more frequently than minimal hand contact areas.
 - When MROs are suspected or known to be present or during outbreak situations; these areas are cleaned twice, with the second cleaning to include a disinfectant recommended by the healthcare facility, e.g. sodium hypochlorite.
 - Shared clinical equipment, such as trolleys, knobs of certain machines, etc. in these areas should be frequently cleaned with detergent.

All healthcare facilities should have a cleaning schedule with clear lines of responsibilities for housekeeping staff and HCWs. The schedule should include:

- a roster;
- frequencies of cleaning required and methods of cleaning for all areas;
- the products used to clean specific areas with standard operating procedures for mixing solutions; and
- clear standard operating procedures on cleaning mops, buckets and other items.

4.6.3 Cleaning equipment

- All cleaning equipment used in healthcare facilities should be cleaned and stored dry between use.
- The equipment should be well maintained and used appropriately.
- Cleaning equipment, including mop heads, should be laundered using hot water and completely dried before re-use.
- Cleaning equipment, such as buckets, should be emptied and cleaned with a new batch of sodium hypochlorite solution and allowed to dry completely before re-use.
- Dust control equipment which generates and disperses dust, such as feather dusters and brooms, should not be used in the healthcare facility.
- The use of spray bottles or equipment that might generate aerosols during usage should be avoided. Chemicals in aerosols may cause irritation to eyes and mucous membranes. Containers that dispense liquid such as 'squeeze bottles' can be used to apply detergent/disinfectants directly to surfaces or to cleaning cloths with minimal aerosol generation.
- Cleaning cloths should be laundered and dried between use. In outbreak situations, it is recommended that disposable cloths are used.

4.6.4 Cleaning techniques

Incorrect or inappropriate cleaning techniques may spread micro-organisms rather than removing them from the surface. The following points should form the basis of all standard operating procedures regarding cleaning in healthcare facilities.

- The flow of cleaning should be from areas that are considered relatively clean to areas that are dirty. This means that areas/elements that are low touch or lightly soiled should be cleaned before areas/elements that are considered high touch or heavily soiled. For example, when cleaning a bathroom, the toilet should be cleaned last as it is likely to be the most contaminated element in that area.
- The flow of cleaning should generally be from high to low reach surfaces. For example, when dusting horizontal surfaces in a patient room, high areas such as those above shoulder



height should be done first, followed by all other surfaces. Dusting techniques should not disperse the dust, so damp cloths should be used.

- When using cloths and bucket/solution system to clean:
 - avoid ‘double-dipping’ used cloths into the bucket containing clean, unused cloths, as this can contaminate the remaining clean cloths in the solution and result in spreading microorganisms to surfaces that are wiped thereafter;
 - maximise the use of cleaning cloths by folding and rotating each cloth so that all surface areas of the cloth, including the front and back, are used progressively as surfaces are cleaned; and
 - if necessary, use more cloths to clean high-touch surfaces than are needed for the same surface area of low-touch surfaces.

Floors

- Instead of sweeping, begin with a damp mop to clean floors. Avoid using brooms as this will disperse dust into the air. Mop from cleaner to dirtier areas. Work in a systematic manner, proceeding from the area farthest from the exit and working towards the exit.
- Change/wash mop heads/floor cloths and buckets of cleaning and disinfectant solutions as often as needed (e.g. when visibly soiled, after every isolation room, every 1–2 hours) and at the end of each cleaning session.
- Use a two-bucket system for routine cleaning and a three-bucket system for floors of isolation units.
 - First bucket with detergent and water
 - Second bucket with disinfectant
 - Third bucket for clean water for rinsing mops

Mopping steps

1. Insert the clean mop into the first bucket, wring it out and mop a portion of the floor using overlapping strokes, turning the mop head regularly (e.g. every 5–6 strokes).
2. After cleaning a small area (e.g. 3 m x 3 m), immerse the mop or floor cloth in the third bucket for rinsing and wring out. Repeat the process from step 1 until you are finished mopping.
3. If cleaning an isolation unit, once the floor is dry, mop with disinfectant from the second bucket.

4.6.5 Use of disinfectants during outbreak of infectious agents

When there is a presence of infectious agents, e.g. COVID-19, *Clostridium difficile* or MRO patient requiring transmission-based precautions, the cleaning schedule and frequency should be intensified to include a two-step clean, which involves a physical clean using detergent solution followed by use of a chemical disinfectant (e.g. sodium hypochlorite). The cleaning schedule and frequency should be intensified to include the following

- First, thoroughly clean with a solution of water and neutral detergent all hard surfaces and all frequently-touched surfaces (e.g. door handles, furniture, light switches). Follow facility procedures on cleaning.
- Second, clean again all hard surfaces and all frequently touched surfaces (e.g. door handles, bedside rails, etc.) with household bleach and water [21].

Physical (manual) cleaning with detergent solution is the most important step in the cleaning process. Sole reliance on using disinfection solution without manual cleaning is not recommended.

Sodium hypochlorite (household bleach) solution for disinfectant. (Refer to Annex 7: How to make chlorine solutions for environmental disinfection.)

Household bleach or sodium hypochlorite is readily available throughout the Pacific and is the disinfectant of choice, as it covers a broad spectrum of microbial activity.

- The minimum concentration of bleach is 1000–5000 ppm or 0.1%–0.5%. Liaise with your pharmacy department for mixing dilution or follow the instructions in Annex 6.
- Sodium hypochlorite solutions should be made fresh daily and left-over solution discarded after 24 hours.
- Gloves must be worn when handling and preparing solutions. Protective eyewear must be worn in case of splashing.
- Never mix sodium hypochlorite solution with ammonia or any other cleanser.
- Follow manufacturer’s instructions for application and proper ventilation.

4.6.6 Colour coding cleaning equipment

A standard for colour coding cleaning equipment is the most effective method of restricting equipment to individual areas of health facilities. Equipment may include dry mops, wet mops, mop handles, buckets, wringer buckets, gloves. All other equipment that would assist in the control of infection should also be colour coded.

Typical colour-coding for equipment

Infectious/isolation areas	yellow
Toilets/bathrooms/dirty utility rooms/slucice	red
Food service/preparation areas	green
General cleaning	blue
Operating theatres	white

4.6.7 Housekeeping audits and checks

It is recommended that healthcare facilities have a system to include colour coding, checklists and cleaning manuals to ensure that cleaning standards are met, regardless of whether cleaning services are outsourced.

Auditing of cleaning should be carried out on a regular basis and is normally done via visual inspection. The feedback, including recommendations regarding adherence to cleaning and disinfection procedures, should be reported to management and to the IPC Committee and provided to staff.

4.6.8 Cleaning spills of blood and other body fluids

The purpose of cleaning up spills of blood and other body fluids is to destroy harmful micro-organisms such as HIV, HCV and HBV.



The items needed for cleaning spills include:

- neutral detergent
- cloth or old pieces of linen, paper towel; and
- a mop.

The procedure for cleaning spills

1. Put gloves on.
2. Wipe up spills with a cloth or paper towel and discard in waste bin.
3. Mop up remainder of the spill using neutral detergent.
4. Follow the two-step clean if an infectious agent is a concern.

4.7 Safe handling of linen

The objective of the laundry system is to provide a properly designed laundering programme in a safe and sanitary environment and ensuring the supply of clean and hygienic laundry. Health service managers and staff share the responsibility for achieving this objective.

Health service managers are responsible for providing:

- an appropriate and safe laundry facility; healthcare linen must not be washed in domestic washing machines;
- standard procedures and guidelines for handling, using and laundering clean and contaminated linen; and
- training, educating and instructing staff about potential infectious hazards and techniques to prevent the spread of infection.

Used linen that is soiled with blood, urine, faeces or other body substances is particularly infectious. Processing soiled linen consists of collecting, transporting and sorting the linen before it is washed, followed by storing and distribution.

HCWs are responsible for ensuring that:

- standard precautions apply when handling clean and contaminated linen;
- linen is free of foreign matter such as sharps and instruments before it is sent for laundering;
- soiled and infectious linen is appropriately treated and handled in accordance with the facility's policies and procedures; and
- used linen is placed in leak-proof bags and bagged at the bedside and not sorted in patient care areas.

4.7.1 Using personal protective equipment

When collecting, handling, transporting, sorting or washing soiled linen, housekeeping and laundry staff should wear:

- household utility gloves;
- closed shoes that protect the feet from sharp items and from blood and body fluid spillages;
- protective eyewear; and
- a plastic or rubber apron.

4.7.2 Collecting and transporting soiled linen

The following steps should be taken when collecting and transporting soiled linen.

1. Place used linen in bags or in linen trolleys with lids. If linen is heavily soiled with blood and/or body fluids, it should be placed in a leak-proof bag or a container with a lid.
2. Handle soiled linen as little as possible and avoid shaking linen to prevent the spread of micro-organisms into the environment and to people.
3. Linen should not be sorted or washed in patient care areas.
4. Transport collected soiled linen in trolley carts with lids or covered carts to the laundry processing area once or twice daily.
5. Transport soiled linen and clean linen separately, using separate trolleys labelled accordingly.

4.7.3 Sorting soiled linen

Sorting soiled linen is important because, in addition to linen soiled with blood and body fluids, linen from places such as operating theatres, labour wards and other procedural areas sometimes contain sharp instruments and soiled dressings soaked with blood and body fluids. When sorting linen, heavy utility gloves, protective eyewear and plastic aprons should be worn. Any items found during sorting should be disposed of properly.

4.7.4 Laundering linen

The following steps should be taken when laundering soiled linen

1. Wash heavily soiled linen separately from non-soiled linen.
2. Use the washing machine's time cycle according to the manufacturer's instructions.
3. Water temperatures should be above 71°C (160°F).
4. When the wash cycle is completed, linen should be checked for cleanliness and rewashed if still stained or dirty.

4.7.5 Storing, transporting and distributing clean linen

The following measures should be taken when storing, transporting and distributing clean linen.

- Store clean linen in clean, dry, closed storage cupboards.
- Use physical barriers to separate folding and storage room from soiled areas.
- Clean and soiled linen should be transported separately in separate trolleys.
- Clean linen should be covered during transport to avoid contamination.

4.7.6 Laundry staff

Good staff practices help reduce the risk of cross-contamination and prevent injury. Therefore, staff should:

- be adequately trained in standard precautions, including hand hygiene and the risks involved if undertaking other tasks in the facility, such as food preparation or patient care which should never be done in laundry areas;
- be educated and trained (and supervised, if appropriate) in the safe use of equipment and machinery, and in safe work practices, including safe manual handling techniques;
- wear appropriate protective clothing and wear appropriate gloves when sorting laundry;
- not eat or smoke in the laundry area; and
- not handle linen if they have exfoliative skin conditions (e.g. conditions where skin flakes off) or unhealed wounds or rashes, unless appropriate protective measures are adopted (such as covering wounds with bandages).



4.7.7 Handling of linen when there is an outbreak of an infectious agent

The following measures should be undertaken when there is an outbreak of an infectious agent such as COVID-19 or the presence of multi-resistant organisms.

- All individuals dealing with soiled bedding, towels and clothes from patients should wear appropriate PPE, including heavy-duty gloves, a mask, eye protection (goggles or a face shield), a long-sleeved gown, and boots or closed shoes.
- Laundry staff must be trained in putting on and removing PPE appropriately.
- Staff should perform hand hygiene after exposure to blood or body fluids and after removing PPE.
- Soiled linen should be placed in clearly labelled, leak-proof bags or containers for collection by laundry staff, after carefully removing any solid excrement.
- The laundry area must be cleaned using a two-step clean, which involves a physical clean using detergent solution, followed by use of a chemical disinfectant (e.g. sodium hypochlorite). The cleaning schedule and frequency should be intensified to include:
 - first, a thorough wash with a solution of water and normal neutral detergent of all hard surfaces and all frequently-touched surfaces (e.g. door handles, furniture, light switches); and
 - a second wash with household bleach and water of all hard surfaces and all frequently-touched surfaces (e.g. door handles, bedside rails, etc.) [14,22].

4.8 Healthcare waste management

Health care waste is all waste generated from all health care facilities, including hospitals, health centres, clinics and nursing station, medical research centres, medical laboratories, blood banks and other institutions that provide isolated or minor health services, such as home dialysis and recuperative care and nursing homes for the elderly.

Safe waste disposal helps:

- to prevent the transmission of infection from healthcare workers who handle the waste to the local community;
- to protect those who handle waste from accidental injury;
- to prevent open piles of waste that can become breeding ground for flies, other insects and rats, which carry diseases;
- to prevent build-up of waste, which may pose fire hazards; and
- to provide a pleasant atmosphere (uncollected waste causes foul smells and is unsightly).

The key to effectively managing healthcare waste is segregation (separation) and identification. Segregation is the responsibility of the waste producer and should take place as close as possible to where the waste is being generated. Healthcare waste should be categorised and placed into colour-coded bags or bins.

4.8.1 Categories of healthcare waste [23]

General waste

General waste includes waste that does not carry harmful micro-organisms. Examples of general waste include kitchen refuse, paper waste, boxes, bottles and plastic containers that store products used by the hospital or clinic.

Infectious and/or clinical waste

Infectious waste is solid and/or liquid waste, potentially carrying harmful micro-organisms likely to cause infection among patients, HCWs or people in the community. Infectious waste may be solid, liquid or laboratory waste. Examples include used dressings, gauze or other items contaminated with blood, pus, faeces, urine, blood or other body fluids; human tissue; body parts; paper specimen collection cups; pathology samples.

Pathological waste

Pathological waste refers to human materials removed during: surgery, labour or delivery; autopsy; embalming; biopsy, including body parts, tissues and foetuses; products of spontaneous or induced human abortions, regardless of the period of gestation; organs and bulk blood and body fluids. Pathological waste also includes laboratory specimens of blood and tissue after completion of laboratory examination.

Sharps

Sharps include needles, lancets, hypodermic syringes with attached needles, scalpel blades, razor blades, glass pipettes, broken glassware, intravenous spikes, and any other sharp object with the potential to penetrate intact skin.

Pharmaceutical and cytotoxic wastes

Pharmaceutical and cytotoxic wastes include expired, unused, spilt and contaminated pharmaceutical products, drugs and vaccines that are no longer required and need to be disposed of appropriately. This category of waste also includes discarded items used in the handling of pharmaceutical supplies, such as bottles and boxes with residues, gloves and masks, connecting tubing and drug vials.

Cytotoxic drugs are also known as anti-neoplastic drugs or cancer chemotherapy drugs. These are highly hazardous wastes that have mutagenic, estrogenic or carcinogenic properties.

Cytotoxic wastes include:

- cytotoxic drugs (e.g. azathioprine, chlorambucil, cisplatin, 5-Fluouracil, cyclophamide, melphalan and methotrexate);
- vomit, urine or faeces from patients treated with cytotoxic drugs; and
- contaminated materials from cytotoxic drug preparation and administration, such as syringes and needles, dressing packs and gauge vials.

4.8.2 Key technical steps for the management of health care waste

All medical waste produced from health care facilities should be: (i) segregated; (ii) stored; (iii) collected safely in designated containers and bags; and (iv) treated and finally disposed of through a safe waste-disposal system.

1. **Segregation:** Waste must be segregated at source between infectious/clinical waste and general waste. Infectious/clinical waste should be further segregated into at least the following: (i) infectious/clinical waste such as blood, body parts and body fluids; (ii) sharps and syringes; (iii) pharmaceutical waste, both liquid and solid, and expired or damaged drugs and medicine.



2. **Storage:** Once segregated, all health care waste should be temporarily stored or kept in proper colour coded storage bags, containers or boxes and labelled to avoid mixing the medical waste with the general waste. General waste that is mixed with medical waste shall be considered as medical waste and should follow the medical waste stream.
3. **Collection and transport:** Waste stored in bags and containers should be transported to a central area for temporary storage or to the disposal site within or outside the compound of the health care facility. Specific pre-treatment of the waste may be needed, especially if the waste is highly infectious.
4. **Final disposal:** This is the final journey of waste. Various systems and technologies are available, including thermal and non-thermal systems. The most common technology for thermal treatment is incineration and non-thermal technology includes microwave, autoclave or controlled or engineered landfill.

4.8.3 Minimum approach to segregation, storage and transport

The minimum standard to segregating health-care waste is the three-bin system, where separate containers are provided for infectious/clinical waste, used sharps, and general waste. The basic features of a minimal level of waste segregation and storage are given below.

- Waste is segregated at the place of production to reduce the health risk from the smaller, potentially infectious fractions (typically waste items contaminated with body fluids and used sharps).
- Infectious/clinical waste, general waste and used sharps waste are stored in separate colour-coded containers and locations within medical areas, and subsequently at a central storage site at the health-care facility.
- Central storage area(s) are fenced, lockable and isolated from patients and the public.
- Maximum storage times before treatment or disposal of infectious waste are not longer than 72 hours in winter and 48 hours in summer in a temperate climate.
- In a warm climate the storage times are 48 hours during the cooler season and 24 hours during the hot season.
 - Staff should receive instruction on three-bin waste segregation and safe handling and storage of health-care waste.
 - Staff should be aware of how to protect themselves from injuries and infection from waste.
 - Waste containers and storage areas should be cleaned regularly.

The minimum measures for transporting health-care waste are listed below.

- General waste and infectious health-care waste are collected separately and at least once a day.
- Collection is at regular times and is reliable.
- Waste containers and onsite transport trolleys are closed with lids to isolate wastes from patients and the public.
- Where waste is transported offsite for disposal, the vehicle must be able to carry the waste in a closed or covered container, and the driver must know what to do if there is an accident or incident during transportation on a public road.
- Transport staff are vaccinated at least against hepatitis A and B, polio and tetanus.
- Waste containers, trolleys and vehicles are maintained and cleaned regularly.

In emergency situations, all waste from patients arriving at a health-care facility could be classified as potentially infectious to minimise the transmission of secondary infection.

4.8.4 Waste segregation

The key to effectively managing healthcare waste is segregation (separation) and identification. Segregation is the responsibility of the waste producers and should take place as close as possible to where the waste is generated. Healthcare waste should be categorised and placed into colour-coded bags or bins; as listed below.

- **Sharps:** Dispose of in puncture-proof containers so they do not cause injury and infection. These items can potentially spread viruses such as HIV, HBV or COVID-19. Sharps containers should be colour-coded red or yellow or, at a minimum, have an infectious sharps sticker placed on the container.
- **Infectious/clinical/pathological:** Collect in separate containers such as heavy duty yellow or red plastic bags with an infectious logo on them.
- **Cytotoxic/pharmaceutical waste:** Collect in separate containers colour-coded purple.
- **General waste:** Collect in separate containers for collection by the municipal authority for disposal. General waste may be collected into black or clear coloured plastic bags.

4.8.5 Procedures for handling infectious/clinical waste bags

1. Check that waste storage bags and containers are effectively sealed. Bags should be picked up by the neck only. They should be placed down in such a way that they can again be picked up by the neck for further handling. Waste bags should be manually handled as little as possible.
2. Bags should not be held against the body nor should collection staff attempt to carry too many bags at a time.
3. Avoid letting the bag come into contact with the body when being carried. A needle stick is the most likely hazard to endanger the person collecting the waste bag. Hypodermic needles that are not properly segregated into correct sharps containers can cause this type of injury.
4. Sharps have been known to pierce the sides and bottom of polypropylene containers. These containers should be picked up and carried by the handle provided. The other hand should not be used to support the bottom of the container.
5. Avoid puncturing or damaging waste bags, and do not throw or drop them.
6. Ensure that infectious wastes are not mixed, and that bags are stored in designated storage areas.
7. Protective clothing should be worn during all waste-handling operations.
8. Transport all waste bags directly to the designated central storage for disposal.
9. Bags of hazardous medical waste and of general waste should not be mixed at any time but should be segregated throughout handling; hazardous waste should be placed only in specific storage areas.

Note: If infectious/clinical waste is accidentally placed in general waste, the entire quantity of waste must be treated as hazardous.

4.8.6 Procedures for handling of sharp waste

1. Wear thick work gloves when transporting sharps containers to the incinerator to prevent injury.
2. Ensure that the sharps container lid is closed or sealed with tape before transporting it to the incinerator site.
3. Collect containers daily, or more often if needed, and carry them to an incinerator for burning.
4. Wash hands after handling sharps containers.



4.8.7 Procedures for handling solid infectious waste

1. This waste should be put in separate clinical waste bins that have a lid and are lined with a plastic bag with no holes. Bins should be labelled **INFECTIOUS WASTE, NO SHARPS**.
2. Place the bins in places where they will be needed.
3. Wear thick gloves when handling and transporting waste.
4. Collect bins daily, or more often if needed, and transport to an incinerator for burning.
5. Clean up all spills immediately with a broom and shovel, and clean the area with a neutral detergent.
6. Each day, wash waste bins with soap and water.
7. Wash hands after handling waste bins.

4.8.8 Procedures for handling liquid infectious waste

Examples of liquid clinical waste include blood, urine, faeces, pus, sputum, spinal and peritoneal fluids, and pathology specimens. Proper disposal of liquid clinical waste helps to prevent the spread of micro-organisms from contaminated liquid waste to staff, patients and the community.

Procedures for the disposal of liquid clinical waste

1. Wear thick work gloves when handling and transporting liquid clinical waste.
2. Wear eye goggles to protect the eyes from splashing.
3. Carefully pour blood, urine or other body fluids directly into a toilet or utility sink drain.
Avoid splashing.
4. Rinse the sink or toilet carefully and thoroughly with water.
5. When stool or sputum is collected in paper specimen cups, treat as clinical solid waste.
6. Wash hands after handling liquid waste.

4.8.9 Procedures for handling laboratory waste

Examples of laboratory waste include used culture plates, specimen containers and specimens. The proper handling of laboratory waste helps to prevent the spread of micro-organisms from microbiology laboratory waste and other specimens to staff, patients and the community. These wastes should be stored in a separate plastic bin with a yellow or red plastic bin liner labelled (in black) **BIOHAZARD WASTE**.

Procedures for disposing of laboratory waste

1. Autoclave all petri dishes and test tubes that have been used to grow micro-organisms before incineration.
2. After sterilising, discard disposable petri dishes and test tubes into a bin marked **CLINICAL WASTE**.
3. After sterilising, remove the culture media from reusable petri dishes and test tubes and discard into a **CLINICAL WASTE** bin.
4. Wash and dry reusable petri dishes and test tubes.
5. Collect **CLINICAL WASTE** bins daily, or more often if needed.
6. Each day, wash bins with soap and water.
7. Wash hands after handling bins.

4.8.10 Procedures for handling of general waste and control of pests [14]

Garbage should be removed at least twice daily and no garbage should be left in kitchen areas overnight. Not only are many common pests capable of transmitting infection, but the sight of insects and pests in the hospital environment can be very disturbing to patients, staff and visitors alike. It is, therefore, a basic requirement of the hospital cleaning programme that

adequate attention be paid to preventive and protective measures designed to minimise this potential form of cross infection.

In general, the six elements that are essential in any effective programme for the control of pests in a hospital are:

- thorough, constant cleaning of all potential areas of infestation;
- regular, careful inspections for evidence of pests
- storage of waste and garbage in water-tight containers;
- thorough cleaning of all garbage containers after use;
- daily removal of all stray garbage not placed in correct receptacles; and
- proper storage of all goods and supplies likely to attract pests.

4.8.11 Collection of health care waste

To prevent open piles and scattering of rubbish, bins must be placed in places where they are easily accessible. Signs on general waste containers should read: **GENERAL WASTE – NO CONTAMINATED/INFECTIOUS WASTE, NO SHARPS.**

Procedures for disposing of general waste

1. Collect waste in leak-proof bins.
2. Place bins at convenient locations so that they will be used.
3. Encourage patients to use the bins.
4. Provide separate containers for non-burnable waste such as bottles and cans.
5. Wear thick work gloves when handling and transporting waste. This will help to prevent injury.
6. Collect bins daily or more often if needed and carry to waste area for incineration or for collection by municipal authorities. A trolley may be used to help transport waste from the hospital to the incinerator.
7. Clean up all spills immediately with a broom and shovel and wash the area with soap and water.
8. Wash all rubbish bins with soap and water daily.
9. Wash hands after handling rubbish bins.

4.8.12 Safe collection infectious waste in the health care facility

Collection times should be fixed and appropriate to the quantity of waste produced in each area of the health-care facility.

- Collection should be daily for most wastes.
 - An operating theatre generates a high proportion of potentially infectious waste and could have several collections during the day to fit in with the schedule of operations.
 - A child and maternal health clinic might generate primarily sharps waste from injections, which would be collected at the end of each working day.
- General waste should not be collected at the same time or in the same trolley as infectious or other hazardous wastes.

4.8.13 Offsite transport of waste

- Offsite transport is the carriage of health-care waste on the public streets away from a health-care facility.
- Offsite transporting hazardous health-care waste should comply with national regulations.



- Where there are no national regulations, responsible authorities may refer to recommendations on the transport of dangerous goods published by the United Nations.
- Any vehicle used to transport health-care waste should fulfil the following design criteria.
 - The body of the vehicle should be of a suitable size commensurate with the design of the vehicle.
 - There should be a bulkhead between the driver's cabin and the vehicle body, which is designed to retain the load if the vehicle is involved in a collision.
 - There should be a suitable system for securing the load during transport.
 - Empty plastic bags, suitable protective clothing, cleaning equipment, tools and disinfectant, together with special kits for dealing with liquid spills, should be carried in a separate compartment in the vehicle.
 - The internal finish of the vehicle should allow it to be steam-cleaned and internal angles should be rounded to eliminate sharp edges to permit more thorough cleaning and prevent damage to waste containers.
 - The vehicle should be marked with the name and address of the waste carrier.
 - An international hazard sign should be displayed on the vehicle and containers, as well as an emergency telephone number.
 - The driver should be provided with details of the waste being carried.

4.8.14 Disposal of health care waste

Open burning and open dumping are not options and must be avoided at all cost to: (i) prevent the spread of infection to healthcare workers who handle the waste and to the local community; and (ii) protect those who handle waste from accidental injury infection and to prevent pollution to the environment.

4.8.15 Minimum approach to treatment and disposal of health care waste

Hazardous health-care waste should be treated to reduce the potential for harm; hence, segregation of waste must be observed strictly.

In extreme circumstances **where no treatment is possible**, the options below may be implemented but should be considered as transitional, interim solutions.

- Small health-care facilities
 - Hazardous health-care waste can be buried within the premises of the facility where public access can be restricted.
- Larger health-care facilities
 - These should make arrangements with a local landfill to provide a special cell or pit, daily soil cover, and restricted access.
- Disinfection using a commonly available disinfectant such as sodium hypochlorite
 - Except for sharps waste, disinfected waste can be disposed of with regular municipal solid waste.
- Disposal of specific infectious/clinical waste
 - Sharp waste
 - A well-designed sharps pit is a minimum option.
 - Can also use encapsulation, inertisation and land disposal. Even after decontamination, sharp waste may still pose physical risks. There may also be risk of reuse. Decontaminated sharp waste can be disposed of in safe sharp pits on the health-care facility premises or encapsulated by mixing the waste with immobilising material like cement before disposal. These procedures are only recommended in cases where the waste is handled manually and the landfill for general waste is not secured.

- Pathological waste
 - Placenta pits can be effective but need to be located at specific sites to avoid contamination of groundwater, locked and fenced for security.
 - Can be buried in cemeteries or approved burial sites.
- Pharmaceutical waste
 - Encapsulation, inertisation and land disposal could be used for some pharmaceutical and chemical wastes.

4.8.16 Methods of health care waste disposal

Steps must be taken to ensure that **scavenging** does not take place at the hospital waste storage sites as this could be detrimental to health. The waste storage shed or area must be kept locked at all times when not attended, and care should be taken to ensure that only properly prepared and non-hazardous waste is disposed of through the municipal garbage disposal system.

4.8.17 Disposal of general non-hazardous waste

General non-hazardous waste should not be disposed on the premises of health-care facilities. Non-hazardous waste should be collected regularly by the municipality or transported by the facility to a known and safely managed public disposal site.

Hazardous medical waste disposal options [23]

- **Incineration:** If incineration is the preferred option, the burning temperature must be high (850°C to 1500°C) to avoid production of dioxins and furans. The best available technology should be used to achieve an emission of lower than 0.1 ng toxic equivalents (TEQ7)/m³ of dioxins and furans. This could be achieved by using dual chamber incineration (850°C/1100°C) with auxiliary burner, two seconds' residence time of air in the second chamber, sufficient oxygen content, and high turbulence of exhaust gases.
 - The hospital incinerator should be housed in a locked enclosure and used only by trained operators.
 - The incinerator must be operated in accordance with the manufacturer's instructions.
 - Incineration equipment must be kept in good working condition and be serviced on a regular basis in accordance with the manufacturer's instructions.
 - Procedures must be in place to manage incomplete incineration and disposal of waste.
- **Steam-based treatment technologies:** Steam-based treatment technologies are used to disinfect/sterilise infectious waste and sharp waste by subjecting it to moist heat and steam for a defined period of time, depending on the size of the load and the content. The combined action of saturated steam and heat kills microorganisms.
- **Autoclaving:** Autoclaving is the most common type of steam treatment and utilises saturated steam under pressure to decontaminate waste. Potential infected air evacuated from the autoclave is filtered effectively (e.g. through a high efficiency particulate air filter). Autoclaves operate at temperatures of 121°C to 134°C.
- **Microwave:** Microwaving technology heats the water contained in the waste by microwave energy. Some microwave-based devices include transformation systems like blending or shredding.
- **Frictional heat treatment:** This treatment is based on friction and grinding of the waste in a moist environment. The treatment process takes place inside a chamber by means of a high-speed rotor. The temperature rises to 150°C and is held for the time necessary to achieve sterilisation. When all the liquid contained in the waste has evaporated, it is brought to dry, superheated conditions. The residue is a dry and unrecognisable product with reduced volume.

- **Land disposal:** When wastes are buried, certain requirements must be met so that children, scavengers and animals cannot dig up the waste.

Note: Sharp objects may not be destroyed by burning and may later spread tetanus infection. Dispose of all sharp objects by putting them underground, even after burning.

Procedures for making and using an underground waste disposal site

1. Select a site that:
 - is at least 50 metres (150 feet) away from any water source, to prevent contamination of the water supply;
 - has proper drainage, is located downhill from any wells, and is free of standing water; and
 - is not in an area that floods.
2. Dig a pit one metre (three feet) wide and two metres (six feet) deep. The bottom of the pit should be two metres above the water table.
3. Fence in the site to keep animals, scavengers and children away.
4. Wear heavy gloves when handling waste buckets.
5. Empty buckets of non-burnable waste into the pit every day.
6. Cover the waste with a thin layer of earth each day. The final cover should be at least 10 centimetres deep.

Note: General waste is the only waste that can be disposed of in a municipal garbage facility (i.e. landfill). It is illegal and dangerous to dispose of other wastes with municipal garbage.

Disposal options in emergency situations

- In an emergency and **where no treatment is possible**, the safe burial of infectious and sharp waste on health-care facility premises or in a protected concrete pit may be the only viable option available. Open dumping of boxes/bagged waste should be avoided.
- Pharmaceutical waste and chemical waste should be stored until a safe disposal option has been identified.

4.8.18 Legal and institutional frameworks for the management of health care waste

All countries should have a national policy document as the basis for developing a national law on health-care waste management and the technical guidelines to implement the law. The national policy should take into account the resources and facilities available in the country and any cultural aspects of waste handling.

The legal health care waste management ‘package’ should specify regulations on the treatment of different waste categories; segregation, collection, storage, handling, disposal and transport of waste; and responsibilities and training requirements. A national law on health-care waste management may stand alone, or constitute part of more comprehensive legislation, such as:

- a law on managing all forms of hazardous wastes, where the application to health-care waste is explicitly stated; or
- a law on hospital hygiene and infection prevention and control, where a specific section should be devoted to health-care waste.

A national law should include the following elements:

- a clear definition of hazardous health-care waste and its various categories,
- a precise indication of the legal obligations of the health-care waste producer regarding safe handling and disposal,
- specifications for record keeping and reporting:
 - establishment of permit or licensing procedures for systems of treatment and waste handling,
 - specifications for an inspection system and regular audit procedures to ensure enforcement of the law and for penalties to be imposed for contravention,
 - designation of courts responsible for handling disputes arising from enforcement of, or non-compliance with, the law.

4.9 Safe reprocessing of reusable equipment and instruments

Used instruments and equipment can be a reservoir for infectious agents, and therefore transmit avoidable hospital acquired infections to patients. Sterilisation and decontamination procedures of medical instruments and devices play a crucial role in the prevention of hospital acquired infections.

Before disinfection and sterilisation can be achieved, all instruments must be cleaned with neutral detergent, rinsed and dried before disinfection or sterilisation [24].

Earl Spaulding [25] established the first criterion for disinfection as shown in Table 4.4.

Table 4.4. Instruments and equipment by application and sterilisation method

Category	Application	Type of processing	Example of items
Critical	Sterile tissues in the body	Sterilisation	Surgical instruments, diagnostic catheters, dental instruments, bronchoscopes, cystoscopes
Semi-critical	Non-sterile tissues in the body – mucous membrane of the respiratory, genital and urinary tracts and skin that is not intact	High level disinfection	Respiratory therapy equipment, dental impressions and other prosthetic appliances, gastroscopes, colonoscopes, endoscopes, ultrasound probes
Non-critical	Instruments that come in contact with intact skin	Adequate cleaning and drying are required, with the need for intermediate- or low-level disinfection on some occasions	Bedpans, ECG leads, thermometers, sphygmomanometers, stethoscopes, beds, bedside tables

After cleaning, all instruments and other items used to touch tissue beneath the skin (such as during surgery or giving an injection) or to touch mucous membranes (such as during vaginal examination) should be sterilised or undergo high-level disinfection (HLD).

Sterilisation is the safest and most effective method for the final processing of instruments. When sterilisation of equipment is not available or not suitable, HLD is the only acceptable alternative.



Definitions association with cleaning, disinfection and sterilisation

Cleaning: Physical removal of soil and micro-organisms from the skin and objects with soap and water.

Detergent: A cleaning agent available in two forms: liquid or powder.

Decontamination: Cleaning an object to reduce the number of micro-organisms on it by either chemical or physical means.

Disinfection: A process that kills or destroys most disease-producing organisms, but rarely kills spores. Disinfectants are used on inanimate objects as opposed to antiseptics, which are used on living tissue.

Sterilisation: A process that destroys all forms of microbial life, including bacteria, viruses, spores and fungi. This method is used for all items that contact normally sterile areas of the body.

Note: Keep used, dirty items separate from clean, sterile items to prevent cross contamination.

4.9.1 Cleaning

The cleaning process is very important because:

- cleaning with neutral detergent and water removes protein, blood and other body fluids, oils and grease;
- disinfection and sterilisation does not destroy micro-organisms trapped in small particles of blood or protein; thorough cleaning must be done to remove these particles; and
- when sterilisation facilities (steam heat or hot air oven) are not available, cleaning is the only way to protect patients from pathogenic spores.

Choosing a detergent for cleaning instruments and equipment

Using a hospital grade neutral detergent is important for effective cleaning because water alone will not remove protein, oils and grease. Bleach powder without a detergent should not be used. Hand soap should not be used because it is made from fat (lard) and will leave a film or scum on instruments. Micro-organisms can become trapped in the scum and will not be destroyed during sterilisation or disinfection.

The cleaning solution must be appropriate for the type of equipment or instrument. Enzymes, usually proteases, are added to solutions to neutralise the PH solutions to aid in removing organic material such as blood and pus.

Additionally, lipases (enzymes to act on breaking down fats) and amylases enzymes (to act on breaking down starch) are added to solutions.

Note: Enzymes are not disinfectants and should be rinsed off instruments.

Do not use abrasive cleaners because they can scratch instruments. Scratches are places where micro-organisms can become trapped, and scratches increase metal corrosion (rusting).

4.9.2 Equipment and procedures for cleaning environmental surfaces

Cleaning environmental surfaces helps destroy and remove soils and micro-organisms, making environmental surfaces such as operating tables or delivery tables safe to use for the next patient.

The items needed to properly clean environmental surfaces include:

- neutral detergent;
- clean water;
- bucket; and
- household gloves.

Procedure for cleaning environmental surfaces is as follows.

1. Put on gloves.
2. Using a cloth soaked in neutral detergent, wipe metal and plastic surfaces.
3. Allow surfaces to air-dry.

4.9.3 Routine cleaning of used instruments and equipment

Routine cleaning of instruments and equipment removes many micro-organisms. The items needed for the routine cleaning of instruments and equipment include:

- neutral detergent;
- clean water;
- brush; and
- gloves (utility gloves are best).

Procedure is as follows:

1. Put on gloves.
2. Completely disassemble all items.
3. Using detergent, water and brush, completely remove all blood, tissue and dirt. Carefully clean small spaces and teeth of clamps.
4. Thoroughly rinse with water, as detergent can interfere with the disinfection or sterilisation process.
5. Air-dry the equipment, as moisture can interfere with the sterilisation or disinfection process.
6. Instruments and equipment are now ready for sterilisation or disinfection.

Points to remember when cleaning instruments and equipment

- Thorough cleaning is the most important step when reprocessing instruments and equipment.
- Wear gloves while cleaning instruments and equipment. Thick household or utility gloves are best because they help to prevent injury from sharp objects.
- Completely disassemble any equipment that can be taken apart, before cleaning (e.g. clamps and scissors).
- Use a brush for cleaning. A small brush (e.g. toothbrush) can be used to carefully clean very small areas where micro-organisms may become trapped (e.g. teeth of clamps, screws and joints).



4.9.4 Disinfection

Disinfection is a process that inactivates vegetative microorganisms from inanimate objects without ensuring the elimination of bacterial spores.

High-level disinfection [25]

High-level disinfection (HLD) is required for items and equipment that touch the mucous membranes, e.g. laparoscopes, respiratory equipment. They cannot be autoclaved. High level disinfectants are liquid chemical agents that eliminate all microorganisms. Examples are glutaraldehyde, formaldehyde and hydrogen peroxide.

To make HLD effective:

- Follow instructions carefully.
- Make sure that the chemical disinfectant touches all surfaces of the item being processed.
- When using heat, make sure to use the correct temperature. For example, if boiling to achieve high level disinfection, instruments should be put in a container with a lid and covered by the water. Bring the water to the boil and boil the items for 20 minutes.
- Be sure all items are thoroughly cleaned and dried.

Note: Sterilisation and HLD do not destroy micro-organisms trapped in small particles or blood. Thorough cleaning must be done to remove these particles.

Intermediate level disinfection

Intermediate level disinfection is carried out using chemical agents (e.g. sodium hypochlorite) that eliminate vegetative bacteria and some bacterial spores.

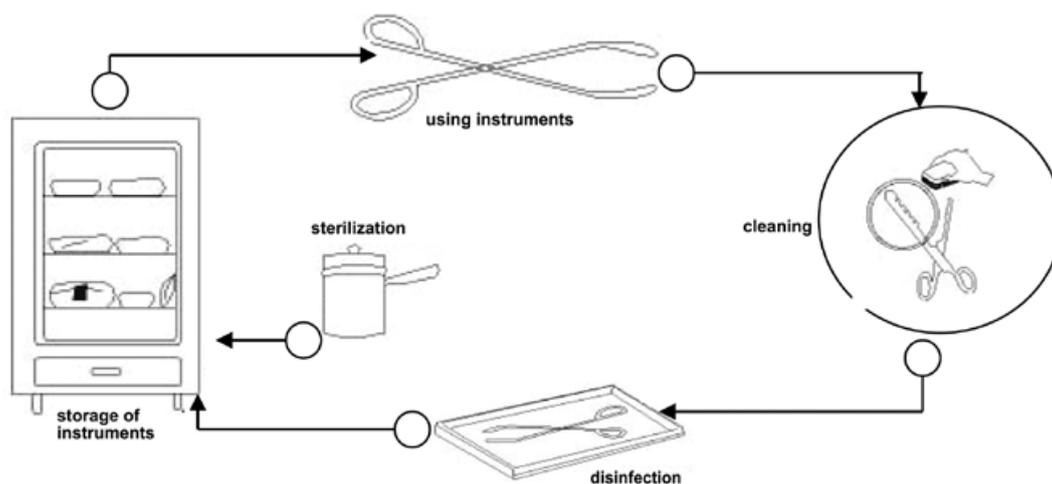


Figure 4.5. Processing instruments.

Source: Adapted from the Fiji Ministry of Health, Infection control manual for health facilities.

4.9.5 Sterilisation [24,25, 26]

Sterilise instruments and other items that come into contact with the bloodstream or tissue beneath the skin (surgical instruments, wound dressings). Sterilisation is the only process that destroys all forms of micro-organisms, including those that cause tetanus and gangrene. (These spore-forming micro-organisms are very hard to kill.)

Sterilisation methods

The most common sterilisation methods in hospitals and clinics are **steam sterilisation** (autoclave or pressure cooker), **dry heat** (hot air oven), and **gas** (ethylene oxide).

Steam sterilisation destroys all micro-organisms on objects that are used beneath the skin (e.g. surgical instruments, gloves, needles and syringes), or those that enter sterile areas of the body (e.g. urinary catheters).

The equipment needed to steam sterilise objects includes:

- wrapping material (e.g. cotton cloth, paper);
- metal instrument trays (with holes in the bottom);
- sterilisation indicator;
- autoclave or pressure cooker;
- heat source (electricity, stove for kerosene); and
- fuel (kerosene, wood).

Procedure for steam sterilisation

1. Clean and dry all items to be sterilised.
2. Open and separate all items before processing. For example, open all instruments (forceps, clamps), and wrap tubing around a towel or cloth and coil gently.
3. Wrap items with double thickness cotton cloth.
4. Insert proper sterilisation indicator (e.g. autoclave tape) to show that the article is sterile.
5. Load packs and items in steriliser so that steam can move around packs and penetrate all surfaces.
6. Sterilise items at the correct temperature and pressure and for the correct amount of time (see below). Begin timing after the desired pressure has been reached (on autoclave, check gauge; on pressure cooker, wait for pressure valve to jiggle).
7. Turn off heat source. Wait 30 minutes for steriliser to cool, then slightly open lid to let steam out.
8. Allow packs to dry before you remove them. This takes 20–30 minutes.
9. Remove items from steriliser.
10. Allow them to cool completely before storage or use immediately.
11. Label the container with the date. Reprocess after expiration.

Table 4.5. Steam sterilisation

Temperature	121° Centigrade (250° Fahrenheit)	
Pressure	106 kPa	
Time	Unwrapped items Wrapped items	20 minutes 30 minutes

Additional notes on steam sterilisation

- The cloth should be washed after each process and discarded in case of any holes.
- **Wrap packs loosely.** Tightly wrapped packs do not allow steam to touch all surfaces of items and equipment. Where steam does not touch, items will not be sterilised.
- Items that are not wrapped must be used immediately.
- Wait for packs to dry before removing them from the steriliser. Micro-organisms can travel through moisture into the sterile packs.
- When using a pressure cooker, all items must be at least five centimetres above the water.
- When using drums, tilt them and open the lids to allow air to drain out and to be replaced by steam.
- As soon as a drum is opened, all unwrapped items inside become contaminated. Therefore, items should be wrapped even when drums are used.

4.9.6 Recommendations for packaging material

- Sterilisation wrap made from cellulose fibres and non-woven material made from a combination of cellulosic and synthetic fibres may be used. Both types are suitable for porous-load steam sterilisation and most gas processes because they are permeable to air, steam and other gases.
- Rigid reusable sterilisation containers should be suitable for the method of sterilisation used and compatible with the cleaning method and cleaning agent.
- Transparent pouches should be placed paper to plastic for sterilisation. Single instruments only should be packed in pouches.
- If linen is used for packaging, make sure that it is placed between two layers of non-woven material before being used to wrap surgical trays.

Packaging material – not recommended

- Metal (sterilisation) drum trays with holes that can be opened and closed manually. These do not guarantee sterility of the contents.
- Newspapers, brown paper bags and other products that do not allow air removal or penetration of steam must not be used.
- Recycled material packaging are not recommended because these have lost their integrity and the bacterial barrier and do not allow adequate air removal or steam penetration.

Table 4.6. Temperature and time for effective dry heat sterilisation [31]

Temperature	Time
180° C	30 minutes
170° C (340° F)	60 minutes (1 hour)
160° C (320° F)	120 minutes (2 hours)
150° C (300° F)	150 minutes (2½ hours)
140° C (285° F)	180 minutes (3 hours)
121° C (250° F)	Overnight

4.9.7 Sterility tests [24,25, 26]

It is strongly recommended that, at the minimum, the chemical indicator Bowie Dick Test is used for each load of the autoclave steam steriliser.

Follow manufacturer instructions on use. The Bowie Dick Test will detect air leaks, inadequate air removal, inadequate steam penetration, and non-condensable gases (e.g. air or gas from boiler additives). Insufficient air removal in an autoclave steriliser, particularly a pre-vacuum cycle, can defeat sterilisation and result in nonsterile supplies if undetected.

Table 4.7. Sterility test indicators

Methods		Indicators		
Agent	Means	Physical	Chemical	Bacteriological
Dry heat	Flames	Must be red hot	None	Monthly check: Mix of spore-producing and non-spore producing bacteria
	Hot ovens	Thermometer	Daily check: heat sensitive dyes	
Humid heat (best method for hospitals)	Autoclaves Pressure cooker (steam under pressure)	Record of: Pressure Temperature Time (duration)	Daily check: heat sensitive dyes for steam saturation	Weekly check: spore test (<i>Bacillus stearothermophilus</i>)
Ethylene oxide	Gas	Is used to sterilise heat sensitive items which cannot withstand temps greater than 60°C	Ethylene gas	Gas indicator

Note: Sterilisers should be routinely tested to make sure that they are working properly and that instruments and equipment are sterile.

Table 4.8. Disinfectants and their uses on instruments and equipment

Disinfectant	Time	Purpose	Dilution	Comments
Alcohol 70%	20 minutes	Kills: Gram-positives Gram-negatives TB HIV Hepatitis B Viruses	None	Does not need to be rinsed off
Chlorine solution (1% available sodium hypochlorite)	Decontamination 10 minutes Disinfection 20 minutes	Kills: Gram-negatives TB Most spores Hepatitis virus HIV virus		Make a fresh solution every day. Rinse off with distilled water.



Disinfectant	Time	Purpose	Dilution	Comments
Formaldehyde (8%)	20 minutes	Kills: Gram-positives Gram-negatives TB Spores Viruses	1 part formaldehyde + 5 parts water	Prepare fresh solution every two weeks. Rinse with distilled water
Glutaraldehyde CIDEX SPORICIDIN 2%	20 minutes	Kills: Gram-positives Gram-negatives TB Spores Viruses	Read manufacturer's directions	Use in a well-ventilated area. Rinse with distilled water. Expensive. Use only for fiberoptics, endoscopes, bronchoscopes

Note: Gram-positive organisms include *Streptococcus*, *Staphylococcus*. Gram-negative organisms include *Escherichia coli*, *Klebsiella*, *Pseudomonas*. Spores include *Clostridium* (gangrene and tetanus). Viruses include measles, mumps, chickenpox and hepatitis.

Table 4.9. Length of safe storage for sterile and high-level disinfected items

Wrapping	Safe storage time
Sterile items	
Single wrapped in cloth	One week
Double-wrapped in cloth	One month
Paper	One week
Metal container with cover	One week
High-level disinfected items	
Dry, high-level disinfected lidded container (unopened)	One week
SVM or 70% Alcohol	One week
CIDEX	One week

4.10 Transmission-based precautions

Transmission-based precautions (TBP) are designed for use on patients who are diagnosed with, or suspected to have, a specific infectious pathogen transmitted by contact, airborne or droplet routes or a combination of these. Whether used singly or in combination, transmission-based precautions are always applied in addition to standard precautions [11, 27, 28]. The application and combination of TBP depends on the infectious agent involved.

The common measures for TBP are listed below:

- continued implementation of standard precautions,
- dedicated patient equipment,
- appropriate use of PPE,
- hand hygiene,
- allocation of single rooms or cohorting of patients with the same infection,
- restricted visitors and transfer of patients,
- enhanced environmental cleaning and use of disinfectant in the patient environment,
- appropriate air flow and handling requirements.

TBP are applied:

- to patients who are symptomatic and suspected or who have a confirmed infection with a highly transmissible pathogen transmitted via contact, droplet or airborne routes;
- when a pathogen is considered important from an epidemiological point of view; and
- when medical interventions increase the risk of transmission of a specific infectious agent, such as an aerosol generating procedure.

4.11 Airborne precautions

Airborne transmission occurs when small infectious droplets travel on air currents and remain suspended in the air for long periods of time. Airborne infectious particles can spread by coughing, sneezing, and talking and during procedures like bronchoscopy, endotracheal intubation or open suctioning and infection occurs when persons inhale particles containing the infectious agent disseminated in the air. Infectious agents carried this way can be widely dispersed via air currents and can remain infectious in the environment for long periods before being inhaled by or deposited onto the susceptible host [3,11, 27, 28].

Airborne precautions

- Continue to apply standard precautions, including respiratory hygiene and cough etiquette.
- Patients should be placed in a negative pressure room with doors closed. If a negative pressure room is unavailable, place the patient in a single room (doors closed) with open windows for natural ventilation, and use a fan (blowing outward) to control the direction of air flow.
- Have separate toilet and bathroom facilities.
- Use dedicated equipment, such as blood pressure cuffs and thermometer.
- Use appropriate PPE: respirator masks (N95) should be worn by HCWs and visitors upon entry into the room in addition to standard precautions.
- Patients should be moved as little as possible out of the room, but if movement is necessary, the patient should wear an N95 mask to minimise dispersion of airborne nuclei.
- Signage: For airborne precautions, signage (see Figure 4.6) should be placed outside the isolation room. This is to ensure that staff and visitors do not enter without appropriate PPE.



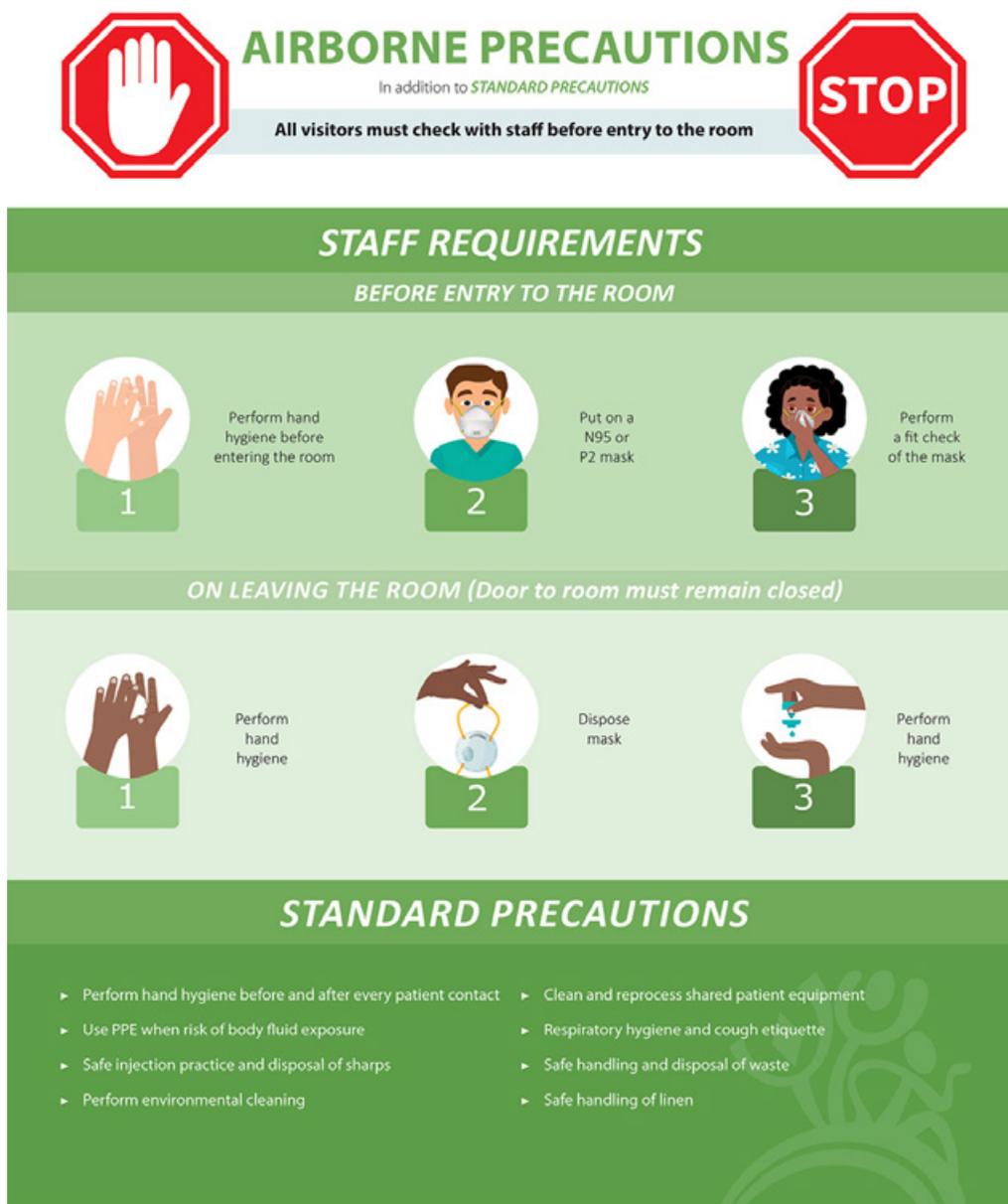


Figure 4.6 Airborne precautions isolation room signage

4.12 Droplet precautions

Droplet transmission occurs when droplets (>5 microns in size), are produced by sneezing, coughing, or even talking. Additionally, transmission occurs when droplets containing infectious agents come in contact with the hands and are transferred to the conjunctivae of the eye, nasal mucosa, or mouth of a susceptible person or inhaled by someone. These droplets may land on objects and surfaces around the infected person, and the virus can be contracted by touching these contaminated objects or surfaces. Due to their size, these droplets in the air travel only a short distance (about one metre) from the infected person before falling [12, 27, 28].

Droplet precautions

- Continue to apply standard precautions, including respiratory hygiene and cough etiquette.
- Use appropriate PPE; surgical masks (not N95) should be worn by healthcare workers and visitors upon entry into the room.
- Patients should be kept in a single room with the door closed or cohort patients infected with the same infectious agents together in a room with good ventilation.
- Separate toilet and bathroom facilities.
- Use dedicated equipment, such as blood pressure machine and thermometer.
- If the patient is transported out of the room, they should wear a surgical mask.
- Signage for droplet precautions (see Figure 4.7) with the necessary precautions to be adopted should be placed outside the isolation room. This is to ensure that staff and visitors do not enter without appropriate PPE.



DROPLET PRECAUTIONS

In addition to *STANDARD PRECAUTIONS*

All visitors must check with staff before entry to the room



STAFF REQUIREMENTS

BEFORE ENTRY TO THE ROOM



1

Perform hand hygiene before entering the room



2

Put on a surgical mask



3

If contact with body fluid likely use gloves, gown & eye wear

ON LEAVING THE ROOM



1

Perform hand hygiene



2

Dispose mask



3

Perform hand hygiene

STANDARD PRECAUTIONS

- ▶ Perform hand hygiene before and after every patient contact
- ▶ Clean and reprocess shared patient equipment
- ▶ Use PPE when risk of body fluid exposure
- ▶ Respiratory hygiene and cough etiquette
- ▶ Safe injection practice and disposal of sharps
- ▶ Safe handling and disposal of waste
- ▶ Perform environmental cleaning
- ▶ Safe handling of linen






For more information, please contact the
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www.spc.int

Figure 4.7. Droplet precautions isolation room signage

4.13 Contact precautions

Transmission of infectious agents occurs via direct and indirect contact routes:

- **Direct contact:** transmission involves direct physical contact and transfer of infectious agents. Example of activities include moving a patient, bathing a patient, oral or skin care.
- **Indirect contact:** transmission involves a susceptible person coming in contact with a contaminated (usually inanimate) object, such as a contaminated instrument or piece of equipment. For example, patient care contaminated equipment/devices are shared between patients [12, 27, 28].

Contact precautions

- Continue to apply standard precautions.
- Use of appropriate PPE: HCWs must wear a clean, non-sterile disposable gown and clean non-sterile gloves when they are in contact with the patient, environmental surfaces and patient care items and equipment in the patient's room.
- The patient should be kept in a single room with the door closed or cohort with other patients infected with the same pathogen.
- Have separate toilet and bathroom facilities.
- Use dedicated equipment, such as blood pressure machine and thermometer.
- Signage, with the necessary precautions to be adopted, should be placed on the patient's door (see Figure 4.8). This is to ensure that staff and visitors do not enter without appropriate PPE.



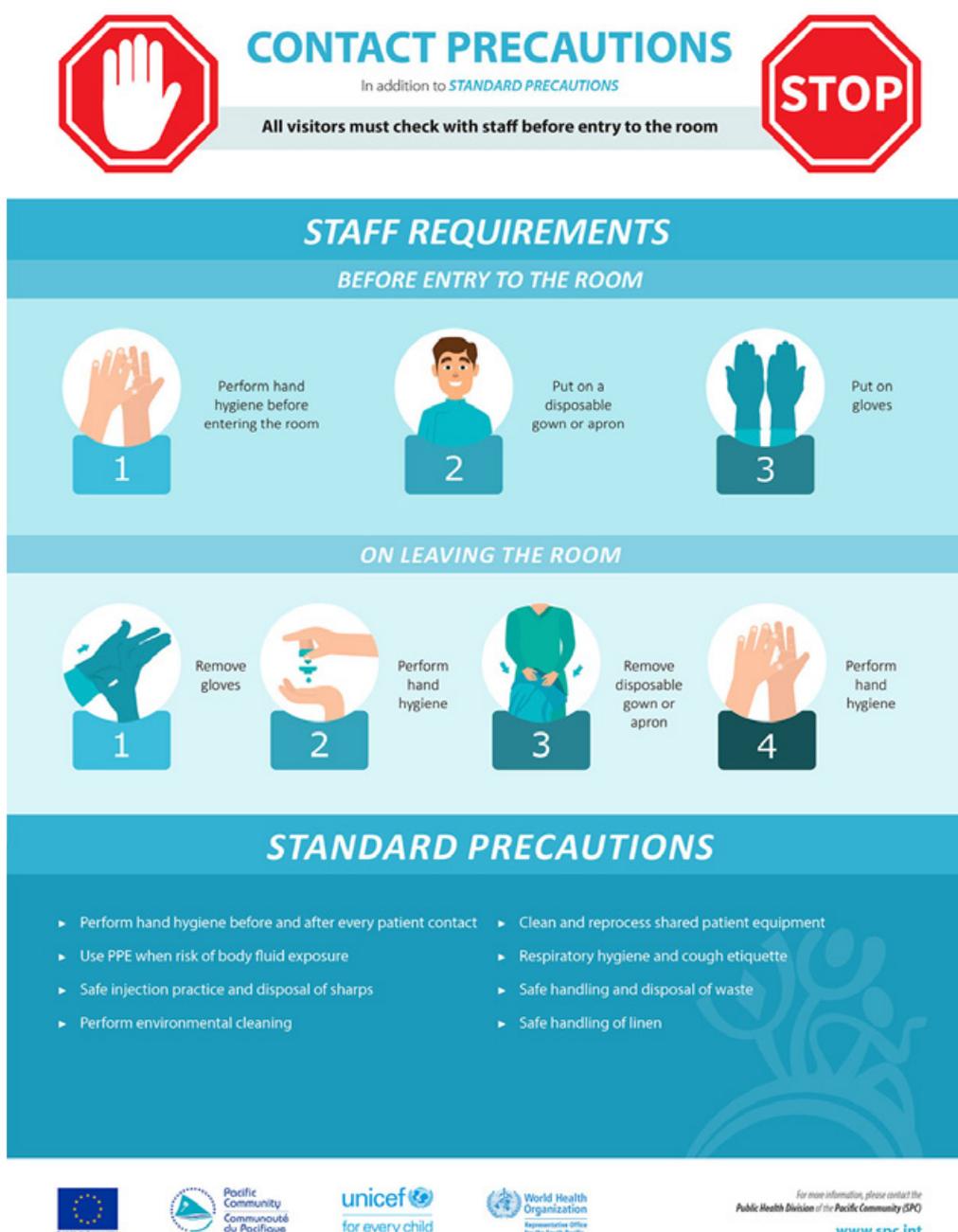


Figure 4.8. Contact precautions isolation room signage

Combination of TBP – Droplet and contact precautions or droplet and airborne precautions

Certain infectious diseases require a combination of TBPs due to the mode of transmission. For example, the COVID-19 virus is transmitted via **close contact** and **droplets** and **airborne spread** during aerosol generating procedures (see Figure 4.9). In this situation, a combination of TBPs should be implemented, depending on the procedures undertaken.



ISOLATION (COVID-19 Use)

Droplet & Contact Precautions

In addition to *STANDARD PRECAUTIONS*



All visitors must check with staff before entry to the room

STAFF REQUIREMENTS

BEFORE ENTRY TO THE ROOM



1

Perform hand hygiene



2&3

Put on disposable gown
Put on mask

1) Medical mask OR
2) Respirator mask (N95, FFP2, FFP3, or equivalent). Only use if performing aerosol generating procedures.



4

Based on risk assessment put on eye protection

Wear goggles OR
face shield



5

Put on gloves

ON LEAVING THE ROOM



1

Remove gloves



3

Remove disposable gown



5

Remove eye protection



7

Remove mask



Perform hand hygiene before/after removal of each PPE



STANDARD PRECAUTIONS

- ▶ Perform hand hygiene before and after every patient contact
- ▶ Clean and reprocess shared patient equipment
- ▶ Use PPE when risk of body fluid exposure
- ▶ Respiratory hygiene and cough etiquette
- ▶ Safe injection practice and disposal of sharps
- ▶ Safe handling and disposal of waste
- ▶ Perform environmental cleaning
- ▶ Safe handling of linen






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Figure 4.9. Droplet and contact precautions isolation room signage

Table 4.9. Recommended IPC measures for standard and transmission-based precautions [28]

IPC Measures	Standard precautions	Airborne precautions	Droplet precautions	Contact precautions
Diseases (examples)	All patients All blood, body fluids, secretions (except sweat), excretions and contaminated items	<ul style="list-style-type: none"> Pulmonary TB suspect/confirmed measles varicella (chickenpox) SARS MDR TB influenza (when performing procedures that are aerosol generating) 	COVID-19 SARS, MERS- CoV Norovirus Haemophilus influenza meningitis/epiglottitis Neisseria meningitidis septicaemia/meningitis diphtheria (pharyngeal) mycoplasma (pneumonia) pertussis influenza parainfluenza mumps parvovirus B19 rubella pneumonic plague Group A streptococcal infections in infants and young Group A Streptococcal pneumonia, scarlet fever in all groups Viral haemorrhagic fever Filovirus disease (Ebola and Marburg), Crimean-Congo haemorrhagic fever, Lassa fever	<ul style="list-style-type: none"> Multi-Resistant organisms (MRSA, VRE, C.difficile, RSV) Herpes simplex (neonatal or mucocutaneous) Highly contagious skin infections (e.g. scabies, lice, impetigo) Herpes zoster (shingles), localised and disseminated Infants/young children (<6 years old), or any patient inconsistent with: <ul style="list-style-type: none"> Enterovirus Hepatitis A Rotaviral enteritis; shigella, giardia, other forms of gastroenteritis. Viral haemorrhagic fever Influenza Norovirus Ebola /Marburg, Crimean-Congo haemorrhagic fever, Lassa fever SARS, MERS- CoV, COVID-19
Single room	No	Yes – Keep door closed; If unavailable, may cohort with patients with same organism	Yes – Keep door closed If unavailable, may cohort with patients with same organism	Use if possible, or cohort with patient with similar condition
Negative pressure-room	No	Yes	No	No
Hand hygiene	Yes	Yes	Yes	Yes
Gloves	For body substances	See standard precautions	Yes	Yes
Gown or coverall	If soiling likely	See standard precautions	Yes	Yes
Apron	Yes	Yes	Yes	Yes
Mask	Protect face if splash likely	Yes (particulate mask N95)	Yes	See standard precautions
Goggles/face shields	Protect face if splash likely	See standard precautions	See standard precautions	See standard precautions
Headcover	Use based on risk of exposure from infectious agent			
Special handling of equipment	Gloves for handling equipment contaminated with blood and body fluids	See standard precautions	See standard precautions	Single use if possible

IPC Measures	Standard precautions	Airborne precautions	Droplet precautions	Contact precautions
Transport of patients	Cover all patient's open wounds	Mask for patient; Notify area receiving patient	Regular mask for patient; Notify area receiving patient	Notify area receiving patient
Room cleaning	Standard cleaning protocol	Enhance additional cleaning with neutral detergent followed by a disinfectant depending on infectious agent See IPC nurse	Enhance additional cleaning with neutral detergent followed by a disinfectant additional cleaning depending on infectious agent See IPC nurse	Enhance additional cleaning with neutral detergent followed by a disinfectant depending on micro-organism See IPC nurse

4.14 Patient placement

Isolating patients who require TBP is very important in preventing transmission of infections.

Hospital beds should be one to two metres apart to reduce the risk of cross infection. If single rooms are not available, patients with the same pathogen should be kept together in either a room or a ward. Patients should not share a bed. The room or ward should be in a well-defined area that is clearly separated from other patient care areas used for uninfected patients [11, 12, 28].

Other points relevant to patient placement are listed below.

- Keep all patient notes and charts (vital signs, fluid balance) outside the room.
- Keep the doors closed.
- Place clear signage outside the room.
- Perform hand hygiene before and after leaving the room and after writing in patient charts or notes.
- Restrict visitors.

4.15 Preparation of the isolation room/ward

- Isolation preparedness is crucial in ensuring that standard precautions and TBPs are implemented to ensure a safe working environment for all staff and patients.
- A sign should be placed on the patient's door explaining the necessary precautions.
- Remove unnecessary furniture and keep only the necessary furniture that can be easily cleaned.
- Ensure adequate linen is available.
- Stock hand hygiene products (e.g. liquid soap, alcohol-based products, paper towels).
- PPE should be available.
- A sharps container should be placed inside the isolation room.
- Garbage bags and bins should be placed in the isolation room.
- Have a trolley to hold PPE.
- Have a container for collection of used eye shields to be decontaminated.
- The recording sheet should be placed at the entrance of the isolation room for staff to record the names and contacts of visitors who enter the isolation room so that contact tracing is possible if necessary.



The following guidance points should be considered as minimum steps when setting up an isolation room/ward [11, 12, 27]. (See Annex 8: Equipment list for isolation rooms and wards.)

- If the room is air-conditioned, ensure 12 air changes/ hour and filtering of exhaust air. A negative pressure in isolation rooms is desirable for patients requiring aerosolisation procedures (intubation, suction nebulisation). These rooms may have stand-alone air-conditioning. These areas should not be a part of the central air-conditioning.
- If air-conditioning is not available, negative pressure could also be created through putting up three or four exhaust fans driving air out of the room or, where there is sufficient space, natural ventilation may be followed. Such an isolation ward/room should have large windows on opposite walls of the room, allowing a natural unidirectional flow and air changes. The principle of natural ventilation is to allow and enhance the flow of outdoor air by natural forces such as wind from one opening to another to achieve the desirable air change per hour.
- Ensure adequate supplies of PPE and hand hygiene supplies.
- Doctors, nurses and non-clinical staff posted to the isolation ward need to be dedicated and not allowed to work in other patient-care areas; all health staff involved in patient care should be well trained in the use of PPE.
- Ensure regular cleaning and proper disinfection of common areas, and adequate hand hygiene by patients, visitors and care givers.
- Visitors to the isolation facility should be restricted. For unavoidable entries, they should use PPE according to the hospital guidance, and should be instructed on its proper use. They should also practise hand hygiene prior to entry into the isolation room/area.
- A telephone or other method of communication should be set up in the isolation room/area to enable patients or family members/visitors to communicate with nurses.
- Avoid sharing of equipment, but if unavoidable, ensure that reusable equipment is disinfected between use.

4.16 Isolation area

The isolation area should have a low risk and high risk zone. The low risk zone should include:

- a “clean” area for health workers to store consumables and supplies of PPE, stationary, hand hygiene and medicine supplies, etc.;
- clear instructions on the flow between areas;
- restriction movement signage; and
- a dedicated changing space in this area allocated to putting on PPE.

An isolation room or ward area is a high risk zone and should:

- be well ventilated with an adjoining bathroom and toilet facilities;
- have hand hygiene facilities, including ABHR;
- have beds one metre apart (3 feet);
- have a sharps container;
- have a container for used linen and other contaminated waste;
- have a dedicated area for contaminated disposal of:
 - liquid and solid waste;
 - storage of used linen;
- have a dedicated area just outside the isolation room/ward:
 - to take off PPE, which must be done under the supervision of a trained buddy or supervisor;
 - with supplies for hand hygiene;
 - with waste containers for contaminated and reusable PPE; and
 - with a container for decontaminating eye goggles/face shields if necessary.

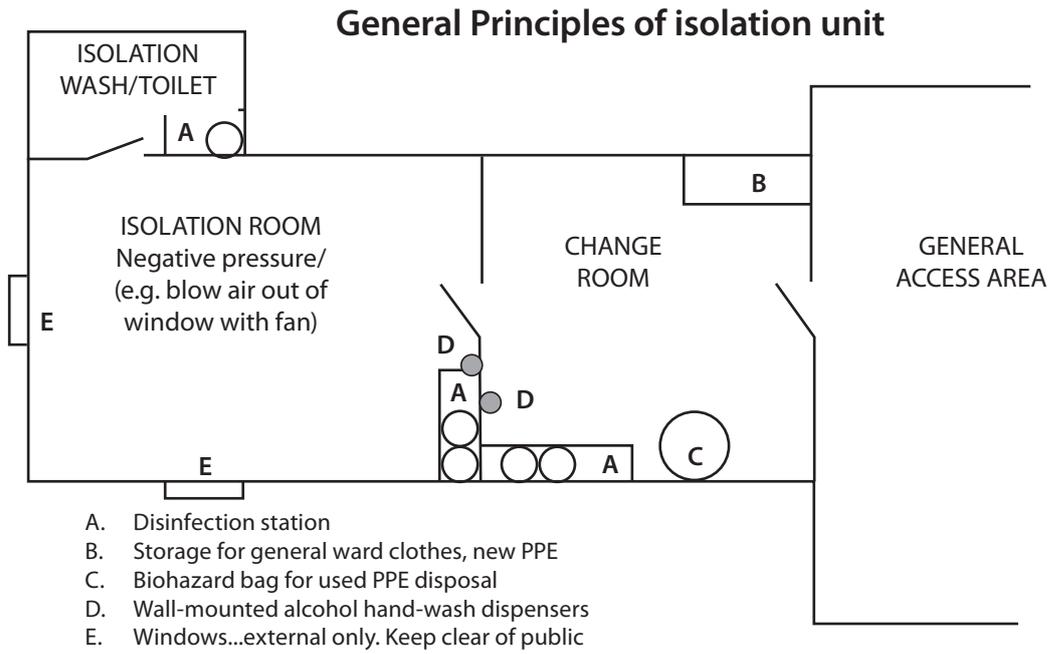


Figure 4.10. General principles of an isolation unit, noting low risk and high risk zones

5 SPECIAL HEALTHCARE AREAS

Some areas of a healthcare facility require very specific IPC measures because of heightened risk of infection or because of the specific nature of the work undertaken.

This section covers IPC in the following units/departments:

- intensive care units
- operating theatres
- maternity units – labour suites
- mortuaries.

5.1 *Intensive care units*

Intensive care units (ICU) including neonatal intensive care unit and the paediatric intensive care unit are where our most vulnerable patients that are most susceptible to HAIs are admitted. The most common infections in the ICU are related to pneumonia from mechanical ventilation and blood stream infections due to intravascular devices (see Section 3.3 for more information on common HAIs and prevention strategies) [7,10, 29].

The following are measures that are crucial to prevent HAIs with intravascular devices and mechanical ventilation.

5.1.1 Hand hygiene compliance

- The five moments for hand hygiene should be strictly adhered to by all healthcare workers in the ICUs. They are designed to protect patients from the risk of microbial transmission from the hands of healthcare workers and they also prevent microbial transmission from the patient to healthcare workers and patient surroundings.
- Also important is the need to ensure consistency of hand hygiene supplies. These include: ABHR, liquid hand soap and single-use paper towels.
- Ensure a system of ongoing monitoring for hand hygiene compliance on a regular basis.

5.1.2 Prevention of contact transmission

The ICU patients are immunosuppressed and susceptible to HAIs and can also become a reservoir for infectious agents. Transmission of infectious agents in the ICU can occur via direct and indirect contact.

- Direct contact: Transmission involves direct physical contact and transfer of infectious agents through secretions and contact with HCW hands. Examples are moving a patient, bathing a patient, and oral or skin care.
- Indirect contact: Transmission involves a susceptible person coming in contact with a contaminated (usually inanimate) object, such as a contaminated instrument or piece of equipment shared between patients.

To prevent contact transfer of HAIs in ICUs, the following precautions should be strictly adhered to.

- Adhere strictly to hand hygiene.
- Use PPE appropriately.
 - Use sterile gloves when undertaking aseptic techniques such as insertion of central venous catheter, indwelling urinary catheterisation and for other procedures that require aseptic technique;
 - Use non-sterile gloves for procedures such as emptying urinary drainage bags, and when in contact with contaminated surfaces or equipment.
 - Use gloves for handling respiratory secretions or objects contaminated with respiratory secretions of any patient; and
 - Change gloves and perform hand hygiene in the following situations:
 - between contacts with different patients,
 - after handling respiratory secretions or objects contaminated with secretions from one patient,
 - before contact with an object, such as a piece of furniture, or environmental surfaces,
 - between contacts with a contaminated body site and the respiratory tract of, or respiratory device on, the same patient.
- Use gowns appropriately.
 - Wear a gown if a patient is on contact precautions or when exposure to respiratory secretions from a patient is anticipated, and change it after soiling occurs and before providing care to another patient.
 - Use plastic aprons when contact with patient body fluids is anticipated.
- Adher strictly to aseptic techniques through the following practices.
 - Clean injection ports with alcohol before accessing the ports for IV medication therapy;
 - Cap all stopcocks when not in use.
 - Use aseptic techniques, including a mask, sterile gown, sterile gloves, and a large sterile sheet, for the insertion of central venous catheters (including peripherally inserted central catheters) or guide wire exchange.
- If there is no medical contraindication, elevate (to an angle of 30-45 degrees) the head of the bed of a patient at high risk of aspiration pneumonia, e.g. a person receiving mechanically assisted ventilation and/or who has an enteral tube in place.

5.1.3 Enhance environmental cleaning and reprocessing of re-useable medical equipment

The environmental surfaces of all intensive care units and all patient equipment, such as ventilators, IV infusion pumps, monitors, warmers, incubators, are potential reservoirs for infectious agents and AMR if not cleaned regularly. Therefore, it is vital that environmental surfaces, including patient equipment, are adequately cleaned to eliminate reservoirs of infectious agents and reduce the risk of acquiring HAI and AMR for critically ill patients who are immunosuppressed in an intensive care unit.

The following measures should be implemented and monitored for compliance.

- Implement a two-step cleaning system that involves a physical cleaning using a neutral detergent solution, followed by a chemical disinfectant of 0.1% hypochlorite solution or 70% alcohol. (See Section 4.6 on environmental cleaning and Annex 7: How to make chlorine solutions for environmental disinfection.)



- Bag valve mask, including laryngoscope blades and handles and all other patient care equipment frequently used in the ICU should be cleaned and disinfected at a minimum on a daily basis and between use.
- Suction bottles should be cleaned and disinfected or sent in for the sterilisation process. Unused bottles should never be left attached to machines with water.
- Ventilators, infusion pumps and other equipment should be cleaned daily and upon discharge. (Refer to manufacturer's cleaning instructions.)
- Frequently change curtains. As a minimum, curtains should be washed once a month but when a patient is a carrier of an infectious agent requiring transmission-based precautions, curtains should be washed or changed after patient discharge.

Care of the incubator

- Wipe daily using liquid soap and water or a neutral detergent. Do not clean with sodium hypochlorite when in use.
- All inserts of the incubator should be removed and thoroughly washed and dried.
- Filters should be changed every three months (labels should indicate the due date for change).
- Incubators should be changed every seven days (labels should indicate the due date for change).

How to clean an incubator upon discharge or transfer of an infant

- Disconnect from electrical socket.
- Use a disposable cloth and a neutral detergent solution or liquid soap to clean/wipe the entire external surface of incubator and its parts.
- All large components of the incubator (i.e. incubator walls, mattress tray and mattress, main deck) should be wiped down and, if recommended by the manufacturer, smaller pieces of the incubator can be submersed in the detergent or sodium hypochlorite solution.
- Sodium hypochlorite solution is corrosive to metals so avoid using it on metal surfaces.
- Reassemble the incubator according to manufacturer's instructions.
- All used cleaning solution must be discarded after cleaning.

Table 5.1. The standards and frequency for cleaning

ICU, NICU and PICU environments	Standard for cleaning	Frequency of cleaning
Neonate/Infant environment	The inside of each incubator or open care cot should be damp dusted using neutral detergent and a disposable cloth or wipes. The detergent cloth/wipe should be changed for inside and outside each cot, radiant warmer or incubator.	Each shift and additionally as required
Immediate care environment	Damp dust using neutral detergent and disposable cloth/wipes: work bench; monitors; infusion devices, including poles; ventilator around the patient/infant, including the outside of each cot radiant warmer or incubator	Each shift and additionally as required
Isolated / cohorted cots	The immediate environment around the isolated / cohorted infant should be damp dusted using neutral detergent and disposable cloth/wipes.	Each shift and additionally as required

ICU, NICU and PICU environments	Standard for cleaning	Frequency of cleaning
Transfer / discharge of patient/infant	Clean the immediate area and all devices with detergent. This includes ventilator, humidifier, monitors & leads, IV pumps and syringe drivers, stethoscope and thermometer. Electrical items such as humidifiers, ventilators or monitors are to be cleaned.	Each transfer / discharge
Multi-drug resistant infections	Clean with sodium hypochlorite 0.1%. <ul style="list-style-type: none"> • Use disposable cloth/wipes each shift and DISCARD AFTER USE. • Clean the immediate environment, including the outside of each cot, radiant warmer or incubator • Clean work spaces and non-critical equipment such as stethoscopes, thermometers, leads, monitors, ventilators, infusion devices and incubators, open care or cots. • Upon discharge, clean outside of each cot, radiant warmer or incubator after use. Avoid using sodium hypochlorite on LED screens and metal surfaces.	Each shift and additionally as required
Shared clinical areas/ devices (Nurses' stations)	Telephones, computer key-boards – clean with neutral detergent on each shift. These areas are high risk areas for the spread of organisms in the unit. <ul style="list-style-type: none"> • Hand hygiene must be performed before & after using keyboards /telephone. 	At each shift
Sinks and surrounding areas are cleaned by the housekeeping staff.	<ul style="list-style-type: none"> • Nothing is to be poured down the hand washing sinks except for the water used for hand washing. • Bath water is to be discarded in the sluice (dirty utility area). • Residual parenteral fluids and antibiotics are to be disposed of in the clinical garbage bins. 	Twice daily and as necessary.
Stock/store rooms	<ul style="list-style-type: none"> • The area should be kept dry, & sterile items handled carefully to avoid damage to seals and wrapping. • Excess stock should be removed from work benches 	Daily damp dusting
Floors	<ul style="list-style-type: none"> • Neutral detergent and hot water are used to mop floors and the bucket should be emptied after each use. • The mop heads are to be replaced/cleaned daily in the hospital laundry. 	Twice a day
Sluice	Clean with neutral detergent and hot water. Store empty buckets upside down in the dirty utility room.	Twice daily
Refrigerators	Clinical fridges contain items requiring cold storage.	Weekly & as necessary
Large suction tubes etc.	Clean with neutral detergent (do not soak), air dry and pack for sterilisation in the central sterile supply department	Daily

5.2 Operating theatres

Operating theatres should be located away from areas of the healthcare facility that are heavily travelled by staff and patients. Enclose the operating theatre to minimise dust, eliminate insects, and facilitate sterility. The environment should be conducive to the prevention of patient and healthcare worker infections. Surgical site infections are common and can be prevented by high



standards of pre-, intra-, and post-operative care. Healthcare worker infections, such as the acquisition of blood borne viruses, can be prevented by safe practices in the operating theatre. It is essential that the number and flow of visitors, patients, clients and staff be regulated and kept to an absolute minimum in the following areas of HCF [30]:

- preoperative and recovery rooms areas where patients wait and where healthcare workers (HCW) examine and treat patients prior to and after being operated on,
- operating theatres,
- procedure rooms – where minor operations are performed, including their preoperative and recovery rooms,
- sterile service departments or areas designated for the decontamination of surgical instruments,
- storage areas for clean items/equipment and sterile instruments.

Other perioperative standards are vital for safe operating environments and optimum patient outcomes. These include: PPE, hand decontamination (scrubbing), cleaning schedules, appropriately trained staff, storage and lay up of sterile equipment, ventilation (air flow), designated zones in the operating theatre area, and reporting systems for any incidents.

Minor operations

The following applies to areas where minor medical procedures are performed on patients.

- Permit only the patient and staff performing and assisting with procedures in the procedure room.
- The number of trainees should be kept to a maximum of two trainees per room.
- Patients should wear clothing provided by the health-care facility; if not available, they may wear their own clean clothing (freshly laundered).
- Procedures should be performed adhering to the same sterility standards as in operating theatres for optimal patient outcome and HCW safety.
- Environmental cleanliness and equipment sterility should be ensured.

Operating theatre environment

Ventilation and temperature controls

- Maintain operating theatres at positive pressure so that air flows from the cleanest areas to the least clean areas.
- Maintain positive pressure ventilation with respect to corridors and adjacent areas.
- Maintain good ventilation.
- Maintain air-handling system, so filtration mechanisms vents are clean and dust free.
- Keep the temperature of the operating theatre between 68°F and 75°F [20°C and 23°C]).
- Design operating theatres to introduce air at the ceiling with the exhaust near the floor.
- If the operating theatre is not equipped with a positive-pressure system, focus on less expensive strategies, such as:
 - keeping doors and windows closed;
 - keeping personnel to a minimum during a procedure and restrict personnel once the operation has started (unless it is absolutely essential); and
 - minimising talking, moving, and opening and closing of doors.

Cleaning

- Clean the operating theatre between each patient, and at the beginning and end of each day.
 - Always keep operating theatres clean, dry and dust free.
 - Avoid unnecessary clutter.
- Do not clean instruments in the operating theatre after an operation but rather send them to the designated decontamination area or the sterile supply department.
- Keep floors smooth, slip resistant and robust enough to withstand frequent washings and harsh cleaning/scrubbing.
- Ensure that walls are water-impermeable, scrubbable, and resistant to cracks. Walls should also be protected from impact by gurneys and other equipment coming to and from the operating theatre department.
- Ensure that ceilings in operating theatres are smooth, washable, and made of a solid surface free from cracks and crevices.
- Seal all ceiling-mounted lights or fixtures so that dust and contaminants cannot enter through these openings and so that there is no compromise to the ventilation system.
- It is permissible to use lay-in ceilings in semi-restricted and unrestricted areas, including recovery and holding areas; lay-in ceilings are not, however, permitted in operating theatres.
- The theatre should be free of all items other than the equipment necessary to perform the surgical procedures. There should be no clutter.

Instrument sterilisation and storage

The decontamination unit should be a one-way flow from dirty to disinfected / sterile. The clean and dirty areas should be clearly demarcated. Decontaminated instruments should be stored in a clean, dry area, appropriately packaged and sealed to prevent contamination prior to use.

5.2.1 Pre-op preparation of the patient [31]

Surgical antibiotic prophylaxis: It is essential that each healthcare facility adhere to local surgical antibiotic prophylaxis policy based on international guidelines. Antibiotic prophylaxis should be considered for:

- clean surgery involving the placement of a prosthesis or implant;
- clean-contaminated surgery;
- contaminated surgery; and
- surgery on a dirty or infected wound (requires antibiotic treatment in addition to prophylaxis).



Table 5.2. Surgical wounds classifications defined by the Centers for Disease Control and Prevention [32]

CLASS I/CLEAN	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow nonpenetrating (blunt) trauma should be included in this category if they meet the criteria.
CLASS II/CLEAN-CONTAMINATED	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
CLASS III/CONTAMINATED	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g. open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered are included in this category.
INFECTED	Old traumatic wounds with retained devitalised tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

The antibiotics selected for prophylaxis must cover the expected pathogens for that operative site. Narrow spectrum, less expensive antibiotics should be the first choice for prophylaxis during surgery. A single dose of intravenous antibiotic with a long enough half-life to achieve activity throughout the operation is recommended and this should be given within 60 minutes before the skin is incised. Prolonging of antibiotic prescription should be avoided during the post-operative period in the absence of an infection [31].

- *Preoperative shaving:* Hair should not be removed at the operative site unless the presence of hair will interfere with the operation. Preoperative shaving, especially with a razor, should be avoided because shaving can cause small nicks and breaks, leaving the skin bruised and traumatised, increasing the risk of colonisation and infection. If hair is to be removed from the operative site, only the area needing to be incised should be shaved. If hair removal is necessary, use clippers; use of a razor must be avoided. Removal of hair, if necessary, should be done immediately before surgeons perform the incision, not the night before surgery.
- *Preoperative showers:* It is preferable that the patient has been instructed to shower or bathe the night before an operative procedure.
- Sterile drapes should be applied after proper asepsis, which must be maintained throughout the surgical procedure.
- The patient identity (e.g. name and date of birth) and allergy status should be confirmed, along with any other risk factors (e.g. risk of significant bleeding), and the site of the surgery should be marked.

5.2.2 Personal protective equipment – theatre attire

- PPE is designed to minimise the transfer of microorganisms from the mucous membranes, skin and hair of the surgical team to the patient.
- PPE provides the surgical team with some protection from the patient.
- It is recommended that perioperative personnel in the semi-restricted and restricted areas wear facility-provided, clean, freshly laundered, or disposable surgical scrub attire.

- When in the restricted areas, all non-scrubbed personnel should completely cover their arms with a long-sleeved scrub top or jacket. (The facility may require this in a semi-restricted area as well.)
- Perioperative personnel should change into surgical attire in designated dressing areas to decrease the possibility of cross-contamination.
- Scrub attire and cover apparel (e.g. lab coats) should be laundered as per facility guidelines after each daily use and when contaminated.
- Personnel should change back into street clothes if they need to leave the facility or travel between buildings in order to prevent contaminating the surgical attire through contact with the external environment.

Gloves: Sterile gloves of good quality and the correct fit/size must be worn.

Disposable hats/hoods: These should completely cover the hair (including facial hair and sideburns) and must be worn when entering the semi-restricted and restricted area. This is particularly important for arthroplasty/prosthetic implant surgery.

Masks: The scrub team must wear surgical masks to completely obscure the mouth and nose. They should be re-moved by the tapes and discarded at the end of each case. Masks must be removed prior to leaving the theatre suite. Respirator masks, e.g. N-95 (fluid repellent), must be available in theatre for procedures where there is a risk of exposure to TB or other airborne pathogens.

Eye protection: Full face shields/visors or protective goggles must be available for all staff and must be worn during invasive procedures that potentially generate splashing. Face shields/visors and goggles should either be disposable or decontaminated according to manufacturer's instructions after use. If magnifying loupes are available, visors cannot be used. Loupes should, therefore, be fitted with side shields.

Scrub gowns: The scrub team should wear either disposable fluid-repellent gowns or reusable gowns that are provided by the organisation and returned for laundering.

Footwear: Staff should wear closed-toe non-slip footwear. Boots should be worn if there is a high risk of heavy blood/body fluid loss. Staff should not leave the operating theatre wearing shoes that are visibly stained.

Cover gowns: The use of cover gowns can be determined using a risk assessment. Cover gowns have been found to have little or no effect on reducing contamination of surgical scrubs but, if used, should be laundered daily.

5.2.3 Theatre cleaning [31]

Preparation of the operating theatre before the first case

- All horizontal surfaces (e.g. furniture, surgical lights, equipment) should be damp-dusted with a clean, lint-free cloth, moistened with 0.05% hypochlorite solution.
- Equipment from areas outside the operating theatre should be cleaned (e.g. with lint-free cloth, moistened in 0.05% hypochlorite solution) before being brought into the operating theatre.
- Equipment that cannot be cleaned should not be brought into the operating theatre.



Between case cleaning

- After the procedure ends and the patient has exited the room, the following personnel and areas need to be cleaned:
 - members of the sterile team, all furniture, anaesthesia equipment, the floor immediately surrounding the focus area or patient area, and patient transport carts,
 - walls, doors and surgical lights and ceilings if soiled with blood, tissue or body fluids.
- Anaesthesia equipment should be cleaned according to good practice international guidelines.
- Floors that are visibly soiled must be cleaned using a new or freshly laundered mop head and soap and water, followed by 0.05% hypochlorite solution.
- Mechanical friction should be used when cleaning, the efficacy of the cleaning is dependent on the scrubbing action.
- Furniture and equipment that are visibly soiled should be cleaned with soap and water, followed by disinfection with 0.05% hypochlorite solution following each procedure.

Terminal cleaning

- At the end of each day, thoroughly clean operating theatres, even if they have been cleaned between cases.
- Terminally clean operating theatres in which procedures may be performed, regardless of use, every 24-hour period during the regular work week.
- Terminally clean scrub/utility areas daily during the regular work week.
- Clean and disinfect all exposed surfaces, including wheels and casters, of all equipment (e.g. foot pedals, kick buckets, telephones, light switches, push plates, Mayo stands, handles on cabinets, vents, walls, etc.).
- Place a special emphasis on cleaning and disinfecting high/hand touch surfaces.
- Clean and disinfect the floor with a wet vacuum or single-use mop, moving equipment around the room to clean the floor underneath.

5.2.4 Waste

- All clinical waste should be placed in biohazard waste bags.
- Biohazard waste bags should not be filled greater than 3/4 full and should be secured/tied to ensure an effective seal.
- Heavily contaminated waste should be placed in double biohazard waste bags to prevent leakage.
- Human body parts should be placed in an approved receptacle.
- Sharps boxes must be used for all metalware.
- All suction equipment, including liners, must be changed between patients to prevent cross-infection and fluid loss volume management in the container.

5.2.5 Managing TB patients in the operating theatre

- Elective surgery on infectious TB patients should be postponed until such patients have received adequate drug therapy.
- If emergency surgery is indicated, schedule the TB patient as the last surgical case to provide maximum time for adequate air changes per hour (ACH) (ventilation of the theatre), and allow terminal cleaning of the operating theatre.
- Operating theatre personnel should use a fluid repellent respirator mask (e.g. N-95).

- Keep the operating theatre door closed after the patient is intubated, and allow adequate time for sufficient ACH to remove 99% of airborne particles (for rooms with 15 ACH, 18 minutes are required to achieve 99% removal of airborne particles).
- Extubate the patient in the operating theatre or allow the patient to recover in an airborne infection isolation (All) room rather than in the regular open recovery facility.
- If All room is not available, recover the patient in a well-ventilated private room.
- Breathing circuit filters with 0.1–0.2 \times m pore size (if available) can be used as an adjunct infection control measure.

5.2.6 After surgical procedures

After each surgical procedure, staff wearing utility gloves should clear the operating theatre.

- Collect all waste in closed, leak-proof containers and remove them from the room.
- Close and remove puncture-resistant containers when they are three-quarters full.
- Remove soiled linen, soiled instruments and equipment, and supplies that have been opened, but not used, in an enclosed cart for reprocessing.

5.3 Antenatal and labour suite

Pregnant women require appropriate clinical and obstetric care at all stages of their pregnancy whilst preventing potential exposure of others to infection. It is important to assess the risk of possible infection transmission at each stage of pregnancy and wear appropriate PPE for the activities being undertaken. Standard precautions as set out in the various sections of these guidelines should always be adhered to with rigorous attention to hand hygiene; waste, sharps and laundry management; environmental cleaning; and decontamination at all times. In addition, it is important that all pregnant women be screened to determine contact risks for infections such as HIV and hepatitis B.

5.4 IPC in mortuary settings

Each healthcare facility should provide a safe working environment in the mortuary and ensure that staff are vaccinated against hepatitis B. The mortuary staff, including the pathologist, should be notified when there is presence of known or suspected high-risk infections prior to commencement of a post-mortem.

5.4.1 Care of the dead body

- Personal care of a dead body should honour the spiritual or cultural wishes of the deceased person. It is essential that the management of dead bodies be handled with extreme sensitivity and a sensible approach. An individualised approach assists with the relationship between the families and carers at a time of probable distress.
- All blood and body substances of all deceased bodies are potentially infectious so standard precautions should be practised at all times. The risk of transmission of infection increases following the death of an infectious patient. Therefore, to minimise the risks of transmission of known and unsuspected infectious diseases, standard precautions are required when handling dead bodies to safeguard the health care worker, mortuary attendant and funeral director.



- It is unusual for organisms in a dead body to infect healthy people with intact skin, but there are other ways infection may be transmitted:
 - needle stick injuries from a contaminated instrument or sharp fragment of a bone,
 - intestinal pathogens from anal and oral orifices,
 - leaking body fluids,
 - through abrasions, wounds and sores on the skin,
 - contaminated aerosols from body openings or wounds, e.g. tubercule bacilli,
 - when condensation could possibly be forced out of the mouth,
 - splashes and/or aerosols onto the eyes.
- The risks of infection are usually prevented by the use of standard precautions. Occasionally, transmission-based precautions are required, as in the handling of a known or possible case of an infectious pathogen. IPC standard precautions should be adhered to at all times in the mortuary and include:
 - hand hygiene;
 - appropriate use of protective clothing, i.e. water-repellent aprons and gloves when handling a body or decontaminating the environment (either disposable or heavy-duty reusable);
 - use of body bags when indicated (see below);
 - appropriate cleaning of the environment;
 - appropriate decontamination of equipment;
 - body fluid spillage management,
 - waste disposal as per waste management guidelines; and
 - safe use and disposal of sharps.
- There may be occasions when a body bag is required because the body is leaking body fluids or exudates, because the cause of death is unexplained or the individual was dead on arrival at hospital. If a body is likely to leak or the cause of death is unknown, it must be placed in a body bag, regardless of the infectivity status.
- If the person had a known infectious disease or an unexplained cause of death, other people coming into contact with the body, e.g. funeral directors, must be informed.

5.4.2 Dirty, clean and transitional zones of the mortuary

The areas of the mortuary and post-mortem room are best segregated into 'clean' and 'dirty' areas and 'transition zones'. These areas can be demarcated by using barriers or red tape and should include warning notices or labels.

A *dirty* area is where all work with bodies, organs and unfixed specimens is carried out. Dirty areas normally include:

- the post-mortem room,
- a dirty utility room,
- the soiled protective clothing discard area,
- refrigerators where bodies are stored.

Clean areas include:

- reception and waiting areas,
- viewing rooms,
- a post-mortem examination observation area.

Transition zones are located between clean and dirty areas. It is recommended that information be provided to the mortuary staff and pathologist (if a post-mortem is to be undertaken) on all deaths where an infection risk is known or thought to exist before the body is delivered.

5.4.3 Personal protective equipment for post-mortem [11]

1. Standard precautions must apply when handling all bodies.
2. Protective clothing must be put on before carrying out a post-mortem examination.
3. Staff performing a post-mortem must wear surgical theatre type clothing: a long-sleeved gown with a plastic apron. This should include anyone entering a dirty area to observe a post-mortem examination. They should wear a gown, rubber boots, a plastic apron and a visor, even though not actively engaged in the work.
4. Impermeable footwear (waterproof boots or gum boots) must be worn by all persons working in the mortuary area.
5. Surgical or post-mortem gloves must be worn by all personnel involved in the post-mortem procedure. Double gloving is required. It is recommended that cut-proof gloves are worn. (Staff must wear them at least on the non-dominant hand.)
6. To protect against splashes, full face protection in the form of either a visor or combination of wrap-around eye protection, such as safety glasses, and full surgical mask must be worn during post-mortems.
7. Hoods and high filtration grade masks must be worn where there is an increased risk of aerosols.
8. Respirators having appropriate filters must be available for use in suspected or known high-risk microbiological or chemical contamination and during aerosolising procedures (high powered saws for example).

Personal hygiene in the post-mortem room

- Hand hygiene must be adhered to at all times. Always wash hands before leaving any of the designated dirty work areas in the mortuary.
- Remove protective clothing after use and do not wear it outside the mortuary.
- No smoking, drinking, eating, applying cosmetics in any work or rest area within a mortuary.
- Avoid all actions that can bring the hands (gloved or otherwise) into contact with the face, eyes, nose and mouth, e.g. cleaning and touching spectacles or contact lenses.
- Ensure that any skin abrasions or cuts are covered with waterproof dressings before starting work.
- People with open wounds or active dermatitis on exposed skin must not come directly into contact with any bodies, body fluids or specimens, unless the wound/affected skin can be adequately protected by dressings.

General precautions during post-mortem examination

- Never pass instruments from hand to hand during a post-mortem examination. The assistant should set them out on a table for selection by the pathologist as required.
- Once used, instruments that are no longer required during a post-mortem examination must be thoroughly cleaned in detergent solution.
- Never attempt to catch a falling instrument. To help prevent accidental falls, do not lay instruments down indiscriminately after use. If no longer required, clean them in detergent solution.



- Wherever possible, avoid operations likely to cause splashing or generate aerosols, such as washing down with high pressure hoses, cleaning instruments under running water and squeezing organs that have been removed from the body.
- For infectious bodies, at the end of the examination, all clothing and protective equipment worn during the examination should be disposed of correctly or treated, where appropriate, as infected linen and placed in appropriate bags for collection or disposal.

Tissue specimens for histopathology

- Tissue specimens should be placed in appropriately sized containers that allow them to be totally immersed in fixative solution.
- Staff may need to decontaminate the outside of the containers before sending them to the pathology laboratory. All specimens sent to laboratories should be contained in containers with fitted lids to minimise the risk of leakage and must be labelled to make clear the nature of the contents.

In Pacific Island countries, it is customary practice for the family of the deceased to undertake the preparation of cleaning and dressing the body of the deceased. In situations where the body of the deceased is infectious, it is essential that family members are educated about the risks of transmission of infection and should ideally be supervised by a trained HCW during this period. PPE should be provided (gloves and a plastic apron or water-resistant gown). For highly infectious bodies, kissing and touching the face of the deceased should be discouraged.

5.4.4 Environmental cleaning

The aim of cleaning is to maintain an environment where any infectious agents that might be present are reduced to a level not harmful to health. Regular cleaning of the mortuary must be carried out using a two-step clean.

- Clean with soap and water, allow to dry.
- After drying, disinfect the surface or objects with disinfectant concentration of 0.1% (1000 ppm) sodium hypochlorite (bleach) and allow to dry.
- Wipe surfaces. Do not use compressed air and/or water under pressure for cleaning, or any other methods that can cause splashing or might re-aerosolise infectious material.
- Environmental surfaces, where the body was prepared, should be cleaned immediately after use.
- Protective equipment, such as waterproof boots and eye goggles, should be cleaned with detergent and disinfected with sodium hypochlorite 0.1% at the end of each session involving known or suspected high-risk cases; otherwise, detergent and water are sufficient.
- All waste from the post-mortem room should be treated as clinical waste, so a clinical waste bag/container should be available for use. No general waste bag/container should be allowed in the dirty areas.

6 GUIDELINES FOR MANAGING OCCUPATIONAL EXPOSURE TO BLOOD AND OTHER BODY SUBSTANCES

HCWs are at risk of exposure to blood and body substances and to infectious diseases. Implementation of preventive measures against infectious diseases and managing occupational exposure to blood and body substances assist in the maintenance of staff health.

The following measures support the minimisation of risk of bodily injury and/or infection in HCWs, and should be addressed by HCF leaders and managers to ensure that all HCWs adhere to the evidence-based guidelines in this section.

Infrastructure/system change: this refers to access to the right equipment and supplies, including PPE, and an environment that is designed and planned to facilitate patient and health worker safety. This includes immunisation programmes.

Training and education: there must be a programme of routine health and safety education and training and periodic retraining for all personnel.

Monitoring, evaluation and feedback: there must be pre-placement health evaluation of HCWs and the establishment of protocols for surveillance and management of job-related illnesses and exposures to infectious diseases.

Awareness raising/promotion: safe work practices, including an appropriate waste disposal management plan, are reinforced through awareness raising, e.g. the use of posters displayed across the health care facility (HCF).

Safety culture: managers and leaders at every level of the HCF show their visible support for occupational health and safety to help develop and reinforce a culture of healthcare worker and patient safety. This includes counselling services for personnel regarding infection risks related to employment, and the development, review and revision of policies and procedures and their ready availability in the HCF. Maintenance of confidential employee health and injury records is important.

6.1 *Employer responsibilities*

- Ensure a healthy and safe working environment for all employees.
- Provide employees with appropriate orientation, training and supervision on safety procedures.
- Have safety and employee health standard operating procedures readily available to staff.
- Assess and manage any identified risks (e.g. investigate accidents and illnesses).
- Document and report worker injury or illness.
- Ensure best practices for HCW safety and IPC, including provision of PPE and staff immunisation for vaccine preventable diseases.
- Have a process for worker feedback on safety issues.



The following recommendations are intended to improve compliance with procedures and eliminate the risk of occupational injuries or HAL.

- Establish appropriate engineering controls (controls used to remove/reduce a hazard, or place a barrier between the worker and the hazard in health care facilities).
- Make available and use appropriate supplies and equipment.
- Hand-washing facilities and materials must be readily accessible.
- Puncture-resistant, leak-proof, labelled or colour-coded sharps containers must be located as close as possible to their places of use.
- Leak-proof containers for specimens and other regulated wastes must be properly labelled or colour-coded.
- Ensure there are mechanisms for safe storage, transport and disposal of regulated waste.
- Have an easily accessible first-aid kit in all departments.
- Implement controls for work practices.
 - Prohibit eating, drinking, smoking, applying cosmetics, and handling contact lenses in the work areas and on work surfaces that carry an inherent potential for contamination.
 - Do not store food and drink in refrigerators, freezers, or cabinets where blood or other potentially infectious material is stored. Such storage equipment should be clearly labelled to prevent this possibility.
 - Wash hands and other skin surfaces that become contaminated with blood or other potentially infectious materials immediately and thoroughly with soap and running water.
 - Thoroughly wash with water (flush) mucous membranes that become contaminated with blood or other body substances.
 - Prohibit HCWs with open wounds or weeping skin rashes from all direct patient-care, potentially hazardous laboratory procedures, and handling patient-care equipment until recovery.
 - Cuts or abrasions should be protected with a waterproof dressing and gloves prior to performing any procedure that involves contact with blood and other potentially infectious material.
 - Provide information and training about workplace health and safety and IPC.
 - Record and monitor exposures to blood and body fluids.
 - Monitor and maintain surveillance of work practices.

6.2 *Healthcare workers responsibilities*

- Follow safe work practices at all times as defined by health facility policy.
- Be familiar with employer's written departmental policies.
- Know the potential health and safety hazards of the job and protective measures by participating in appropriate occupational health and safety training programmes.
- Use personal protective equipment (PPE) as trained and report changes in any personal medical conditions that would require a change in PPE wearing status.
- Report unsafe working conditions as per health facility policy.
- Report any work-related injury or illness to supervisor.
- Participate in accident and injury investigations.
- Know what to do in an emergency of accidental occupational exposure to blood and body substances.
- Participate in health and safety committees (when available).

6.2.1 Pre-employment health evaluations

When personnel are initially appointed or are reassigned to different jobs or areas, a pre-placement evaluation can be used to ensure that persons are not placed in jobs that would pose undue risk of infection to them, other personnel, patients, or visitors. A health inventory is an important part of this evaluation. This inventory can include determining a healthcare worker's immunisation status and obtaining a history of any conditions that may predispose the health worker to acquiring or transmitting an infectious disease.

6.2.2 Personnel infection prevention and control and health and safety education

- Personnel are more likely to comply with an IPC programme if they understand the rationale; thus staff education should be a central focus of the IPC programme.
- Clearly written policies, guidelines and procedures are needed for uniformity, efficiency, and effective coordination of IPC activities. These should be accessible to all healthcare workers.
- All healthcare facilities should develop and implement appropriate orientation and in-service training programmes for new employees, as well as in-service refresher training (e.g. yearly) for existing employees.
- Training should be designed to cover all cadres of staff, including doctors, nurses, clinical officers, laboratory workers, non-medical workers, and support staff and should be matched to the roles/responsibilities of each group.
- Health and safety training should ensure that workers know and understand the potential risks that are associated with waste from health care facilities, the value of immunisation against vaccine preventable diseases such as HBV, and the importance of appropriate use of PPE.

6.2.3 Immunisation

Since hospital personnel are at risk of exposure to and possible transmission of vaccine-preventable diseases because of their contact with patients or material from patients with infections, maintenance of immunity is an essential part of a hospital's occupational health and IPC programme. An effective immunisation programme safeguards the health of personnel and also protect patients from becoming infected by personnel. Following a consistent programme of immunisations can eliminate the problem of susceptible personnel and avoids unnecessary activity restrictions. Immunisations should be free of charge and at least include the following:

- hepatitis B vaccine (for HCWs whose occupational tasks place them at risk of exposure to blood or other potentially infectious material),
- MMR (measles, mumps, rubella),
- influenza,
- chickenpox (varicella),
- tetanus, diphtheria, pertussis,
- meningococcal meningitis.

The following sections cover the infection prevention issues for HCWs and include:

- human immunodeficiency virus (HIV),
- hepatitis B Virus (HBV),
- hepatitis C Virus (HCV),
- tuberculosis (TB),
- meningococcal meningitis,
- tetanus,



- work restrictions for healthcare workers exposed to, or infected with, selected infectious diseases,
- guidelines for managing occupational exposure to blood and body substances for HIV and hepatitis B.

6.3 HIV

HIV is transmitted from person to person via sexual contact, sharing of needles contaminated with HIV, infusions contaminated with HIV, and transplantation of organs or tissues infected with HIV. The risk of a HCW acquiring HIV after a needle stick or other sharp injury route is 0.3% and 0.9% via the mucous membrane and non-intact skin.

There are no confirmed effective methods of treatment and no cures for HIV, so the focus must be on preventing exposure to HIV through safe infection control work practices, such as standard precautions, ongoing IPC education and training, safe management, proper disposal of healthcare-related waste and sharps, and appropriate use of personal protective equipment. There is no vaccine for HIV.

6.4 Exposure to hepatitis B virus

The transmission route of hepatitis B is through blood and other body substances such as blood products, saliva, cerebrospinal fluid, peritoneal, pleural, pericardial and synovial fluid, amniotic fluid, semen and vaginal secretions. Studies state that although HBV is present in saliva and tears, these body fluids have not represented an occupational risk to HBV unless they contain blood.

Blood from persons infected with HBV contains the highest HBV titres of all body fluids. HBV, like HIV, cannot be cured and often results in severe liver damage or death. There is a highly effective vaccine for HBV.

6.4.1 Hepatitis B immunisation

Immunisation is the best way of preventing HBV transmission to healthcare staff and should be offered to all HCWs. Immunisation for adults is a series of three injections: an initial injection, an injection given one month after the initial injection, and one given six months after the initial injection.

6.4.2 Antibody testing

Post-immunisation testing for seroconversion should be done one to two months after the third immunisation dose. All HCWs should be responsible for knowing their immune status. An HCW who does not respond to the initial course of hepatitis B vaccine (titres <10 mIU/mL) after the three doses one month apart, followed by antibody testing, should have a repeat of the vaccine series and testing done after the second series.

6.5 Exposure to hepatitis C virus

In the healthcare setting, the transmission route of HCV is largely parenteral (a needle stick through the skin, for example) through exposure to blood and body substances. Sexual transmission does occur but is far less frequent. As with HIV, there are no confirmed effective

methods for treating HCV, so the focus must be on preventing exposure to HCV through safe infection control work practices (e.g. standard precautions, ongoing education and training, safe management and disposal of healthcare-related waste and sharps, and appropriate use of personal protective equipment). There is no vaccine for HCV.

6.6 Tuberculosis

Tuberculosis (TB) is an airborne infectious disease caused by the bacteria *Mycobacterium Tuberculosis* (MTB) and is usually transmitted by exposure to airborne particles called ‘droplet nuclei’ produced by individuals infected with TB while coughing and/or sneezing. Prolonged close contact with such TB infected individuals increases the risk of transmission. The aerosol droplets are very small, less than five microns in size, and can stay infectious for long periods in the air, making transmission possible when they are inhaled and settle into the lungs.

All healthcare settings need a TB infection prevention and control programme designed to ensure prompt detection, initiation of airborne precautions and treatment of persons who have suspected or confirmed MTB disease (or prompt referral of persons who have suspected MTB disease in settings where persons with MTB disease are not expected to be encountered). Healthcare workers, including nurses, doctors, clinical officers, nursing and medical students, housekeeping staff, and others are vulnerable to TB exposure, infection, and disease. Healthcare workers are at even greater risk [3]:

- during aerosol-generating or aerosol-producing procedures, including bronchoscopy, endotracheal intubation, suctioning, other respiratory procedures, open abscess irrigation, autopsy, sputum induction, and aerosol treatments that induce coughing;
- when they are working with difficult-to-treat TB, such as relapses, treatment failure, multi-drug resistant (MDR), and extensively drug-resistant (XDR) TB;
- after prolonged contact with patients with unrecognised TB disease who are not promptly handled with appropriate airborne precautions or patients moved from an airborne infection isolation room too soon (e.g. patients with unrecognised TB, patients with MDR or XDR TB);
- after long duration of employment;
- when working without following IPC procedures; and
- when they have HIV infection.

General IPC recommendations on TB

- Assign responsibility for TB IPC in the HCF setting.
- Conduct initial and ongoing evaluations of the risk of transmission of TB, regardless of whether or not patients with suspected or confirmed TB are expected to be encountered in the setting.
 - The TB risk assessment determines the types of administrative, environmental, and respiratory-protection controls needed for a setting and serves as an ongoing evaluation tool of the quality of TB infection control and for the identification of needed improvements in IPC measures.
 - The risk assessment will help determine the facility’s risk classification (low, medium, potential transmission of TB).
 - Risk classification should be used as part of the risk assessment to determine the need for a TB screening programme for HCWs and the frequency of screening.



- Bacille Calmette–Guerin (BCG) is given as a childhood vaccination schedule in most nations to prevent severe forms of TB in children; it likely has little protective effect in adults.
- Ongoing education should be provided to all healthcare personnel regarding the recognition, transmission and prevention of TB.
 - HCWs working in TB wards and intensive care units, medical nursing staff, mortuary staff, radiographers, physiotherapists, maids and laboratory staff working with TB specimens should be offered baseline Mantoux (PPD / TST / TB skin test) testing and chest x-rays.

6.6.1 Recommendations for TB screening procedures for medium risk settings [3]

- All HCWs should receive baseline TB screening on commencing employment, using the two-step tuberculin skin test (TST) or a single BioMedical Admissions Test (BAMT) to test for infection with TB.
- After baseline testing, HCWs should receive TB screening annually (e.g. symptom screen for all HCWs and test for infection with TB for HCWs with baseline negative test results).
- HCWs with a baseline positive or newly positive test result for TB infection or documentation of previous treatment for latent TB infection or TB disease should receive one chest radiograph result to exclude TB disease.

HCWs with TB disease should be allowed to return to work when they:

- have had three negative acid-fast bacilli (AFB) sputum smear results collected 8–24 hours apart, with at least one being an early morning specimen because respiratory secretions pool overnight;
- have responded to anti-tuberculosis treatment that will probably be effective based on susceptibility results; and
- when a physician knowledgeable and experienced in managing TB disease determines that the HCW is non-infectious.

Consideration should also be given to the type of setting and the potential risk to patients (e.g. general medical office versus HIV clinic).

Note: HCWs with active TB should be provided with sick leave (with pay) during the period of the illness and treatment.

6.7 Meningococcal meningitis

Neisseria meningitidis is transmitted via direct contact, particularly by respiratory droplets from the nose or throat of colonised or infected people. Individuals with meningococcal septicaemia (blood poisoning) or meningitis are usually not infectious after 24 hours of appropriate antibiotic therapy.

The risk of transmission is high for HCWs who have been in direct prolonged contact with the patient and have not been wearing personal protective equipment (i.e. masks), or have been involved in mouth to mouth resuscitation, intubation or bronchoscopy of infected patients. Antibiotic prophylaxis (treatment to prevent developing symptoms) should be made available to HCWs in these situations, ideally within 24 hours if the risk of exposure has been deemed significant. No prophylaxis can be considered 100% effective. Therefore, droplet precautions in addition to standard precautions should be adhered to by all staff when caring for individuals infected or suspected of being infected with *Neisseria meningitidis*.

6.8 Tetanus

Tetanus enters the body through wounds contaminated with soil, human and animal faeces, and street dust. Tetanus vaccinations are given as a childhood vaccination schedule in most nations. A booster vaccination is required every 10 years. Tetanus status should be reviewed in the event of an occupational exposure to blood or body substances, particularly those involving used or discarded sharps or needles, or for deep or dirty wounds. People who have not had a recent booster should be re-vaccinated.

6.9 Work restrictions

Table 6.1. Work restrictions for healthcare workers exposed to, or infected with, selected infectious diseases [28]

Disease/pathogen	Relieve from direct patient contact	Partial work restriction	Duration
Conjunctivitis Infectious	Yes		Until discharge ceases
Cytomegalovirus Infectious	No		
Diphtheria	Yes		Exclude from duty exposed staff and those identified as asymptomatic carriers until antimicrobial therapy is completed and results of two nasopharyngeal cultures obtained at least 24 hours apart are negative.
Gastroenteritis Acute	Yes		Until symptoms resolve and until 24 hours after symptoms have resolved, and infection with salmonella is ruled out.
Group A streptococcus infections	Assess		Do not routinely exclude personnel unless it is shown epidemiologically that they are responsible for disseminating the organism in the healthcare setting.
Hepatitis A	Yes		Until seven days after onset of jaundice
Hepatitis B acute symptoms	Assess		Refer to specialist
Chronic antigenemia	Assess	May be restricted from performing exposure prone procedures.	Refer to specialist
Hepatitis C	Assess	May be restricted from performing exposure prone procedures.	Refer to specialist

Disease/ pathogen	Relieve from direct patient contact	Partial work restriction	Duration
Herpes simplex orofacial or genital	Assess		Assess the potential for transmission to high-risk patients (neonatal intensive care unit patients, patients with severe burns or eczema, and severely immunocompromised patients) and the need for exclusion from the care of such patients. Counsel to cover and not touch the infected lesions, hand hygiene, do not allow the lesions to touch patients with dermatitis.
Herpetic whitlow (fingers and hands)	Yes		Exclude until lesions are healed

Table 6.2. Work restrictions for healthcare workers exposed to, or infected with, selected infectious diseases (cont'd) [3, 47, 48, 49, 50, 51, 52, 53, 54]

Disease/ pathogen	Relieve from direct patient contact	Partial work restriction	Duration
Herpes zoster Shingles	Yes	Restrict immunocompetent personnel with localised zoster from the care of high-risk patients until lesions are crusted; allow them to care for other patients with lesions covered.	Restrict immunocompromised personnel with zoster from contact with patients until lesions are crusted. Restrict susceptible personnel exposed to zoster from patient contact from the 10 th day after the first exposure through the 21 st day after the last exposure.
HIV	Assess	May be restricted from performing exposure prone procedures (invasive procedures that carry a risk of injury to the HCW, that may result in the exposure of the patient's open tissues to the blood of the worker)	Refer to specialist
Influenza and other viral respiratory illness, including the common cold	Yes		Consider excluding personnel with acute febrile respiratory infections from the care of high risk patients (e.g. neonates, young infants, patients with chronic obstructive lung disease and immunocompromised patients) during community outbreaks of influenza or respiratory syncytial virus (RSV) infections.
Measles active	Yes		Until seven days after the rash appears or for the duration of their acute illness, whichever is longer.

Disease/ pathogen	Relieve from direct patient contact	Partial work restriction	Duration
Post exposure (susceptible personnel)	Yes		From the 5 th through to the 21 st day after the last exposure OR seven days after the rash appears or for the duration of their acute illness, whichever is longer.
Meningococcal disease	Yes		Exclude personnel with <i>N. meningitidis</i> infections from duty until 24 hours after the start of effective antibiotic therapy. Do not routinely exclude personnel from duty who only have nasopharyngeal carriage of <i>N. meningitidis</i> .
Mumps	Yes		Exclude from duty susceptible personnel who are exposed to mumps from the 12 th day after the first exposure through the 26 th day after the last exposure or, if symptoms develop, until nine days after the onset of parotitis.
Pertussis	Yes		Exclude personnel in whom symptoms develop (cough \times seven days, particularly if accompanied by paroxysms of coughing, inspiratory whoop, or vomiting) after known exposure to pertussis from patient care areas until five days after the start of appropriate therapy.
Rubella	Yes		Exclude from duty susceptible personnel who are exposed to rubella from the 7 th day after the first exposure through to the 21 st day after the last exposure. Exclude personnel who acquire rubella from duty until 7 days after the beginning of the rash.

Table 6.3. Work restrictions for healthcare workers exposed to, or infected with, selected infectious diseases (cont'd)

Disease/ pathogen	Relieve from direct patient contact	Partial work restriction	Duration
Scabies and pediculosis	Yes		Exclude personnel with confirmed scabies from the care of patients until they have received appropriate treatment and have been shown, by medical evaluation, to have been effectively treated. Exclude personnel with confirmed or suspected louse infestation from contact with patients until after they receive appropriate initial treatment and are found to be free of adult and immature lice.
Staphylococcal infection or carriage	Assess		Do not routinely exclude personnel unless it is shown epidemiologically that they are responsible for disseminating the organism in the healthcare setting.
Tuberculosis, lung or larynx	Yes		Exclude personnel with infectious pulmonary or laryngeal TB from the workplace until the facility has documentation from their healthcare provider that they are receiving adequate therapy, their coughs have resolved, and they have had three consecutive sputum smears collected on different days with negative results for acid-fast bacilli (AFB). After personnel return to work, obtain periodic documentation from their healthcare provider that effective drug therapy has been maintained for the recommended period and that sputum smear results are AFB negative.
Other sites	Assess		Do not exclude personnel from the workplace who have TB only at sites other than the lung or larynx.
Varicella	Yes		Exclude personnel from work who have onset of varicella until all lesions have dried and crusted. Exclude from duty after exposure to varicella personnel who are not known to be immune to varicella (by history or serology), beginning on the 10 th day after the first exposure until the 21 st day after the last exposure.

6.10 Guidelines for managing occupational exposure to blood and body substances

Occupational exposure is defined as an incident that occurs during the course of a person's employment and involves contact with blood or body substances. Such exposure may put the person at risk of acquiring a bloodborne infection.

Adherence to standard infection control practices remains the first line of protection for HCWs against occupational exposure to HIV, HBV and HCV.

Policies should be developed at national and local level to cover all people in a healthcare setting, including all staff and visitors, clinical staff, non-clinical staff (e.g. administrators, housekeeping and laundry staff, maintenance workers), laboratory staff, volunteers, private contractors and consultants.

6.10.1 Prevention of occupational exposure to blood and other body substances

Preventing exposure through safe practices, barrier precautions, safe needle devices and other methods remains the most effective strategy for reducing the risk of infection with HIV and other bloodborne pathogens in healthcare settings.

Two significant prevention priorities are that all:

- HCWs should be trained in, and be able to demonstrate competence in, standard precautions; and
- staff should be provided with the necessary materials and protective equipment.

Staff should also be knowledgeable about the risks of acquiring HIV and other blood borne pathogens through sexual contact and should have ready access to condoms and confidential sexually transmitted infection treatment services.

The following measures aimed at reducing the incidence of occupational exposures should be taken.

- Never recap needles.
- Do not disconnect needles from the syringe.
- Always transport (or pass to another person) sharp objects in a kidney dish or puncture-proof container.
- Sharps should be disposed of in puncture-proof containers and should not be filled further than the 'fill line' and should be disposed of promptly.
- Wear appropriate PPE if there is anticipated exposure to blood and body substances.
- Take care with all blood contaminated equipment.

6.10.2 All employers must ensure that the following management strategies are implemented

The management strategies include:

- an efficient system for reporting and managing potential exposure of HCWs to blood and body substances,
- confidentiality of injured HCWs,
- expert advice available to all HCWs 24 hours a day,
- processes to facilitate ready access to appropriate treatment,



- rapid assessment of HCWs to ensure timely administration of specific prophylaxis if appropriate,
- all occupational exposures fully documented to meet regulatory requirements.

6.10.3 Definition and reporting of occupational exposure

Occupational exposure includes:

- percutaneous injuries or cuts with used instruments, such as needles or scalpel blades, and involving blood or other body substances;
- contamination of fresh cuts or abrasions with blood or other body substances; and
- contamination of the eyes or other mucous surfaces with blood or other body substances.

6.10.4 Immediate care of the exposed person

It is strongly recommended that immediately after an occupational exposure to blood or other body substances, the following measures are followed.

- Perform first aid.
- Wash with soap the affected site of exposure and any remaining blood on the skin under running water.
- Apply a sterile dressing if necessary and apply pressure through the dressing if the wound is still bleeding.
- Do not squeeze or rub the injury site.
- Do not use strong solutions such as iodine or bleach on the wound.
- If eyes have been exposed or contaminated, irrigate gently with normal saline or water while the eyes are open for at least 30 seconds (remove contact lens).
- If blood or body substances get in the mouth, spit it out immediately and rinse the mouth with water several times.
- If clothing is contaminated, remove it and shower.
- If water is not available for washing percutaneous exposure or punctures of the skin, a ABHR or antiseptic should replace soap and water.

6.10.5 Needle stick injuries

Needle stick injuries should be reported and documented in a form in accordance with the healthcare facility's policy on management of occupational exposures (See Annex 2 on a sample occupational exposure form).

It is strongly recommended that immediately after occupational exposure to blood or other body substances, the following measures be followed.

- Wash affected site of exposure and any remaining blood on the skin under running water with soap.
- Apply a sterile dressing if necessary and apply pressure through the dressing if the wound is still bleeding.
- Do not squeeze or rub the injury site.
- Do not use strong solutions such as iodine or bleach on the wound.
- If water is not available for washing percutaneous exposures or punctures of the skin, a non-water cleanser or antiseptic should replace soap and water.

6.11 Procedures for reporting occupational exposures are as follows:

1. The HCW should IMMEDIATELY report the exposure to their supervisor or manager (24 hours per day).
2. The supervisor should arrange immediate medical assessment (24 hours per day) of the HCW and the patient who is the source of the exposure.
3. Complete an exposure report. An exposure report should contain the following information:
 - the name of the staff member involved,
 - the area where the incident occurred, such as the ward, operating room or emergency room,
 - a description of the incident,
 - the name of the source person whose blood or body substances were involved in the incident. **Note:** If the source of the blood is unknown, this must also be documented.

As soon as possible (within one day), a copy of the incident form should be sent to the infection control nurse (or equivalent) and the exposed HCW's supervisor, so that they can be aware of any standard precaution procedural risks or lapses, in a confidential, sensitive and non-judgmental way.

6.11.1 Medical assessment

Health care workers should have immediate access to post exposure prophylaxis (PEP) 24 hours a day, seven days a week to be freely dispensed by any hospital (private or public), regardless of the location or type of work they do. The minimum care following potential exposure to HIV should be risk assessment and, if deemed necessary, the first dose of PEP medication.

A medical risk assessment involves taking and recording the history and details of the occupational exposure and assessing the risk of HIV, HBV and HCV from the source person and the exposed person. This assessment should be undertaken by a trained person IMMEDIATELY after first aid is given, REGARDLESS OF WHAT TIME OF DAY THE OCCUPATIONAL EXPOSURE OCCURS. Immediately after the reporting the incident, arrangements should be made to release the HCW from work so that immediate risk assessment can be made and, if deemed necessary, the first dose of PEP medication.

Assess the following to evaluate the eligibility for HIV PEP [48]:

- the timing of the potential exposure,
- the HIV status of the person exposed,
- the nature and risk of the exposure (i.e. needle stick injury, mucous membrane exposure or intact skin exposure,
- the HIV status of the source of the potential exposure.

PEP is not indicated [47, 48]:

- if the source patient is infected with HIV-1 and an exposed healthcare worker is positive for HIV-2; or
- if the exposure does not pose a risk of transmission:
 - exposure of intact skin to potentially infectious body fluids,
 - exposure to non-infectious body fluids (such as faeces, saliva, urine, and sweat),



- exposure to body fluids from a person known to be HIV-negative, unless this person is identified as being at high risk of recent infection
- if the exposure occurred more than 72 hours previously.

A starter pack (or a first dose) of PEP drugs should be offered to individuals who are determined to be at risk as soon as possible, within one hour and not later than 72 hours, after exposure. An HIV test should normally not be a condition of initiating PEP, nor should PEP be delayed until the results of an HIV test become available [47].

6.11.2 Exposure and source patient

Exposure should be assessed for its potential to transmit a bloodborne pathogen (based on the clinical assessment of the exposure and the eligibility for post-exposure prophylaxis).

If testing a source patient of unknown status is possible, it should occur only after obtaining informed consent and should include appropriate pre-test counselling and a referral plan for care, treatment and support. Confidentiality must be maintained throughout the process.

Medical assessment constitutes an emergency for the exposed HCW. Baseline testing for HIV and follow-up testing should form part of the clinical pathway but **should not delay initiating post-exposure prophylaxis where warranted.**

Baseline testing is done at this time to ascertain whether the exposed person has been infected from a previous exposure at the time of the incident.

- After first aid has been completed, baseline testing should occur as soon as possible, but at least within 72 hours following exposure.
- Baseline tests are usually HIV antibody, hepatitis B surface antigen (HbsAg) and hepatitis B and C antibodies.
- The HCW's tetanus immunisation status should be considered.
- Pre-test counselling for HIV should occur before any blood is taken for testing (but blood drawing should not be delayed if an appropriate counsellor cannot be located right away).
- Follow-up retesting for HIV, HBV and HCV should occur at six weeks and three months. There is also a six-month follow up for HIV and HCV only.

Clinical evaluation and baseline testing of the exposed HCW, which should proceed only after pre-test counselling and after obtaining informed consent, should always include:

- an explanation of privacy and confidentiality,
- further explanation of HIV, HBV and HCV infection and its consequences if necessary,
- an explanation of testing, possible results and confirmatory testing,
- an assessment of risk related to past and current sexual and other behaviour,
- an assessment of risk related to the occupational exposure in question,
- an explanation of low transmission risk associated with occupational exposure,
- an assessment of anxiety level and coping mechanisms,
- informed consent for testing,
- informed consent for pregnancy test (if indicated),
- a plan for precautions while awaiting test results (and while on PEP, if indicated): adverse effects of anti-retrovirals (ARVs), safer sexual practices or abstinence, cessation of breast feeding if lactating,
- a list of any other risks identified by sexual and behavioural history,

- a mechanism for support while patient waits for test results, and while on PEP if indicated,
- a review of the sequence of events that preceded the exposure, and provision of exposure risk reduction education in a sensitive and non-judgmental way.

6.11.3 Risk of HIV and other infections following occupational exposure

Data from several studies of HCWs exposed to HIV in the workplace suggest that the risk of HIV transmission after percutaneous exposure to HIV-infected blood is approximately 0.3% (95% confidence interval [CI] 0.2 to 0.5%) [47].

Risks towards the higher range are associated with exposures such as:

- a deep injury,
- visible blood on the “sharp” device causing the injury,
- a hollow-bore needle (as opposed to a solid one),
- injury by a needle that was previously used in the patient’s vein or artery,
- a high viral load on the part of the patient (either acute or late-stage HIV infection or, if being managed at a specialist centre overseas, a known high viral load).

The risk of transmission from a sharp object contaminated with other infected body fluids or tissues is believed to be lower than for exposure to infected blood.

After a mucous membrane (eye, nose or mouth) exposure to HIV-infected blood, the risk is approximately 0.09% (95% CI = 0.006 to 0.5%) [47].

According to the Centers for Disease Control [50], studies indicate that HCWs who sustained injuries from needles contaminated with blood contaminated by HBV, the risk of developing **clinical hepatitis** if the blood was both HBsAg-positive and HBeAg-positive was 22%–31%, and the risk of developing serologic evidence of HBV infection was 37%–62%. By comparison, the risk of developing clinical hepatitis from needles contaminated with HBsAg-positive and HBeAg-negative was 1%–6%, and the risk of developing serologic evidence for HBV infection was 23%–37%.

The risk of hepatitis C infection after percutaneous exposure to infected blood is approximately 1.8%. Infection with hepatitis C following mucous membrane exposure has not been quantified but is thought to be rare.

Post-exposure prophylaxis (PEP) is treatment to reduce the likelihood of HIV, HBV and tetanus infection in HCWs after possible occupational exposure. There is no PEP available for HCV.

6.11.4 Annual review of personal protection equipment guidelines

Due to the rapidly evolving nature of all aspects of HIV/AIDS and other bloodborne pathogens (e.g. diagnosis, treatment and care), these guidelines should be reviewed annually by the HIV/AIDS clinical team in the healthcare facility.

6.11.5 HIV post exposure prophylaxis

Health care workers should have immediate access to PEP, 24 hours a day, seven days a week to be freely dispensed by any hospital (private or public), regardless of the location or type of work they do. The minimum care following potential exposure to HIV should be risk assessment and, if deemed necessary, the first dose of PEP medication.



Table 6.4. Summary of post-exposure management to HIV recommendations [47]

<ul style="list-style-type: none"> • Post-exposure prophylaxis (PEP) is recommended when occupational exposures to HIV occur. • Determine the HIV status of the exposure source patient to guide the need for HIV PEP, if possible. • Start PEP medication regimen as soon as possible after occupational exposure to HIV and continue for four weeks. • New recommendation – PEP medication regimens should contain three (or more) antiretroviral drugs for all occupational exposures to HIV. • Expert consultation is recommended for any occupational exposure to HIV. • Provide close follow-up for exposed personnel that includes counselling, baseline and follow-up HIV testing, and monitoring for drug toxicity. Follow-up appointments should begin within 72 hours of an HIV exposure. • New recommendation – If a newer fourth generation combination HIV p24 antigen-HIV antibody test is utilised for follow-up HIV testing of exposed HCP, HIV testing may be concluded at four months after exposure. If a newer testing platform is not available, follow-up HIV testing is typically concluded at six months after an HIV exposure.
Preferred HIV PEP regimen
Raltegravir (Isentress, ®RAL) 400 mg PO twice daily, plus: Truvada™, 1 PO once daily [Tenofovir DF (Viread®; TDF) 300 mg + emtricitabine (Emtriva™; FTC) 200mg]

Table 6.5. Alternative regimes [47]

Alternative regimes	
Alternative regimes may combine one drug or drug pair from the left column. Prescribers unfamiliar with these agents/regimes should consult physicians familiar with the agents and toxicities.	
Raltegravir (Isentress®; RAL)	Tenofovir DF (Viread®; TDF) + emtricitabine (Emtriva™; FTC); available as Truvada™
Darunavir (Prezista®; DRV) + ritonavir (Norvir®; RTV)	Tenofovir DF (Viread®; TDF) + lamivudine (EpiVir®; 3TC)
Etravirine (Intelence®; ETR)	Zidovudine (Retrovir™; ZDV; AZT) + lamivudine (EpiVir®; 3TC); available as Combivir®
Rilpivirine (Edurant™; RPV)	Zidovudine (Retrovir®; ZDV; AZT) + emtricitabine (Emtriva™; FTC)
Atazanavir (Reyataz®; ATV) + ritonavir (Norvir®; RTV)	
Lopinavir/ritonavir (Kaletra®; LPV/RTV)	
The following alternative is a complete fixed-dose combination regimen and no additional antiretrovirals are needed: Stribild™ (elvitegravir, cobicistat, tenofovir DF, emtricitabine)	

Table 6.6. Alternative antiretroviral agents [47]

Alternative antiretroviral agents for use as PEP only with expert consultation
Abacavir (Ziagen®; ABC)
Efavirenz (Sustiva®; EFV)
Enfuvirtide (Fuzeon™; T20)
Fosamprenavir (Lexiva®; FOSAPV)
Maraviroc (Selzentry®; MVC)
Saquinavir (Invirase®; SQV)
Stavudine (Zerit®; d4T)
Antiretroviral agents generally not recommended for use as PEP
ANTIRETROVIRAL AGENTS GENERALLY NOT RECOMMENDED FOR USE AS PEP
Didanosine (Videx EC ® ddl)
Nelfinavir (Viracept ®NFV)
Tipranavir (Aptivus®; TPV)
Antiretroviral agents contraindicated as PEP
Nevirapine (Viramune ®; NVD)

6.11.6 Timing and duration of PEP

Occupation exposure to HIV should be treated immediately as a matter of urgency. PEP should be started as soon as possible after the injury or exposure, ideally within 72 hours. Although animal studies have indicated that PEP is less likely to be effective after 72 hours post exposure, the interval to which no benefit is gained from PEP in humans is undefined. Therefore, initiating PEP after a longer period (one week) should still be considered for exposures that represent an extremely high risk transmission. Expert advice is recommended.

PEP should be administered for four weeks or 28 days if tolerated [47].

6.11.7 Antiretroviral drugs during pregnancy and lactation

According to the Centers for Disease Control and Prevention, the decision to offer HIV PEP to pregnant or breastfeeding health care workers should be based on the same considerations that apply to any other healthcare worker who sustains an occupational exposure to HIV. The risk of HIV transmission not only poses a threat to the mother but also to the foetus and infant as the risk of mother-to-child HIV transmission is markedly increased during acute HIV infection during pregnancy and breastfeeding [47].

It is advisable, however, to get expert counselling on the risks and benefits of PEP and the selection of antiretroviral drugs in pregnant women.

6.11.8 Obtaining advice

If exposure to drug-resistant HIV has occurred (e.g. if the source patient is on second-line ARVs) or if there are concerns about other aspects of PEP, an expert should be consulted. In such cases, the PEP regimen will be decided on the basis of drugs taken previously by the source



patient, their known or possible resistance to different drugs, and the ARVs available in-country at the time.

Initiation of prophylaxis should not be delayed pending such consultation. In the absence of known resistance in the source patient, the combinations and recommended doses in Table 6.4 should be followed:

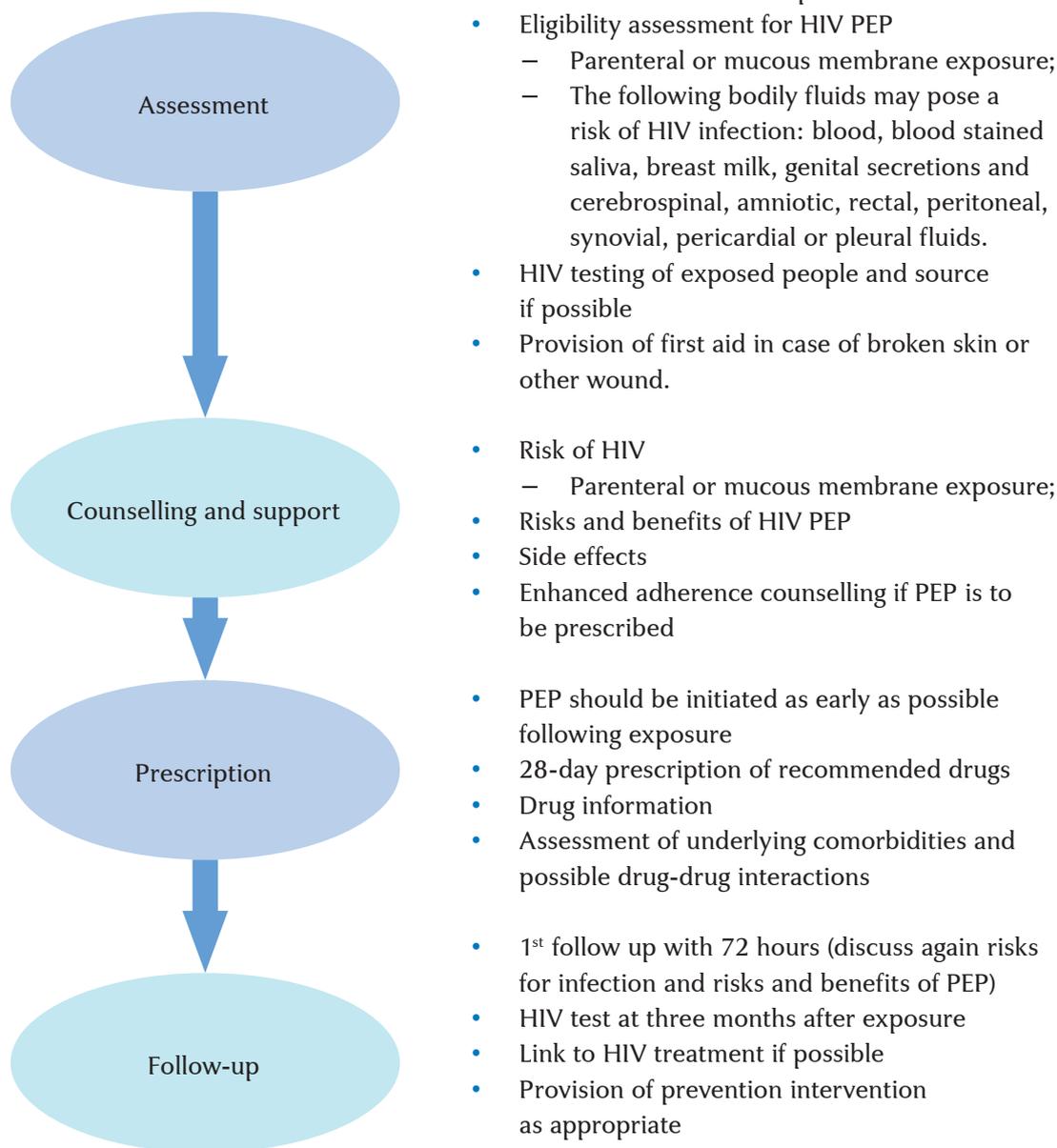


Figure 6.1. Care pathway for people exposed to HIV

6.11.9 Clinical follow-up and counselling

HCWs who have had an occupational exposure to HIV should receive follow-up counselling regardless of whether they received PEP. It is essential to provide follow up for HCWs on HIV PEP within 72 hours post-exposure to provide an opportunity for the HCW to ask questions and for the counsellor to make certain that the HCW understands the risks of infection and the risks and benefits of the PEP [47].

In addition to HIV antibody testing at the time of the injury, exposed HCWs should also undergo repeat testing at six weeks, three months and six months after exposure.

If the HCW sero-converts (acquires HIV infection), this will usually occur two to six weeks after exposure, accompanied by a symptomatic acute retroviral syndrome: an acute mononucleosis-like illness with fevers, sweats, malaise, lethargy, anorexia, nausea, myalgia, arthralgia, headache, sore throat, diarrhoea, lymphadenopathy and rash.

HCWs on PEP should practise safer sex (or abstain from sexual intercourse) until serology is negative at three months post-exposure. Female HCWs who are lactating should consult a specialist regarding cessation of breast feeding while they are taking anti-retrovirals (ARVs).

Occupational exposure to HIV can be a frightening experience and some psychological morbidity (e.g. anxiety, depression, insomnia) and even post-traumatic stress disorder are relatively common among HCWs following such an exposure. Early and frequent follow-up appointments for counselling and clinical review are essential.

Should HCWs become HIV positive, clinical management should follow existing national guidelines, and ongoing counselling and support should be maintained. International guidelines and recommendations for the management of HIV positive HCWs are also available online.

6.11.10 Effectiveness of personal protection equipment in preventing HIV infection following occupational exposure

Factors affecting the likelihood of HIV transmission include the quantity of virus inoculated, the interval between viral inoculation and treatment initiation, treatment duration, and the choice of ARV drugs. Current understanding of the pathogenesis of HIV infection suggests that ARVs should be capable of further reducing the already low rate of infection following occupational exposure, provided treatment is initiated early enough [47].

6.11.11 Special considerations

Where the source person is already on ARVs (especially a second-line or other drug combination), the possibility of HIV drug resistance should be considered. In this situation, expert advice must be sought.

6.11.12 Hepatitis C PEP

There is no HCV prophylaxis to offer HCWs at this time. For hepatitis C, PEP agents (e.g. ribavirin, interferon) are expensive and potentially very toxic. Prevention remains the best way to avoid hepatitis C.

6.11.13 Hepatitis B PEP

Childhood vaccination against hepatitis B is included in the expanded programme on immunisation. Management of possible exposure to hepatitis B should follow existing national



guidelines and protocols but, ideally, all HCWs should already be immune to hepatitis B. Hepatitis B immunoglobulin (HBIG) is available, and vaccination should be given to exposed individuals who have not been previously vaccinated.

Hepatitis B vaccination is 20×g intramuscularly per dose and is administered at 0, 1 and 6 months [50].

Table 6.7 summarises the recommended actions to protect HCWs against occupationally acquired hepatitis B.

Table 6.7. Post-exposure prophylaxis against hepatitis B infection where serological testing and hepatitis B immunoglobulin are available [50]

Healthcare worker	SOURCE PATIENT	
	HBSAg+	Unknown
Unvaccinated		
	HBIG x 1 dose plus hepatitis B vaccine x 3 doses	hepatitis B vaccine x 3 doses
Vaccinated		
Serological “responder” (anti-HBs ≥10 mIU/ml)	No treatment	No treatment
Serological “non-responder” (anti-HBs <10 mIU/ml)	HBIG x 1 dose plus hepatitis B vaccine x 3 doses	If higher risk exposure: HBIG x 1 dose plus hepatitis B vaccine x 3 doses
Antibody status unknown	Test for anti-HBs if available If anti-HBs ≥10 mIU/ml: No treatment If anti-HBs <10 mIU/ml: HBIG x 1 dose plus hepatitis B vaccine x 1 dose	Test for anti-HBs if available If anti-HBs ≥10 mIU/ml: No treatment If anti-HBs <10 mIU/ml: hepatitis B vaccine x 3 doses

Note: Hepatitis B Immune Globulin (HBIG) should be administered soon after the exposure when indicated. It is administered intramuscularly either on the gluteal or deltoid muscle. The dosage for HBIG is 0.06 ml/kg or 500 IU [49, 50].

6.11.14 Tetanus PEP

Tetanus prophylaxis should be recommended, depending on the type of exposure and the exposed person’s past history of tetanus immunisation.

- If less than five years since immunisation, then no tetanus immunoglobulin or tetanus toxoid is necessary.
- If five to ten years since immunisation, a tetanus toxoid booster is recommended.
- If more than ten years since immunisation, both tetanus immunoglobulin and tetanus toxoid are recommended [51].

Table 6.8. Immunisation of healthcare workers

Vaccines	Recommendations
Hepatitis B vaccine	<p>If you do not have documented evidence of a complete blood test that shows you are immune to hepatitis B (i.e. no serologic evidence of immunity or prior vaccination) then you should:</p> <ul style="list-style-type: none"> • get the 3-dose series (dose #1 now, #2 in 1 month, #3 approximately five months after #2). • get anti-HBs serologic tested one or two months after dose #3 [50].
Influenza	Get one dose of influenza vaccine annually
MMR (Measles/Mumps/Rubella)	<p><i>If you were born in 1957 or later and have not had the MMR vaccine, or if you do not have an up-to-date blood test that shows you are immune to measles or mumps (i.e. no serologic evidence of immunity or prior vaccination), get two doses of MMR (one dose now and the second dose at least 28 days later).</i></p> <p><i>If you were born in 1957 or later and have not had the MMR vaccine, or if you do not have an up-to-date blood test that shows you are immune to rubella, only one dose of MMR is recommended. However, you may end up receiving two doses, because the rubella component is in the combination vaccine with measles and mumps.</i></p> <p><i>For HCWs born before 1957 without acceptable evidence of measles, rubella, and mumps immunity. Health-care facilities should consider vaccinating unvaccinated personnel born before 1957 who do not have laboratory evidence of measles, rubella, and mumps immunity; laboratory confirmation of disease; or vaccination with two appropriately spaced doses of MMR vaccine for measles and mumps and one dose of MMR vaccine for rubella. Vaccination recommendations during outbreaks differ from routine recommendations for this group. [54]</i></p>
Varicella	If you have not had chickenpox (varicella), if you have not had varicella vaccine, or if you do not have an up-to-date blood test that shows you are immune to varicella (i.e. no serologic evidence of immunity or prior vaccination) get two doses of varicella vaccine, four weeks apart [53].
TDap (Diphtheria/tetanus-acellular pertussis)	<p>Get a one-time dose of Tpa as soon as possible if you have not received Tpa previously (regardless of when previous dose of Td was received).</p> <p>Get a Td boosters every 10 years thereafter.</p> <p>Pregnant HCWs need to get a dose of Tdap during each pregnancy [51].</p>
Meningococcal	During a serogroup B meningococcal disease outbreak, CDC [52] recommends MenB vaccination for people at increased risk because of the outbreak.

7 SURVEILLANCE FOR INFECTION PREVENTION AND CONTROL

WHO defines surveillance as a systematic collection, analysis and interpretation of health-related data needed for the planning, implementation and evaluation of clinical practice [33]. The specific goals of surveillance may vary somewhat, depending on who is conducting it and the population under study, and may include any or all of the following: (i) establishing baseline or endemic rates of disease; (ii) identification of disease outbreaks or changes in disease trends; (iii) determination of risk factors for or the natural history of specific diseases; (iv) measurement of compliance with established standards; and (v) assessment of the effect(s) of practice changes, new interventions, or new technology.

Surveillance in an infection prevention and public health context aids in the detection of communicable diseases of public health importance that should be reported to health authorities to prevent spread (e.g. tuberculosis, viral haemorrhagic fevers, sexually transmitted infections). Surveillance provides the foundation for immediate preventive actions (e.g. in outbreaks of disease) and directs public health policy. Ultimately, surveillance should generate data that can be applied in some manner to improve care [35].

IPC surveillance:

- provides a baseline for HAIs on agents, host and environment from a range of sources;
- serves as an early warning system for outbreaks and identifies the break-down in IPC;
- documents the impact of an intervention or tracks progress towards specific goals; and
- make improvements to infection prevention and control programme and strategies.

Active surveillance is a core component of the IPC programme and is normally performed by the IPC nurse/officer. It is not, however, recommended to conduct facility-wide surveillance for all areas of the IPC programme. Surveillance should respond to actual needs of the healthcare facility and is often targeted to specific areas and populations and those infections that are preventable.

7.1 Objectives of surveillance

An effective surveillance programme includes a written plan that outlines the goals and objectives of the programme and should be based on a framework that includes several well-defined practices. A written plan also allows for strategic allocation of resources to enable effective and meaningful surveillance, decrease HAI rates, and improve patient safety. Surveillance programmes should be evaluated periodically to ensure that they are effectively meeting the needs of the facility.

The specific objectives of a surveillance programme are:

- to improve awareness for clinical staff and other HCWs (including administrators about HAI and AMR);
- to identify high-risk populations, procedures and exposures;
- to monitor of trends over time;

- to identify possible areas of improvement in patient care, and for further epidemiological studies;
- to detect outbreaks early: and
- to assess the impact of interventions.

7.2 *Surveillance inclusions*

The following may be considered for HAI surveillance:

- specific sites of infection (e.g. bloodstream, surgical site infection, indwelling urinary catheters),
- specific populations (e.g. HCWs who have had an occupational exposure to blood and body substances, neonates),
- specific organisms that can have severe outcomes (e.g. multidrug resistant organisms),
- specific locations (e.g. intensive care units, neonatal intensive care units).

A surveillance programme should include:

- a nationally standardised set of case definitions that are consistently and accurately applied;
- standardised methods for identification of the number of persons developing an infection (numerator);
- standardised methods for detecting the exposed or at risk population (denominator);
- the time period involved; and
- a process for analysis of data and reports, calculation of rates and both numerator and denominator.

HAI rates are developed by three elements:

- numerator – the number of persons developing an infection,
- denominator – the exposed or at risk population,
- the time period involved.

Other surveillance/audits activities can include:

- hand hygiene audits for specific areas, e.g. intensive care units,
- environmental audits on cleaning schedules, colour-coding of cleaning equipment,
- waste management audits,
- audits on specific work practices, such as:
 - the use of surgical antimicrobial prophylaxis; and
 - aseptic manipulation of invasive devices.

7.3 *National IPC surveillance*

At the national level, IPC surveillance activities and responsibilities should include:

- coordination, gathering and documentation of available data on HAI from all levels of health service delivery,
- establishing the priorities for surveillance of infections, pathogens and others,
- establishing what data should be provided to the MHMS and how,
- reporting to interested parties on the national situation of HAI and special events,
- promoting the assessment of IPC practices and other relevant processes in a blame-free organisational culture,



- standardising:
 - case definitions
 - methods of surveillance.

7.4 *Healthcare facility surveillance*

At the health service delivery level, IPC surveillance activities and responsibilities should include [4, 5, 6, 7] the items below:

- They document the situation of HAI and IPC processes in the healthcare facility.
- They ensure that the local objectives of surveillance are aligned with the national objectives.
- They establish the priorities for surveillance according to the scope of care in the facility.
- They establish the minimum registers necessary for medical records used for surveillance purposes and monitor compliance.
- They conduct surveillance, applying national standardised case definitions and methods of surveillance of infections.
- They detect outbreaks and coordinate the response.
- They report HAI and events to the local interested parties and the MHMS as required by regulations.
- They conduct the assessment of IPC practices and other relevant processes in a blame-free organisational culture.

7.5 *Minimum requirements*

Performing accurate and reliable surveillance may be challenging, even in the most well-resourced settings, where multiple data sources are accessible to the surveillance team, information technology services and computer infrastructure are well established, and dedicated trained personnel (i.e. IPC professionals) are present.

The International Federation for Infection Control recommends that, for resource-limited settings that may be lacking in one or more of these dimensions, the following may be considered as minimum requirements for surveillance.

1. Assess the population (hospital patients). Even the most basic surveillance programmes must consider the types of patients receiving care, and the types of services the facility provides, to determine the risks of infection.
2. Select processes or outcomes for surveillance. Identifying and measuring the most important outcomes and limiting process measures to those that are most important in the patient population can conserve time and other resources in limited settings.
3. Use surveillance definitions. For some surveillance activities, collecting limited data may be simpler and more time efficient, with less dependence on other resources.
4. Collect surveillance data. Because data collection can be labour- and time-intensive, and many resource-limited settings do not have access to computerised data, some people may need to be trained to assist with data collection. Severely resource-limited settings may consider conducting repeated point prevalence surveys that can identify high-risk areas requiring more attention, and to monitor HAI or process indicators in these areas. In lieu of ongoing continuous surveillance, sampling or more prolonged periodic surveillance of specific programmes or procedures can also save time and resources. For example, SSI or ICU surveillance might be conducted for only three months each year instead, recognising that seasonal or other unexpected variation may be missed.

5. Analyse and interpret data. In smaller or more basic surveillance programmes, data analysis can be simplified to provide only the most important results. Risk stratification may not be feasible for various reasons (e.g. missing data, or inadequate training or resources) and can be omitted, although this may limit comparisons with other organisations or published benchmarks.
6. Report and use surveillance information. In any system, it is critical that surveillance information is provided to and used by the relevant stakeholders; failure of either renders the surveillance programme meaningless.
7. Evaluate the programme. Surveillance activities should be evaluated periodically in any surveillance programme. At a minimum, assessment of the acceptability of the surveillance programme, the quality of the data, and any changes in the patient population that affect the relevance of the surveillance programme should be conducted.
8. Appropriately trained investigators.
9. Standardised methodology.
10. Risk-adjusted rates for comparison.

7.6 Methods of surveillance

‘Passive surveillance’ with reporting by individuals outside the IPC team (laboratory-based surveillance, extraction from medical records post-discharge, infection notification by physicians and nurses) is of low sensitivity and should not be performed. Therefore, some form of active surveillance for infections (referred to as prevalence or incidence studies) is recommended, such as:

- active surveillance (prevalence and incidence studies); and
- targeted surveillance (site, unit, priority-oriented) [7, 36].

7.6.1 Prevalence study

Infections in all patients hospitalised at a given point in time are identified (point prevalence) in the entire facility, or in selected units. Typically, a team of trained investigators visits every patient of the hospital on a single day. The outcome measure is the prevalence rate.

Prevalence rates are influenced by duration of the patient’s stay (infected patients stay longer, leading to an overestimation of patient’s risk of acquiring an infection) and duration of infections. Another problem is determining whether an infection is still ‘active’ on the day of the study. In small hospitals, or small units, the number of patients may be too few to develop reliable rates, or to allow comparisons with statistical significance.

The prevalence of a HAI is the proportion of patients who have active (new and previously diagnosed) HAI in a defined patient population during the surveillance period. These may be new cases, or cases that developed before the survey.

Prevalence (%): $\frac{\text{number of new and existing cases of specific HAI during the specified survey period}}{\text{total number of patients surveyed for specific HAI during the specified survey period}} \times 100$

In general, prevalence increases the longer the duration of the disease. Prevalence can be assessed at one single point in time (point prevalence) or over a defined time period (period prevalence). Since prevalence rates include new and existing infections, these cannot be compared with incidence rates, which include only new infections.



7.6.2 Incidence study

Prospective identification of new infection (Incidence surveillance) requires monitoring of all patients within a defined population for a specific time period. Patients are followed throughout their stay, and sometimes after discharge (e.g. post-discharge surveillance for surgical site infections). This type of surveillance provides attack rates, infection ratio and incidence rates (It is more effective in detecting differences in infection rates, following trends, linking infections to risk factors, and for inter-hospital and inter-unit comparisons).

Incidence surveillance is more labour-intensive than a prevalence survey, more time-consuming, and more costly. Therefore, it is usually undertaken only for selected high-risk units on an ongoing basis (i.e. in intensive care units), or for a limited period, focusing on selected infections and specialties (i.e. three months in surgery).

Common priority areas can include:

- ventilator associated pneumonia,
- surgical site infections,
- intravascular device associated infections,
- multi-resistant organisms (MRO) (MRSA, extended spectrum beta-lactamase producing organisms).

The incidence of a HAI is a specific rate that represents the occurrence (number) of new cases of a disease (e.g. a specific HAI) occurring in a defined patient population during a defined period. All individuals in the population being surveyed must be at risk of developing the outcome. To calculate incidence, the number of patients at risk of the specific HAI during the surveillance period forms the denominator:

$$\frac{\text{number of patients diagnosed with new specific HAI during surveillance period}}{\text{number of patients at risk of the specific HAI during the surveillance period}} \times 100$$

7.7 Calculating rates of HAI

Rates are obtained by dividing a numerator (number of infections or infected patients observed) by a denominator (population at risk, or number of patient-days of risk). The frequency of infection can be estimated by prevalence and incidence indicators.

For MRO surveillance, the three main indicators used are:

- the percentage of antimicrobial resistant strains within isolates of a species, e.g. percentage of *Staphylococcus aureus* resistant to methicillin (MRSA);
- the attack rate (i.e. number of MRSA/100 admissions); and
- the incidence rate (MRSA/1000 patient-days).

For both prevalence and incidence rates, either the global population under surveillance, or only patients with a specific risk of exposure, may be the denominator.

Incidence rates are encouraged, as they take into account the length of exposure, or the length of stay (and/or follow-up) of the patient, giving a better reflection of risk and facilitating comparison. Either patient-day rates or device-associated rates can be used.

7.7.1 Organisation for efficient surveillance

HAI surveillance includes data collection, analysis and interpretation, feedback leading to interventions for preventive action, and evaluation of the impact of these interventions. It is important that all those involved in surveillance undergo training, including training of HCWs responsible for data collection. A written HCF protocol must describe the methods to be used, the data to be collected (e.g. patient inclusion criteria, definitions), the analysis that can be expected, and preparation and timing of reports, as well as roles and responsibilities [4, 6, 7, 33, 34].

7.7.2 Data collection and analysis

Data collection requires multiple sources of information as no method, by itself, is sensitive enough to ensure data quality. Trained data extractors performing active surveillance will increase the sensitivity for identifying infections.

Techniques for case-finding include:

- ward activity
 - the presence of devices or procedures known to be a risk for infection (indwelling urinary and intravascular catheters, mechanical ventilation, surgical procedures)
 - record of fever or other clinical signs consistent with infection
 - antimicrobial therapy
 - laboratory tests
 - medical and nursing chart review
 - patient interview
- laboratory reports
 - isolation of microorganisms potentially associated with infection, antimicrobial resistance patterns, serological tests. Microbiology laboratory reports have low sensitivity because cultures are not obtained for all infections, specimens may not be appropriate, some infectious pathogens may not be isolated (e.g. virus), and the isolation of a potential pathogen may represent colonisation rather than infection (e.g. for surgical site infections, pneumonia). Laboratory reports are, however, reliable for urinary tract infection, bloodstream infections,
- other diagnostic tests, e.g. white blood counts, diagnostic imaging, autopsy data
- discussion of cases with clinical staff during periodic ward visits.

Continuing collaboration among IPC staff, the laboratory (where available) and clinical units will facilitate an exchange of information and improve data quality. The patient is monitored throughout the hospital stay, and in some cases (e.g. for surgical site infections), surveillance includes the post-discharge period. The progressive reduction of the average length of stay with recent changes in healthcare delivery increases the importance of identifying post-discharge infections.

8 INFECTIONS BY SELECTED DISEASES

This section is dedicated to selected diseases that are either present in the region or may become present and are of importance to healthcare settings.

8.1 COVID-19 Virus

Coronavirus disease 2019 (COVID-19) is caused by SARS-CoV-2, a novel coronavirus that was first detected in Wuhan, China in December 2019. Genetic sequencing of the virus suggests that it is a beta-coronavirus, closely linked to the SARS virus. By way of definition, a symptomatic COVID-19 case is a person who has developed signs and symptoms suggestive of COVID-19 [1, 2,12,27,36].

8.1.1 Mode of transmission

The COVID-19 virus is a respiratory disease that is transmitted via droplets through close contact with infected individuals and bodily fluids following coughing and sneezing. These droplets may land on objects and surfaces around the infected person, and the virus can be contracted by touching these contaminated objects or surfaces. The main route of entry into a host is via the eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs, sneezes, or exhales droplets. Airborne transmission may be possible in specific circumstances and settings, such as in the ICU, in which procedures or support treatments that generate aerosols are performed. Examples are: endotracheal intubation, bronchoscopy, open suctioning, administration of nebulised treatment, manual ventilation before intubation, turning the patient to the prone position, disconnecting the patient from the ventilator, non-invasive positive-pressure ventilation, tracheostomy, and cardiopulmonary resuscitation [1, 2,12,27,36].

Incubation period averages five or six days but ranges from two to 14 days.

Period of infectiousness

An infected person may be infectious one to three days before the onset of symptoms and up to 14 days after the onset of symptoms.

8.1.2 IPC measures for COVID-19

The application of **standard precautions** are the basic infection prevention and control measures that should be applied in all areas, including outbreak situations. These measures are necessary to reduce the risk of transmission of the COVID-19 virus from both recognised and unrecognised sources.

The elements of standard precautions are hand hygiene, use of PPE according to risk assessment, respiratory hygiene, safe injection practice, injury prevention, sharps management, waste management, environmental cleaning, safe handling, cleaning and disinfection of patient care equipment, and safe handling of soiled linen.

For suspected or confirmed COVID-19 patients, standard precautions should be applied at all times with the addition of contact and droplet precautions. Airborne precautions should be applied when performing aerosol generating procedures (AGPs): tracheal intubation or extubation, manual ventilation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, open suctioning, etc. All AGPs must be performed in an adequately ventilated room, that is, natural ventilation with airflow of at least 160 L/s per patient, or in negative pressure rooms with at least 12 air changes per hour and controlled direction of air flow when using mechanical ventilation [12].

Basic IPC measures to prevent the spread of COVID-19 include [12]:

- isolation of suspected and confirmed COVID-19 patients with full implementation of standard, droplet and contact precautions and airborne precautions for AGPs;
- regularly cleaning your hands with an alcohol-based hand rub or washing with soap and water;
- the practice of good respiratory hygiene by covering the mouth and nose with bent elbow or tissue when coughing or sneezing and disposing of the used tissue immediately;
- effective use of personal protective equipment (PPE);
- thorough cleaning and disinfecting of environmental surfaces; and
- maintaining physical distance of at least one metre.

Hand hygiene

Hand hygiene is mandatory and includes washing with soap and water or the use of an alcohol-based hand rub. The appropriate steps must be followed to achieve effective hand hygiene. This includes ensuring washing with soap and water for 40–60 seconds when hands are visibly soiled, or the use of alcohol-based hand rub for 20–30 seconds when hands are not visibly soiled.

The five moments of hand hygiene should always be observed.

Respiratory hygiene

Healthcare facilities should promote respiratory hygiene by:

- ensuring that patients with fever and cough are seated away from others in common waiting areas (ideally at least three feet/1.5 metres from others);
- ensuring that appropriate supplies are available for patients to adhere to respiratory hygiene and cough etiquette;
- promoting the use of disposable tissues (if available) as opposed to using handkerchiefs;
- making masks available in waiting areas to reduce the risk of infection transmission;
- providing dispensers of alcohol-based hand rubs with instructions for their use in waiting areas during an influenza outbreak;
- educating patients, family members and visitors on the importance of covering their mouth and nose with a tissue to help prevent the transmission of COVID-19 virus and other respiratory viruses;
- making available appropriate garbage bins (pedal operated) or open bins in waiting areas for disposal of used tissues;
- posting signs requesting that patients and family members with acute febrile respiratory illness use respiratory hygiene and cough etiquette; and
- educating patients about spitting and, where possible, provide containers/bags/bowls for patients to spit into.



8.1.3 IPC management for airway management [37]

Airway management is a high-risk procedure for contact, droplet or aerosol-based transmission. Coughing, positive pressure ventilation, laryngoscopy, tracheal intubation, bronchoscopy, open tracheal suctioning, and front of neck airway access can generate aerosols during airway intervention. During this time staff are also in close proximity to the patient's airway.

Considerations to minimise health care worker infection

- Intubation should preferentially be performed in a negative pressure room or, if not available, then a single room with open windows. If no single rooms are available, ensure maximum distance possible from unprotected staff and patients.
- Airborne and contact precautions are required for all staff in assisting with intubation.
- If there are large numbers of patients with COVID-19 admitted, consider the use of a dedicated Covid-19 airway trolley that has designated pre-prepared intubation equipment. This may avoid need for a main airway trolley to be taken into a patient's bed space and avoid contamination. The dedicated trolley should be kept close to the area of the ward where COVID-19 positive patients are cared for.

Other considerations

- A viral filter should be placed between the mask and bag in the bag-valve-mask (BVM) setup.
- The duration of use of BVM should be minimised.
- A two-handed BVM technique should be used to minimise leak.
- Avoid open airway suctioning. It is not recommended because it involves breaking the ventilator circuit and exposes staff to aerosols. If closed suction systems are not available, the principles of open airway suctioning would be the same as for all AGPs. It should be carried out only when essential/minimised as much as possible. Only those staff who are needed to undertake the procedure should be present and they should wear airborne + contact precautions. It should be carried out in a single room with the doors shut, ideally a negative pressure room, or a room with windows open.
 - Post-intubation – Do not ventilate the patient until the endotracheal cuff is inflated.
 - Suctioning can be performed post-intubation using a closed-circuit suctioning technique.
 - The laryngoscope should be placed in a sealed bag immediately after use and sent for sterilisation (if not single use), or cleaned with detergent and water, dried, and wiped with 70% alcohol.

8.1.4 Personal protective equipment

PPE is required by healthcare workers caring for patients with suspected or confirmed COVID-19 virus to prevent transmission to themselves and others. The effective use of PPE strongly depends on adequate and regular supplies, adequate staff training on how to put on and remove PPE, disposal of PPE, and appropriate hand hygiene. Refer to Figures 4.3 and 4.4 on the sequence to follow to put on and remove PPE safely [16].

For suspected or confirmed COVID-19 cases, the required PPE for staff are:

- disposable long-sleeved, fluid-resistant gown;
- gloves;

- N95/P2 respirator mask for aerosol generating procedures (AGP) or surgical mask; and
- protective eyewear (goggles or face shield).

8.1.5 Environmental cleaning (refer to Annex 7: How to make chlorine solutions for environmental disinfection) [21]

All housekeeping staff should be required to attend mandatory training in IPC, including how to put on and safely remove PPE.

The respiratory droplets from a COVID-19 case may land on objects and surfaces around the infected person, and the virus can be contracted by touching these contaminated objects or surfaces. Therefore, frequent cleaning and disinfection is very important in preventing further transmission of the COVID-19 virus. Environmental surfaces inside and outside patient rooms; non-critical medical equipment, such as blood pressure cuffs, cardiac monitors; and highly touched surfaces, such as tables, counter tops, light switches all need to be cleaned and disinfected.

Cleaning with neutral detergent, followed by a chemical disinfectant can effectively inactivate the COVID-19 virus. Environmental cleaning requires a two-step system.

- **First**, thoroughly clean all hard surfaces and frequently touched areas with a solution of water and normal neutral detergent. Allow to air-dry completely.
- **Second**, disinfect all cleaned surfaces with a household bleach solution, 0.5% chlorine solution, or 70% alcohol.

Cleaning equipment and supplies

- Isolation rooms should have their own dedicated cleaning equipment and supplies, which should be kept in that isolation room/area.
- Cleaning equipment, including mop heads, should be laundered using hot water and disinfected with sodium hypochlorite and completely dried before re-use.
- Buckets should be emptied and cleaned with a new batch of chlorine bleach solution and allowed to dry completely before re-use.
- The use of spray bottles or equipment that might generate aerosols during usage should be avoided. Chemicals in aerosols may cause irritation to eyes and mucous membranes. Containers that dispense liquid such as 'squeeze bottles' can be used to apply detergent/disinfectants directly to surfaces or to cleaning cloths with minimal aerosol generation.
- Cleaning cloths should be laundered and dried between use. In outbreak situations, it is recommended that disposable cloths are used

8.1.6 Waste and laundry management

- All healthcare waste generated in a facility with COVID-19 patients is considered infectious and should be collected safely in clearly marked lined containers and sharps boxes.
- All waste handlers should be trained in appropriate use of PPE and IPC measures and must wear the following PPE: boots, long-sleeved disposable gown, heavy duty rubber gloves, eye goggles/face shield and a mask.
- Laundry from COVID-19 patients should ideally be machine-washed with warm water and laundry detergent at 60–90°C. If machine washing is not possible, linens can be soaked in hot water and soap in a large drum using a stick to stir them, taking care to avoid splashing. Following this, the linen should be soaked in 0.05% chlorine for approximately 30 minutes and then rinsed with clean water and allowed to dry fully, if possible in sunlight.



8.1.7 Handling of bodies of the deceased with confirmed or suspected COVID-19 [38, 39]

- Mortuary staff must be trained putting on and removing PPE and how to appropriately perform hand hygiene. The following PPE must be worn by anyone who has direct contact with the deceased:
 - face mask (surgical mask),
 - eye protection (for example, safety glasses/goggles or face shield),
 - long-sleeved gown that is fluid resistant,
 - gloves (non-sterile).
- A separate morgue is not required but a dedicated area should be allocated within the mortuary refrigerator for COVID-19 bodies. The area dedicated for COVID-19 can be separated by tape or rope and clearly marked for COVID-19.
- Where possible, mortuaries should have procedural arrangements to segregate clean and dirty areas.
- Store the body of a deceased person with suspected or confirmed COVID-19 in a leak resistant body bag if available and clearly label it as containing COVID-19, e.g. **Risk of COVID-19 – Handle with care**. If no body bag is available, wrap the body in a sheet or cloth and attach the label.
- Decontaminate the casket with sodium hypochlorite before issuing it to the family for burial
- Belongings of the deceased (non-clothing items) should be handled with gloves and cleaned with neutral detergent, followed by disinfectant of at least 70% ethanol or 0.5% (1000 ppm) bleach before returning them to the next of kin.
- The clothing items of the deceased person should be handled with gloves and bagged. The outside of the bag should be wiped with 70% alcohol or 0.5% (1000 ppm) bleach before returning it to the next of kin.
- Family viewing should be arranged and allowance made for a few family members to view the body only; no touching or kissing of the body should be allowed. Families should use standard precautions during and after viewing, including hand hygiene with either hand washing or hand sanitiser.
- Regular cleaning of the mortuary must be carried out using a two-step clean:
 - Clean with soap and water, allow to dry.
 - After drying, disinfect the surface or objects with disinfectant concentration of 0.5% (5000 ppm) sodium hypochlorite (bleach) and allow to dry.

8.2 Dengue fever, malaria and leptospirosis

An awareness of dengue fever, malaria and leptospirosis and their prevention, together with the effective control of mosquito and vermin breeding, underpins successful control of these diseases and many others. Good workplace housekeeping and institutional management lessens the presence of rodents and insects in the healthcare facility and reduces the prospect of disease and contamination to patients and staff. It is also important that environmental health officers are involved in preventive activities in hospitals during peak periods of the diseases mentioned below.

8.2.1 Dengue fever

The dengue virus is transmitted by female mosquitoes mainly of the species *Aedes aegypti* and, to a lesser extent, *Ae. albopictus*. These mosquitoes are also vectors of chikungunya, yellow fever and Zika viruses. The main species responsible for transmission of dengue fever and dengue haemorrhagic fever are *Aedes aegypti* and *Aedes albopictus* [55]. *Aedes aegypti* breeds

inside and outside buildings in artificial containers that store water (e.g. pot plants, water storage drums). *A. albopictus* can breed in scant amounts of water and in naturally occurring water collection areas such as tree holes. When dried under natural conditions, *Aedes* sp. eggs remain viable for six months. Transmission of the dengue virus may be either immediate (if the mosquito's blood meal is interrupted and it changes host) or delayed (occurring one week after feeding on an infected host when the virus load in the mosquito's salivary gland is high). The virus is transmitted to humans through the bites of infected female mosquitoes, primarily the *Aedes aegypti* mosquito. Other species within the *Aedes* genus can also act as vectors, but their contribution is secondary to *Aedes aegypti* [55].

8.2.2 Suspicion of a dengue outbreak

A sudden increase in the number of patients suffering from an undiagnosed febrile illness is characterised by:

- high fever for two to seven days;
- failure of cases to respond to treatment for commonly occurring febrile illnesses in the affected area;
- unexplained deaths with or without haemorrhagic event within one week of onset of febrile illness;
- febrile patients presenting with one or more haemorrhagic events (petichiae, epistaxis, gum bleeding, haematemeses or melena); and
- febrile patients remaining ill despite drop in temperature; the clinical condition deteriorates with development of cold and/or clammy skin, drowsiness and restlessness.

8.2.3 Dengue prevention and control activities

Identification and elimination of actual and potential breeding sites and sites that harbour adult mosquitoes is very important.

In healthcare facilities, the following receptacles have the potential to store water, and thus breed mosquitoes:

- flower vases,
- disused toilet cisterns and pans,
- sterilisers and other equipment that are out of service,
- receptacles used for collecting and storing water:
 - leakage from sink plumbing
 - leaking roofs
 - water for hand washing during water shortages.

A good housekeeping policy should be developed and rigidly implemented.

Outdoors, the following measures should be taken.

- Cover all receptacles used for water storage.
- Implement solid waste management in accordance with hospital or healthcare facility policy – uncovered waste such as bottles and cans can fill with water and promote mosquito breeding.
- Promote the basic rule of “reduce, recycle, reuse”.
- Remove features that promote the stagnation of water.
- Modify architectural features that promote the stagnation of water.
- Remove accumulated debris, such as tires and abandoned cars.
- Control overgrown vegetation within a 100 m radius of every building.



Long-term measures to minimise exposure to mosquitoes

- Screen all windows.
- Promote the use of personal bed nets for facilities without screens.
- Pay meticulous attention to self-closing doors to minimise migration of mosquitoes in high patient/staff density areas.
- Encourage personal protection for all patients and hospital employees who are on healthcare facility premises at peak biting times (i.e. early morning and evenings).

Measures to minimise in-house transmission during a dengue epidemic

- Require the use of (preferably insecticide-impregnated) mosquito nets by patients admitted to the healthcare facility in the acute phase of dengue infection.
- Encourage the use of insect repellent preparations by staff and patients, although continuous repellent use is not recommended (to avoid toxicity).
- Use of repellent to coincide with peak biting times.

Note: In areas occupied by patients and HCWs, use only electronic mosquito destroyers, mosquito coils and household insecticide sprays. Professional insecticide treatment of unoccupied and/or dead spaces and the external environment should be restricted to the use of available space spraying techniques.

Awareness of dengue fever and its prevention, together with the effective control of vector breeding, underpins the successful control of the disease. Every employee of the healthcare facility should attend a minimum of two hours of dengue-related education and training during a 12-month period.

Every patient admitted to a healthcare facility during dengue high-risk periods should be counselled on admission and provided with an information brochure (where available) on dengue fever and personal protection measures.

Dengue awareness is to be integrated in other health education activities conducted at all service delivery points in the healthcare facility.

8.3 Malaria

Malaria is caused by parasites belonging to the genus *Plasmodium* parasites and spreads from person to person through the bites of infected female *Anopheles* mosquitoes, called malaria vectors. There are five parasite species that cause malaria in humans, and two of these species – *P. falciparum* and *P. vivax* – pose the greatest threat. The common initial symptoms – fever, headache, chills and vomiting – appear 10–15 days after a person is infected. If not treated promptly with effective medicines, malaria can cause severe illness that is often fatal [56].

8.3.1 Malaria prevention

All of the important vector species bite between dusk and dawn. The intensity of transmission depends on factors related to the parasite, the vector, the human host, and the environment. *Anopheles* mosquitoes lay their eggs in water, which hatch into larvae, eventually emerging as adult mosquitoes. The female mosquitoes seek a blood meal to nurture their eggs. Each species of *Anopheles* mosquito has its own preferred aquatic habitat. For example, some prefer small,

shallow collections of fresh water, such as puddles and hoof prints, which are abundant during the rainy season in tropical countries [56].

The main objective of malaria vector control is to significantly reduce both the number and rate of parasitic infections of clinical malaria by controlling malaria-bearing mosquitoes and reducing and/or interrupting transmission. Two forms of vector control are: insecticide-treated mosquito nets and indoor residual spraying that are effective in a wide range of circumstances. Vector control is achieved in the following ways.

- **Indoor residual spraying (IRS) of a long-acting insecticide.** This involves spraying the inside of housing structures with an insecticide, typically once or twice a year. To confer significant community protection, IRS should be implemented at a high level of coverage [56].
- **Using long-lasting insecticidal nets,** which can be complemented by other methods (e.g. larval control activities). Sleeping under an insecticide-treated net (ITN) can reduce contact between mosquitoes and humans by providing both a physical barrier and an insecticidal effect. Population-wide protection can result from the killing of mosquitoes on a large scale where there is high access and usage of such nets within a community[56].
- **Education** on malaria by HCWs.

8.4 *Leptospirosis*

Leptospirosis is an acute febrile disease caused by bacteria that affects humans and other animals. It is caused by bacteria of the genus *Leptospira*. In humans, it can cause a wide range of symptoms, some of which may be mistaken for other diseases. Some infected persons, however, may have no symptoms at all. Without treatment, leptospirosis can lead to kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, respiratory distress, and even death [57].

Leptospirosis is spread by contact with urine from cattle, dogs, mongooses, pigs, rats and from water or soil contaminated with the urine from these animals. Outbreaks occur among those exposed to stagnant and slow-flowing water contaminated by the urine of domestic or wild animals. Entry of *Leptospira* bacteria into the human body occurs by penetration of intact, diseased and damaged skin.

8.4.1 Symptoms of leptospirosis

Symptoms of this disease are fever, headache, chills, severe malaise, vomiting and muscle pains. As the disease advances, the liver, kidneys, blood and brain are affected. Involvement of the liver and kidneys may cause death from organ failure. Leptospirosis is a deadly disease if left unattended, although it carries a good prognosis if detected and treated early.

Suspicion of a leptospirosis outbreak (clinical case definition):

- high fever of sudden onset
- severe headache
- severe myalgia (especially in thighs, calves and loins)
- conjunctival suffusion (red eyes).



8.4.2 Leptospirosis control and prevention activities

Measures to control and prevent leptospirosis

- Avoid swimming or wading in water that may contain the *Leptospira* bacteria.
- Wear protective gloves and boots while working in areas suspected of having been exposed to the bacteria (e.g. farms, abattoirs, rivers, ponds, sewage plants).
- Eliminate rats and mice in homes, schools and other buildings.
- Protect food and drinking water from rats and domestic animals.
- Dispose of rubbish properly.

Controlling rodents, insects and related pests that live in close association with humans is essential to public health. The presence of rodents and insects within and around healthcare premises is a measure of the status of workplace housekeeping and institutional management, and serves as a yardstick for implementation and evaluation of control programmes.

While a detailed discussion of vermin control is beyond the scope of this document – for complete advice, an expert in pest control should be consulted – the following general rodent and insect control measures should be taken:

- Food storage, preparation, delivery and consumption areas should be structurally rodent and insect proof.
- Refuse bins with a tight-fitting lid should be provided, and bins should be properly cleansed after daily disposal.
- All internal refuse bin storage areas should be fully screened or rodent proof.
- Food storage and preparation areas should be cleaned monthly.
- Carry out monthly pest control activities (e.g. setting out poison baits).

Outdoors, control measures

- Control overgrown weeds within a 100 m radius of all hospital buildings.
- Screen external garbage bin storage areas from insects, rodents and other animals.
- Install grating within roof gutters and down pipe connectors.
- Install grating to all sub-drainage inlets.
- Conduct a monthly inspection of all drainage and sewer lines, inspection chambers and manhole covers.
- Remove excess debris (e.g. woodpiles, car parts) that may provide shelter for vermin.

9 OUTBREAK INVESTIGATION AND MANAGEMENT

WHO defines an outbreak as an unusual or unexpected increase in cases of a known nosocomial infection or the emergence of cases of a new infection [41]. When an outbreak of an infectious agent is identified in acute healthcare settings, the IPC team should be notified, as well as hospital management, so that the IPC outbreak management committee (OMC) can be set up to promptly investigate and appropriately manage the outbreak. All outbreaks should be investigated, reported and managed because of their importance in terms of mortality, morbidity, costs, litigation issues and institutional image [7, 40].

Surveillance is key to rapid recognition of outbreaks and ongoing monitoring of clusters of unexpected increases of cases of known nosocomial infections.

Each healthcare facility should have an outbreak management plan which should ideally be developed under the chairperson of the IPC committee. Its membership may include:

- chairperson ICC,
- IPC officer,
- infectious diseases physician and/or microbiologist,
- head of department and nursing representative where the outbreak has been identified,
- housekeeping,
- administrator,
- other relevant stakeholders,
- public health representative when appropriate e.g. for notifiable diseases.

Table 9.1. Steps in outbreak investigation (see checklist in Annex 8) [7]

Steps	Activities/Tasks	Responsibility
Step 1. Notification of outbreak by HCW		
Determine if there is a real outbreak.	<ul style="list-style-type: none"> • Establish single comprehensive case list. • Collect relevant clinical or environmental specimens for laboratory analysis. Establish likely source and mode of transmission	IPC officer and laboratory staff
Determine if immediate IPC measures are needed.	<ul style="list-style-type: none"> • Reinforce standard precautions and implement transmission-based precautions 	IPC officer and HCWs
Notify and communicate outbreak	<ul style="list-style-type: none"> • HCWs where outbreak has been identified • Head of healthcare facility • Chairperson of ICC & IPC nurse 	IPC nurse HCW OMC
Formation of outbreak management team	Chair ICC to convene meeting	OMC members Head of health care facility

Steps	Activities/Tasks	Responsibility
Step 2. Verify diagnosis and confirm that an outbreak exists		
Confirm if there are more cases than expected number of cases.	<ul style="list-style-type: none"> Review and confirm lab data and clinical diagnosis 	Lab staff Clinicians with IPC Nurse
Develop draft outbreak definition	<ul style="list-style-type: none"> Review all clinical patient notes; Are there more cases identified? Consider epidemiology of cases, are there two or more cases linked? 	OMC
Step 3. Establish case definition and find cases		
Confirm outbreak case definition	<p>Confirm cases definition in the following categories:</p> <ul style="list-style-type: none"> confirmed probable suspect <p>Case definition should include:</p> <ul style="list-style-type: none"> Clinical information about the disease or infectious agent Characteristics of affected people. Location of the outbreak. Time period associated with the onset of illness under investigation. 	OMC
<p>Collect data (line list): Find, count and tabulate cases</p> <p>Create epidemic curve No. of cases on y axis Time on x axis</p>	Gather information on time (onset of illness), demographics and clinical information, location and other relevant information	OMC
Reinforce IPC measures	<ul style="list-style-type: none"> Appropriate precautions (transmission based) implemented Enhanced two-step cleaning with appropriate disinfectants Isolation and cohorting of cases Screening of cases with isolation and cohorting of cases Restrict movement of staff 	IPC staff with HCWs
Step 4. Develop hypothesis		
Analyse data based on epi curve	<ul style="list-style-type: none"> Form hypothesis on the cause of the outbreak Calculate attack rates Confirm factors common to all or most cases Test and review hypothesis of cause collect further clinical or environmental specimens for laboratory analysis <p>Ascertain source and mode of spread: look at changes which may have affected the rate of infection, new tests, new staff, new procedures, nurse patient ratio, etc.</p>	OMC

Steps	Activities/Tasks	Responsibility
Step 5. Ongoing measures for infection prevention and control		
Evaluate ongoing measures to prevent further illness	Enhance standard and transmission-based precautions	OMC
Step 6. Communicate findings		
Written report on methodology	Include: <ul style="list-style-type: none"> • Factors leading to outbreak, timelines and actions • Recommendations for prevention of similar outbreak • Declare outbreak over with date 	OMC

Adapted from *Australian Guidelines for the Prevention and Control of Infection in Healthcare*

10 FOOD SAFETY

The kitchen area plays an important role in the prevention of infection. Cleanliness and safe food preparation and storage practices are critical to:

- prevent outbreaks of food-borne illness among patients;
- minimise microbiologic contamination of food by using appropriate food handling techniques during the preparation of food; and
- protect food from contamination by insects, rodents and moisture.

10.1 Food services hygiene

During food preparation, all kitchen staff should wear appropriate protective clothing such as waterproof or fabric aprons. If fabric aprons are used, the aprons should be changed after each task and before leaving the kitchen area. Staff should also wear clean hats or hairnets that completely cover the hair while preparing food. It is advisable for staff to keep an extra clean uniform on hand to change into, in case of excessive perspiration. This may particularly apply to cooking staff.

Some other food service hygiene practices are listed below.

- Wash hands before handling food or utensils and wear plastic seamed gloves when appropriate.
- Wash hands and clean nails after:
 - arriving for work;
 - using the toilet;
 - handling any foods;
 - having contact with unclean equipment and work surfaces, soiled clothing and dishcloths; and
 - removing gloves.
- Coughing and sneezing near food or dishes should be avoided. Where necessary, disposable tissues (rather than a handkerchief) should be used to cover the nose and mouth; hands should be washed immediately.
- Hands and fingers should be kept away from hair and face where food contaminant organisms can be picked up and transmitted to food.
- Tongs, forks and spoons should be used when preparing foods to minimise hand contact. Cracked and chipped crockery should be discarded.
- Food should **not** be tasted with the ladle or spoon used in food preparation. Utensils used for tasting should be thoroughly washed between tastes, or disposable utensils used.
- Work areas, surfaces and utensils must be cleaned between different preparation tasks.
- Plastic gloves are to be worn when direct contact is made with food that is to be consumed without further cooking.
- Food service staff must have clean fingernails. Wearing rings and nail polish should be discouraged.
- Employees suffering from infectious diseases should be excluded from duty. (Refer to Section 6.9 on staff work restrictions). If staff with mild respiratory infections are allowed to work, they should wear surgical masks while preparing food.
- There should be a dedicated hand-washing basin within the food preparation and cooking area.

10.2 *Preparing and serving food*

To prevent contamination of food during preparation and serving [42, 43]

- Staff suffering from diarrhoea should not handle food or have contact with patients until they have been symptom free for more than 24 hours.
- Do not allow staff with infections (sore throat, uncovered skin or wound infections, nausea or vomiting, or diarrhoea) to handle food or equipment.
- Raw food and cooked food should always be prepared separately, using separate equipment, including utensils, bowls and cutting boards (use colour-coded cutting boards).
- Clean benches and equipment properly before, during and after food preparation.
- Wash hands before and after handling any food.
- All unused food returned to the kitchen after the service should be discarded. Do not serve leftovers.
- Single-use disposable gloves should be worn to handle foods that will not receive any further heat treatment (i.e. cooked meats/salad vegetables).

The items and equipment needed for the safe preparation of foods include:

- soap for hand washing
- adequate water supply (hot water is best)
- adequate supply of equipment for preparing and serving food
- smokeless stove or ventilated cooking area.

The following procedures should be followed when preparing and serving food.

- Wash hands thoroughly with soap and water before preparing and serving food. When available, wear gloves while handling food.
- Minimise hand contact with food by providing suitable equipment for food preparation and serving.
- Cut fruits and vegetables on a different surface than from that used for meat preparation.
- Cook foods on a smokeless stove or in a well-ventilated cooking area to prevent smoke inhalation.
- Serve food as soon as possible after cooking.

10.3 *Preventing contamination*

- Inspect food on delivery to ensure that no insects or foreign material are present.
- Store food at the correct temperature (see below).
- Separate the storage of raw and cooked foods.
- Thoroughly wash hands before handling food, and after cleaning and handling waste.
- Use correct handling techniques during food preparation.
- Promptly serve food at the correct temperature.
- Immediately clean the preparation area, surfaces, machines and utensils after use to remove spills, food particles and moisture (always wipe dry).
- Use correct handling and storage techniques for garbage containers and wash containers after emptying.
- Check temperatures of the freezers and coolers and document logs twice daily.



10.4 Food storage

Proper food storage prevents contamination from moisture and chemicals and protects against insects and rodents.

Some important points to remember when storing food [42, 43]

- Buy meats, milk and vegetables as close to cooking time as possible.
- Do not store these foods overnight, unless refrigeration is available and reliable.
- All perishable food not currently being processed should be stored in a refrigerator at a temperature below 5°C.
- Perishable food is any food that has not been pasteurised or contains moisture.
- All frozen foods should be stored at a temperature of –18°C. [1]
- Store foods in their dedicated storage space to avoid cross contamination.
- Raw foods and cooked foods should be kept separate at all times.
- Store raw food below cooked food to prevent drip contamination.
- Cover all food to prevent entry of foreign objects.

The equipment needed to properly store food includes:

- enclosed rooms or cabinets;
- adequate shelving; and
- leak-proof buckets (plastic or galvanised metal) with lids.

Procedures for storing food

1. Provide adequate shelf space for all food.
2. The bottom shelf must be 10–12 cm above the floor to permit proper floor cleaning under it.
3. Build cabinets with doors to keep out rodents and insects.
4. Store flour and other dried foods in plastic buckets or tins, and cover with a tight-fitting lid.
5. Do not use insect sprays and/or rodent poisons in food storage areas, because they may poison the food.
6. Maintain secure storage and control over food items.

10.5 Thawing food

Some important points to remember when thawing food items.

- Never thaw foods at room temperature.
- All frozen poultry, red meats and seafood should be thawed by one of two methods.
 - **Slow thaw:** Food is removed from freezer and placed in a refrigerator 24 hours in advance of using.
 - **Rapid thaw:** Food is kept under cold water for two hours.
- Make sure that all poultry is totally thawed prior to cooking to prevent growth of surviving Salmonella and other bacteria.

10.6 Chilling hot food [42, 43]

Some important points to remember when chilling hot foods.

- Foods such as stews and soups that are pre-prepared for later consumption should be rapidly chilled from cooked to 21°C within two hours, and from 21°C to 5°C within four

hours to ensure that surviving bacteria do not have the opportunity to multiply. The food can be checked with a thermometer to ensure the required temperature is achieved.

- Divide large quantities into smaller quantities so that the maximum depth of the food in the container does not exceed 10 cm. This enables rapid cooling to ensure that hot food is not placed into the refrigerator.

The frequency of cleaning food preparation equipment, surfaces and premises depends on the degree of use in any given period. As a general rule, equipment, utensils and immediate working areas should be cleaned after each use. Premises should be thoroughly cleaned at least daily, with spot cleaning occurring as and when required, so as to maintain a safe, hygienic environment.

Major cleaning of large equipment (e.g. ovens) should be carried out at least weekly, or more frequently, depending on use. Irrespective of any set frequencies laid down, common sense dictates that if an item or surface is soiled, it must be cleaned as soon as possible. Cleaning services in kitchen areas must be able to respond to these situations.

Special emphasis must be placed on hygienic practices and cleaning when there is a change of tasks from raw to cooked food preparation. Meat boards can be cleaned and disinfected with bleach after use.

Washing cooking and eating utensils

The following equipment is needed to properly wash cooking and eating utensils so that micro-organisms are removed:

- powdered soap (neutral detergent)
- soap for hand washing
- adequate water supply (hot water is best)
- scouring agent.

Procedures for washing cooking and eating utensils

1. Wash pots, pans, utensils and trays thoroughly with detergent and water (hot water is best). Use a hard brush to remove difficult particles and stains. Rinse with fresh water.
2. Wash all surfaces used for cutting or slicing food with a scouring agent and water (hot water is best). Use a hard brush to remove difficult particles and stains. Rinse with fresh water.
3. Allow utensils and surfaces to air-dry before storage.

Cleaning the kitchen and food storage areas

Maintaining a clean, sanitary work and storage area is essential. The following equipment is needed:

- powdered soap (neutral detergent)
- soap for hand washing
- adequate water supply (hot water is best)
- scouring agent, hand or machine scrubbing device
- broom, dustpan and brush
- mop and bucket
- machine scrubber.



Procedures for cleaning kitchen and food storage areas

1. At the beginning of each day, wipe all surfaces with a clean damp cloth.
2. At the end of each day, clean the kitchen thoroughly with detergent and water (hot water is best).
3. Use separate cleaning equipment for kitchen.
4. Use a broom, dustpan and brush to sweep up all traces of food on the floor. Place in a covered rubbish bin to keep out insects and rodents.
5. Wipe floors with a clean damp mop, detergent and water.
6. Wipe shelves with a clean damp cloth, detergent and water.
7. Wash all cleaning equipment and dry thoroughly to prevent growth of micro-organisms.
8. Remove all waste containers, transport waste to disposal site.
9. Wash waste containers with soap and water.

11 SAFETY OF WATER SUPPLY FOR HEALTH CARE FACILITIES

There are many factors that can significantly influence the transmission of a healthcare associated infection. One factor is the availability of water. Healthcare facilities need to have access to basic water and sanitation services and hygiene facilities. Where there is no or limited access to safe/treated water, there is a need for disinfection of the source or access to alternative sources of water. The following section will focus on ensuring safe and secure water supplies during emergencies.

11.1 *Water in healthcare facilities*

Each healthcare facility must have a safe, adequate water supply that is free of physical, chemical and microbiologic pollution. Water used for consumption needs to be free from toxic substances, and be clear, colourless, odourless and drinkable.

There should be adequate water for:

- drinking, bathing and washing patients;
- operating excreta disposal systems;
- washing hands and equipment after contact with patients (including for sterilisation of theatre instruments); and
- other cleaning activities to maintain a healthy environment.

11.2 *Ensuring a safe and adequate water supply*

11.2.1 **Monitoring of water supply in healthcare facilities**

The quality and safety of the water supply in healthcare facilities should be monitored regularly by responsible personnel of the health ministry under the public health team (such as the health inspector/environmental health officer/sanitation officer) as per requirements under existing national policies to ensure the water supply is:

- protected from contamination;
- stored appropriately, free from contamination; and
- in sufficient quantity for meeting all needs of the healthcare facility.

11.2.2 **Water safety planning**

If the water supply is likely to be contaminated, then the source of contamination must be determined so it can be managed appropriately, such as by disinfection. If this is not possible, an alternative, safer source that can be supplied to the healthcare facility must be identified.

The principles of 'water safety planning' (a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer) may be used to inform on the next course of actions [44].



11.2.3 Water disinfection

Although disinfection can be an expensive exercise, it is the ideal method of ensuring access to safe drinking water. The alternative is to boil water for at least 10 minutes.

In emergencies caused by outbreaks of waterborne diseases, the necessary equipment and procedures for disinfecting small quantities of water by chlorination are as follows.

Equipment needed:

- plastic bucket for mixing solution
- plastic containers, with cover, for storage of solution
- large plastic closed bucket with a tap
- tablespoon or measuring cup for measuring
- large stick for mixing.

Procedures for disinfecting water

1. Prepare a stock solution of 1% chlorine concentration according to Table 11a.
2. Mix and wait for 30 minutes.
3. Pour the clear chlorine stock solution into another container for storage and use.
4. Always keep the stock solution in a cool, dark place.
5. To disinfect water that is clear and has a light colour, add three drops of the stock solution to each litre of water. If the water to be disinfected is clear, but is like the colour of tea, add six drops of the stock solution to each litre of water. If the water is cloudy, it must be filtered before chlorine can be effective.
6. After adding the chlorine solution to the water, mix the water thoroughly and wait for 30 minutes before using the water.
7. Use clean containers that have a tap for storing disinfected water. Wash the containers once a week, or more often if they get dirty. Wash the containers using boiled water, or water that has six drops of chlorine stock solution to each litre of water.

Note: Stock solution must be freshly prepared each time it is used. Stock solution that is left standing will quickly lose its disinfecting ability.

Table 11.1. Ingredients for making a stock solution of chlorine (1% concentration by weight of available chlorine)

Product (Per cent concentration by weight of available chlorine)	Amount (Add to 1 litre of water)
Calcium hypochlorite (70%) or Bleaching powder or chlorinated lime	15 g
Sodium hypochlorite (liquid bleach)	33 g
(30%) or	357 ml
(3.5%)	313 ml
(4.0%)	250 ml
(5.0%)	210 ml
Clorox (6.0%)	

11.3 Alternative water sources

In some areas, rainwater catchment systems and wells that are protected from sources of pollution can provide an adequate supply of safe water for healthcare facilities without any need for further treatment.

11.3.1 Collecting rainwater using a roof catchment system

A rainwater collection and storage system consists of a catchment area (usually the roof of a permanent structure), guttering channels, and downpipes that direct rainwater into a water collection vessel (e.g. storage tank, pot, bucket).

Though rainwater sources are generally considered to be of a higher quality than surface water sources, appropriate disinfection/treatment of rainwater is recommended where there is a risk of contamination.

Equipment used to catch rainwater from roofs:

- water tank with outlet tap
- guttering
- spouting
- pipes
- wire mesh screens.

Procedure for collecting rainwater

1. Collect rainwater only from roofs made of tiles, slates, galvanised iron or aluminium sheeting which is clean (Note: When roofs are clean it means that the roof and gutters are regularly cleaned to remove dust, tree branches or leaves and bird droppings. This will ensure that the collected water is safe to drink and that it does not pool in the gutter where mosquitoes can breed.)
2. Make sure roof gutters slope towards the downspout to prevent pools of water forming where mosquitoes can breed.
3. Arrange the downspout so that the first water from each rainfall does not run directly into the tank. This ensures that any debris from the roof does not end up in the tank. The downspout can be moved again to collect water after the first, dirty water has passed through. This will need to be done if it does not rain regularly in the area.
4. Put a wire mesh screen over the top of the downspout and the tank overflow to prevent debris from collecting.

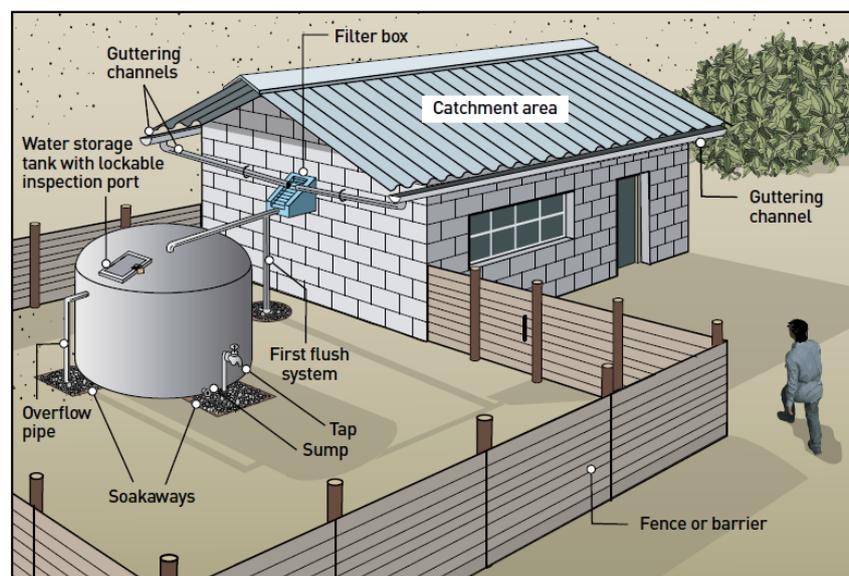


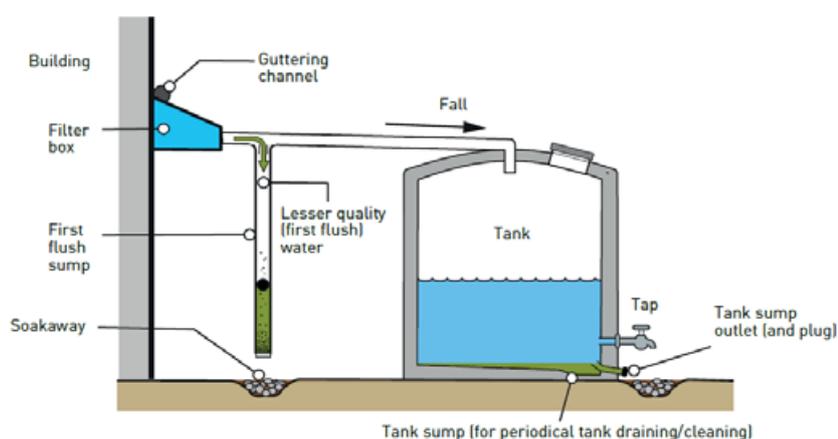
Figure 11.1. A common rainwater collection and storage system for drinking water [45]

11.3.2 The first flush system

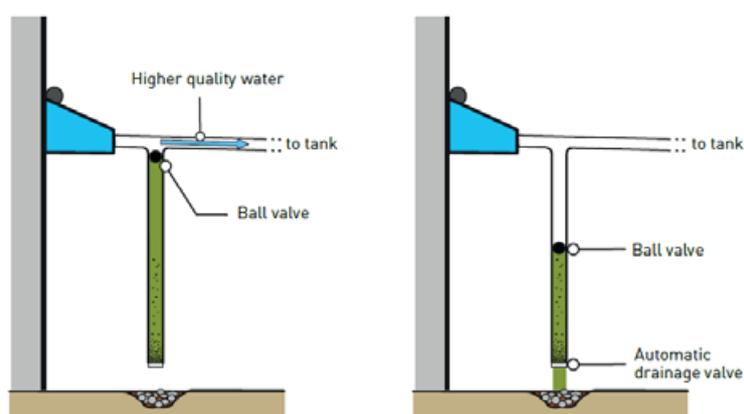
One of the important components of the rainwater collection and storage system is the first flush system. The first flush system (Figure 11a) reduces the potential for contamination by redirecting the first flush of rainwater (which is typically of lesser quality due to the accumulation of contaminants on the catchment area between rainfalls) away from the water storage tank.

This first flush should be appropriately sized relative to the roof catchment area to effectively manage the first flush of rainwater and should drain to waste (or other non-drinking-water uses).

Ideally, the first flush system should drain automatically (e.g. via a drip valve) as opposed to manually, to minimise operational inputs from the user and the potential for contamination. The first flush system should be located downstream of the filter box to prevent larger debris entering/blocking the first flush device.



a: The first flow of captured rainwater and any suspended debris enter the first flush sump rather than the tank.



b: Later flows, which should contain much less debris, pass into the tank because the first flush sump is full. A ball valve should be in place to prevent any carry over of water from the sump to the tank once the first flush sump is full.

c: An automatic drainage valve cleans out the lesser quality water and sediment in the first flush sump preparing it for the next rainfall event.

Figure 11.2. Typical “first flush” system for rainwater collection [45]

11.3.3 Providing protection to wells used for drinking water

The equipment needed to protect well-water:

- handpump suitable for the well depth
- cement and reinforcement
- tools for concrete construction and handpump installation
- wire fence to protect the well from animals.

Procedure for protecting well-water

1. Select a handpump that is durable, easily maintained and suitable for local conditions.
2. Mortar the upper two liner joints to prevent contamination from the surface entering the well.
3. Use concrete well liner rings to construct the well.
4. Construct a concrete cover and apron on the top of the well; this will also prevent contamination entering from above.
5. The apron cover should also provide drainage of water away from the well.
6. Install the pump on the well.
7. Be sure to organise a maintenance procedure, including a stock of spare parts that may be required.

Drainage systems include pipe drains, open drains (lined or unlined), subsoil drains, vertical drains or soak holes. It is important to have drainage systems to remove unwanted surface water by gravity and prevent breeding of insects. Soak holes and soak pits are ground holes that are filled with stones and should be around public taps and handpumps. Unwanted water in the facility grounds can be removed by filling the hollows in the ground and building a piped or open ditch drainage system.

Note: Surface water is dangerous. Get rid of unwanted surface water so that mosquitoes cannot breed in it. Diesel and benzene fuel pumps are now available and should be used wherever possible

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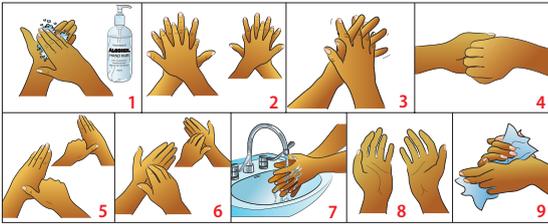
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Annex 1: Personal protective equipment (PPE) competency checklist; Putting on and removing PPE

Employee Name:		Date	
Competency Checked by:		Name/Designation/Signature:	
	Putting on PPE	Competent Yes	No
Gathers equipment and performs hand hygiene	Gathers all relevant PPE supplies, checks for correct size.		
	Removes personal items (e.g. ring/watch/bracelet).		
	Ensures they have a supervisor or mirror.		
	<p>Performs hand hygiene steps:</p>  <p>Washes hands for 40 to 60 seconds; or cleanses hands with alcohol hand rub for 20 seconds.</p>		
Gown	<ul style="list-style-type: none"> • Puts on disposable single use, long-sleeved gown. • Opens gown without gown touching any surfaces such as floor or walls. • Ties secured to the back of neck and waist. 		
Apron	Puts on apron, if necessary.		
Mask (surgical or respirator)	<ul style="list-style-type: none"> • Puts on surgical mask. • Places mask over the nose and mouth and below chin. <p>Or</p> <p>Puts on a respirator mask by placing mask over nose and mouth and pulls elastic bands over the head.</p>		
	Places upper band above ear line and lower band below ear line; and		
	Performs a fit check by moulding nose strip over bridge of nose with fingertips of both hands to get a snug fit.		
	<p>Positive seal check.</p> <ul style="list-style-type: none"> • Exhales sharply. A positive pressure inside the respirator = no leakage. • If leakage, adjust the position and/or tension straps. 		
	<p>Negative seal check</p> <ul style="list-style-type: none"> • Inhales deeply, if no leakage, negative pressure will make respirator cling to face. 		

Protective eyewear/visor	Puts on protective eyewear, adjusts to fit.		
Gloves	<ul style="list-style-type: none"> • Puts on gloves. • Pulls over wrist of isolation gown. 		
	Removing PPE	Competent Yes	No
Removes gloves	Grasps the outside of the first gloved hand with opposite gloved hand and peels off.		
	Holds removed glove in gloved hand.		
	With ungloved hand slides finger just under the wrist of the gloved hand and peels over the first glove.		
	Discards gloves in waste bin.		
Performs hand hygiene	Follows the steps for 40 to 60 seconds for hand washing; or hands are cleansed with alcohol hand rub for 20 seconds.		
Removes apron	If wearing apron, employee removes apron safely. Leans forward and tears off disposable apron from the neck and rolls it forward without touching the front area of the apron.		
	If reusable, unties from the waist and lifts off apron from the neck away from the body.		
	Places in bin.		
Performs hand hygiene	Follows the steps for 40 to 60 seconds for hand washing; or hands are cleansed with alcohol hand rub for 20 seconds.		
Removes gown	Does not touch outside of gown.		
	Undo ties at neck and waist.		
	Roll off from neck and shoulders.		
	Turns gown inside out and rolls gown into a bundle and discard in waste bin.		
Performs hand hygiene	Follows the steps for 40 to 60 seconds for hand washing; or hands are cleansed with alcohol hand rub for 20 seconds.		
Removes protective eyewear	Does not touch the front of the goggles or face shield.		
	Removes re-usable eye protection from behind the head and places in a container for reprocessing.		

Removes mask (surgical or respirator)	Does not touch the front of the mask.		
	Removes the mask from behind and lifts away from face and discards in a bin.		
	Or if wearing a respirator mask, grasps the top tape and then the bottom tape from behind with the hands.		
	Lifts carefully overhead and removes and discards in a bin.		
Performs hand hygiene	Follows the steps for 40 to 60 seconds for hand washing; or hands are cleansed with alcohol hand rub for 20 seconds.		

Annex 2: Occupational exposure report form

Hospital or workplace: _____
 Report completed by: _____
 Date and time of exposure: _____
 Date and time of report: _____

1. The injury occurred in which work area?

- Medical ward
- Surgical ward
- Operating room
- ICU
- Nursery
- Labor ward
- Laboratory
- Other _____

2. Job classification of the injured worker?

- Dentist
- Technician
- Housekeeper/laundry
- Doctor
- Nurse
- Student
- Security
- Other _____

3. How did the incident occur?

- Patient moved and jarred device
- While inserting needle in line or patient
- While withdrawing needle from line/patient
- Passing/transferring equipment
- Suturing
- Recapping
- Disassembling device/equipment
- Opening/breaking glass container
- Injured by sharps being disposed of
- Over-filled sharps container
- Sharps in improper place (general waste, linen, etc.)

4. What type of device caused the injury?

- Hollow bore needle
- Glass object
- Non-healthcare item
- Other sharp object
- Unknown
- Other _____

5. When in the use of the object did the exposure occur?

- Before contact with source blood or body fluid
- Following contact with source blood or body fluid
- Unknown
- Other _____

6. Type of exposure

- Percutaneous
- Mucous membrane
- Non-intact skin
- Intact skin

7. Part of body

injured: _____

8. Type of body fluid exposed to:

9. Was first aid given? YES NO

10. Were gloves worn? YES NO

11. Was staff member vaccinated against Hepatitis B? YES NO



12. When was vaccination given
(year)? _____

13. Post immunization HBsAb tested?
YES NO

14. Was Hepatitis B immunoglobulin given?
YES NO

15. Is anti-retroviral therapy required?
YES NO

16. Baseline serology
(if performed/consented)
HBV
HCV
HIV
Other

17. Considered immune?
YES NO

18. Was on-call physician contacted?
YES NO

Follow up required? YES NO

SOURCE FOLLOW UP

Source name (if known): _____

Source agreed to blood tests?
YES NO

Annex 3: Consent form for post-exposure prophylaxis

I,, have been duly provided with all the necessary information in order for me to make an informed choice. I therefore accept/do not accept [delete one] post-exposure prophylaxis as per Needle-Stick Injury Protocol.

Signature of exposed HCW

Signature of attending clinician

Completed forms must be submitted to the infection control officer.



Annex 4: HIV counselling form checklist

1. What the test means:

- The **Elisa** test is looking for antibodies, not the virus itself.
- **Time Frame** “Window Period”: 2–12 weeks.

2. What a positive result means with regard to:

- medical aspects;
- the duration of the infection is life long and you can pass on the virus from the time of infection;
- modes of transmission: exposure to blood and body fluids, i.e. through a needle stick injury; sexual intercourse with an infected partner, or sharing used needles and syringes; and
- medical progression; this is such that you may be well for many years before experiencing other symptoms progressing to **AIDS**.

3. Psychological aspects: Thinking through possible results

- Have you thought about the test being positive? How do you think you would feel?
- Assessing coping ability. How have you coped before with stressful life events?
- Do you have back up services available if unable to cope while waiting for results?

4. Notification requirements

- **HIV** positive results – testing laboratory notifies Ministry of Health – all that is required is:
 - DOB
 - SEX
 - MODE OF TRANSMISSION

5. Social aspects

- Client’s legal obligation – inform current and future sexual partners of infection
- Discussion re: family, friends and support
- Need for care re disclosure – should your test be positive – be selective who you discuss this with
- Implications for travel, housing, employment

6. Travel

- Some countries will not allow HIV positive people to visit, e.g. USA.
- Other countries (e.g. Australia and the Emirates) do not allow HIV positive people to work and for this reason when applying for an overseas work permit you may be asked to supply a recent HIV result.

7. Housing

- People who are HIV positive may also experience some difficulties with long-term housing loans.

8. What a negative result means

- Interpreted in relation to time frame of test/risk practices

9. Preventive aspects (whatever the test result)

- Safer needle and syringe use
- Reinforce non sharing of needle and syringes
- Safer sex practices
- Information re condoms, high and low risk sexual practices
- Check the expiry date on condoms and if this is a month of expiry, a new pack should be used. Also give instructions on how to apply a condom in the correct way, i.e. ensure the air bubble at the end of the condom is firmly clasped expelling the air while rolling down the shaft of the penis.

10. How results of tests are obtained

- All staff **MUST** receive results face-to-face, never over the phone.

11. Counselling on drug therapy

- Toxicity and side effects profile of drugs. Patients must be made fully aware of the associated side effects of these drugs.
- Monitoring and evaluation of post exposure prophylaxis.

Annex 5: Position description

Position: Infection prevention and control nurse/officer

Primary purpose

Responsible for the overall co-ordination, implementation and monitoring of the infection control policies and procedures, conduct relevant training, education and provision of relevant advice in hospitals and other health facilities.

Duties and responsibilities

- Maintain close liaison with all departments to provide advice on matters relating to infection control and to ensure adherence on infection control guidelines.
- Ensure ongoing review and update of all policies and procedures in relation to infection control in line with new developments and changing trends.
- Participate as the principal working member of the Infection control committee and act as secretary to the committee.
- Deliver verbal and written infection control reports in the required format to the infection control committee.
- Provide all new staff with infection control orientation and maintain ongoing infection control education programmes for all staff.
- Investigate specific outbreaks of nosocomial infection in order to identify specific procedures that may constitute a risk of infection transmission.
- Review usage of all chemical cleaning products and antiseptics to ensure appropriateness of products and usage.
- Ensure appropriate follow-up of staff who suffer occupational accidents involving blood and body substances.
- Be involved in the development of staff health programmes in relation to hepatitis B immunisation and any other infectious disease-related matter.
- Establish and maintain ongoing surveillance on the occurrence of nosocomial infection.
- Develop, update and implement infection prevention techniques according to current standards of practice, which provide optimum care to patients with infections.

Annex 6: How to make an alcohol handrub

WHO (2009) Recommendation of two formulations for local production

Formulation 1

To produce **final concentrations** for ethanol 80% v/v, glycerol 1.45% and hydrogen peroxide (H₂ O₂) 0.125% v/v.

Pour into a 1000 ml graduated flask:

- a. ethanol 96% v/v – 833.3 ml
- b. H₂ O₂ 3% v/v – 41.7 ml
- c. glycerol 98% – 14.5 ml

Top up flask to 1000 ml with distilled or cool boiled water and shake gently to mix contents.

Formulation 2

To produce **final concentrations** for isopropyl alcohol 75% v/v, glycerol 1.45% and hydrogen peroxide (H₂ O₂) 0.125% v/v.

Pour into a 1000 ml graduated flask:

- a. isopropyl alcohol (with a purity 99.8 % – 751.5 ml
- b. H₂ O₂ 3% v/v – 41.7 ml
- c. glycerol 98% - 14.5 ml

Top up flask to 1000 ml with distilled or cool boiled water and shake gently to mix contents.

Note:

- Hydrogen peroxide is added to eliminate contaminating spores in the bulk solution.
- Glycerol is a humectant or emollient added for skin care to increase the acceptability of use.
- Bottles should be labelled as follows.
 - Date of manufacture
 - Composition: ethanol, glycerol, and hydrogen peroxide
 - Who recommended handrub formulation
 - For external use only
 - Avoid contact with eyes
 - Keep out of reach from children
 - Apply a small amount of alcohol handrub and cover all the surfaces of the hands, rub until dry
 - Keep away from flame and heat



Annex 7: How to make chlorine solutions for environmental disinfection (WHO EVD Guideline 2014)

Example 1 – using liquid bleach

Chlorine in liquid bleach comes in different concentrations. Any concentration can be used to make a dilute chlorine solution by applying the following formula:

$$\left[\frac{\% \text{ chlorine in liquid bleach}}{\% \text{ of chlorine desired}} \right] - 1 = \text{Total parts of water for each part bleach}^\dagger$$

Example: To make a 0.5% chlorine solution from 3.5% ‡ bleach:

$$\left[\frac{3.5\%}{0.5\%} \right] - 1 = 7 - 1 = 6 \text{ parts water for each part bleach}$$

Therefore, you must add 1 part 3.5% bleach to 6 parts water to make a 0.5% chlorine solution.

† “Parts” can be used for any unit of measure) e.g. ounce, litre or gallon) or any container used for measuring, such as a pitcher.

‡ In countries where French products are available, the amount of active chlorine is usually expressed in degrees chlorum. One degree chlorum is equivalent to 0.3% active chlorine.

Example II – using bleach powder

If using bleach powder,† calculate the amount of bleach to be mixed with each litre of water by using the following formula:

$$\left[\frac{\% \text{ chlorine desired}}{\% \text{ of chlorine in bleach powder}} \right] \times 1000 = \text{Grams of bleach powder for each litre of water}$$

Example: to make a 0.5% chlorine solution from calcium hypochlorite (bleach) powder containing 35% active chlorine:

$$\left[\frac{0.5\%}{35\%} \right] \times 1000 = 0.0143 \times 1\,000 = 14.3$$

Therefore, you must dissolve 14.3 grams of calcium hypochlorite (bleach) powder in each litre of water used to make a 0.5% chlorine solution.

† When bleach powder is used; the resulting chlorine solution is likely to be cloudy (milky)

Example III – formula for making a dilute solution from a concentrated solution

$$\text{Total Parts (TP) (H}_2\text{O)} = \left[\frac{\% \text{ Concentrate}}{\% \text{ Dilute}} \right] - 1$$

Example: To make a dilute solution (0.1%) from 5% concentrated solution.

$$\text{Calculate TP (H}_2\text{O)} = \left[\frac{5.0\%}{0.1\%} \right] - 1 = 50 - 1 = 49$$

Take one part concentrated solution and add to 49 parts of cool boiled water (filtered if necessary)

Sodium hypochlorite is more commonly known as household bleach and is a very effective disinfectant for killing bacteria, fungi and viruses, including the influenza virus. Sodium hypochlorite for disinfection of patient equipment and environmental surfaces can be easily diluted from the household bleach concentration at the local pharmacy.

Bleach precautions

- Bleach can be corrosive to metals and damage painted surfaces.
- Use mask, household rubber gloves, goggles (to protect eyes from splashes) and waterproof apron when preparing diluted bleach.
- Mix the bleach in a well-ventilated area with cold water because hot water decomposes the sodium hypochlorite.
- If bleach gets into the eyes, immediately rinse with water for 15 minutes and consult a doctor.
- Diluted bleach should be made fresh daily, labelled, dated, and unused portions should be discarded 24 hours after preparation.
- Organic materials inactivate bleach; surfaces must be cleaned of organic materials prior to disinfection with bleach.
- Bleach should NEVER be used together with, or mixed with, other household detergents because this reduces its effectiveness and can cause chemical reactions.
- A toxic gas is produced when bleach is mixed with acidic detergents such as those used for toilet cleaning and this gas can cause death or injury. If necessary, use detergents first and rinse thoroughly with water before using bleach for disinfection.
- Undiluted bleach liberates a toxic gas when exposed to sunlight and should be stored in a cool, shaded place out of reach of children.

Source: AVSC International (1999). Infection Prevention Curriculum. Teacher's Manual. New York, p.267



Annex 8: Equipment list for isolation rooms and wards

- Signage for rooms and/or wards
- Stocks of PPE: eye protection, face shields, disposable gowns, surgical and N95 particulate masks, gloves, aprons. Optionals include hair covers, boots, etc.
- Stocks of hand hygiene (liquid soap, alcohol-based hand rub, paper towels)
- Stocks of linen
- Trolley to hold PPE outside isolation room
- Sharps containers
- Linen bag for isolation room
- Garbage containers for isolation room
- Garbage bags
- Container for collection of reusable eye shields, etc.
- Stethoscope, blood pressure cuff, sphygmomanometer, thermometer, blood sample bottles, specimen bottles, intravenous giving sets, intravenous fluids, plaster, tourniquet, lab forms and other necessary items such as needles, syringes
- Equipment for cleaning and disinfection
- Telephone should also be made available in the ward and isolation room for ease of communication to minimise the need for HCWs to enter isolation rooms
- Stationery

Note: Items should be kept to a minimum inside the isolation room.

Annex 9: Checklist outbreak investigation and management

✓ if action indicated	Action	× if action completed
<input type="checkbox"/>	Do you have an outbreak? i.e. a higher than expected number of cases of infection with the same causative micro-organism (if known in the early stages of the outbreak)	<input type="checkbox"/>
<input type="checkbox"/>	Has the source of the outbreak been identified?	<input type="checkbox"/>
<input type="checkbox"/>	Do you need to convene the Outbreak Management Committee (OCC)? Factors to be considered in the decision to convene an OCC include: (a) the type of infectious agent involved - In the case of possible healthcare associated transmission of a blood borne virus. (b) the number of confirmed or suspected cases - large numbers of cases - two or more cases of a notifiable condition in the same ward/area, within an incubation period (c) the size and nature of the population at risk (d) the likely source (e) potential impact on service delivery - involvement of management is required to implement measures to control disease spread, e.g. closure of wards/beds - involvement of more than one ward or department.	<input type="checkbox"/>
<input type="checkbox"/>	Inform staff ▪ Inform all staff that a possible outbreak is occurring, including advice regarding infection control measures, e.g. pharmacy. ▪ include supply staff in correspondence - consider the need to inform visitors and patients	<input type="checkbox"/>
<input type="checkbox"/>	▪ inform your senior nursing staff on duty	<input type="checkbox"/>
<input type="checkbox"/>	▪ Work with laboratory regarding any additional specimen requirements	<input type="checkbox"/>
<input type="checkbox"/>	Implement additional infection control measures ▪ Ensure sufficient supplies of appropriate personnel protective equipment (PPE) are available in the affected areas, e.g. mask, gloves, gowns, aprons, eyewear, as indicated by mode of transmission	<input type="checkbox"/>
<input type="checkbox"/>	▪ Enhance cleaning	<input type="checkbox"/>
<input type="checkbox"/>	▪ Isolate affected patients	<input type="checkbox"/>
<input type="checkbox"/>	▪ Display signage regarding necessary additional precautions	<input type="checkbox"/>
<input type="checkbox"/>	▪ Reinforce hand hygiene practices as appropriate - Alcohol-based hand hygiene products may not be suitable for certain micro-organisms e.g. <i>Clostridium difficile</i>	<input type="checkbox"/>
<input type="checkbox"/>	Stop or limit further spread ▪ Consider the need to dedicate staff to affected patients e.g. in gastroenteritis outbreaks	<input type="checkbox"/>
<input type="checkbox"/>	▪ Consider the need to cohort patients with the same infection	<input type="checkbox"/>
<input type="checkbox"/>	▪ Increase cleaning frequencies in affected areas	<input type="checkbox"/>
<input type="checkbox"/>	▪ Limit transport of affected patients to essential purposes only	<input type="checkbox"/>
<input type="checkbox"/>	▪ Restrict visitors where necessary, particularly young children and people with suppressed immune systems	<input type="checkbox"/>
<input type="checkbox"/>	▪ Reinforce hand hygiene with visitors	<input type="checkbox"/>

✓ if action indicated	Action	× if action completed
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Document the outbreak <ul style="list-style-type: none"> ▪ List all know cases and update information daily ▪ Include details of affected patients and staff ▪ Include details of onset date of symptoms/diagnosis for each case 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/> <input type="checkbox"/>	Notify authorities Public health notified: date: __/__/__ <ul style="list-style-type: none"> ▪ Chief Executive Officer: date: __/__/__ 	<input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Collect specimens <ul style="list-style-type: none"> ▪ Observe standard and appropriate additional precautions when collecting relevant specimens, e.g. utilising correct PPE ▪ Collect appropriate specimens – liaise with infectious diseases physician or microbiology to determine collection method and specimen types ▪ Ensure specimens are labelled appropriately 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/> <input type="checkbox"/>	Review and up-date outbreak management plan <ul style="list-style-type: none"> ▪ Regularly during the outbreak ▪ Following resolution of outbreak 	<input type="checkbox"/> <input type="checkbox"/>
<input type="checkbox"/>	Outbreak management report <ul style="list-style-type: none"> ▪ Complete outbreak management report highlighting recommendations for preventing future occurrences 	<input type="checkbox"/>

Annex 10: Recommended cleaning schedule

The table outlines a cleaning schedule guide for healthcare facilities to use to develop their local schedule to suit their environment.

Level of risk	Area/Ward
Very high risk	Outbreak area
High risk	Intensive care units, operating theatres, burns units, dialysis units, post-operative care units
Significant risk	General wards
Low risk	Office area, non-clinical areas
Level 1	Detergent
Level 2	Disinfectant for MRO and detergent (disinfectant should have a label indicating evidence against the organism of concern)

Item	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Bathrooms	Daily after use	Daily after use	Daily after use	Daily after use	1 2
Bed	Daily and after discharge	Daily and after discharge	Daily and after discharge	After discharge	1 2
	Weekly and at discharge under bed	Weekly and at discharge under bed	Weekly and at discharge under bed		1 2
Bedrails bedside table and lockers	Twice daily and at discharge	Twice daily and at discharge	Daily and at discharge	Weekly and at discharge	1 2
Catheter stands and brackets	Clean daily and after use	Clean daily and after use	Clean before and after use	Clean before and after use	1
Ceiling	Spot clean and yearly	Spot clean and yearly	Spot clean and yearly	Spot clean and yearly	1
Chairs	Twice daily	Twice daily	Daily and at discharge	Daily and at discharge	1 2
Cleaning equipment	Clean after use	Clean after use	Clean after use	Clean after use	1 2
Clipboards	Daily and between patient use	Daily and between patient use	Daily and between patient use	Daily and between patient use	1

Item	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Commode	After use and daily	After use and daily	After use and daily	After use and daily	1 2
Computer and key-boards	Weekly	Weekly	Weekly	Weekly	1
Curtains	After discharge	Monthly	Biannually	Annually	Laundry wash
Door-knobs and handles	Twice daily	Daily	Daily	Weekly	1 2
Floors	Damp mop twice daily	Daily	Daily	Daily	1 2
Fridges	Daily	Daily	Daily spot clean, and clean weekly	Spot clean weekly	1
Fridge (drug)	Weekly	Weekly	Weekly	Weekly	1
IV stands and poles 7 hooks	Daily and after use	Daily and after use	Daily and after use	After use	1 2
Light switch	Daily	Daily	Weekly	Weekly	1
Mattress	Weekly and after discharge	Weekly and after discharge	After discharge	After discharge	1 2
Medical equipment (infusion pumps) not connected to patient	Daily between patient use	Daily between patient use	Daily between patient use	Weekly between patient use	1 2
Medical gas	Daily	Daily	Daily	Weekly	1
Nebuliser machine	Daily after use	Daily after use	Daily after use	Daily after use	1
Oxygen equipment	Daily after use	Daily after use	Daily after use	Daily after use	1
Pillows (waterproof cover)	Weekly and after discharge	After discharge	After discharge	After discharge	1 2
Dressing trolleys	Before and after use	Before and after use	Before and after use	Before and after use	1 2
Sinks (hand washing)	Twice daily	Daily	Daily	Daily	1
General surfaces in patient's room	Twice daily and after discharge	Twice daily and after discharge	Daily and after discharge	Weekly and after discharge	1 2
Telephones	Twice daily	Twice daily	Daily	Weekly	1
Toilet	Twice daily	Twice daily	Twice daily	Daily	1

Item	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Trolley linen	Daily	Daily	Daily	Weekly	1
Trolley resuscitation	Daily	Daily	Daily	Weekly	1
Walls	Spot clean	Spot clean	Spot clean	Spot clean	1
Patient bowls	Between use	Between use	Between use	Between use	1 2
Wheelchair	Daily and after use	Daily and after use	Monthly and after use	Monthly and after use	1
Waste bins	Weekly	Weekly	Weekly	Weekly	1

Adapted from: Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010)

Annex 11: WHO Surgical Safety Checklist

Surgical Safety Checklist		
 World Health Organization		Patient Safety <small>A World Alliance for Safer Health Care</small>
Before induction of anaesthesia	→ Before skin incision	→ Before patient leaves operating room
(with at least nurse and anaesthetist)	(with nurse, anaesthetist and surgeon)	(with nurse, anaesthetist and surgeon)
Has the patient confirmed his/her identity, site, procedure, and consent? <input type="checkbox"/> Yes	<input type="checkbox"/> Confirm all team members have introduced themselves by name and role.	Nurse Verbally Confirms: <input type="checkbox"/> The name of the procedure <input type="checkbox"/> Completion of instrument, sponge and needle counts <input type="checkbox"/> Specimen labelling (read specimen labels aloud, including patient name) <input type="checkbox"/> Whether there are any equipment problems to be addressed To Surgeon, Anaesthetist and Nurse: <input type="checkbox"/> What are the key concerns for recovery and management of this patient?
Is the site marked? <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<input type="checkbox"/> Confirm the patient's name, procedure, and where the incision will be made.	
Is the anaesthesia machine and medication check complete? <input type="checkbox"/> Yes	Has antibiotic prophylaxis been given within the last 60 minutes? <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	
Is the pulse oximeter on the patient and functioning? <input type="checkbox"/> Yes	Anticipated Critical Events To Surgeon: <input type="checkbox"/> What are the critical or non-routine steps? <input type="checkbox"/> How long will the case take? <input type="checkbox"/> What is the anticipated blood loss?	
Does the patient have a: Known allergy? <input type="checkbox"/> No <input type="checkbox"/> Yes Difficult airway or aspiration risk? <input type="checkbox"/> No <input type="checkbox"/> Yes, and equipment/assistance available Risk of >500ml blood loss (7ml/kg in children)? <input type="checkbox"/> No <input type="checkbox"/> Yes, and two IVs/central access and fluids planned	To Anaesthetist: <input type="checkbox"/> Are there any patient-specific concerns? To Nursing Team: <input type="checkbox"/> Has sterility (including indicator results) been confirmed? <input type="checkbox"/> Are there equipment issues or any concerns?	
	Is essential imaging displayed? <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

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