KINGDOM OF TONGA

MINISTRY OF HEALTH

INFECTION PREVENTION AND CONTROL GUIDELINES

October 2020

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PREFACE

The health challenge to the world posed by Emerging Infectious Diseases such as Multi-drug resistant micro-organisms and the current COVID-19 Pandemic has highlighted the vulnerability of national health systems to these public health threats. This is evident by the significant number of infections occurring in the health-care settings, either to visitors, patients or staff. Such a situation is commonly seen in countries with fragile health systems, especially in developing countries like Tonga.

I am pleased that the MOH of Tonga has completed the development of this updated Infection Prevention and Control Guidelines, as a way forward to mitigate the global threat of emerging infectious diseases. The two objectives of this guideline are:1) To strengthen the knowledge and skills of Health Care Workers to prevent cross infections between patients and staff and 2) To provide an evidence based guideline for all health-care hospitals and facilities to guide the development and adaptation of their own specific institutional guideline.

The scope of the guideline is comprehensive and is of high quality and should be commended. I note that it includes a management structure, clear processes, monitoring and evaluation guideline, indicators to facilitate surveillance, auditing and compliance activities. There is a comprehensive information on potential infectious risks, precautions to take to safeguard against exposure to specific risks and even the identification and management of an outbreak. The inclusion of the following key components is also to be acknowledged: Environmental Health, Waste Management, Food Safety, Laundry, Cleaning and Disinfection and Sterilization, PPE, MDR and ILI. COVID-19 has been given special emphasis in this document and this has made this IPC Guidelines timely and highly relevant to current global health challenges of 2020 and beyond.

I wish to congratulate Dr Lisiate ‘U1ufonua, the Medical Superintendent and Chair of Tonga's Infection Prevention and Control Committee, Sister Sulia Nonu, Sister Pinomi Latu, and team for completing this important and timely guideline. Achievement of this work was done through close collaborations between key health experts including; public health epidemiologist and infectious diseases specialist, laboratory microbiologist, environmental health practitioners, infection control and prevention nurses and last but not the least, the support and guidance of WHO, World Bank, and SPC Consultants. I sincerely thank you all for your effective partnership and commitment.

I am confident that this guideline will strengthen the MOH's health care systems and significantly minimize the health risks to patients, families and staff, from being infected by emerging infectious diseases of public health concern, such as MDR micro-organisms and COVID-19 disease caused by the coronavirus, SARS-CoV-2.

Fakaapaapa atu,

Hon. Associate Professor Ámelia Afuhaámango Tuípulotu Minister for Health

Date: 19/10/2020

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To Margret Leong (Infection Control Nurse, WHO Consultant) and Dr Richard Evert (Infection Control Doctor, WHO Consultant) for their kind assistance in the development of the first Tonga Infection Prevention and Control Guidelines. It is the first such set of IPC guidelines for Tonga and this also made possible with the ongoing support of the Tonga Infection Prevention and Control Committee.

Tonga Infection Prevention and Control Committee are grateful to SPC for the permission of their Infection Control Manual to be utilized as a reference for IPC Tonga guideline development.

This guideline is formulated to the context of Tonga and for-cast that it could be utilized at the outer island and remote areas of Tonga.

I would also like to extend our sincere acknowledgement to Dr Seini Kupu (Former Senior Medical Officer, Public Health), Dr Eka Buadromo (Tonga Former Pathologist), Dr Seventeen Toumo'ua (Tonga pathologist), Senisaleti Pasikala and Sitanilei Hoko (Tonga microbiologists), Dr 'Ofa Tukia (Senior Medical Officer) and Levaitai 'Asaeli (Senior Clinical Pharmacist), for their continuous support and contribution that enable the first production of Tonga Infection Prevention and Control Manual.

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Tonga Infection Prevention and Control Office's appreciation is also extended to the World Bank (WB) for their support in ensuring that an IPC guideline is in place as a safeguard requirement specific to their funded equipment provided through the COVID-19 pandemic.

Pinomi Vaioleti Manu Latu
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LIST OF ABBREVIATIONS

AIDS	acquired immunodeficiency syndrome
ABHR	alcohol based hand rub
AMR	anti-microbial resistance
BCG	Bacilli Calmette–Guerin
COVID-19	Coronavirus disease-2019
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	hospital associated infections
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
N95 mask	particulate respirator that filters more than 94% of airborne particle
OMC	outbreak management team
PEP	post-exposure prophylaxis
PICNet	Pacific regional Infection Control Network
PPE	personal protective equipment
PPHSN	Pacific Public Health Surveillance Network
QSINAH	Queen Salote Institute of Nursing and Allied Health
SARS	severe acute respiratory syndrome
SPC	Secretariat of the Pacific Community
SVM	spiritus vini methylatus (methylated spirits, denatured alcohol)
TB	Tuberculosis
WB	World Bank
WHO	World Health Organization

GLOSSARY

Additional precautions (transmission-based): Additional or transmission-based precautions are 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.

Airborne transmission: Transfer of particles containing infectious agents that are disseminated in the air. Micro-organisms 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.

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 strain of the influenza virus.

Contact transmission: The transmission of infectious agents can be divided into two subgroups: direct contact transmission and indirect contact transmission:

- **Direct contact** transmission involves the direct physical transfer of micro-organisms from an infected or colonized person to a susceptible host.
- **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.

Coronavirus disease 2019 (COVID-19): A respiratory infection caused by SARS-CoV-2. It is transmitted mainly through close physical contact and respiratory droplets, while airborne transmission is possible during aerosol generating medical procedures.

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.

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 handwashing with soap and water, use of alcohol hand rub and antiseptic solutions.

Medical equipment reprocessing: 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.

N95 Mask: 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. It has the capacity to filter 95% of airborne infectious particles from the air.

Nosocomial infection: (Also known as a hospital-acquired infection.) An infection that is acquired during hospital admission as a result of health care interventions.

Occupational exposure: An incident that occurs during the course of a person's employment and involves contact with blood or body substances**.** Occupational exposure includes:

- 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; and
- 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.

Sterilization: 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.

Standard precautions: Precautionary measures designed to reduce the risk of transmission of micro-organisms from both recognized and unrecognized sources of infection in hospitals. Standard precautions involve safe work practices and include 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

1 INTRODUCTION

1.1 Background

The Ministry of Health of Tonga is dedicated to providing quality care through the promotion of good health, reducing morbidity, disability and premature mortality for all its citizens. To achieve this mission, one of the strategies is to ensure that all hospitals, health centres and dispensaries implement the minimum standards for infection prevention and control.

This updated comprehensive Infection Prevention and Control (IPC) guidelines provide the minimum standards for IPC and can be adapted in any of our healthcare settings throughout the Kingdom of Tonga. The responsibility for implementation of these standards lies first with the manager of the hospital/facility and with all section managers of every healthcare facility.

Infection prevention and control has an integral role in the provision of a safe healthcare environment to ensure patient and healthcare worker (HCW) safety across the continuum of care. Lack of adherence to safe practices or inadvertent exposure to pathogens, including HIV, in the healthcare environment can lead to significant morbidity and mortality in patients and HCWs alike.

A safe working environment in the healthcare setting includes the provision of a safe physical environment, the use of safe work practices, the availability of adequate resources, the provision of safety equipment and consumable items, and a culture of patient safety embedded within the organization. Safety in healthcare also includes mechanisms for reporting events of an unsafe environment or practice that may result in premature death or disability.

IPC standards, particularly in healthcare facilities, are critical in interrupting the transmission of priority infectious diseases and healthcare-associated infections. Therefore, having a functional IPC committee in all our hospitals is essential to oversee the activities of the IPC program. In the smaller facilities, it may not be possible to have a stand-alone IPC committee; under these circumstances, infection control is included as a standing agenda item for other committees.

1.2 Purpose

The purpose of this guideline is to:

- Provide Health Care Workers (HCW) with the knowledge and skills to take reasonable steps to prevent the spread of infections from patient to patient, staff to patients, and patient to staff.
- Provide guidance on IPC standards for all of Tonga's hospitals/facilities to use as a guide in developing/adapting for their institutional guidelines.

1.3 Contents of Guideline

More specifically, these guidelines cover:

- Management of the IPC program;
- Components and the application of standard and transmission-based precaution's;
  - Hand hygiene
  - Healthcare waste management
  - Principles of PPE

- safe handling and disposal of sharps
- environmental cleaning
- safe handling of laundry
- safe reprocessing of reusable medical equipment
- airborne precautions
- droplet precautions
- contact precautions

- Outbreak management.
- IPC in special care areas
- Guidelines for management of occupational exposures
- Surveillance for IPC
- Ensuring safety of water supply for health care facilities
- Infections by selected diseases

1.4 Guidelines use

The implementation of the Tongan IPC guidelines will be successful when the following conditions are met:

1. There must be strong national commitment for enforcement of the national IPC guidelines.
2. The IPC guidelines and program are utilized to help foster, develop and reinforce a culture of patient and HCW safety and IPC.
3. Infrastructure/system change: availability of human resource for IPC at national and facility level and access to the right 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 Ministry of Health's strategic and operational plans.
5. Training and education: a program of routine training, education, and periodic annual training for ALL personnel responsible for IPC (ALL HCWs).
6. Monitoring, evaluation and feedback: a program of regular supervision and feedback is in place in relation to the guideline recommendations including a surveillance program.
7. Safety culture: managers and leaders AT EVERY LEVEL of the Ministry show their visible support for implementation of the National IPC Guidelines.

The table on the next page shows 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.

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

Category	Component
IPC Programs	An IPC program with a dedicated, trained team should be in place in each acute health care facility for the purpose of preventing HAI and combating anti-microbial resistance (AMR) through IPC good practices. • one full-time focal point trained in IPC. • a dedicated budget for implementing IPC strategies/plans. • Stand-alone, active national IPC programs 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 programs should be linked to other relevant national programs and professional organizations.
Evidence-based guidelines	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 with guideline recommendations should be undertaken to achieve successful implementation.
Education and training	At the facility level, IPC education should be in place for all health care workers by utilizing 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 program should support education and training of the health workforce as one of its core functions.
Surveillance	Facility-based HAI surveillance should be performed to guide IPC interventions and detect outbreaks, including AMR surveillance with timely feedback of results to health care workers and stakeholders and through national networks. National HAI surveillance programs 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.

Multimodal strategies	At the facility level, IPC activities should be implemented using multimodal strategies to improve practices and reduce HAI and AMR. National IPC programs should coordinate and facilitate the implementation of IPC activities through multimodal strategies at the national or sub-national level.
Monitoring, audit and feedback	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. A national IPC monitoring and evaluation program should be established to assess the extent to which standards are being met and activities are being performed according to the program's goals and objectives. Hand hygiene monitoring with feedback should be considered as a key performance indicator at the national level.
Workload, staffing and bed occupancy	In order to reduce the risk of HAI and the spread of AMR, the following should be addressed: (1) bed occupancy should not exceed the standard capacity of the facility; (2) health care worker staffing levels should be adequately assigned according to patient workload.
Built environment, material and equipment	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. At the facility level, materials and equipment to perform appropriate hand hygiene should be readily available at the point of care.

2 INFECTION PREVENTION AND CONTROL (IPC) PROGRAMME

2.1 Introduction

An IPC program is a set of organized activities related to the prevention and control of infectious diseases and Hospital Associated Infections (HAIs) in the healthcare environment.
IPC programs 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. However, to ensure successful implementation in healthcare facilities throughout Tonga, it is imperative that a governance structure is established and that the IPC committees promote and effectively implement standards for IPC.

The purposes of the infection prevention and control program are to:

- To prevent the spread of infections from patient to patient, staff to patients and patient to staff.
- To prepare hospitals to detect early outbreaks of HAIs and respond promptly and effectively manage such situations.
- To protect patients from hospital-associated infections and to prevent the transmission of antimicrobial resistant organisms (AMR).
- To be prepared to manage and respond to epidemics of emerging infectious diseases in the community and hospitals.
- To maximise with community health colleagues to better coordinate and respond to large scale epidemics.

Organization Responsibility for Infection Prevention and Control

It is essential that all leaders within the ministry of health of Tonga support and promote the IPC program through the following strategies:

- Develop a national IPC program with clear objectives and functions and activities
- Ensure national and facility level implementation of IPC policy and guidelines.
- Ensure IPC education and training is part of every health care facility orientation program for new employees and ongoing education program for all existing staff regardless of level and position.
- Ensure that HAI surveillance is standardized and performed to guide IPC interventions and detect outbreaks, including antimicrobial resistance (AMR) surveillance with timely feedback of results to health care workers through local networks and IPC committee.
- For a large hospital like Vaiola with over 150 beds, the IPC nurse is appointed at a high level within the nursing structure.
- For small hospitals/facilities, this could be a shared responsibility with other duties at a senior level.
- Ensure microbiology laboratory support at hospital level to work with the infection control nurse and to use microbiology data for IPC surveillance and early detection of HAIs.
- Regularly monitor and evaluate compliance with IPC standards and program interventions.
- The chair of the IPC committee meeting should be the manager of the hospital or his/her delegate at a high level.

- By having responsibility for IPC incorporated into job descriptions of all HCWs.
- Ensuring that there is a senior medical practitioner's participation in the IPC program and IPC committee meetings.
- Ensure that IPC key performance indicators are incorporated into the healthcare facility business plan.

The components of the IPC program include:

- A surveillance program including:
    - Multidrug resistant organisms (MDROs) daily surveillance for HAIs targeting areas posing the highest risks of mortality, morbidity, and cost;
    - Surgical Site Infections (SSI) and other device-related infections;
    - hand hygiene audits in 3 periods per year (i.e. Jan-March, April-June and July-October;
    - Hospital ward's monthly audit;
    - Health centre's quarterly audit; and
    - Outer- island annually audit
    - Ensure compliance with environmental management practices such as management of healthcare-related waste, support services such as food and linen, use of therapeutic devices);

- Education and training of staff, patients and families on IPC policies and procedures, including;
    - Outbreak management plan;
    - Mandatory training on IPC for all continuing and new staff on standards for IPC including staff health occupational issues, hepatitis B vaccination program and management of occupational exposures to blood and body substances and corona virus disease 2019 (COVID-19).

The objectives of an infection control program to:

- Develop IPC standards, processes and practices to prevent the transmission of HAIs and AMR in healthcare facilities;
- Detect and manage outbreaks of HAIs with good outcomes and implement lessons learned;
- manage epidemics with good outcomes;
- have compliance of infection prevention and control work processes or with standards;
- have ongoing targeted surveillance with the desired aim to reduce the incidence and risk of preventable healthcare-associated infection;
- prevent infection transmission within healthcare facilities and the community;
- have an education program to cover all departments within the healthcare facility;
- develop and review institutional IPC guidelines and standards.

2.2 Monitoring and evaluating an infection prevention and control program

Routine monitoring and evaluation of the IPC standards are important for measuring the program's effectiveness. The success of an IPC program is determined by the hospital's ability to prevent HAIs and its transmission which are dependent on the following:

- A facility-wide application;
- Integration into a comprehensive quality management program;
- Ongoing assessment;
- Regular evaluation of effectiveness.

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

Monitoring and evaluation are performed every two months via internal audits and reviews of antibiotic resistance reports, reports of nosocomial (hospital-derived) infections, and other reports. Report findings are presented to national and hospital IPC committees.

2.3 Organising an infection prevention and control programme

2.3.1 Infection prevention and control committee

Responsibility for coordinating, monitoring and evaluating the IPC program is carried out at the national level and at the Vaiola hospital by representatives from the laboratory, operating theatres, pharmacy, communicable diseases, nursing matron and others, who forms the infection prevention and control committee. In smaller hospitals like in Vava'u, etc. the IPC committee is a part of another committee's standing agenda.

The functions of the IPC committee are to:

- Provide a strategy for the implementation (including unplanned events, such as outbreaks) and improvement of the IPC program;
- Ensure monitoring and evaluation of IPC policies;
- Ensure implementation of multimodal strategies to achieve IPC practice improvement
- Ensure access to resources and equipment's are consistently available, used efficiently and cost effective;
- Advocate for the necessary resources required for the IPC program goals;
- develop policies, guidelines, and procedures relating to infection prevention and control and ensuring their currency and accessibility to staff and resources;
- review IPC reports and problems that may cause infection, and identify areas for intervention by using surveillance and other data;
- assess and promote improved practice at all levels of the healthcare facility;
- ensure appropriate staff training in IPC and safety management, provision of safety materials such as personal protective equipment and products;
- ensure that there is a defined program for healthcare-associated infection surveillance that includes collection, analysis and reporting back of data to departments and clinicians;
- ensure that reports on the occurrence of healthcare-associated infections are received and that actions resulting from these reports are determined and monitored;
- provide guidance, advice, and support is given to the IPC officer.

Members of the committee include staff from a variety of departments. Membership includes:

1) The Medical Superintendent (Chairperson of the IPC committee);
2) Pathologist (Deputy Chairperson);
3) Head of the communicable disease section;
4) Senior medical officer;
5) Principal dental officer;
6) Clinical pharmacist;
7) Microbiologist;
8) Supervising public health inspector;
9) Hospital administrator;
10) Bio-med engineer;
11) Matron;
12) In-charge nurse OT;
13) Senior midwife –in charge in obstetrics;
14) In-charge nurse surgical;
15) Infection control nurse (secretary).

However, specialists from various departments [for example, the principal of Queen Salote Institute of Nursing and Allied Health QSINAH)] can be called to meetings when a problem arises in their department, or when they can offer specialised information.

The IPC committee meets regularly (i.e. every two months) to discuss infection prevention activities/reports, and to solve problems from previous meetings. In the event of a critical incident or outbreak situation, the committee should be able to convene promptly.

The IPC Nurse is the secretary of the IPC Committee and maintain the master set of minutes. An agenda is being prepared and distributed prior to each meeting. Minutes of the previous meeting are distributed with the agenda.

The agenda and minutes will be distributed via e-mail and will include a:

- report by the IPC nurse on monitoring and surveillance/audit activities;
- report on actions taken on problems identified at the last meeting;
- report on training activities and needs;
- list of new problems; and
- set of recommendations for change, if needed, and a list of who will be responsible.

Good communication and exchange of ideas with staff can improve work habits and attitudes. Staff should be informed about the infection control committee and the purpose of the program. Hospital management should share ideas and materials with staff, and be ready to listen to their perspective.

A work plan for the IPC program, via the IPC committee should identify key priorities for the period (3 months, 6 months, 9 months, 12 months) of the program – 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 program

2.4 Infection Prevention and Control Nurse/officer

The infection prevention and control nurse/officer is a member of the IPC committee and the role of the IPC nurse is to work with all departments, including the public, community, and clinical sections in the implementation of the IPC program. Two full-time equivalent infection control nurses are working in Vaiola Hospital.

The IPC officer's responsibilities are to:

- coordinate and conduct training activities;
- formulate the annual IPC workplan and budget proposal and its implementation
- carry out audits and surveillance activities;
- develop and disseminate IPC policies and procedures;
- review and update infection control policies;
- monitor staff health status;
- observe IPC practices and make suggestions for improvement;
- help identify problems and assist in problem-solving;
- provide secretarial services and report to the infection control committee at every meeting; and
- support and participate in research.

2.5 Infection Prevention and Control Link Nurses

Link nurses act as a link between their own clinical area and the IPC team. Their role is to increase awareness of infection prevention and control issues in their ward and motivate staff to improve practice. It is essential that they receive training from the IPC team to ensure their competence. They have been shown to be of value to improving clinical ward audit scores, assisting IPC officer to implement policies and collecting data on hospital-acquired infections. In some hospitals, however, there are operational difficulties for link nurse schemes including high turnover of staff and insufficient time for training and monitoring their effectiveness.

The IPC link nurse's responsibilities are to:

- act as a role model to staff on the ward/unit/department by carrying out a high standard of infection prevention and control practices;
- be a proactive resource person in their ward/unit/department when there are specific infection prevention and control needs;
- disseminate information to colleagues on new or revised IPC policies, procedures and guidelines;
- audit compliance with IPC policies, procedures and guidelines within ward/unit/department;

- identify and report on IPC problems and issues on the ward/unit/department;
- identify training needs and assist IPC nurse to provide supplementary education on ward/unit/department;
- and network with other IPC link nurses at regular meetings (i.e. monthly).

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

An IPC program can be successful only when everyone is involved. IPC protects HCWs and their families and communities as well as the patients and their families. However, people are usually willing to change bad habits to good ones when they understand the reasons and the importance of each procedure. Therefore, each hospital and health centre should plan frequent in-service education programs for staff, patients and visitors. In-service training is an ongoing process.

IPC In-service training should be used to teach good practices, change bad habits, and demonstrate new equipment or procedures. IPC is a mandatory annual education and training program for all and new staff orientation programs. The IPC staff education and training program objectives should include; sound knowledge of IPC principles, how these are applied to practice, challenges and problem solving, introduction of new equipment, guidelines and procedures, updates on IPC activities including IPC committee reports

Every level of staff (i.e. nurses, doctors, students and allied health) needs to learn the importance of infection prevention. Even workers who have little contact with patients, such as pharmacy or kitchen staff, are included. All staffs have a responsibility in preventing infections in the healthcare facility.

All HCWs must:

- understand how infection transmission occurs 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.

2.6.1 Orientation

All new staff must attend the IPC orientation program prior to starting work at the hospital. It must include the principles and methods of preventing the spread of infection within staff members' unit or department. The new employee should know their responsibility in the prevention of infection.

2.6.2 In-service education

A program of frequent in-service education is planned for all staff, beginning as soon as the infection control 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 micro-organisms.

2.6.3 Patient teaching

It is the HCW's responsibility to instruct patients 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 their elbows or teach patients with the 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

Visitors must be made aware of the risks they pose by staying within the hospital environment for long periods of time, the importance of washing hands, crowding around patients, handling intravenous sets, catheters, and other patient care equipment. Every opportunity can be used to give one-on-one education in order to increase visitors' knowledge about infection prevention. An excellent time to educate visitors is during the ward round and 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).

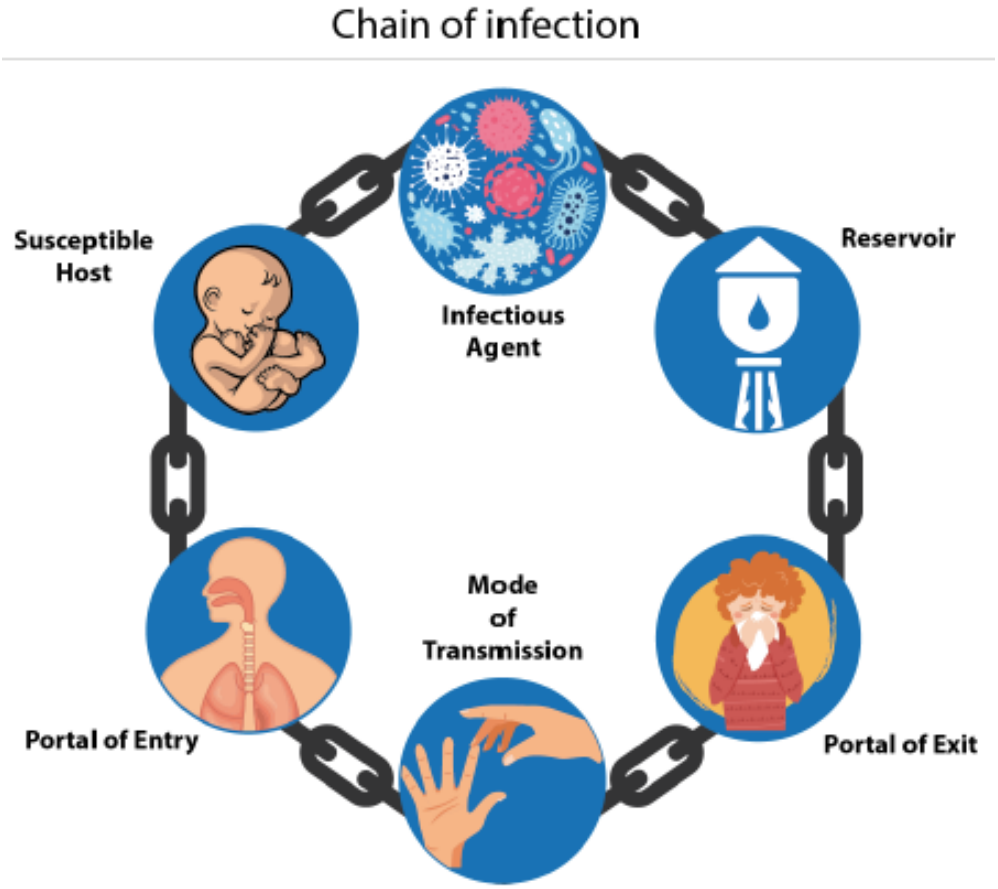
3 INTRODUCTION TO HOSPITAL ACQUIRED INFECTIONS (HAI) AND IPC

3.1 The Chain of Infection

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 COVID-19 infectious disease as an example in this interactive below to explain the chain of infection.

Figure 3.1: Chain of Infection



Infectious agent

First there must be something that causes the disease. The COVID-19 virus is an infectious disease called SARS-CoV-2.

Reservoir

A reservoir is the place the organism or virus is found and sustained. This can be an animal or it can be something in the environment such as water, food and soil.

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 transmit to the host and survive the journey. The COVID-19 virus can survive in bodily fluids for a limited time, and typically is transmitted via contact, and especially inhalation. After sneezing or coughing, infected respiratory fluids can either be directly inhaled by a nearly human (inhalation) or land somewhere which then comes into contact with another person's eyes, nose or mouth e.g. tissue (contact).

<u>Infectious agents can be spread in five main ways:</u>

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 (blood borne)
    - 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
    - Also a type of contact transmission, the 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 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 ~ 3 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 foetus via the placenta. The mother acts as the reservoir and the embryo is the susceptible host.

Portal of entry
Infectious agents gain entry into 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 a few 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. Standard precautions include hand hygiene, use of personal protective equipment, practising appropriate respiratory hygiene, safe use and disposal of sharps, appropriate decontamination of medical equipment, 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 aerosolized particles.

3.3 Common and Important HAI

The healthcare environment includes people, instruments, equipment's, 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 health care facility a safe and comfortable place for the patient. In addition, proper care of the hospital environment can prevent HAI infection.

A HAI is one that the patient did not have when he or she was admitted to the healthcare service. 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 a HAI, because there was no infection before the operation. Other types of nosocomial 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, which has just been used on an HIV-infected patient.

Preventing HAI 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
- 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 differ between the two categories.

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. However, they can be controlled by helping to protect the resistance of the person to infection (e.g. mobilising the patient, providing adequate nutrition, or avoiding the use of urinary catheters and intravenous catheters if possible, promoting patient hand hygiene after defecation and before eating and before touching wounds/skin breaks).

Exogenous infection

Exogenous infections are a result from the transfer of microorganisms to the patient or HCW from an external reservoir. For example, microorganisms can be transferred through direct contact with contaminated hands of HCWs and other patients (cross-contamination), contaminated instruments and needles, or the environment greatly reduce the frequency of cross contamination between patients and HCWs and thus reduce 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 on-going cross 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:

1. urinary tract infection (UTI),
2. surgical-site infection (SSI),
3. associated pneumonia (HAP),
4. 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 a HCF.

For all of the HAIs addressed in this chapter the following preconditions for prevention should be addressed by all managers throughout the Tongan Ministry of Health, informed by the evidence based information provided:

1. Infrastructure/system change: access to the right equipment, supplies and an environment that facilitates the right actions for patient and health worker safety
2. Training and education: a program of routine training and education for all relevant HCWs that is in line with the recommendations presented in this chapter
3. Monitoring, evaluation and feedback: a program of regular monitoring and feedback is in place
4. Awareness raising/promotion: the practices described in the chapter are reinforced through awareness raising such as use of posters referenced in the chapter, displayed at the point of care
5. 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
6. Policies and procedures should be developed, reviewed periodically, revised as necessary, and readily available in the practice setting

3.3.1 Urinary tract infection (UTI)

Urinary tract infection 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 catheterization. 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 include:

- Urinary catheterization which creates a pathway that allows for endogenous transfer of microorganisms (e.g. bacteria from the patient's GI tract can be transmitted to the urinary tract)
- Passage of organisms from the urine bag to the bladder (retrograde contamination) can occur in patients with indwelling catheters
- Some microorganisms that can grow on the outside or inside of the catheter's tubing and in the urine itself
- Handling of the urinary catheter and urine bag by HCWs

Reducing healthcare associated UTI:

- Introducing an indwelling urinary catheter should be done only when necessary and no other options are effective. It is particularly important to limit the duration of catheterization as much as possible
- Following appropriate procedures for inserting and removing urinary catheters will also reduce the risk of UTI
- Consider other methods for managing urinary tract problems that do not require the use of an indwelling catheter
- Ensure that only properly trained persons insert and maintain catheters

- Minimise the duration of catheterisation

Insertion procedure for urinary catheter:

- Explain the procedure to the patient and get his / her consent
- It is recommended that during the procedure an assistant is available
- 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 single use lubricant
- Lubricant is not really necessary, in case you decide to use, be sure is single use
- Practice aseptic non touch technique (ANTT)
- Perform hand hygiene and put on clean examination gloves
- Clean with soap and water and rinse the urethral area and external genitals carefully and thoroughly
- Separate and hold the labia apart or hold the head of penis with the non-dominant hand and prepare the urethral area with the antiseptic solution using a sterile gauze or a sponge forcep with sterile gauze
- Perform hand hygiene and put on a pair of sterile gloves
- Grasp the catheter about 5 centimetres from the catheter tip with the dominant hand and place the other end in the urine collection bag
- 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
- Do not use undue force. In the event of pain, blood or resistance during insertion stop the procedure
- If the catheter is indwelling, pull it out gently to feel resistance, and secure the indwelling catheter properly to the thigh
- For in and out catheterization, allow the urine to slowly drain into the collection bag, then gently remove the catheter
- Dispose of waste appropriately
- Remove gloves and practice hand hygiene

Removal procedure for urinary catheter:

- Indwelling urinary catheters should be removed as soon as possible to reduce the risk of UTI
- Before removing the catheter, ensure that a new pair of clean examination gloves, a syringe is in the point of care
- Practice hand hygiene
- Put on clean examination gloves
- Empty the catheter balloon using a syringe, compare the volume removed to that inserted, it should be the same
- Swab the urethra two times with an antiseptic solution using sponge forceps with sterile gauze
- Gently remove the catheter
- Dispose of all waste appropriately
- Remove gloves and practice hand hygiene

Catheter maintenance:

- Daily cleaning of the peri-urethral area
- Do not rest the bag on the floor
- Urine flow through the catheter should be checked 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 raise the bag above the level of the patient's bladder during transfer of the patient to a bed or stretcher, clamp the tubing
- Before the patient stands up, drain all urine from the tubing into the bag
- Remove the urine after performing hand hygiene and while wearing clean examination gloves
- To avoid contamination, the collection bag should be emptied in a clean fresh vessel, do not permit the tip touch the urine vessel
- For samples collection aspirate the urine from the needleless sampling port with a sterile needle
- Unless obstruction is anticipating bladder irrigation is not recommended
- The catheter collection closed system should remain always closed. Unless absolutely necessary open systems can be open
- In open system replace bags when needed
- Clamping catheters prior to removal is not necessary
- Daily review of urinary catheter necessity and remove as soon as indicated preferably within 24 hours

3.3.2 Surgical site infection (SSI)

Surgical site infections are often the result of contamination during the 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 a 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 hospitalization 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 minimize 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 should be used
    - Antimicrobial agents with an appropriate spectrum of activity should 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
    - Selection of antimicrobial agent(s) for surgical prophylaxis should take
    - account of local/national data on antimicrobial resistance where this is available

- Follow the Tongan ministry of health antibiotic guideline on 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 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
    - In most instances, a single 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 *(Appendix 8)*

3.3.3 Healthcare associated pneumonia (HAP)

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 maximize prevention of cross-transmission of microorganisms
- Additionally, patients should be educated about the following postoperative practices that can prevent development of healthcare-associated pneumonia:
    - 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 and con-sider decontamination program for all patients at high risk for VAP
- If reusable breathing circuits are used, they must be cleaned and appropriately sterilized between patients according to the manufacturers 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, masks are intended for single patient use and are not suitable for cleaning, decontamination and reuse
- Disinfect or sterilize resuscitation devices, such as Ambu bags, promptly according to the manufactures guidelines

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

- Practice hand hygiene
- Wear sterile examination gloves, a mask, and protective eyewear
- Use only sterile fluid to clear a catheter that you're using to suction secretions from the patient's lower respiratory tract if you are planning to reinsert it into the ET tube
- Discard waste appropriately
- Decontaminate and clean suction catheters and then disinfect them with high-level steam
- Remove gloves immediately after therapy and practice 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 patients stop taking solid foods 4-6 hours prior to 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 and encourage deep breathing/coughing
- 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 mobilization of patients
- Ensure adequate nutrition

3.3.4 Infections related to use of intravascular devices

Intravascular 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 de-vice (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 avail-able 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 adherence to hand hygiene during insertion and care of the device
- Immunosuppression
- Cracks in infusion bottles and punctures in plastic containers, allowing for contamination of substance being infused
- Contaminated infusion fluid or additives
- Leaky intravenous administration sets with multiple connections
- Non sterile preparation of intravenous infusion fluid
- Non sterile 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 and see Appendix 6 and 7 “Focus on caring for a patient with a central venous catheter” and “Focus on caring for a patient with a peripheral venous catheter”:

- Avoid intravascular catheterisation when possible
- Practice 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
- Allow the skin antiseptic solution to dry after applying before inserting the intravascular catheter
- Follow Aseptic Non Touch Technique (ANTT) 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 be-comes 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 practice 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
- Routine change of intravascular catheters after 72 hours is not necessary provided that 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

For inserting central venous catheters:

- Avoid use of central venous catheter unless it is essential
- Avoid using the femoral or jugular sites for adults (if possible)
- Central venous catheters should only be inserted 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 ANTT/maximal 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 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 use of intravascular catheters unless essential
- Practice 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 manufacture's recommendation for cleansing site) and allow the antiseptic solution to dry
- Avoid use of intravascular catheters unless essential
- Practice hand hygiene and wear clean single-use examination gloves
- Cleanse the insertion site with antiseptic solution using a circular motion outward from the insertion site (or follow manufacture's recommendation for cleansing 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:

- Practice 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 practice hand hygiene
- If clinical exit site infection is present, assess whether or not it requires antimicrobial treatment
- Document clinical observations of IV site (example: Intact without signs/symptoms of infection, warm, erythema, pus etc.) in patient 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.

Causes of food and water borne infectious diarrhoea which are important in the community (rotavirus, campylobacter, salmonella, cholera) can also be introduced into a HCF 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, diarrhoeal infection may be spread through person-to-person transmission.

Factors that put patients at particular risk for healthcare associated diarrhoea include the following:

- 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 at the correct moments

Prevention of healthcare associated diarrhoea can be achieved by:

- Ensure 5 Moments for hand hygiene
- Single room isolation, cohorting in a separate space or keeping distance between patients should be practiced 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 separate space and use separate washing and toilet facilities if at all possible (i.e. isolation)
- If a separate space is not possible, consider how to help the patients with diarrhoea 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 diarrhoea has resolved

3.4.2 Blood borne pathogens

Blood-borne transmission of viral infection is a recognised risk to both healthcare workers and the 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 virus are important blood-borne pathogens that can be trans-mitted in the health care setting through administration of blood and blood products, use of contaminated needles or sharps injuries.

3.4.3 Tuberculosis

Tuberculosis (TB) is a bacterial infection caused mainly by the species *Mycobacterium tuberculosis*. Transmission is through the airborne route when someone with active disease (untreated smear-positive) coughs, talks, sneezes, or spits. The bacteria can then be inhaled into the lung by people nearby. Only patients who develop lung disease generate the aerosols that allow for 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.

Follow these procedures for patients who are suspected of having TB:

- Initial evaluation and testing is best done on an outpatient basis if possible
- Collect a sample of sputum for smear examination as a matter of urgency. Where available rapid molecular testing may be preferred
- Disposable, non-transparent sputum cups with lids should be used for sample collection
- Perform a chest X-ray to aid diagnosis when available
- Initiation of effective treatment rapidly reduces the risk of infection from infected patients
- All HCFs should be assessed to identify areas where TB transmission can occur
- Adequacy of airflow and natural light should be determined
- In areas where airflow by cross-ventilation is inadequate, extractor fans should be installed
- Natural light should be increased where necessary
- Patients who are coughing in the outpatient clinic or emergency department should wait outside if possible, or in a well-ventilated area. Signs reminding patients about respiratory hygiene precautions, such as the use of tissues when coughing should be displayed prominently
- Patients suspected of having TB should be examined in a well-ventilated area
- The patient should wear a surgical mask if possible
- HCWs treating patients with TB should wear a mask, ideally a fitted respiratory protection mask. Work in the patient area should be planned so as to be performed as efficiently as possible to limit time spent there
- 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 additional patients suspected of having TB in a cohort area of the ward
- Patients with multi-drug resistant (MDR) or extensively drug resistant (XDR) TB should be nursed in isolation
- 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
- 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
- When the patient needs to move within the hospital, he or she should wear a mask. Inform staff in the area or ward to which the patient is taken or transferred so that they can implement effective IPC measures
- 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 2 to 3 weeks, have responded to the treatment, and have had three consecutive negative smear examinations from sputum taken on 3 separate days are no longer infectious]. It will take about 2 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
- If emergency surgery is required, it should be planned to minimise risk of occupational exposure. Numbers of HCWs in the operating room should be minimised and respiratory protection masks should be worn as appropriate
- Every patient that is confirmed to have TB via laboratory smear should be informed of their positive result

- 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)
- Contact tracing for screening should be performed and the patient should be monitored to ensure full compliance with treatment

4 STANDARD AND TRANSMISSION BASED PRECAUTIONS

Infection prevention and control precautions are divided into two distinct groups: standard precautions and transmission-based precautions. It is a set of tasks designed to protect staff and patients from contact with infectious agents wherever healthcare is delivered. This chapter will cover each of the elements of standard precautions and transmission-based precautions.

4.0 Standard Precautions

It is essential that all HCW's apply standard precautions at all times to protect themselves and patients 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 or from equipment;

Standard precautions should be used for all patients, regardless of their diagnosis or presumed infection status and are used in handling all 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.

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

- hand hygiene
- respiratory hygiene/cough etiquette
- personal protective equipment (PPE) according to the risk
- safe injection practices, sharps management, and injury prevention
- routine environmental cleaning
- appropriate handling of laundry
- Reprocessing of reusable medical equipment and instruments
- Waste management

4.1 Hand Hygiene

4.1.1 The Importance of 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. Bacteria are present on the hands most of the time and are categorized into two, namely the:

- **Resident flora -** resides on the surface of the skin and
- **Transient flora** – microorganisms found in the body mainly hands of the HCW during contact with patients and contaminated environmental surfaces within the patient surrounding. The transient organism survives and multiplies on the surface of the skin

and can easily be removed by frequent hand hygiene. Transient organisms are most often associated with HAI's.

Several studies have highlighted that HCW's hands contaminated with transient organisms have been responsible for outbreaks of gastroenteritis and other multi-resistant gram-negative organisms in the neonatal intensive care unit and adult intensive care units. In addition, hands can be contaminated with the Influenza and other virus through contact with secretions and contaminated environmental surfaces and can lead to cross-infection.

4.1.2 Indications for Hand Hygiene

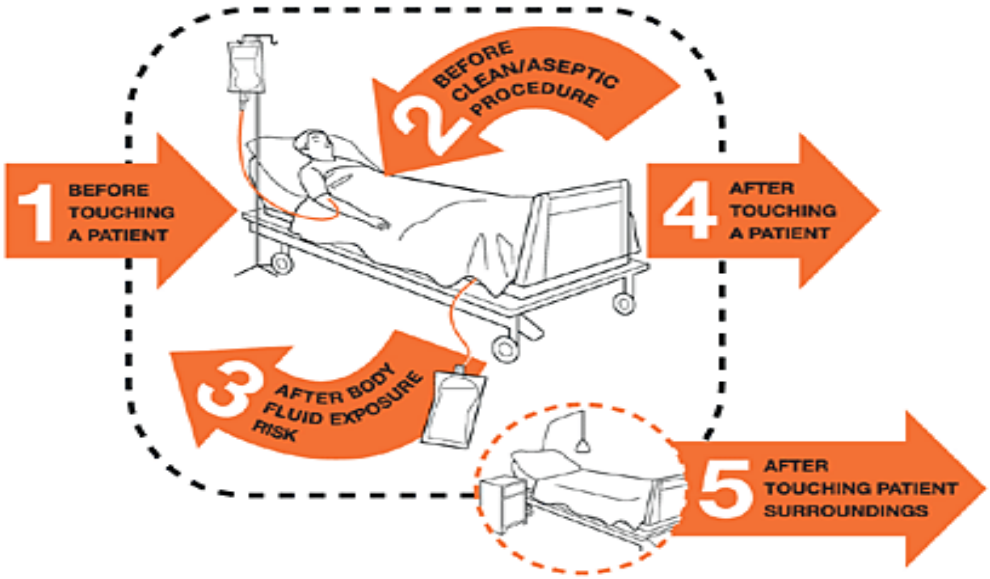
Hand hygiene is mandatory and is the single most important measure to prevent and minimize the spread of infections within hospital environments.
The main purpose of hand hygiene is to prevent the spread of infection by removing visible soil and micro-organisms (Transient microorganisms) carried on the hands of both staff and patients.

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

To ensure proper hand hygiene soap must be rubbed on all surfaces of both hands followed by rinsing with running water and drying by a single-use hand towel or paper towel.

The Five (5) moments for Hand Hygiene developed by the World Health Organisation (2009) is strongly recommended in clinical settings and is applicable to all hospitals, health centres and dispensaries.

Figure 4.1a: The Five (5) moments for hand hygiene



Note: Hand hygiene should also be done before and after removal of gloves.

Other Examples of when to Perform hand hygiene

- Before and after eating or preparing to serve or handle food
- Before administering medications to a patient
- When hands become visibly soiled
- After using the toilet
- Before and after removing gloves
- Before and after leaving work
- Before and after using computer keyboards especially in the clinical environment
- After wiping mouth and nose secretions
- Entering and when leaving the patient environment especially during an outbreak of an infectious agent
- After handling laundry and equipment

Note: Access to hand hygiene must also be provided to immobile inpatients after toileting and before meals and encouraged with patients and visitors.

4.1.3 Hand hygiene Products

Hand hygiene includes both handwashing 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.
Water alone is not suitable for cleaning soiled hands; soap must be used with water for effective hand washing.

Hand drying
This is an essential part of handwashing. Ideally, hands should be dried with a single-use paper towel or single use cloth towel or hand driers that are able to dry hands as quickly as paper towels. The reuse of cloth hand towels should be avoided because of the risk of cross-contamination.

Reusable single-use towels should be the size of a face cloth and be placed in a hand-made dispenser or container beside the sink, once used the cloth should be dropped in a receptacle and then collected for washing at least 3 times a day.

Plain soaps
Soaps are more commonly available in the form of being bar or cake soaps and liquid, the use of plain soap preparations and water act by removing microorganisms but have no antimicrobial activity. If bar soaps are used, it is important to ensure that it placed on a well-drained holder and should not be immersed in liquid. It is preferable to use liquid soap preparations.
Handwashing with liquid plain soap aids in the removal of dirt, soil, and various organic substances from the hands. Plain soaps have minimal, if any, antimicrobial activity, though handwashing with plain soap can remove loosely adherent transient flora.

Hand hygiene with plain soap and water is indicated for removing certain organisms like *C. difficile and non-enveloped viruses e.g. norovirus.* According to Maiwald (2009), alcohol hand rub is effective at removing vegetative forms of C. difficile but is not effective at removing spores.

4.1.4 Alcohol-Based Hand Rubs (ABHR)

According to the WHO, alcohol-based hand rub preparations contain either ethanol, isopropanol or the combination of two 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 highlighted that an alcohol-based hand rub preparation of at least 70% isopropanol, 0.5% chlorhexidine and a skin emollient is effective against HAI's.
The efficacy of alcohol-based hand rub depends on appropriate usage which includes:

- Type of alcohol used;
- Whether hands were wet when alcohol was used (hands should be dry before use of ABHR);
- The volume of alcohol used (ideal volume is unknown, however, if hands dry before 10 - 15 seconds after being rubbed then it is likely that insufficient volume of alcohol was used;
- Hands that are visibly soiled (if hands are visibly soiled, wash with soap and water).

A culture of hand hygiene should be encouraged not only among healthcare staff but also with patients and visitors and the general community at large.

Note: HCWs must maintain short clean fingernails and must not wear nail polish or artificial nails when at work.

4.1.5 Hand hygiene technique

The appropriate steps must be followed to achieve effective hand hygiene. This includes ensuring that the duration of hand hygiene is followed for hand washing and the use of alcohol handrub and the necessary steps during hand hygiene to ensure that all surfaces of the hands are covered.
The following steps should be followed when performing hand hygiene with either soap and water or alcohol based hand rub (Refer to figure 4.1b to follow the steps for hand washing or when using alcohol hand rub).

1. Ensure jewellery has been removed
2. Lather hands with liquid soap and water or if using alcohol hand rub and rub hands palm to palm
3. Right palm over back of left hand with fingers interlaced finger and vice versa
4. Palm to palm with fingers interlaced
5. Backs of fingers to opposing palms with fingers interlocked
6. Rotational rubbing of left thumb clasped in right palm and vice versa
7. Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa
8. Rinse under running water if hand washing:
    a. Do not touch taps with clean hands – if elbow or foot controls are not available, use paper towel to turn off taps
    b. Pat hands dry using paper towel or single use hand towel

There are three (3) types of hand hygiene techniques;

- *Social or routine hand-wash*
- *Aseptic or Clinical hand wash*
- *Surgical hand antisepsis*

i. Social or routine hand hygiene

(Refer to figure 4.1b to follow the steps for hand washing).

Hands and wrists are washed for 40–60 seconds ***with plain liquid or bar soap to remove dirt, soil and other organic substances from hands and transient microorganisms.*** Hands are then dried with a paper towel or, if unavailable, a single-use hand towel. This type of hand hygiene is suitable for all routine procedures.

Routine social hand hygiene with Alcohol-Based Hand Rub (ABHR)

Many studies have stated that ABHR is more effective than handwashing with soap and water. 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:

- 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 hands are dry about 20–30 seconds; if hands are dry in less than 20 seconds, not enough hand rub was used. *(Follow the same steps for handwashing in figure 4.1b).*
- Hand hygiene with ABHR can be used according to the indications for 5 moments (refer to figure 4.1a).

ii. Aseptic Clinical hand hygiene

Aseptic clinical hand hygiene is undertaken to remove or destroy transient micro-organisms and inhibit the growth of resident microorganisms. This 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 or urinary catheterization.

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

- by washing hands and forearms with antimicrobial soap (chlorhexidine gluconate 2% soap) and water, for 40–60 seconds and dried with a hand towel. **(Follow the same steps for handwashing in figure 4.1b)**
- if using ABHR, your hands should stay wet for 20–30 seconds. ABHR is only appropriate for hand hygiene if your hands are not soiled with protein matter or fat, or otherwise visibly dirty. **Follow the same steps for handwashing in figure 4.1b.**

Note: Immersing hands in bowls of antiseptics is not recommended.

iii. Surgical hand Antisepsis

Surgical hand antisepsis is done in the operating theatre and it removes or destroys transient micro-organisms and reduces the resident flora. Hands and forearms are washed thoroughly with antiseptic soap for a minimum of 3–5 minutes. Hands are dried using a sterile towel. This should be carried out before all invasive procedures. The most commonly used products for surgical hand antisepsis are povidone-iodine (PVP-1) or chlorhexidine containing soaps.

The pacific perioperative practice bundle - Infection Prevention: Scrubbing, Gowning & Gloving recommendations that the criteria for antimicrobial scrub solution should be:

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

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

Note: The 1st scrub of the day is five (5) minutes.

5 MINUTE SURGICAL SCRUB TECHNIQUE

The following is a recommended procedure for a 5-minute scrub (1st 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 cm 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 they are 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

In addition:

- if scrub sponge and nail cleaners are unavailable – greater attention must be paid to the first-hand wash of the procedure to ensure nail beds are thoroughly cleaned by dipping 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.

3 MINUTES SURGICAL SCRUB TECHNIQUE

The following is a recommended procedure for a 3-minute scrub – used 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 cm 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

rinse for the final time.

Steps before starting surgical hand preparation (WHO, 2009)

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

iv. Surgical hand preparation with ABHR

Several long-acting (chlorhexidine gluconate or quaternary compounds) ABHR's are licensed for the commercial market. Surgical hand antisepsis using commercially prepared ABHR requires 3 minutes' contact time. However, manufacturer instructions should be followed.

It is important for all HCWs to learn the steps for HH to ensure that all surfaces of the hand are cleaned.

Figure 4.1b: Steps for hand washing

Figure 4.1c Hand hygiene audit form- used for hand hygiene audits

Hand Hygiene observation - Data collection form.

Organisation: ____________________

Depart/Ward: ____________________

Date: ____ / ____ / ________

Auditor: __________ Session No.: __________

Start Time: __________ Finish Time __________

Duration of Session: __________ mins

FIVE MOMENTS FOR HAND HYGIENE

1. Before touching a patient
2. Before a procedure
3. After a procedure or body fluid exposure risk
4. After touching a patient
5. After touching a patient's surroundings

Notes

Hcw	Moment	Action	Glove	Hcw	Moment	Action	Glove	Hcw	Moment	Action	Glove
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.
	○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.		○ 1 ○ 2 □ 3 □ 4 □ 5	□ 1. Rub □ 2. Wash □ 3. Missed	○ 1. On □ 2. Off □ 3. Cont.

Total Correct Moments: **Total Moments:**

Figure 4.1d: Bare below the elbow (BBE) policy Audit Form

AUDIT OF COMPLIANCE WITH BARE BELOW THE ELBOW POLICY
Ward: _____ Auditor: _____ Date: _____

Please answer "Yes" if the staff member has sleeves above the elbows, no wrist jewelleries including watches, no ring/s or short clean nails.

Staff Category: Nursing/Midwife– N, Medical – DR, Personal Care Worker – PC, Allied Health – AH Administrative staff – AC, Invasive Technician – BL, Domestic – D, Student Doctor – SDR, Student Nurse/Midwife – SN, Student Allied Health – SAH, Other Staff - O	Sleeves above the elbow [Yes/No]	No Wrist Jewellery [Yes/No]	No Rings [except significant ring] [Yes/No]	Short Clean Nails with no fingernail enhancements [Yes/No]
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note:
1. Significant ring: a plain band ring may be worn.
2. Fingernail enhancements: include but are not limited to nail polish, artificial nails, tips, wraps, appliqués, acrylics, gels and any additional items applied to the nail surface are not recommended.
3. Formula for the calculation of compliance rate:
No. of Yes/Total number of staff assessed X 100/1

4.2 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 virus and other influenza like symptoms.
Respiratory hygiene is an element of standard precautions and should be practiced at all times by all patients with respiratory symptoms (e.g. coughing, sneezing).

The following key messages can be delivered in both outpatient and inpatient settings to people with respiratory infections to:

- 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 then wash immediately;
- spit into tissue if spitting is necessary and dispose of tissue into waste and/or garbage bin;
- 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 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 and nose.

Our hospitals and health centres should promote respiratory hygiene and cough etiquette by:

- ensuring that appropriate materials are available for patients to adhere to respiratory hygiene and cough etiquette;
- Maintaining at least 3 feet (1 meter) distance from other patients;
- 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;
- making hand hygiene (e.g. dispensers of alcohol-based hand rubs) with instructions on how to use it 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;
- ensuring that all staff have access to and are trained in using personal protective equipment.

4.3 Personal Protective Equipment (PPE)

PPE is an important component in the prevention and control of infectious diseases. PPE is a set of barriers or equipment used to protect the mucous membranes (eyes, nose mouth), airway, skin, and clothing from infectious agents.
PPE also reduces the risk of occupational exposure to a variety of infections, such as avian influenza, SARS, Ebola Virus Disease (EVD) and recently, the new deadly and COVID-19 (SARS-CoV-2) disease.

Depending on circumstances, PPE is part of Standard precautions and includes: surgical mask or NIOSH-certified N95 particulate respirator masks, eye shields, face shields, eye goggles,

waterproof gowns and coveralls, shoe covers, head covers, rubber boots (gumboots), plastic linings for gumboots, and gloves.
PPE cannot be used on its own and must be used simultaneously with standard and additional precautions. It is important to use PPE effectively, correctly, and at all times where contact with blood, body substances, excretions, and secretions may occur.

The selection of PPE is based on the assessment of:

- 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;
- Type of known or possible infectious agent in consideration of:
    - The local context, current epidemiology
    - What is happening in your area, city, other countries
    - Is there an outbreak??
- Likely modes of transmission of the infectious agent.

The use of comprehensive PPE is mandatory if direct, close contact with patients suffering from highly pathogenic airborne and droplet viruses such as Filovirus disease (Ebola and Marburg), MERS-CoV, Avian influenza A (H5N1) in humans, SARS and SARS-CoV-2 (COVID-19) is anticipated.
Careful removal of PPE is also very important and healthcare workers should receive training in how to put on (donning) and remove PPE (doffing) *(follow the steps from figures 4.3a and 4.3b).* Additional specialized 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. **This applies to the Operating Room (OR) area as well, OR attire should not be worn outside (i.e. other areas of the hospital). Also, PPE must not be worn over uniform as a matter of keeping warm. However, in the context of SARS-CoV-2 (COVID-19), there is an extra ordinary precaution required of PPE donning and doffing at different level of facilities that require PPE.**

4.3.1 Gloves

Gloves can protect staff and patients from infectious agents like multi-resistant organisms (MRO's) and is an essential component of Standard and Contact precautions. Gloves are used to protect HCW's hands against contamination and should be worn by all HCW's when touching blood, body substances secretions, excretions, and contaminated equipment or surfaces.

When to Change Gloves:

- Hand hygiene should be performed before and after removal of gloves;
- Between care/treatment of patients (to prevention cross-transmission of infection);
- when performing separate procedures on the same patient;
- As soon as they are torn or punctured;
- Before touching non-contaminated items and environmental surfaces.

Table 4.3a Types and Indications of Use for Gloves

Glove Type	Indication	Examples
Non-Sterile Examination gloves	• 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.	• Venipuncture • Vaginal examination • Nasogastric tube insertion • Rectal Examination • Emptying urine bags • Minor dressings (cuts) • Saliva in dental procedures
Sterile Gloves	• Any surgical invasive procedures where aseptic condition must be maintained	• Vaginal delivery • Insertion of Central line etc. • Preparation of Chemotherapy drugs and total parental nutrition • Radiological procedures etc. • Lumbar puncture • Etc.
Nitrile Gloves (is resistant to chemicals and disinfectants such as chlorine and glutaraldehyde)	• Preferable for clinical procedures requiring more patient contact • Alternative for latex sensitivity or allergy.	• 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	• Cleaning reprocessing equipment in the Central Sterile department • Contaminated equipment • Cleaning contaminated surfaces etc.

4.3.2 Masks, Eye Protection (face shields/eye goggles)

Masks, eye protection, and face shields should be worn to protect 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 is an essential component of Airborne and Droplet precautions.

Table 4.3b Types of Mask and Indications

Surgical Mask Indications	**N95 or P2 particulate respirator Mask Indications**
• 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	• Airborne precautions e.g. TB, MERS, SARS –CoV-1 and SARS CoV-2 (COVID-19) • Procedures that generate aerosols of particles of known or suspected infectious agents **Not all N95 particulate respirator masks are fluid resistant, only N95 respirators labelled Surgical respirators are tested for fluid resistance.**

Note: Surgical masks can be used by patients who are coughing to prevent transmission of infectious agents.

When Masks are worn ensure that:

- Perform hand hygiene before putting on a mask;
- It is changed when it becomes wet (it is no longer effective when wet);
- Do not reuse mask once it is removed;
- Do not allow the mask to hang on the neck;
- Do not touch the front of the mask while it is in use;
- Perform hand hygiene after removal of a used mask.
- The front of the mask is considered contaminated.

How to perform a Seal Check when wearing a Respirator Mask (N95 or P2)

A 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 readjusted. The user seal check can either be a positive pressure or negative pressure check. Before checking ensure that you cover the front of the respirator mask with both hands, being careful not to disturb the position of the respirator

1. Positive seal check
    a. Exhale sharply. A positive pressure inside the respirator = no leakage. If leakage, adjust the position and/or tension straps

2. Negative seal check
    a. Inhale deeply. If no leakage, negative pressure will make respirator cling to your face
    b. 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 (2014), both face shields and goggles are considered to be equally effective, therefore either device can be selected on personal preference.
- Fogging can affect both 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 enhance more patient interaction**.**
- Reusable eye shields and goggles should be cleaned with detergent and water or disinfected using the manufactures instructions.
- The front of the eye shield/goggle is considered contaminated**.**

4.3.3 Fluid Resistant Gowns, Coveralls and Aprons

According to the WHO (2014), Guide on PPE in the context of Filovirus, coveralls, and gowns are equally acceptable as there is a lack of comparative evidence to show if one is more effective than the other. Gowns are easier to put on and take off and are more familiar to HCW's.

NB: In hot and humid climates like Tonga, heat and humid stress is less with gowns.

- 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. The following gowns and coveralls are fluid resistant:
    - EN13795 is tested for fluid resistance penetration high performance or AAMI Level 3 performance;
    - AAMI PB70 tested for resistance to blood-borne pathogen penetration- Level 4.
- The 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 sleeve 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 Multi-drug resistant organisms or other infectious agents that require contact precautions.
- Removal of gowns/aprons should be done before leaving the patient area to prevent contamination of the environment.

Head cover

This 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.

Shoe cover and Boots are highly recommended when caring for patients with the confirmed or unknown infectious agent that has rapid fatality with a high mortality rate like the Ebola virus. In

this situation, boots are preferred because it is easier to clean and disinfect. Shoe covers are worn over closed shoes to facilitate against decontamination.

4.3.4 Sequence for putting on (Donning) and Removing(Doffing) PPE All health care workers caring for highly infectious patients must be trained and competent in putting on and removing PPE.

Before Donning PPE

- HCW's must be trained and competent in PPE donning and doffing 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 procedures should be available in the donning and doffing area 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 and to check that the PPE is placed on correctly and during the removal of PPE.

When Putting on PPE

PPE must be put on using the correct order according to the donning procedure *(see figure xx below)* which ideally should be in the area prior to the entering the isolation room, this is because once the HCW enters the patient zone, the PPE cannot be adjusted;

When Wearing PPE during Patient care

- Do not touch the eye protection (face shield/goggle) or mask;
- Keep hands away from the 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 goggle, the HCW must immediately leave the patient environment to the doffing area to remove PPE under the supervision of the trained observer or buddy.

When Removing PPE

- This must be done in the designated doffing area under the supervision of the observer/buddy;
- The buddy must guide the HCW through the correct steps for doffing PPE, slowly to avoid self-exposure;
- Discard PPE in the appropriate designated container;
- Perform hand hygiene

Figure 4.3a: Sequence on Putting on Personal Protective Equipment (PPE)

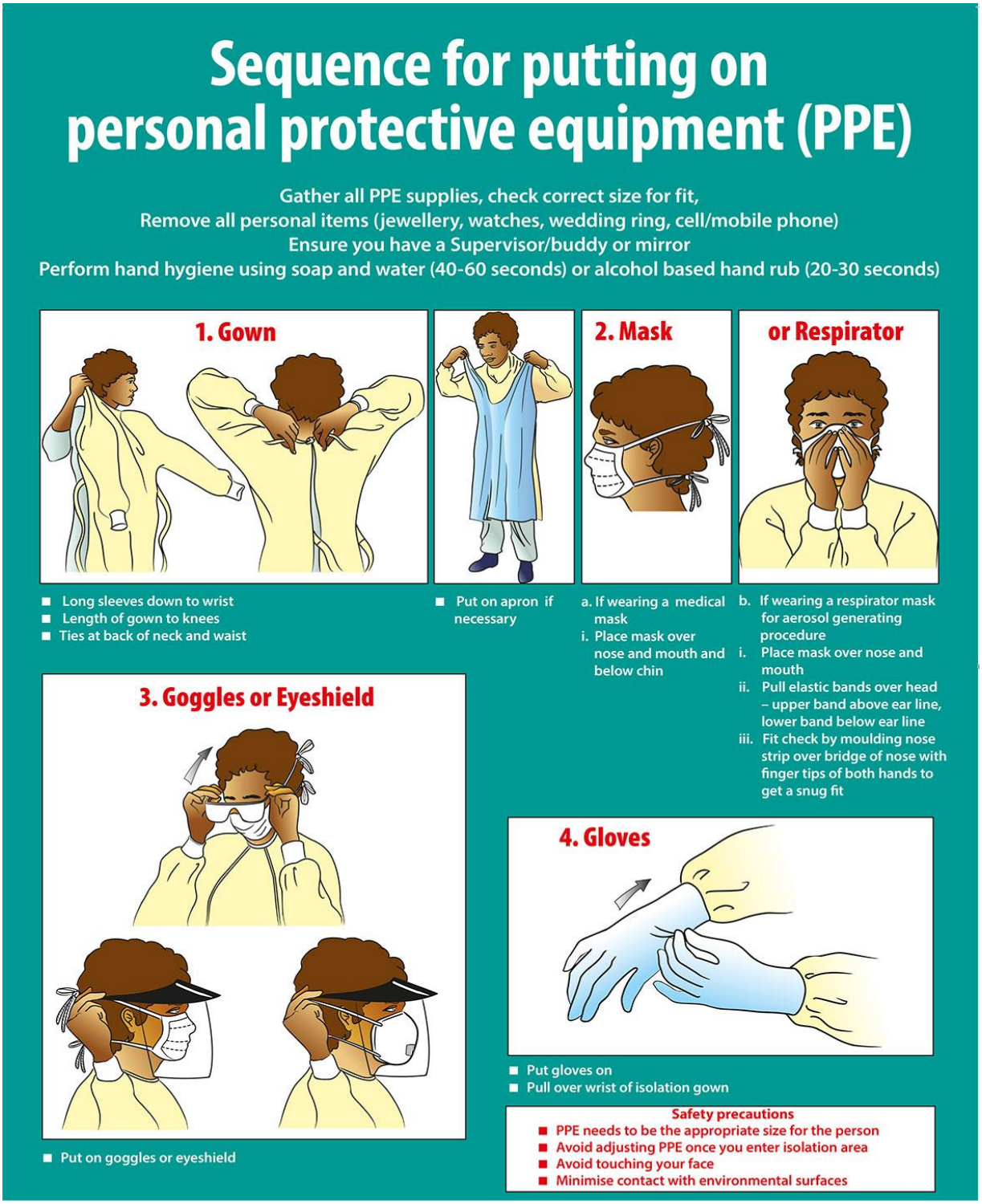
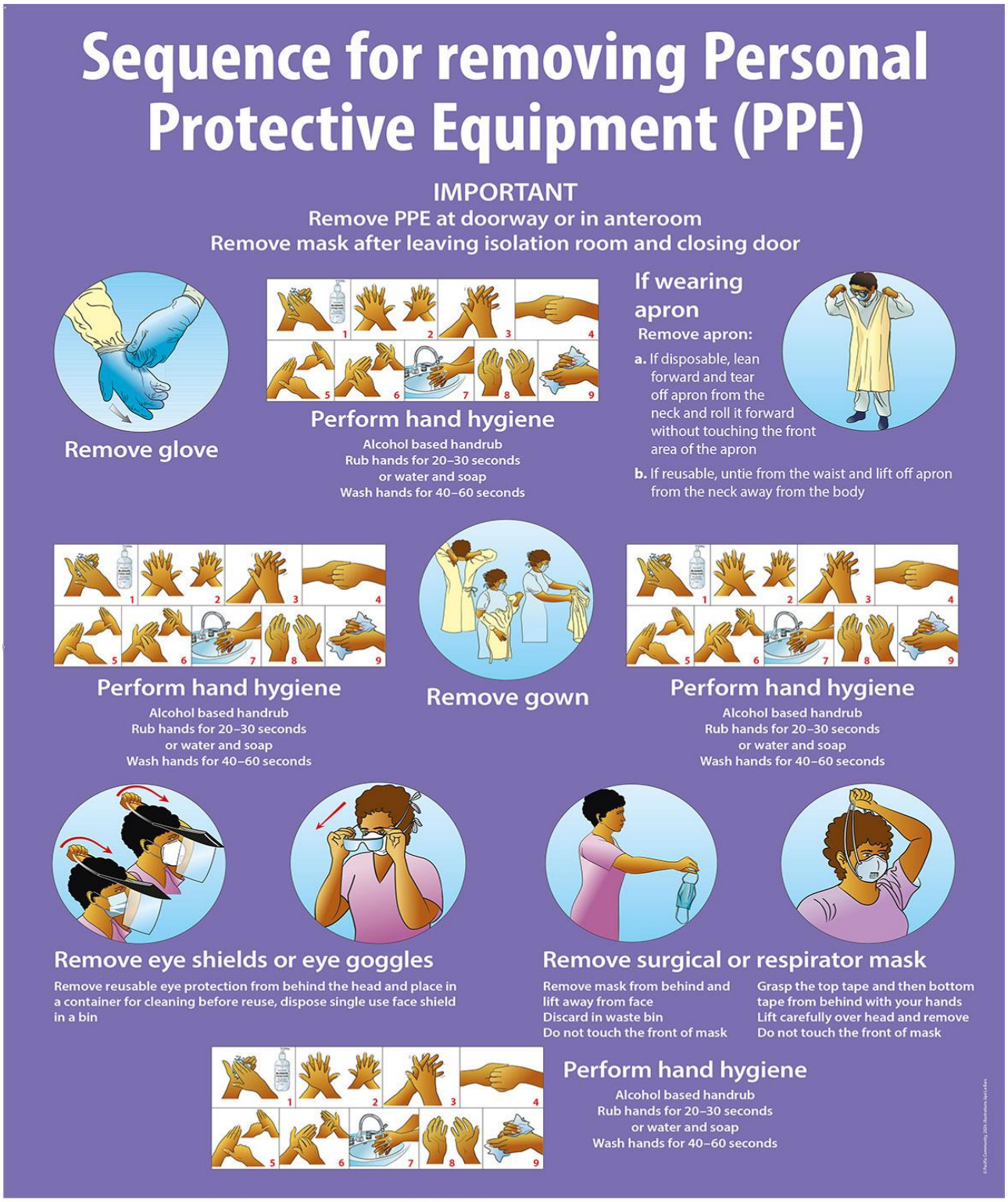


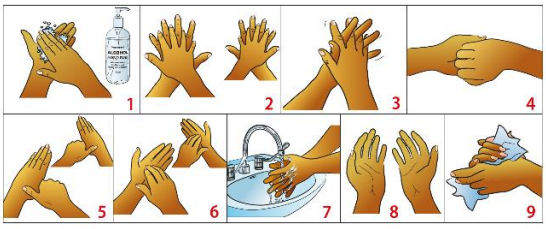
Figure 4.3b: Sequence on Removing Personal Protective Equipment (PPE)



4.3.5 PPE Competency Assessments for Healthcare workers

PPE is designed to protect healthcare worker safety. Therefore, it is vitally important that all healthcare workers are 100% competent in the correct procedure for putting on and removing PPE.
In this assessment the staff trained on PPE are required to demonstrate the correct steps in performing hand hygiene and donning/removing PPE.

Figure 4.3c: PPE Competency Assessment

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.		
	Performs hand hygiene steps:  Washes hands for 40 to 60 seconds; or cleanses hands with alcohol hand rub for 20 seconds.		
Gown	Puts on disposable single use long sleeve 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)	Puts on surgical mask. Places mask over the nose and mouth and below chin.		
	Or puts on a respirator mask by placing mask over nose and mouth and pulls elastic bands over head		

	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 finger tips of both hands to get a snug fit.		
	Positive seal check. • Exhales sharply. A positive pressure inside the respirator = no leakage. • If leakage, adjust the position and/or tension straps .		
	Negative seal check • Inhales deeply, if no leakage, negative pressure will make respirator cling to face.		
Protective eyewear/visor	Puts on protective eyewear, adjusts to fit.		
Gloves	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 second 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 roll 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 mask from behind and lifts away from face and discards in a bin.		
	Or if wearing a respirator mask, grasp the top tape and then the bottom tape from behind with your hands.		
	Lift carefully overhead and remove and discard 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.		

4.4 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.

4.4.1 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 sharp after use.
- Sharps should never be forced into a sharps container.

Cleaning staff should not be required to clean up loose sharps. Loose sharps should be notified to the on-duty medical supervisor so that HCWs can dispose of sharps properly. This will also serve to encourage proper disposal of sharps in the first place.
In situations where by sharps are on the ground or floor, use tongs or similar implement to pick up the needle and syringe. If no implement is available, put on gloves and carefully pick up the needle and syringe with the needle furthest away from your fingers and body

4.4.2 Sharps containers

Standard sharps containers should be ordered well in advance of their anticipated need 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 in a place 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.

4.5 Cleaning the Healthcare Environment

Infectious agents present in the hospital environment can be transmitted to patients via the hands of staff when they have contact through contaminated equipment or the environment. Therefore, frequent environmental cleaning reduces the number of micro-organisms 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 soils from the environmental surface.
Routine environmental cleaning prevents microorganisms from multiplying on clean dry surfaces and also enhances the well-being of patients and staff.

Even though the housekeeping staff has the responsibility of keeping the environment clean and safe, nurses and supervisors must supervise the cleaning in the wards and clinics. Housekeeping staff is an integral part of the healthcare system.

In Vaiola hospital, housekeeping services have been outsourced. However, it is still the responsibility of the nurse unit managers and the IPC nurses to ensure that the hospital environment is cleaned appropriately.

The level of cleaning required in certain areas of a health facility depends on the risk of contamination with infectious agents. For example, the general areas of the hospital will require regular cleaning as opposed to areas like the Isolation ward and the Intensive care units where there is a risk of multidrug-resistant organism's transmission, will require additional levels of cleaning.

4.5.1 Cleaning Chemicals

There are two main groups of cleaning chemicals that are to be used 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 within a healthcare setting must be either be an approved hospital-grade disinfectant, preferably with label claims against specific organisms, OR a chlorine-based product such as sodium hypochlorite.

4.5.2 Cleaning Schedules

It is vital that all hospitals and health centres throughout Tonga have a documented cleaning schedule that should be monitored by the Sister in charge. Cleaning schedules in the hospital environment, especially in the wards is determined by the risk of transmission of an infection within the environment.

The recommended schedules for cleaning include: frequency and methods and are divided into two main areas:

- **Minimal hand contact areas** e.g. floors, walls, ceilings, and non-patient areas;
    - These areas require routine cleaning with a detergent solution.
    - Damp mopping is recommended over dry mopping.

- **Frequently hand contact areas or high-risk surface areas are in-patient areas** e.g. doorknobs, bedrails, bedside table, wall areas around the toilet and bathroom. These areas:
    - Require cleaning with a detergent solution more frequently than minimal hand contact areas.
    - When multi-drug resistance is suspected or known to be present in an area, routine cleaning should be intensified and is cleaned twice with the 2nd clean to include a disinfectant recommended by the healthcare facility (e.g. sodium hypochlorite).
    - Shared clinical equipment's in these areas such as trolleys, knobs of certain machines, etc. should be frequently cleaned using detergents.

The tables below outline a cleaning schedule for levels of risk and cleaning frequency.

Table: 4.5a

KEY for cleaning Schedule	
Level of Risk	**Area/Ward**
Very High Risk	Outbreak area
High Risk	Intensive care units, operating theatres, burns units, post-operative care units
Significant Risk	General wards
Low Risk	Office area, nonclinical areas
Level 1	Detergent
Level 2	Disinfectant for multi-drug resistance or MRSA and Detergent (disinfectant should ideally have a label indicating evidence against the organism of concern

Table: 4.5b

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 & after discharge	Daily & after discharge	Daily & after discharge	After discharge	1 2
	Weekly & at discharge under bed	Weekly & 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 & 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
Commode	After use and daily	After use and daily	After use and daily	After use and daily	1 2
Computer and keyboards	weekly	weekly	weekly	weekly	1
Curtains	After discharge	monthly	biannually	annually	Laundry wash
Doorknobs 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 the 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
Nebulizer 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 & after use	before & after use	Before & after use	before & after use	1 2
Sinks (handwashing)	Twice daily	daily	daily	daily	1
General surfaces in the patients 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
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 Prevention and Control of Infection in Healthcare (2010)

All hospitals and health centres should have a cleaning schedule with clear lines of responsibilities for Housekeeping staff and should include:

- Rosters;
- Frequencies of cleaning required and methods for cleaning;
- The products used to clean specific areas with standard operating procedures for mixing solutions;
- Clear standard operating procedures on cleaning mops, buckets, and other items.

4.5.3 Cleaning techniques

Incorrect or inappropriate cleaning techniques may spread micro-organisms around 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 which are considered relatively clean to dirty. This means that areas/elements which are low touch or lightly soiled should be cleaned before areas/elements which 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 elements. Dusting technique should not disperse the dust, (i.e. use damp cloths).
- When using cloths and bucket/solution system to clean:
    - avoid 'double-dipping' used cloths into the bucket containing clean, unused cloths. Doing this can contaminate the remaining clean cloths which are in the solution and result in spreading microorganisms to surfaces that are wiped thereafter.
    - to maximise the use of cleaning cloths, they should be folded and rotated in a manner so as all surface areas of the cloth, including the front and back, are used progressively as elements are cleaned
    - more cloths may be required to clean 'high-touch surfaces' compared to 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 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 3-bucket system for floors when cleaning isolation units or 2-bucket for routine cleaning:

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

Use of Disinfectants (sodium hypochlorite 1%)
When there is a presence of infectious agents e.g. Clostridium difficile or MRSA patient requiring transmission-based precautions, the cleaning schedule and frequency should be intensified to include:

- physical clean with detergent and followed by a disinfectant, this is called a two (2- step clean); or
- physical clean with a two in one (2-in-1step clean) which consist of a combined detergent and disinfectant.

Note: Physical (manual) cleaning with a detergent solution is the most important step in the cleaning process, sole reliance on using detergent solution or 2-step clean without manual cleaning is not recommended.

4.5.4 Colour coding cleaning equipment

Table 4.5c describe the colour coding for all cleaning equipment in healthcare facilities throughout Tonga.
A standard for colour coding cleaning equipment is the most effective method of restricting cleaning equipment to individual areas of health facilities for example; colour coding will prevent the use of the dirty utility mop (the mop handle should be painted red) from being used in the main ward area (this is where the mop handle with the blue paint should be used).

Equipment may include dry mops, wet mops, mop handles, buckets, wringer buckets, and gloves. All other equipment that would assist in the control of infection should also be colour coded.

Table: 4.5c

Typical colour coding for equipment	
AREA	**Colour**
Infectious/isolation areas	yellow
Toilets/bathrooms/dirty utility rooms/sluice	red
Foodservice/preparation areas	green
General cleaning	blue
Operating theatres	white

4.5.5 Important housekeeping practices

Important housekeeping practices include the following.

- Prepare cleaning solutions daily according to facility procedure;
- When using neutral detergent, follow dilution instructions. Too much or too little water may not destroy micro-organisms.
- Scrubbing with detergent and water is the most effective way to remove dirt and micro-organisms.
- Always wash hands after cleaning procedures.

- Wear utility gloves to clean contaminated areas such as toilets, spills of blood and body fluids.
- Write schedules for all housekeeping personnel for more effective housekeeping practices
- Use a wet cloth or mop for walls and floors. Dry sweeping and dusting spread dust and micro-organisms into the air and onto patients and clean surfaces.
- Use separate equipment (e.g. cloth, brushes, and buckets) for cleaning. Use separate equipment (e.g. cloth, brushes, and buckets) for cleaning contaminated areas such as toilets.
- Change solutions when they look dirty.
- Wash cleaning cloths and mops daily and soak then in bleach solution for 15 minutes and then dry them in the sun. Soiled cleaning equipment can spread micro-organisms.
- Always clean from top to bottom, so that soil and dust that falls on the floor will be cleaned-up last.

Note: Avoid soiling clean areas while you are cleaning dirty areas. Manual cleaning with detergent and water is more effective way to remove micro-organisms from rooms and cabinets.

Note: Always use a different cloth when cleaning floors, bathrooms, and patient items.
Establish schedules for cleaning floors, environmental surfaces, sinks and toilet areas.

4.5.6 Housekeeping Audits and Checks

Auditing of cleaning is carried out regularly (i.e. monthly) and is normally done via visual inspection. The results of the audits are discussed in the hospital management committee meetings or the Infection Prevention and Control Committee meeting.

4.5.7 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, HBV, MERS, SARS-CoV-1, and SARS-CoV-2 (COVID-19).

The items needed for cleaning spills include:

- Neutral detergent.
- Cloth or old pieces of linen, paper towel.
- Mop.

The procedures for cleaning spills are:

1. Wear gloves.
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 2 – step clean if infectious agent is a concern.

4.6 Safe Handling of Healthcare 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.

Hospital managers are responsible for providing:

- an appropriate and safe laundry facility;
- 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.

Linen used hospitals and health centres carry many micro-organisms. Used linen that is soiled with blood, urine, faeces or other body substances may be 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 are applied 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 not sorted or washed in patient care areas.

4.6.1 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 feet from sharp items and from blood and body fluid spillages;
- protective eyewear; and
- plastic or rubber aprons.

4.6.2 Collecting and transporting soiled linen

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

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

4.6.3 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.

Note: Soiled linen should be sorted and processed in a separate area (e.g. away from clean linen, patient care areas and food preparation areas).

4.6.4 Laundering linen

The following steps should be taken when laundering soiled linen.

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

4.6.5 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 (this should be done in a separate area from the washing area;
- 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.

4.6.6 Laundry staff

It is important that the laundry staff adhere to safe work practices to help reduce the risk of cross-contamination and prevent injury in the laundry. Therefore, staff should:

- be adequately trained in standard precautions, including hand washing and the risks involved if undertaking other tasks within the facility (e.g. food preparation, patient care). These activities 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;
- Do not eat or smoke in the laundry area;
- Do not handle linen if they have exfoliated skin conditions (e.g. conditions where skin flakes off), unhealed wounds or rashes, unless appropriate protective measures are adopted (such as covering wounds with bandages).

4.6.7 Handling of Linen when there is an outbreak of an infectious agent such as COVID-19 or presence of Multi-Resistant Organisms.

The following measures should be undertaken:

- 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
- 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, after carefully removing any solid excrement for collection by laundry staff.
- The laundry area must be cleaned using a 2-step clean which involves a physical clean using detergent solution followed by use of a chemical disinfectant (e.g. sodium hypochlorite) is recommended and the cleaning schedule and frequency should be intensified to include:
    - First, thoroughly clean 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). Follow facility procedures on cleaning.
    - Second, clean again with household bleach and water, all hard surfaces and all frequently touched surfaces (e.g. door handles, bedside rails, etc.).

4.7 Safe Handling of Healthcare Waste

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 categorized and placed into color-coded bags or bins. For example, in Vaiola Hospital, yellow garbage bins are used for infectious waste and green garbage bins are for general and food waste.

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

4.7.1 Categories of healthcare waste

General waste

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

Infectious and/or clinical wastes

Solid and liquid infectious and/or clinical wastes carry harmful micro-organisms and are likely to cause infection among patients, HCWs or people in the community. Infectious wastes may be solid wastes, liquid wastes or laboratory wastes. 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 and pathology samples.

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

Sharps
These include needles, lancets, hypodermic syringes with attached needles, scalper 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, split 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, cyclosphamide, melphalan and methotrexate).
- Vomit, urine or feces from patients treated with cytotoxic drugs.
- Contaminated materials from Cytotoxic drug preparation and administration (e.g. syringes and needles, dressing packs and gauge vials).

4.7.2 Key technical steps for the management of health care waste

All medical waste produced from the health care facilities, should be (1) segregated, (2) stored and (3) collected safely in designated containers and bags, and (4) treated and final disposal through a safe waste disposal system.

1. **Segregation** – waste must be segregated at source between medical waste and general waste. Medical waste should be further segregated into at least the following – (a) infectious waste such as blood, body parts and body fluids; (2) sharps and syringes; (3) pharmaceutical waste both liquid and solid expired or damaged drugs and medicine.
2. **Storage** – once segregated, all health care waste should be temporarily stored or kept in proper storage bags, containers or boxes with specific colour and labelled to avoid mixing the medical waste with the general waste. General waste which is mixed with medical waste shall be considered as medical waste and should follow the medical waste stream;
3. **Collection and transport** – waste which are stored in bags and containers shall be transported or collected temporarily to a central storage area or to the disposal site within or outside the compound of the health care facilities. Specific pre-treatment to 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 or non-thermal systems. The most common technology for thermal treatment is incineration and non-thermal technology includes microwave, autoclave or controlled or engineered landfill.

4.7.3 Minimum approach to segregation, storage and transport

The minimum standard to segregating health-care wastes is the "three-bin system", where separate containers are provided for infectious waste, used sharps and general waste. The basic features of a minimal level of waste segregation and storage are as follows:

- Wastes are segregated at their place of production to reduce the health risk from the smaller potentially infectious factions (typically waste items contaminated with body fluids and used sharps).
- Infectious 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 a 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 temperate climate: 72 hours in winter and 48 hours in summer
    - warm climate: 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 wastes.
    - 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 wastes are as follows:

- General waste and infectious health-care waste is 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 wastes are transported offsite for disposal, the vehicle is able to carry wastes in a closed or covered container, and the driver knows what to do if there is an accident or incident during transportation on public roads.
- 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 minimize the transmission of secondary infection.

4.7.4 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 being generated. Healthcare waste should be categorized and placed into colour-coded bags or bins.

General tips for safe waste disposal

- Use separate marked containers for clinical wastes.
- Use washable waste containers that are strong and will not rust (plastic is best). All waste containers should have lids.
- Do not use waste containers for any other purpose in the hospital or health centre.

4.7.5 Colour-coding or labelling containers

Colour-code or label containers for the following types of waste:

- **Sharps:** Dispose of in puncture-proof containers so they do not cause injury. These items can spread HIV and Hepatitis B. Sharps containers are colour-coded red or yellow, or at a minimum, have the word 'sharps' labelled on the container.
- **General:** Collect in separate containers for burning or for collection by the municipal authority for disposal at the landfill. General waste may be collected into black or green bins.
- **Infectious/clinical/pathological:** Collect in separate containers for incineration. Yellow container/bags with an infectious logo on them.
- **Cytotoxic/pharmaceutical waste**: Collect in separate containers for incineration. Cytotoxic waste is usually stored in purple coloured bags if available.

4.7.6 Safe collection of general waste

General waste does not carry harmful micro-organisms and are usually collected by municipality authorities. Examples of general waste are kitchen refuse, paper waste, boxes, bottles and plastic containers that store products used by the hospital or clinic. 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 WASTE, NO SHARPS**".

Procedures for disposing of general waste:

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

4.7.7 Safe collection and disposal of infectious and/or clinical waste

Infectious and/or clinical waste carries harmful micro-organisms and can cause infection among patients, HCWs or people in the community. For this reason, infectious waste should always be separated from general waste. Infectious and/or clinical waste is divided into four categories:

- Sharps.
- Solid clinical waste.
- Liquid clinical waste.
- Pathological waste.

4.7.7.1 Sharps disposal

Procedures for collecting and disposing of sharps:

1. Wear thick work gloves when transporting sharps containers to the clinical waste storage area for incineration 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 transport to waste storage area to await incineration.
4. Wash hands after handling sharps containers.

4.7.7.2 Solid clinical waste disposal

Examples of solid clinical waste include used dressings, gauze or other items contaminated with blood, pus, faeces or other body fluids; human tissue; body parts; paper specimen collection cups. Proper disposal of solid clinical waste helps to prevent the spread of micro-organisms from contaminated waste to staff, patients and the community. Clinical solid waste should be burned or incinerated.

There should be a separate clinical waste bin with a lid. The bin should be lined with a plastic bag and should have no holes. Bins should be labelled "**CLINICAL WASTE, NO SHARPS"**

Procedures for disposing of solid clinic waste:

1. Place bins in places where they will be used
2. Wear thick gloves when handling and transporting wastes.
3. Collect bins daily, or more often if needed, and transport to clinical waste storage area to await incineration
4. Clean up all spills immediately with a broom and shovel, and clean area with a neutral detergent.
5. Each day, wash waste bins with soap and water.
6. Wash hands after handling waste bins.

4.7.7.3 Liquid clinical waste disposal

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 wastes.
2. Wear eye goggles to protect eyes from splashing

3. Carefully pour blood, urine or other body fluids directly into the sluice hopper or utility sink drain. **Avoid splashing.**
4. Rinse the sluice hopper 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.

4.7.7.4 Laboratory waste disposal

Examples of laboratory waste include used culture plates, specimen containers and specimens. The proper disposal of laboratory waste helps to prevent the spread of micro-organisms from microbiology laboratory waste and other specimens to staff, patients and the community.

An autoclave or pressure cooker is used to sterilise laboratory waste before disposal into 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 sample tubes and containers, petri dishes and test tubes that have been used to grow micro-organisms *before* incineration.
2. After sterilising, discard all wastes including disposable petri dishes and test tubes into a bin marked "**CLINICAL WASTE**".
3. Some glass tubes are reusable and will be sterilized then washed and dried for reuse.
4. Collect "**CLINICAL WASTE**" bins daily, or more often if needed.
5. Each day, wash bins with soap and water.
6. Wash hands after handling bins.

4.7.8 Handling and Collection of healthcare waste bags

Procedures for handling healthcare 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 healthcare 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. If hazardous waste is accidentally placed in general waste, the entire quantity of waste must be treated as hazardous.

4.7.9 Scavenging

Steps must be taken to ensure that scavenging does not occur at the hospital waste storage sites as this could be detrimental to the individual's 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. waste from accidental injury infection and to prevent pollution to the environment.

4.7.10 Minimum approach to treatment and disposal of health care waste

- Hazardous health-care waste should be treated to reduce the potential for harm and hence segregation of waste must be observed strictly;
- **In extreme circumstances where no treatment is possible**, the following options may be implemented but should be considered as transitional, interim solutions:
    - small health-care facilities
        - hazardous health-care waste could be buried within the premises of the facility where public access can be restricted;
    - larger health-care facilities:
        - should make arrangements with a local landfill to provide a special cell or pit, daily soil cover, and restricted access;
    - disinfection as using a commonly available disinfectant such as hypochlorite.
        - except for sharps waste, disinfected waste can be disposed of with regular municipal solid waste.
    - disposal of specific medical hazardous waste:
        - Sharp waste:
            - a well-designed sharps pit is another minimum option.
            - Can also use encapsulation, inertization 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 waste with immobilizing 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, inertization and land disposal could be used for some pharmaceutical and chemical wastes.

4.7.11 Disposal of general non-hazardous waste

General non-hazardous and 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 waste disposal options:

There are available disposal options for the final disposal of hazardous medical waste:

- **Incineration** – if incineration is a preferred option, the burning temperature must be very 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 dual chamber incineration - (850°C/1100°C), auxiliary burner, 2 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 only used 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.

- **Steam-based treatment technologies**- steam-based treatment technologies are used to disinfect/sterilize highly infectious waste, 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 utilizes 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 (HEPA) 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 sterilization. When all the liquid contained in the waste has evaporated, it is brought to dry, superheated conditions. The residue is a dry and unrecognizable product with reduced volume.

- **Land disposal**: When wastes clinical and non-clinical wastes cannot be burned or incinerated, wastes are buried. Sanitation officers must make sure that all clinical and non-clinical wastes collected separately and put them in a safe plastic or container for disposal. The only waste collected by the town collection system is the non-clinical wastes whereas the sanitation officer collected from the hospital ready to pick up. The

clinical wastes are taken by the sanitation officer to the landfill and buried so that certain requirements must be met so that children 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:
    a. is at least 50 meters (150 feet) away from any water source, to prevent contamination of the water supply.
    b. has proper drainage, is located downhill from any wells, and is free of standing water.
    c. is not in an area that floods.
2. Dig a pit 1 meter (3 feet) wide and 2 meters (6 feet) deep. The bottom of the pit should be 2 meters above the water table.
3. Fence in the site to keep animals 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 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 emergency situation 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.

Note: PPE should always be worn when collecting ash from the incinerator.

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.

Table 4.7a Safe waste disposal

	Waste type	**Waste bag or bin colour**	**Disposal**
General waste	Kitchen refuse, paper waste, boxes, bottles, plastic containers	Black or green	Local level govt. collection
Sharps	Needles, broken or disposal syringes, razors, lancets, scalpel blades	sharps container yellow or red	Incinerate, then bury
Solid infectious and/or clinical waste	Dressings, gauze, or other items contaminated with blood, pus, faeces or other body fluids; human tissue; body parts; paper specimen collection cups	yellow or red	Incinerate
Liquid and clinical waste	Blood, urine, faeces, pus, sputum, spinal and peritoneal fluids, pathology specimens	no bags	Drain fluids into toilet or utility sink; or place in contaminated waste bin, and incinerate
Laboratory waste	Used culture plates, specimen containers, specimens	yellow or red	Sterilise, place in contaminated waste binds, and incinerate
Cytotoxic waste	Cancer treatment drugs and used consumables	purple	Incinerate
Pharmaceutical waste	Tablets, mixtures and injectable	yellow	Incinerate

4.7.12 Garbage storage and disposal

The waste storage shed or area must be made available to store waste prior to incineration of infectious waste and collection by the municipal authority. The storage area should be kept locked at all times when not attended. Ideally this area should be fenced with **'Keep Out'** signage to prevent unauthorised entries.

Garbage should be removed at least daily from wards 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 within 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, six elements are essential in any effective programme for the control of pests in a hospital.

- 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.
- Proper storage of all goods and supplies likely to attract pests.

4.7.13 Waste Management Audits

It is advisable that waste audits are undertaken on a regular basis to measure compliance of waste segregation and waste disposal at the incinerator. The results should be shared to all departments and discussed at the hospital management and Infection prevention and control committee meetings for further actions.

4.8 Safe Reprocessing of Reusable Equipment and Instruments

Used instruments and equipment can be a reservoir for micro-organisms, and therefore spread infections to patients and staff. Procedures that prevent the spread of infection from reusable instruments and equipment are cleaning, disinfection and sterilisation.
In Healthcare facilities throughout Tonga, Nurses are mainly responsible for the overall cleaning of contaminated equipment's and the processes of sterilization or disinfection.
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's is not available or not suitable, HLD is the only acceptable alternative.

Earl Spaulding established the first criterion for disinfection below:

Table 4.8a: 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, Dental 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 with skin that is not intact.	High level Disinfection	Respiratory therapy equipment, dental impressions and other prosthetic appliances, gastroscopes, colonoscopes, endoscopes
Non-critical	Instruments that come in contact with intact skin	Adequate cleaning and drying are required, with the need for intermediate- or low-level level disinfection on some occasions	Bedpans, ECG leads, thermometers, sphygmomanometers stethoscopes, beds, bedside tables

Note: Before disinfection and sterilisation can be achieved, all instruments must be cleaned and rinsed.

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 and sterile ones to prevent cross contamination.

4.8.1 Why cleaning is important

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 will not destroy micro-organisms trapped in small particles of blood or protein. Thorough cleaning must be done to remove these particles;
- disinfection and sterilisation will not be achieved if cleaning is not done first; and
- when sterilisation facilities (steam heat or hot air oven) are not available, cleaning is the only way to protect patients from pathogenic spores.

4.8.2 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. The cleaning solution must be appropriate for the type of equipment or instrument. Enzymes usually Proteases are added to solutions to neutralize the PH solutions to aid in removing organic material such as blood and pus.
Additionally, lipases (enzymes to act on breaking down fats) and amylase enzymes (to act on breaking down starch) is 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).

4.8.3 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
- Plastic bucket
- Household gloves

Procedures for cleaning environmental surfaces are 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.

4.8.4 Routine cleaning of used instruments and equipment

Routine cleaning of instruments and equipment removes many micro-organisms. Cleaning of used instruments should be done in the dirty utility/sluice room and then taken to the central sterilizing sterile department (CSSD) for further cleaning or the clean room for packing prior to sterilization.

Note: Used equipment's that will be autoclaved **should not be soaked** for long periods; they should be washed with detergent and hot water.

The items needed for the routine cleaning of instruments and equipment include:

- Neutral detergent.
- Clean water.
- Brush.
- Gloves (utility gloves are best).

Procedures are as follows.

1. Put on gloves.
2. Completely disassemble all items.
3. Using detergent and hot water and brush, completely remove all blood, tissue and dirt. Carefully clean small spaces and teeth of clamps.
4. Thoroughly rinse with water, because detergent can interfere with the disinfection or sterilisation process.
5. Air-dry 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).

4.8.5 Disinfection

Disinfection is a process that inactivates vegetative microorganisms from inanimate objects without ensuring the elimination of bacterial spores. The following are the two main disinfectants that are available through the central stores or your pharmacy:

Glutaraldehyde- High-level disinfection
High-level disinfection (HLD) is a liquid chemical agent that eliminate all microorganisms, examples are: glutaraldehyde, hydrogen peroxide etc.
Glutaraldehyde is available in the main hospitals for use in the operating theatre for disinfection of endoscopes, (for more information, refer to **9.3.4** to see 'Steps on How to use Glutaraldehyde Solution').

To make sterilisation or HLD effective:

1. Follow instructions carefully.
2. Make sure that chemical disinfectant touches all surfaces of the item being processed.
3. When using heat, make sure to use the correct temperature, for example if boiling to achieve high level disinfection, instruments should be covered in water with a lid and timing begins for 20 mins when water begins to boil.
4. Be sure all items have been thoroughly cleaned and dried.

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

Chlorine - Intermediate level disinfection
Is carried out to eliminate vegetative bacteria and some bacterial spores, (e.g. sodium hypochlorite**),** is available in health facilities throughout Tonga.

Sodium hypochlorite is available and is known as household bleach but must be diluted by the pharmacist before use.

Table 4.8b: Disinfectants and their uses on instruments and equipment

Disinfectant	Time	Purpose	Dilution	Comments
Alcohol 70% (SVM)	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)	Non critical 1-10 minutes Semi-critical 12-30 minutes	**Kills**: Gram-positives Gram-negatives TB, COVID-19 virus. Most spores Hepatitis virus HIV virus		Make a fresh solution every day. Rinse off with distilled water.
Glutaraldehyde CIDEX SPORICIDIN 2% (see 9.3.4 on steps to use)	20 minutes	**Kills:** Gram-positives Gram-negatives TB Spores Viruses	Read manufacturer's directions (see 9.3.4)	Use in a well ventilated area. Rinse with distilled water. Expensive. Use only for fibre optics, endoscopes, bronchoscopes

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

4.8.6 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 of 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. On 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:

$$\left[\frac{\text{\% chlorine desired}}{\text{\% of chlorine in bleach powder}}\right] \times 1\,000 = \text{Grams of bleach powder for each litre of water}$$

Example: to make a 0.5% chlorine solution from calcium hypochlorite (bleach) powder containing 35% active chlorine:

$$\left[\frac{0.5\%}{35\%}\right] \text{ X } 1\,000 = 0.0143 \text{ X } 1\,000 = 14.3$$

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

$$\text{Total Parts (TP) (H2O)} = \left[\frac{\text{\% Concentrate}}{\text{\% Dilute}}\right] - 1$$

Example: To make a dilute solution (0.1%) from 5% concentrated solution.

$$\text{Calculate TP (H2O)} = \left[\frac{5.0\%}{0.1\%}\right] - 1 = 50 - 1 = 49$$

Take 1 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 in killing bacteria, fungi and viruses including the influenza virus. Sodium hypochlorite can be easily diluted from the household bleach concentration at the local pharmacy for disinfection of patient equipment and environmental surfaces.

Table: 4.8c Sodium hypochlorite concentration and use

Starting Solution	Item or surface to be disinfected	Most household bleach* contains 5% sodium hypochlorite (50 000 parts per million (ppm) available chlorine)
Recommended chlorine	Environmental surfaces Also in COVID-19	1:100 dilution of 5% sodium hypochlorite is the usual recommendation. Use 1 part bleach to 99 parts cold tap water (500 ppm).
		1:10 dilution (5000 ppm) should be considered to avoid risk for infection when cleaning a large amount of spilled blood (>10mL) and when cultures or concentrated preparations of microorganisms have been spilled.
	Patient equipment	1:50 dilution (1000 ppm) is recommended, with different contact times for non-critical objects, (i.e. that will come in contact with intact skin) and semi-critical objects, (i.e. that will come in contact with mucous membranes or non-intact skin and require High Level Disinfection)
Available chlorine after dilution		For bleach containing 5% sodium hypochlorite, a dilution of: - 1:10 will yield 0.5% or 5000 ppm - 1:50 will yield 0.1% or 1000 ppm - 1:100 will yield 0.05% or 500 ppm
Contact time	Environmental surfaces	A contact time of ≥ 10 minutes
	Patient equipment	Non-critical items, 1–10 minutes
		Semi-critical items, 12–30 minutes

The recommendation of 0.1% (1000ppm) in the context of COVID-19 is a conservative concentration that will inactivate the health-care setting. However, for blood and body fluids large spills (i.e. more than about 10ml) a concentration of 0.5% (5000ppm) is used.

Bleach precautions

- Fully immerse items for sterilization for a minimum of 15 minutes but not longer than 30 minutes.
- 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 the reach of children.

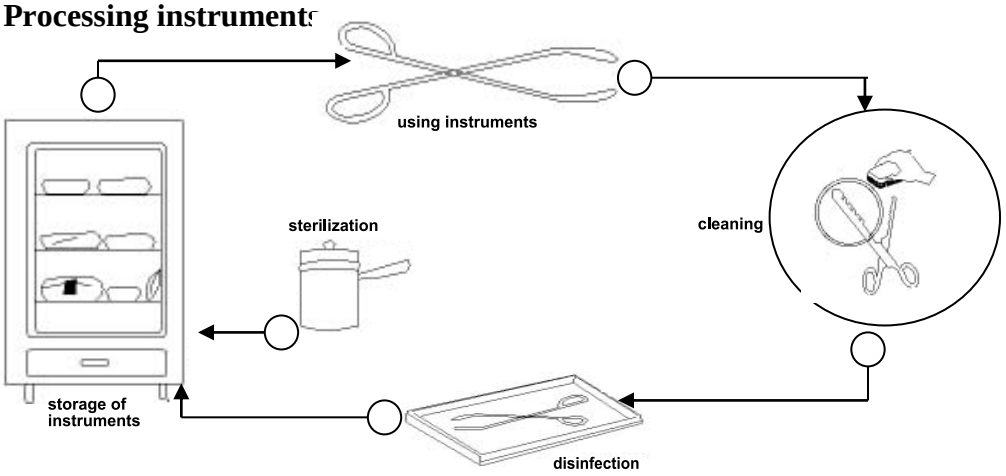
Source: *AVSC International (1999). Infection Prevention Curriculum. Teacher's Manual. New York, p.267*

4.8.7 Steps on How to Use Glutaraldehyde Solution

- The first step in the disinfection/sterilization process is thorough cleaning, contaminated instruments must be thoroughly cleaned prior to disinfection or sterilization since residual organic matter will decrease the effectiveness of the glutaraldehyde solution;
- To remove debris, thoroughly clean all instrument surfaces and the lumens of hollow instruments (e.g. endoscopes) with a mild protein dissolving detergent such as an Enzymatic Detergent;
- Following cleaning, rinse instrument surfaces and lumens with large amounts of fresh water to remove residual detergent;
- Remove excess moisture from instrument prior to disinfecting. This will help prevent water from rapidly diluting the glutaraldehyde;
- Once the instruments have been properly cleaned, you are now ready to begin using the glutaraldehyde Solution;
    - Prepare glutaraldehyde Solution for use by first adding the entire contents of the activator vile to the solution in the container. Shake well;
- Do not use activated solution beyond stated 14 days or 28 days if stated (check the label, some solutions are to be discarded at 14 days and some 28 days);
- Record the date of activation (mixing date) and expiration date;
- Immerse clean instruments completely in the glutaraldehyde Solution;
- Fill all lumens of hollow instruments;
- To reduce exposure to glutaraldehyde vapour which can be irritating, cover the glutaraldehyde Solution tray or bucket with a secure lid. Soak instruments for the amount of time (usually 20 minutes) required for disinfection or sterilization; **See label and package insert for complete instructions/ information on soak times**
- For devices that have been disinfected: Remove instruments from solution and rinse thoroughly with sterile water or potable tap water;
- Dry the instruments. Disinfected or sterilized equipment should be used immediately or stored in a manner to minimize recontamination.

Reference: ASP, 2004 Irvine, California 926

Figure 4.8a: Processing instruments



4.8.9 Sterilisation

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.)

4.8.10 Sterilisation methods

The most common sterilisation methods in hospitals and clinics are **steam heat** (autoclave or pressure cooker).

Steam sterilisation (autoclave, pressure cooker) 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 include:

- Wrapping material (e.g. cotton cloth, paper).
- Metal instrument trays (with holes in bottom).
- Sterilisation indicator (Table 9.4).
- Autoclave or pressure cooker.
- Heat source (electricity, stove for kerosene).
- Fuel (kerosene, wood).

Procedures for steam sterilisation are as follows:

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 muslin cloth or paper.
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.

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).

6. Turn off heat source. Wait 30 minutes for steriliser to cool, then slightly open lid to let steam out.
7. Allow packs to dry before you remove them. This takes 20–30 minutes.
8. Remove items from steriliser.
9. Allow them to cool completely before storage, or use immediately.
10. Label the container with the date. Reprocess after expiration.

Table 4.8d Steam sterilisation

Temperature	**:**	134^0 Centigrade (273^0 Fahrenheit)
Pressure	**:**	106 kPa
Time	**:**	Unwrapped items: 20 minutes Wrapped items: Instrument: 30 minutes General Linen: 1 hour

Additional notes on steam sterilisation.

- 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 5 cm above the water and cook for 20 minutes.
- 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.

Table 4.8e Temperature and time for effective dry heat sterilisation

Temperature	**Time**
170^0 C (340^0 F)	60 minutes (1 hour)
160^0 C (320^0 F)	120 minutes (2 hours)
150^0 C (300^0 F)	150 minutes (2½ hours)
140^0 C (285^0 F)	180 minutes (3 hours)
121^0 C (250^0 F)	Overnight

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

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 sterilizer, particularly a pre-vacuum cycle, can defeat sterilization and result in nonsterile supplies if undetected.

Table 4.8f: Sterility tests

Methods		**Indicators**		
Agent	**Means**	**Physical**	**Chemical**	**Bacteriological**
Dry heat	Flames Hot ovens	Must be red hot Thermometer	None Daily check: heat sensitive dyes	Monthly check: Mix of spore-producing and non-spore producing bacteria
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 (*Bacillus stearothermophillus*)

Note: Sterilisers are tested monthly to make sure that they are working properly and that instruments and equipment is sterile.

Table 4.8g: Length of safe storage for sterile and high-level disinfected items

Wrapping	**Safe storage time**
Sterile items	
Single wrapped in cloth	1 week
Double-wrapped in cloth	2 weeks
Paper	1 week
Metal container with cover	1 week
High-level disinfected items	
Dry, high-level disinfected lidded container (unopened)	1 week
SVM or 70% Alcohol	1 week
CIDEX	1 week

4.9 Transmission-Based Precautions (TBP)

Transmission-based precautions 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. Transmission based precautions are categorized according to the route of transmission of the infectious agent.

Application of Transmission-Based Precautions

The application and combination of transmission-based precautions depend on the infectious agent involved. Whether used singularly or in combination they are always used in addition to standard precautions.

Table 4.13a provides the recommended transmission-based precautions to apply for specific infectious agents/diseases.

The combination measures for additional precautions involve the following:

- 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 *(see appendix 2 for steps on cleaning isolation rooms for patients on transmission- based precautions)*

When to apply TBP

- 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,
- For 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,
- when medical interventions increase the risk of transmission of a specific infectious agent.

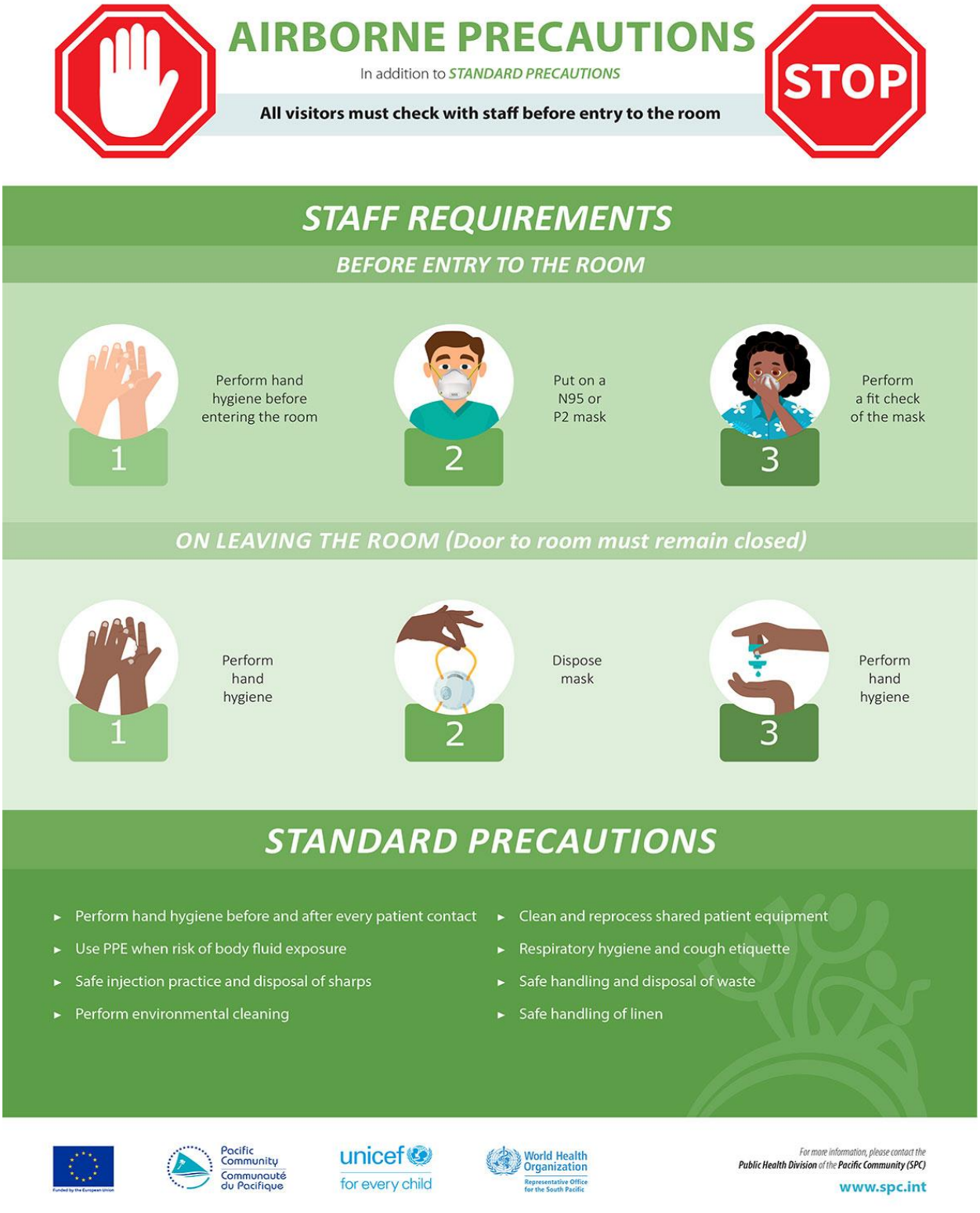
4.10 Airborne Precautions

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 etc. and infection occurs when HCW's inhale particles containing the infectious agent that are 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.

The following Airborne precautions should be implemented:

- Continue to apply standard precautions including respiratory hygiene and cough etiquette.
- Patients should be placed in the Isolation Ward single room (with doors closed). In Vaiola Hospital, the negative pressure rooms should be used for this purpose. In other hospitals, this patient can be placed in a single room (doors closed) with open windows for natural ventilation, and use a fan (blowing outward) to control the direction of airflow;
- Separate toilet and bathroom facilities
- Dedicated equipment's such as blood pressure cuffs and thermometer etc.
- Use of appropriate PPE, respirator masks (N95) should be worn by HCWs and visitors upon entry into the room. In addition to standard precautions, if N95 mask is not available, wear a double mask;
- Patients must be remained in the room, but if the movement is necessary, the patient should wear an N95 mask to minimize the dispersion of airborne nuclei;
- A signage for airborne precautions (as below) should be placed on the patient's door. This is to ensure staff and visitors do not enter without appropriate PPE.

Figure 4.10a Airborne Precautions Signage for Isolation Room



4.11 Droplet Precautions

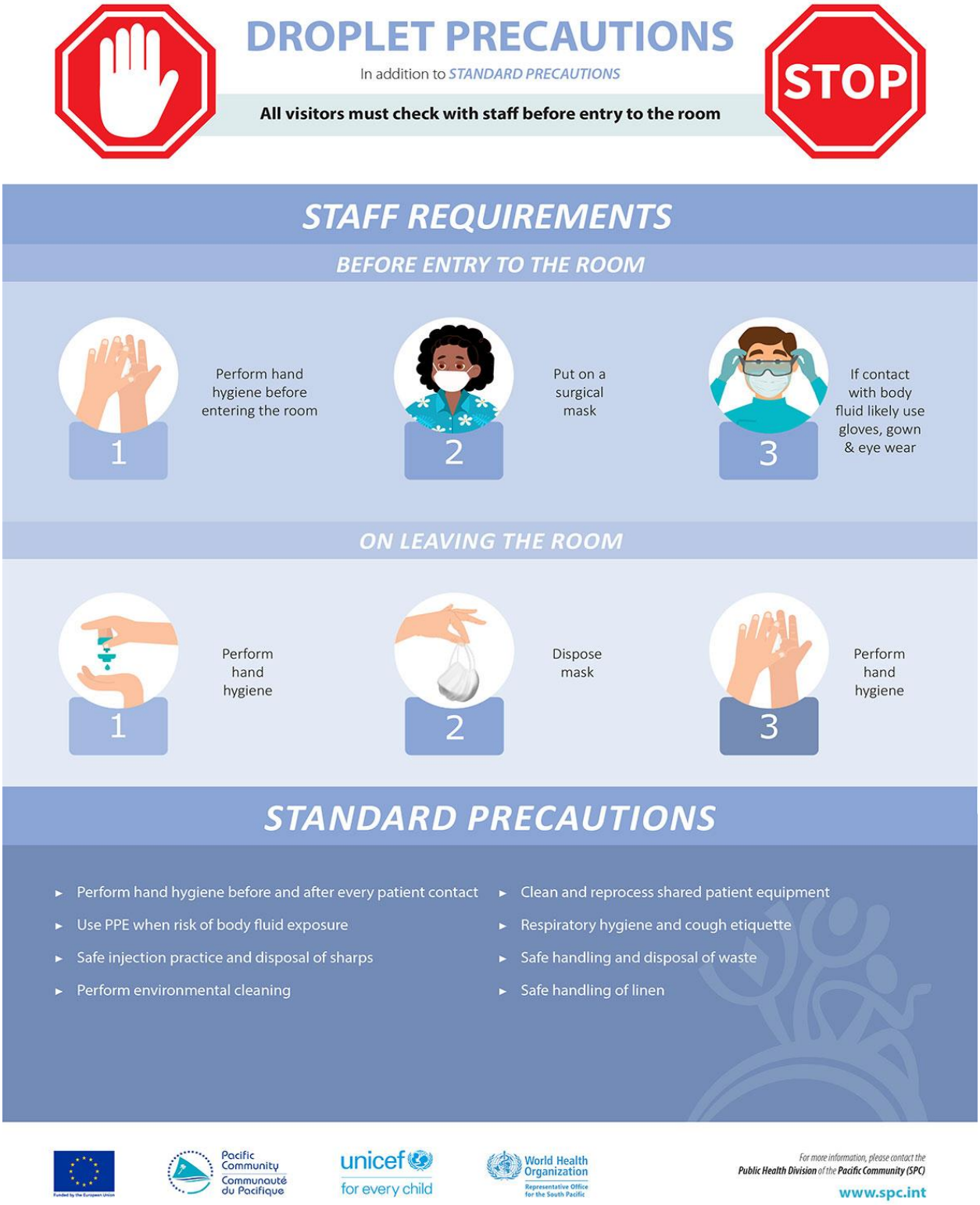
(see table 4.13a for diseases that are spread via droplet)

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 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 (around a metre) from the infected person before falling.

The following droplet precautions should be implemented:

- Continue to apply standard precautions including respiratory hygiene and cough etiquette.
- Use of appropriate PPE, Surgical masks (not N95) should be worn by healthcare workers and visitors upon entry into the room in addition to standard precautions;
- Patients should be placed in the Isolation ward single room with the door closed if available, or cohort patients infected with the same infectious agents together in a room with good ventilation;
- Separate toilet and bathroom facilities
- Dedicated equipment's such as blood pressure machine and thermometer etc.
- If the patient is transported out of the room, then they should wear a surgical mask;
- A sign for droplet precautions (as below) should be placed on the patient's door as a reminder to staff and visitors explaining the necessary precautions and PPE.

Figure 4.10b Droplet Precautions Isolation Room Signage



4.12 Contact Transmission is divided into two subgroups

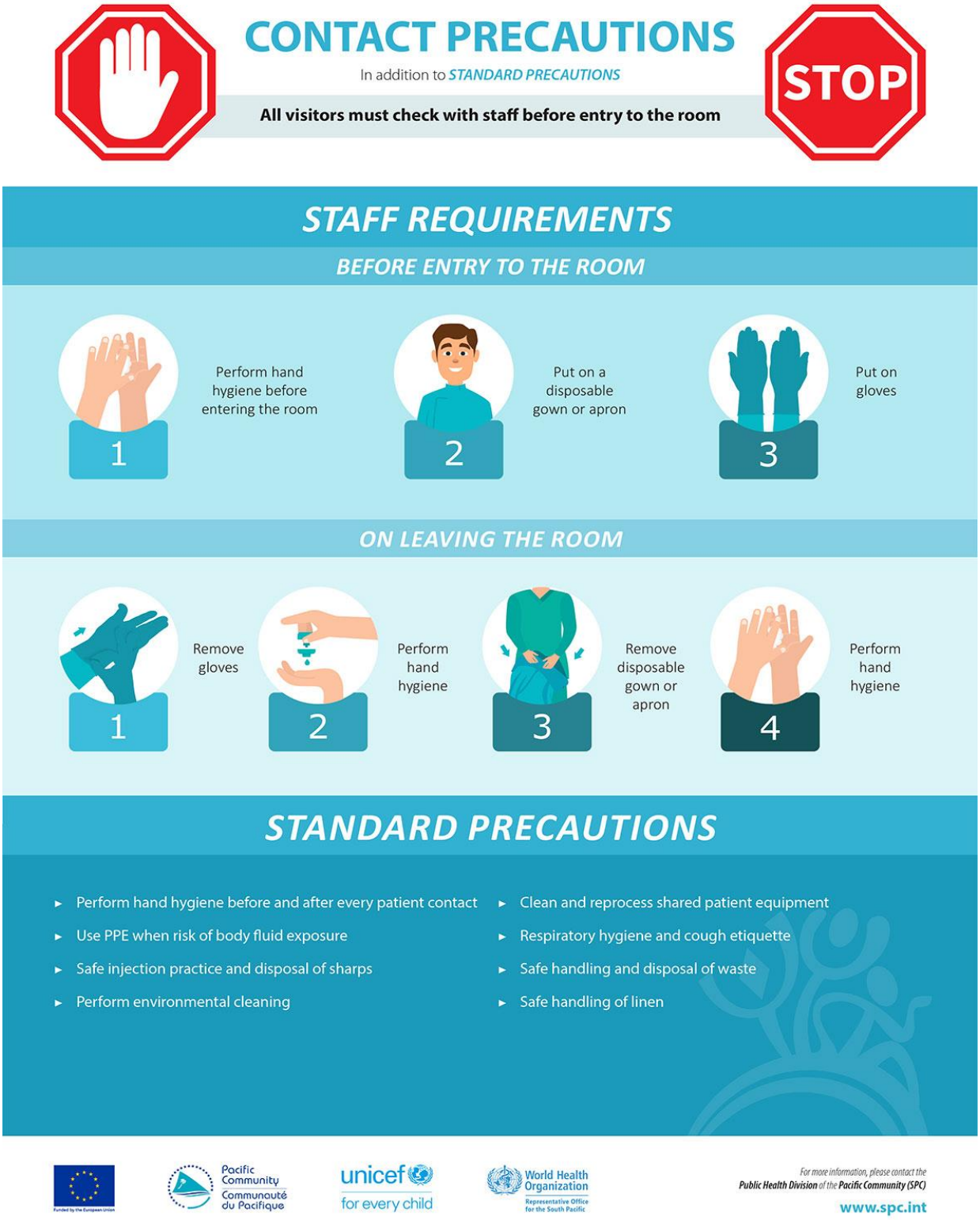
(see table 4.13a for diseases that are spread via contact):

- **Direct contact** transmission involves the direct physical transfer of micro-organisms e.g. gastroenteritis or multi-drug resistant organism from an infected or colonized person to a susceptible host via the contaminated hands and clothing of HCW's;
- **Indirect contact** transmission involves a susceptible person coming in contact with a contaminated (usually inanimate) object, such as a contaminated instrument or equipment, e.g. when patient care contaminated equipment/devices are shared between patients.

The following contact precautions should be implemented:

- Continue to apply standard precautions,
- Use of appropriate PPE. HCW must wear a clean, non-sterile disposable gown or plastic apron 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 in addition to standard precautions (in the absence of a disposable gown a cloth gown can be worn but must be discarded after contact with patient;
- The patient should be kept in a single room with the closed door if available or cohort with other patients infected with the same pathogen.
- Separate toile and bathroom facilities,
- Dedicated equipment's such as blood pressure machine and thermometer etc.
- A sign should be placed on the patient's door explaining the necessary precautions. This is to ensure staff and visitors do not enter without appropriate PPE.

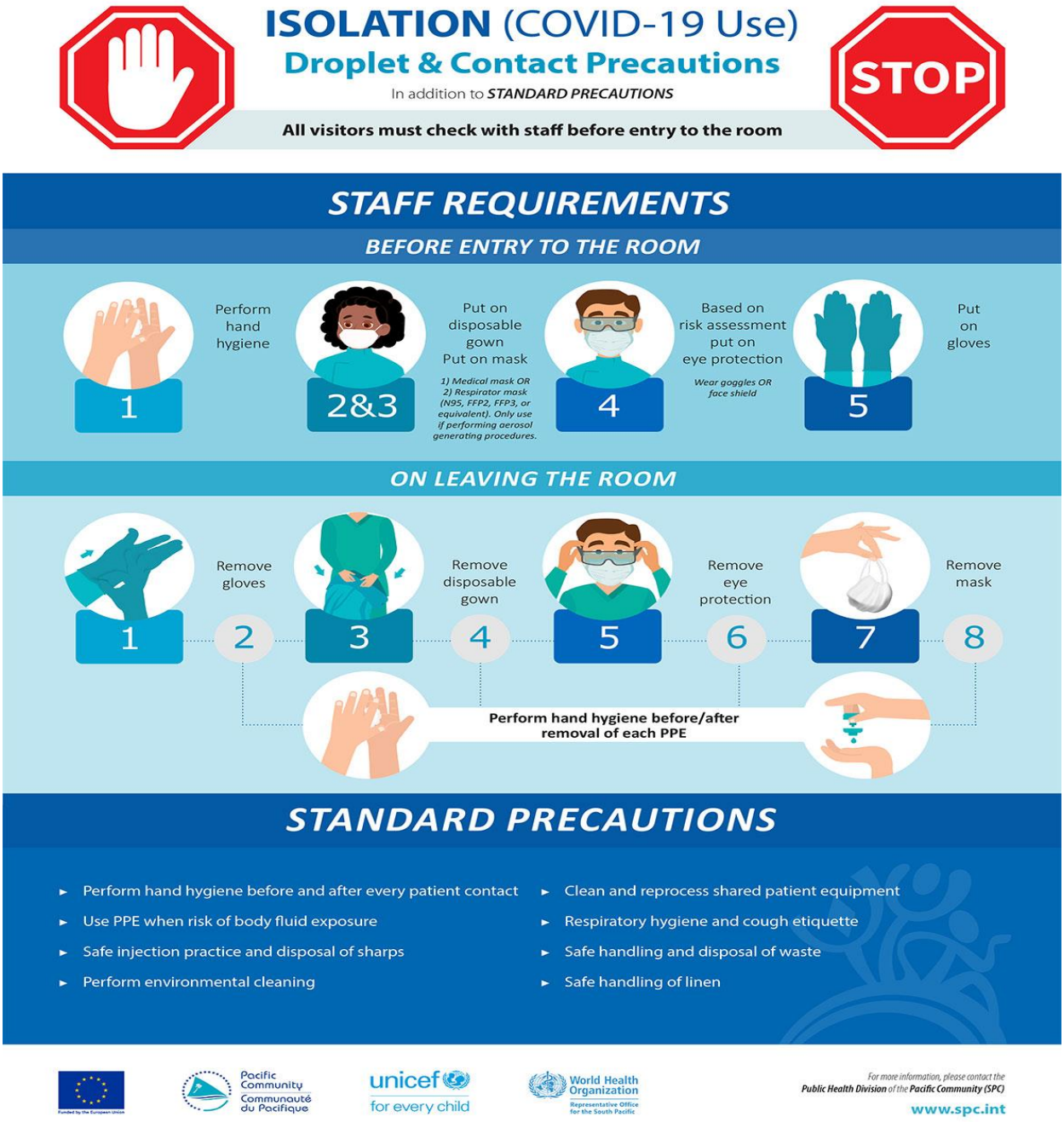
Figure 4.11 Contact precautions Isolation Room Signage



4.13 Combination of TBP - Droplet and Contact Precautions or Droplet and Airborne precautions for COVID-19

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

Figure: 4.12a Droplet and Contact Precautions Isolation Room Signage



4.14 Patient placement

Isolating patients who require additional precautions are very important in preventing the transmission of infection within the hospital.

Staff should also explain to patients and families why they are being isolated and ensure that there is an understanding that certain precautions are implemented to protect everyone from the spread of infection.

Ideally, patients needing isolation should be placed in a single room. However, if single rooms are not available, patients with the same pathogen should be kept together in either a room or ward, and there should be 1–2 metre space between hospital beds to reduce the risk of cross-infection. The room or ward should be in a well-defined area that is clearly separated from other patient care areas used for uninfected patients.

Other points relevant to patient placement include the following:

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

Table 4.13a: Recommendations for Transmission based precautions

Isolation Type	**Standard precautions**	**Airborne precautions**	**Droplet precautions**	**Contact precautions**
	All patients All blood, body fluids, secretions (except sweat), excretions and contaminated items	• TB suspect/confirmed • measles • varicella (chickenpox) • SARS • MDR TB • Influenza • COVID-19 virus (when performing procedures that are aerosol-generating)	*COVID-19 virus* *Haemophilus influenza* meningitis/ epiglottis *Neisseria meningitidis* septicemia/meningitis diphtheria (pharyngeal) mycoplasma (pneumonia) Pertussis Influenza Para influenza Mumps Parvovirus B19 rubella pneumonic plague GroupA streptococcal infections in infants and young GroupA Streptococcal pneumonia, scarlet fever in all groups viral hemorrhagic fever Filovirus disease (Ebola and Marburg),	• Resistant bacteria (MRSA, VRE, *C. difficile*, RSV • Herpes simplex (neonatal or mucocutaneous) • Highly contagious skin infections (e.g. scabies, lice, impetigo) • Herpes zoster (shingles), localized and disseminated • Infants/young children (<6 years old), or any patient inconsistent with: - Enterovirus - Hepatitis A - Rotaviral enteritis; - shigella, giardia, other forms of gastroenteritis. • Viral haemorrhagic fever

			SARS-CoV-1, SARS-CoV-2 (COVID-19) MERS- CoV **Crimean-Congo hemorrhagic fever, Lassa fever**	• Influenza • Norovirus • **Ebola /Marburg, Crimean-Congo haemorrhagic fever, Lassa fever** • SARS-CoV-1 SARS-CoV-2, and MERS- CoV
Single room	No	Yes-keep door closed; If unavailable, may cohort with patients with the same organism	Yes-keep door closed If unavailable, may cohort with patients with the same organism	Use if possible, or cohort with a patient with a 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
Head cover	Use based on the risk of exposure from an 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
Transport of patients	Cover all patient's open wounds	Mask for the patient; Notify area receiving Patient	Regular mask for the patient; Notify area receiving patient	Notify area receiving patient
Room cleaning	Standard cleaning protocol	Enhance additional cleaning with disinfectant depending on micro-organism See infection control nurse	Enhance additional cleaning with disinfectant additional cleaning depending on micro-organism See infection control nurse	Enhance additional cleaning with disinfectant depending on micro-organism See infection control nurse

4.15 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, stationaries, hand hygiene and medicine supplies etc.
- There should be clear instructions on the flow between areas
- Restriction movement signage
- A dedicated changing space in this area allocated to PUT ON PPE

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

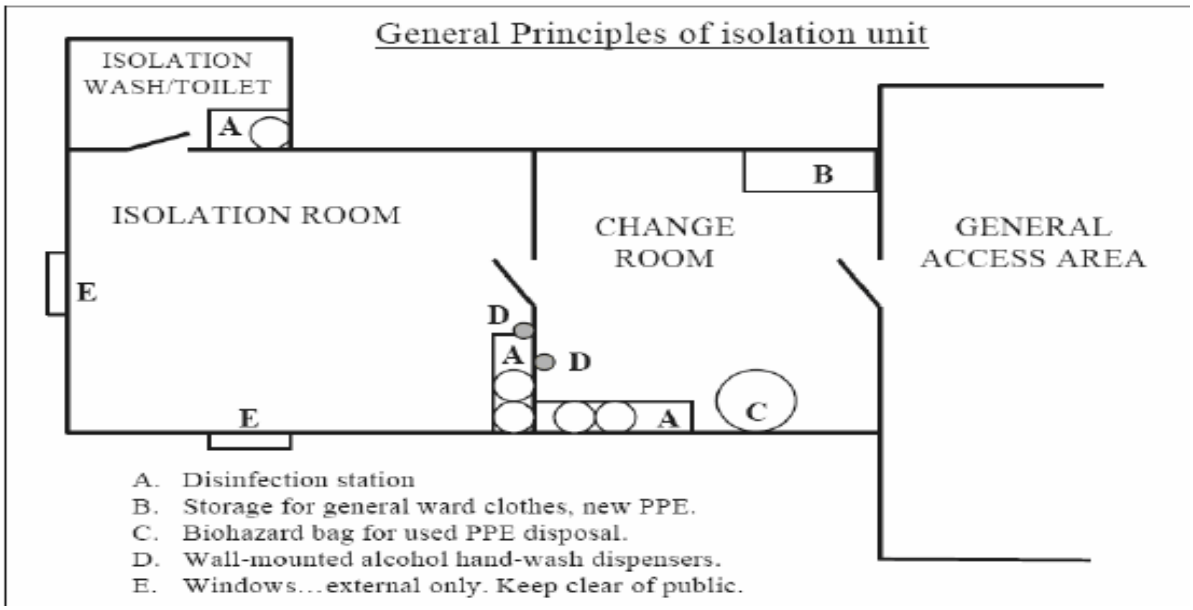
- Be well ventilated with an adjoining bathroom and toilet facilities
- Have hand hygiene facilities including ABHR
- Have beds separated in distance 1 meter apart (3 feet)
- Have sharps container
- Container for used linen and other contaminated waste
- Avoid sharing of equipment, but if unavoidable, ensure that reusable equipment is disinfected between use
- A dedicated area for contaminated disposal of:
    - liquid and solid waste
    - storage of used linen

A dedicated area just outside the isolation room/ward to:

- TAKE OFF PPE, this must be done under the supervision of a trained buddy
- Have supplies for hand hygiene
- Have containers for contaminated and reusable PPE
- A container for decontaminating eye goggles/face shield if necessary

Figure 4.14a General principles of an isolation unit

General principles of an isolation unit



5 SPECIAL HEALTHCARE AREAS

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

This section covers:

- Intensive care units
- Operating theatres
- Dental facilities
- Laboratories
- Maternity units – labour suites
- Mortuaries

5.1 Intensive Care Units (ICU)

The Intensive Care Units (ICU) including Neonatal Intensive Care Unit (NICU) and the Paediatric Intensive Care Unit (PICU) 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)*

The following are measures are crucial to prevent HAIs with intravascular devices and mechanical ventilation in the ICU's:

5.1.1 Hand hygiene compliance

- The Five (5) moments for hand hygiene should be strictly adhered to by all HCWs in the ICUs. The 5 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.
- Also important is the need to ensure consistency of hand hygiene supplies. These include: alcohol based hand-rub, 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, contact with HCW hands. Example of activities include moving a patient, bathing patients, 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 equipment, e.g. when patient care contaminated equipment/devices are shared between patients.

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

- Strick adherence to hand hygiene,
- appropriate use of PPE, including:
    - use of sterile gloves for procedures when undertaking aseptic technique such as insertion of central venous catheter, indwelling urinary catheterization and for other procedures that require aseptic technique.
    - use of non-sterile gloves for procedures such as emptying urinary drainage bags, and contact with contaminated surfaces or equipment etc.
    - Wear gloves for handling respiratory secretions or objects contaminated with respiratory secretions of any patient.
    - 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 object, or environmental surface.
        - Between contacts with a contaminated body site and the respiratory tract of, or respiratory device on, the same patient.
    - Appropriate use of gowns:
        - Use if 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 of plastic aprons when contact with patient body fluids is anticipated
    - Strick adherence to aseptic technique 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 technique including a mask, sterile gown, sterile gloves, and a large sterile sheet for the insertion of central venous catheters (CVCs) (including peripherally inserted central catheters [PICCs]) or guide wire exchange.
    - If there is no medical contraindication, elevate the head of the bed of a patient at high risk for aspiration pneumonia, e.g., a person receiving mechanically assisted ventilation and/or who has an enteral tube in place, at an angle of 30-45 degrees.

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

The environmental surfaces of the ICU, NICU and PICU and all patient equipment's such as ventilators, IV infusion pumps, monitors, warmers, incubators etc. are potential reservoirs for infectious agents and AMR. In addition, this creates a perfect environment for critically ill patients who are immunosuppressed in the ICU, NICU and PICU at high risk of acquiring HAIs. Therefore, it is vital that environmental surfaces including patient equipment are adequately cleaned to eliminate reservoirs of infectious agents to reduce the risk of acquiring HAI and AMR.

The following measures should be implemented and monitored for compliance:

- Implement a two-step cleaning system which involves a physical clean using a neutral detergent solution, followed by a chemical disinfectant of 0.5% sodium hypochlorite solution or 70% alcohol. *(see section 4.5 on environmental cleaning)*
- Ambu bags including laryngoscope blades and handles and all other patient care equipment that are 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 sterilization process. Unused bottles should never be left attached to machines with water.
- Ventilators, Infusion Pumps and other Equipment's (clean daily and upon discharge) - Refer to manufacture cleaning instructions
- Frequency change curtains. As a minimum, curtains should be washed once a month. However, curtains should be washed or changed after patient discharge when a patient is a carrier of a microorganism requiring contact precautions.

Care of the Incubator

1. Wipe daily using liquid soap and water or neutral detergent. Do not clean with sodium hypochlorite when in use.
2. All inserts of the Incubator should be removed and thoroughly washed and dried.
3. Filters should be changed every three months (labels should indicate due date for change).
4. Incubators should be changed every 7 days (labels should indicate due date for change)

How to Clean an Incubator upon Discharge or Transfer of an Infant?

1. Disconnect from electrical socket.
2. Clean/wipe with neutral detergent solution or liquid soap the entire external surface of incubator and parts by wiping with a disposable cloth.
3. All large components of the incubator (i.e. incubator walls, mattress tray and mattress, main deck) should be wiped down and smaller pieces of the incubator can be submersed, if recommended by the manufacturer, in the detergent or Milton solution.
4. Sodium hypochlorite solution is corrosive to metals therefore avoid use on metal surfaces.
5. Reassemble incubator according to manufacturer's instructions.
6. All used cleaning solution must be discarded after cleaning.

Table 5.1a The following table outlines 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 with 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	Includes work bench, monitors, infusion devices including poles, ventilator around the patient/infant including the outside of each cot, radiant warmer or incubator should be damp dusted using neutral detergent and disposable cloth/wipes.	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.
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 0.5%:** • 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,	Each shift and additionally as required.

	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.	
Shared clinical areas /devices (Nurses' stations)	Including telephones, computer key-boards– Clean with Neutral detergent- each shift these areas are high risk areas for the spread of organisms in the unit Environment. • Hand hygiene must be performed before & after using keyboards /telephone.	At each shift
Sinks and surrounding areas are cleaned by the Housekeeping staff.	• 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. • Left over expressed breast milk or formula is to be transferred to the Milk Room for disposal.	Twice daily and as necessary.
Stock/store rooms	• 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	• Neutral detergent and hot water are used in the bucket to mop floors and 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 are used to clean the sluice. 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 sterilization in CSSD.	Daily

5.2 Operating theatres (OT)

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 minimize dust, eliminate insects, and facilitate sterility and an environment conducive to the prevention of patient and healthcare worker infections. Surgical site infections are common and can be prevented based on 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 should be regulated and kept to absolute minimum in the following areas of HCF:

- Preoperative and Recovery rooms i.e. areas where patients wait and where healthcare workers (HCW) examine and treat patients prior to and after being operated
- 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 OT area, and reporting systems for any incidents.

Minor operation

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 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 a good ventilation
- Keep the temperature of the operating theatre between (68°F–75°F [20°C–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)
  -Absolutely minimizing 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 cutter to aid cleaning
- Do not clean any instruments in the operating theatre after an operation but rather send it 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, scrub able, 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; however, lay-in ceilings are not 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 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

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
- surgery on a dirty or infected wound (requires antibiotic treatment in addition to prophylaxis)

Table 5.2a Surgical wound classification as defined by the CDC

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 non-penetrating (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 devitalized 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.

- *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 traumatized, increasing the risk of colonization 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 minimize 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 (facility may require this in 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: 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: 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. High efficiency masks e.g. N-95 masks (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, 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 either wear disposable fluid repellent gowns or reusable gowns that are provided by the organization 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.

Use of Cover gowns: 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

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 of 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 are considered contaminated:
    - Members of the sterile team, all furniture, anaesthesia equipment, the floor immediately surrounding the focus area or patient area, and patient transport carts
    - 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
    - Walls, doors, and surgical lights and ceilings should be cleaned if soiled with blood, tissue, or body fluids
- Anaesthesia equipment should be cleaned according based on the good practice international guidelines
- Floors that are visibly soiled must be cleaned using a new or freshly laundered mop head with 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

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 to prevent leakage
- Human body parts should be placed in an approved receptacle
- Sharps boxes must be used for all metal ware
- All suction equipment including liners must be changed in-between patients to prevent cross infection and fluid loss volume management in the container

5.2.5 Managing TB patients in OT

- 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 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 (AII) room rather than in the regular open recovery facilities
- If AII room is not available, recover the patient in a well ventilated private room.
- Breathing circuit filters with 0.1–0.2 μm 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 Dental Clinic Facilities- IPC Standards

Most dentistry and a range of minor surgery are carried out in an office practice environment. The principles of infection prevention and control apply equally for surgical procedures in both the hospital and office setting, as well as for mobile medical/dental clinics.

Office spaces and facilities will vary. It is recommended that each practice develops a manual of protocols to be carried out during all procedures. These protocols should be developed co-operatively with the appropriate health care workers involved in the delivery of the service. They should demonstrate clearly to HCWs, patients and regulatory bodies that the principles of infection control are understood and practiced.

The protocol should define:

- methods of hand hygiene for both routine and surgical,
- personal protective equipment requirements,
- the define areas of contamination which require draping and cleaning between patients,
- clean-up procedures between patients,
- management of blood or body fluids spills,
- management of blood/body fluid exposure,
- handling and disposal of sharps,
- waste disposal,
- processing of re-usable items – cleaning, packaging, sterilization, or disinfection and storage,
- quality control mechanisms – documentation of maintenance and monitoring programs for equipment and;
- staff immunization requirements.

5.3.1 Special requirements in dental practice

In addition to the general requirements for office/clinic practice, the following are some special considerations and requirements for a dental practice:

5.3.1.1 Protective Apparatus

Dental operators and their assistants should wear adequate eye and face protection where aerosols are likely to be generated. Patients must also be offered protective glasses.

5.3.1.2 The integrity of the operating field

The integrity of the operating field should be maintained during dental procedures. These include;

- Appropriate use of rubber dam, high-velocity air evacuation, and proper patient positioning should minimize the formation of droplets, splatter, and aerosols during treatment.
- barrier draping using either plastic wrap, sterile drape or pre-formed plastic tubing, may apply to the following:
    (i) Any hand-operated control in the operating field, the operating light handle, the x-ray head and the suction tubing,

(ii) Any intra-oral light source e.g. polymerizing light and handle,
(iii) The bracket table and its handle.

- Pre-dispensing of materials should be routine. However, the retrieval of additional instruments and materials from outside the operating field during dental procedures is inevitable. In these circumstances:
  (i) Gloves must be removed and hands washed to dispense materials from their containers into the field. Alternatively, over gloves can be used,
  (ii) Drawers must be opened by elbow touch, de-gloving or a suitable no-touch technique (use of transfer tweezers),
  (iii) Pre-cut supplies of some materials (e.g. floss, cellulose acetate strips, gingival retraction cord, and articulating papers) which can be stored in the drawers can reduce the needs to deglove.

-All articles within the operating field should be deemed contaminated by the case in progress and must be removed, cleaned and disinfected or sterilized before the next case can commence.

5.3.1.3 Intra-oral dental handpieces

It is difficult to monitor the sterilization process within a dental handpiece. All dental handpieces, including ultrasonic tips, should be disassembled if possible for cleaning and sterilization between patients. Follow the manufacturer's instructions. Dental units supplying water to intra-oral dental handpieces should have non-return (anti-retraction) valves.

The manufacturer's instruction regarding the choice of lubricants should be followed and care must be taken to choose a lubricant that does not interfere with the sterilization process. If the handpiece is re-lubricated after sterilizing, then the lubricant system should be used solely for this purpose, and should not re-contaminate the instrument. It is strongly recommended that automatic flush through and lubricant systems are used.

5.3.1.4 Aspiration into water lines

Air and water lines should be flushed for a minimum of 2 minutes at the start of the day and for 30 seconds between patients. All dental equipment which supplies water to the oral cavity should be fitted with anti-retraction valves. Routine maintenance of anti-retraction valves is necessary to ensure their effectiveness and should follow the manufacturers should be followed with an appropriate maintenance routine.

5.3.1.5 Dental materials - Impressions

The efficacy of the disinfection of dental materials should be determined. The most important step is the thorough decontamination of material that has been contacted with oral tissue. Thorough rinsing with cold running water followed by the application of diluted detergent and further rinsing should continue until all visible contamination is removed.

5.3.1.6 The Dental Laboratory

All materials transported to and from dental lab should be contaminated, disinfected and placed into a sealed container. In each case, the method of disinfection should be noted on the laboratory form.

5.3.1.7 Receiving Area

Standard precautions should apply when handling dental materials. An area should be set aside to receive incoming cases. The lab request form should be checked for details of what decontamination procedures have been done.

When opening the work, wear appropriate safety and protective apparel such as disposal gloves, apron, eye protection or facial shield. A mask should be worn where there is a risk of aerosolization or air-born transmission of infection.

If required, items should be rinsed in the decontamination sink in cold running water, detergent applied and rinsed again until all traces of blood, debris and body fluids are removed. After drying, the items should be disinfected.

Dispose of all packing materials and waste according to waste regulation. Reusable containers should be cleaned with detergent and disinfected.

The receiving area should be cleaned with detergent between cases. The placement of a single-use impenetrable barrier (i.e. plastics, plastic-backed paper) on the surface is recommended.

5.3.1.8 Working Area

Prostheses/appliances which have already been inserted in the mouth require special attention. Any instruments of attachments and materials which contact these prostheses should be cleaned and disinfected between cases. A small amount of pumice should be dispensed for individual use and discarded. Clean the splash guard between cases.

Polishing buffs and rag wheels should be washed and either autoclaved (where possible) or disinfected after each case.

Persons working on such appliances should wear a clean uniform of a lab coat, disposable gloves, protective eyewear or face shield, and a mask if necessary. Strong exhausted air evacuation near the work area is recommended.

Always wash hands before leaving the work area and DO NOT EAT OR DRINK when in the working area.

5.3.1.9 Outgoing Cases

On completion of the work, items should be rinsed, dried and then disinfected. This procedure should be documented prior to returning the material to the dental practice.

5.4 Antenatal and Labor 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 chapters 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 should be screened to determine contact risks for infections such as HIV and hepatitis B.

5.5 IPC in Mortuary Settings

Each healthcare facility should provide a safe working environment in the mortuary and ensure that staffs 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 post mortem.

5.5.1 Care of the dead body

- Personal care of a body should honor 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 individualized 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 therefore standard precautions should be practiced at all times. The risk of transmission for infection increases following the death of an infectious patient. Therefore, to minimize 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 spread:
    - Needle stick injuries from a contaminated instrument or sharp fragment of 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 TBP 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
- 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 not met in the criteria above. If a body is likely to leak or cause of death is unknown, then it must be placed in a body bag regardless of their infectivity status.
- If the person had a known infectious disease or an unexplained cause of death you must inform anyone else coming into contact with that body e.g. Funeral Directors.

5.5.2 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 tapes 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 includes:

- post-mortem room;
- dirty utility room;
- soiled protective clothing discard area;
- refrigerator's where the bodies are stored.

The clean areas include:

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

Transition zones are located between clean and dirty areas.

It is recommended that information is 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.

5.5.3 Personal protective equipment for Post- Mortem

1. Standard precautions must apply when handling all bodies;
2. Protective clothing must be worn before carrying out post-mortem examination;
3. Staff performing post- mortem must wear surgical theatre type clothing, a long sleeve 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 (water proof 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.

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;
- avoiding 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 do 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 are no longer required during a post-mortem examination, clean them thoroughly 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 which 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 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 whereby the body of the deceased is infectious, it is essential that family members are educated about the risks for 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.

5.5.4 Environmental Cleaning

- The aim of cleaning is to maintain an environment where any infectious agents which might be present are reduced to a level which is not harmful to health. Regular cleaning of the mortuary must be carried out using a 2-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), 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-aerosolize infectious material.
    - Environmental surfaces, where the body was prepared, should be cleaned immediately after.
    - Protective equipment such as waterproof boots and eye goggles should also be cleaned with detergent and disinfected and sodium hypochlorite 0.1% at the end of each session involving known or suspected high-risk cases, otherwise detergent and water is sufficient.
    - All waste from the post-mortem room should be treated as clinical waste, therefore 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 BODY SUBSTANCES FOR HIV AND HEPATITIS B

HCWs are at risk of exposure to blood and body substances, and to infectious diseases therefore, it is vital that there is a process to manage personnel with communicable infections. The implementation of preventative measures against infectious diseases, and management of occupational exposures to blood and body substances will assist in the maintenance of staff health.

All HCWs must receive annual training on prevention of sharps injuries, first aid procedures required following an inoculation or splash injury including baseline blood tests and availability of Post-exposure prophylaxis (PEP) for HIV.
The infection prevention issues for HCWs described in this section include:

- human immunodeficiency virus (HIV)
- hepatitis B virus (HBV)
- hepatitis C virus (HCV)
- tuberculosis (TB)
- meningococcal meningitis
- tetanus
- work restrictions
- Guidelines for managing occupational exposure to blood and body substances for HIV and hepatitis B.

6.1 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 an HCW acquiring HIV after a needle stick or other sharp injury route is 0.3% and 0.09% via the mucous membrane and non-intact skin.

There are no confirmed effective methods of treatment and no cures for HIV; however, there is a treatment that will prevent death. Hence the focus must be on preventing exposure to HIV through safe infection control work practices, such as standard precautions, ongoing education and training, safety management, proper disposal of healthcare-related waste and sharps, and use of personal protective equipment. There is no vaccine for HIV.

6.2 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. However, studies state that although HBV is present in saliva and tears, these body fluids have not represented an occupational risk to HBV unless it contains blood.
Blood from persons infected with HBV contains the highest HBV titer of all body fluids.

HBV is one of several viruses that may be transmitted by significant exposure to blood or other body substances. HBV, like HIV, cannot be cured and often results in severe liver damage or death. There is a highly effective vaccine for HBV.

6.2.1 Hepatitis B immunization

Immunization is the best way of preventing HBV transmission to healthcare staff and must be offered to all HCWs. However, arrangements must be made first with the reproductive health team to ensure that supplies of Hep B vaccines are adequate.

Hepatitis B immunization 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.

6.2.2 Antibody testing

Post-immunization testing for seroconversion should be done one to two months after the third immunization dose if available. All HCWs should be responsible for knowing their immune status.

6.3 Exposure to Hepatitis C virus

In the healthcare setting, the transmission route of HCV is largely parenteral (through the skin, for example, a needle sticks), through exposure to blood and body substances. The sexual transmission does occur but is far less frequent.

HCV infections are not common in Tonga. As with HIV, there are no confirmed effective methods for treating HCV, hence the focus must be on preventing exposure to HCV through safe infection prevention and control work practices (e.g. standard precautions, ongoing education and training, safe management and disposal of healthcare-related waste and sharps, and use of personal protective equipment). There is no vaccine for HCV.

6.4 Meningococcal meningitis

Neisseria meningitidis is transmitted via direct contact, particularly by respiratory droplets from the nose or throat of colonized or infected people. Individuals with meningococcal septicemia (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 if the risk of exposure has been deemed to be significant. No prophylaxis can be considered 100% effective; prevention of exposure should, therefore, be aimed for.

6.5 Work restrictions

Table 6.5a: Work restrictions for healthcare workers exposed to, or infected with, selected infectious diseases

Disease/pathogen	Relieve from direct patient contact	Partial work restriction	Duration
conjunctivitis infectious	Yes	No	Until discharge ceases
Coronavirus disease 2019 (COVID-19)	Yes	No	14 days quarantine + 7 days self-isolation and waiting for the lab result of at least 24 hours (follow designed pathway).
cytomegalovirus Infectious	No		
Diphtheria	Yes	No	Exclude exposed staff and those identified as asymptomatic carriers from duty until antimicrobial therapy is completed and results of two nasopharyngeal cultures obtained at least 24 hours apart are negative.
Extended Spectrum Beta-Lactamase (ESBL)	Yes	Yes	Refer to specialist
gastroenteritis Acute	Yes	**No**	Until symptoms resolve 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	**No**	Until 7 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
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

herpes zoster shingles	Yes	Restrict immunocompetent personnel with localized zoster from the care of high-risk patients until lesions are crusted; allow them to care for other patients with lesions covered, and avoid contact with pregnant women.	Restrict immunocompromised personnel with zoster from contact with patients until lesions are crusted. Restrict susceptible personnel exposed to zoster from patient contact from the 10th day after the first exposure through the 21st day after the last exposure.
HIV	Assess	May be restricted from performing exposure-prone procedures.	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 7 days after the rash appears or for the duration of their acute illness, whichever is longer.
post-exposure (susceptible personnel)	Yes		From the 5th through the 21st day after the last exposure OR 7 days after the rash appears or for the duration of their acute illness, whichever is longer.
meningococcal disease	Yes		Exclude personnel with *N. meningitidis* 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 *N. meningitidis*.

Methicillin Resistant *Staphylococcus aureus* (MRSA)	Yes		Exclude from duty for 5 days to perform chlorhexidine decolonization then re-swab on day 7 to test result.
Mumps	Yes		Exclude susceptible personnel who are exposed to mumps from duty from the 12th day after the first exposure through the 26th day after the last exposure or, if symptoms develop, until 9 days after the onset of parotitis.
Pertussis	Yes		Exclude personnel in whom symptoms develop (cough ≥7 days, particularly if accompanied by paroxysms of coughing, inspiratory whoop, or posttussive vomiting) after known exposure to pertussis from patient care areas until 5 days after the start of appropriate therapy.
Rubella	Yes		Exclude susceptible personnel who are exposed to rubella from duty from the 7th day after the first exposure through the 21st day after the last exposure. Exclude personnel who acquire rubella from duty until 7 days after the beginning of the rash.
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 of 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 that 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 AFB negative.
Typhoid	Yes		Refer to specialist
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 the 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 10th day after the first exposure until the 21st day after the last exposure.

Source: CDC 1998

6.6 Guidelines for managing occupational exposures to blood and body substances, including HIV prophylaxis in healthcare settings

Occupational exposure is defined as an incident that occurs during a person's employment either in a hospital, health centre or dispensary 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. However, please refer to existing HIV core team for managing HIV prophylaxis.

6.6.1 Prevention of occupational exposure

Preventing exposure through safer practices such as not recapping needles 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:

1. HCWs must be trained in, and be able to demonstrate competency in, standard precautions; and
2. Staff must be provided with the necessary materials and protective equipment.

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

The following measures are aimed at reducing the incidence of occupational exposures and are part of the annual education and orientation programs in every department/ward or clinic throughout all hospitals and health centers in Tonga:

- 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.
- Take care of all blood contaminated equipment.

All Hospitals and health centers must ensure that the following management strategies are implemented:

- An efficient system for reporting and managing potential exposures of HCWs to blood and body substances;
- Confidentiality of injured HCWs is maintained;
- Expert advice is available to all HCWs 24 hours a day, and that processes are in place to facilitate ready access to appropriate treatment;
- Rapid assessment of HCWs is available to ensure timely administration of specific prophylaxis, if appropriate.

6.6.2 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.

6.6.3 Immediate Care or First Aid Procedure of the Exposed Person

It is strongly recommended that immediately after occupational exposure to blood or other body substances, the following measures must 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 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 it is 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 and shower.
- If water is not available for washing percutaneous exposures or punctures of the skin, a nonwater cleanser or antiseptic should replace soap and water.

6.6.4 Procedures for reporting occupational exposures are as follows:

- The HCW must IMMEDIATELY report the exposure to their supervisor or charge nurse and the doctor on call (24 hours per day);
- The supervisor then arranges an immediate medical assessment by a doctor in the Accident and Emergency department (24 hours per day) for the HCW and the patient who is the "source" of the exposure if known. (if in a hospital, the infection control nurse could be contacted for more information and to take over from the supervisor);
- If the incident exposure form is available *(see appendix 6)*, the form must be completed, if the form is not available, a book or register book could be used to document all exposures. The report contains 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 (if known) whose blood or body substances were involved in the incident.
    - If the source of the blood is unknown this must also be documented.

As soon as possible (within one day), the incident form is sent to the infection control nurse or 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.

Note: See appendix **6** for a copy of the incident exposure form.

6.6.5 Medical assessment

A medical risk assessment involves taking and recording the history and details of the occupational exposure and assessing the risk for HIV, HBV, and HCV from the source person and the exposed person. This assessment is undertaken by the Accident and emergency doctor or nurse practitioner 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. Information to be examined during the assessment includes:

- date, time and location of the exposure;
- duty being performed at the time of exposure;
- how the exposure occurred;
- protective clothing such as gloves being worn at the time of the incident;
- nature of exposure such as percutaneous, mucous membrane non-intact skin;
- type and volume of blood and/or body substances exposed to;
- duration of contact with blood and/or body substances;
- if a sharps injury: type of implement involved, whether it was visibly contaminated with blood, depth of injury, if bleeding occurred;
- if a needle stick injury: needle gauge, syringe size, purpose for which needle had been used;
- if non-intact skin: the condition of the skin;
- HIV, HBV and HCV status of the source (if known); and
- HBV immunity and vaccination history of the exposed person.

6.6.6 Exposure and source patient

Exposure must 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) is possible, it must only occur 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.
The 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. The following should be done:

- Baseline testing should occur immediately (after first aid has been completed) following exposure, but at least within 72 hours.
- Baseline tests are usually HIV antibody, hepatitis B surface antigen (HbsAg) and hepatitis B and C antibodies (if available).
- HCW's tetanus immunization 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 *(see annex 5)* and after obtaining informed consent, should always include a/an:

- explanation of privacy and confidentiality;
- and, if necessary, further explanation of HIV, HBV and HCV infection and its consequences;
- explanation of testing, possible results, and confirmatory testing;
- assessment of risk related to past and current sexual and other behaviour;
- assessment of risk related to the occupational exposure in question;
- explanation of low transmission risk associated with occupational exposure;
- assessment of anxiety level and coping mechanisms;
- informed consent for testing;
- informed consent for a pregnancy test (if indicated);
- plan for precautions while awaiting test results (and while on PEP, if indicated): adverse effects of anti-Retro-Viral (ARVs), safer sexual practices or abstinence, cessation of breastfeeding if lactating'
- list of any other risks identified by sexual and behavioural history;
- the mechanism for support while the patient waits for test results, and while on PEP if indicated; and
- Review of the sequence of events that preceded the exposure, and provide exposure risk reduction education in a sensitive and non-judgmental way.

Note: Some Ante-Natal Clinic nurses have been trained to carry out pre-test HIV counselling they should be contacted to do the counselling for you or call them for guidance.

6.6.7 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%).
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; and
- 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%).

According to the Centre for Disease Control (CDC) in the United States of America, studies indicate that HCW's 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%,** the risk of developing **serologic evidence of HBV infection was 37% - 62%.** By comparison, the risk for developing **clinical hepatitis** from needles contaminated with **HBsAg-positive and HBeAg- negative was 1% - 6%,** the risk for developing **serologic evidence for HBV infection was 23% - 37%.**

The risk for 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 a treatment to reduce the likelihood of HIV, HBV and tetanus infection in HCWs after possible occupational exposure. There is no PEP available for HCV.

6.6.8 HIV Post Exposure Prophylaxis (WHO 2014)

- Post-exposure prophylaxis should be offered, and initiated as early as possible, to all individuals with the exposure that has the potential for HIV transmission, and ideally within 72 hours.
    - Assessment for HIV PEP should still be considered even after 72 hours.
- Assessment eligibility should be based on the HIV status of the source whenever possible and may include consideration of background prevalence and local epidemiological patterns.
- **Exposures that may warrant post-exposure prophylaxis include:**
    - Parenteral or mucous membrane exposure;
    - The following bodily fluids may pose a risk of HIV infection: blood, blood-stained saliva, breast milk, genital secretions, and cerebrospinal, amniotic, rectal, peritoneal, synovial, pericardial or pleural fluids.

- **Exposures that DOES NOT REQUIRE post-exposure prophylaxis include:**
    - When the exposed person is already HIV positive;
    - When the source is established to be HIV negative; and
    - When exposure to bodily fluids that do not pose a significant risk: tears, non-blood stained saliva, urine, and sweat.
- Assessment of the HIV status of the exposed individual should not be a barrier to initiating PEP. In emergency situations where HIV testing and counselling is not readily available but the potential HIV risk is high or if the exposed person refuses initial testing, PEP should be initiated and HIV testing and counselling undertook as soon as possible.

Previous ARV regimens recommended different post-exposure prophylaxis regimens for different circumstances, with two drugs recommended as a standard and the addition of a third drug in situations of known risks of ARV drug resistance.

There is now a major shift in this treatment guideline towards an emphasis on simplification and does not differentiate between exposure sources but rather provides recommendations across all exposures.
The recommendation is a 3 drug regimen for everyone regardless of the circumstance. The new regimen is to simplify prescribing for PEP and reduce time in initiation (WHO, 2014).

Recommendations for Post Exposure Prophylaxis ARV Regimens for Adults and Adolescents

Table 6.6a Post-exposure prophylaxis

A two drug PEP regimen is effective, but three drugs are preferred (conditional recommendation, low quality evidence.

- TDF + 3TC (or FTC) is recommended as the preferred backbone regimen for HIV post-exposure prophylaxis for adults and adolescents.
    - (**Strong recommendation**, low-quality evidence)
- DTG is recommended as the preferred third drug for HIV post-exposure prophylaxis for adults and adolescents. (Strong recommendation, low-certainty evidence.)
- Where available RAL, DRV/r, LPV/r or EFV may be considered as alternative third drug options. (conditional recommendation, low-certainty evidence)

WHO, 2016 Guidelines of post-exposure prophylaxis for HIV and the use of Cotrimoxazole prophylaxis for HIV-related infections among adults, adolescents and children: recommendations for a public health approach.

Table 6.6b: Doses for ARV drugs for HIV Prophylaxis for Adults and Adolescents

GENERIC NAME	DOSE
Tenofovir (TDF)	300mg once daily
Lamivudine (3TC)	150 mg twice daily or 300 mg once daily
Emtricitabine (FTC)	200 mg once daily
Lopinavir/ritonavir (LPV/r)	400 mg/100 mg twice daily or 800 mg/200 mg once daily[a]
Atazanavir/ritonavir (ATV/r	300 mg + 100 mg once daily
Raltegravir (RAL)	400 mg twice daily
Darunavir + ritonavir (DRV/r)	800 mg + 100 mg once daily or 600 mg + 100 mg twice daily
Efavirenz (EFV)	600 mg once daily
Dolutegravir (DTG)	50mg once daily

6.6.9 Timing and Duration of PEP

Occupational exposures to HIV should be treated as a matter of urgency and treated immediately. The PEP should be started as soon as possible (within hours) after the injury or exposure ideally within 72 hours. Although animal studies have indicated that PEP is less likely to be effective after 72hours post-exposure, the interval to which no benefit is gained from PEP in humans is undefined. Therefore, initiating PEP after a longer period (1 week) should still be considered for exposures that represent an extremely high-risk transmission. Expert advice is recommended.

The PEP should be administered for four (4) weeks or 28 days if tolerated.

6.6.10 Antiretroviral Drugs during Pregnancy and Lactation

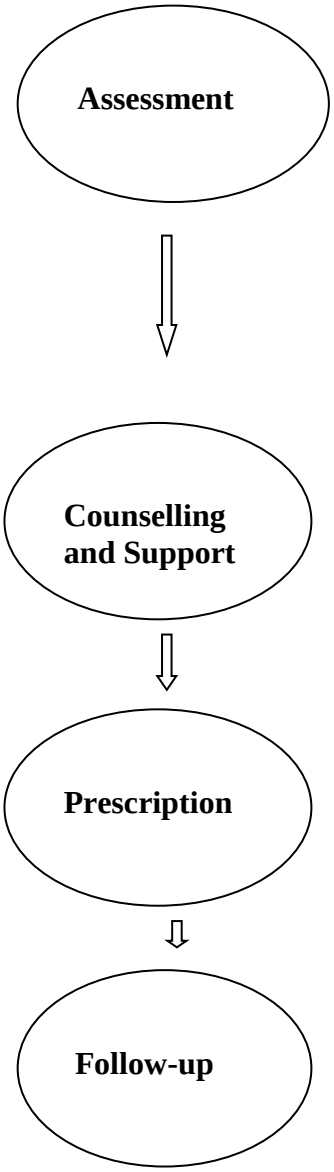
According to the CDC, the decision to offer HIV PEP to pregnant or breastfeeding health care workers should be based upon the same considerations that apply to any other healthcare worker who sustains an occupational exposure to HIV. The risk of HIV transmission not only poses a threat to the mother but also to the fetus and infant as the risk to mother to child HIV transmission is markedly increased during acute HIV infection during pregnancy and breastfeeding.
However, due to the complexities associated with counselling on the risks and benefits PEP and the selection of antiretroviral drugs in pregnant women, it is advisable to get expert consultation.

6.6.11 Obtaining advice

If exposure to drug-resistant HIV may have 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 6.6a* should be followed.

Figure 6.6a Care pathway for people exposed to HIV



- Clinical assessment of exposure
- Eligibility assessment for HIV PEP
    - Parenteral or mucous membrane exposure;
    - The following bodily fluids may pose a risk of HIV infection: blood, blood-stained saliva, breast milk, genital secretions, and cerebrospinal, amniotic, rectal, peritoneal, synovial, pericardial or pleural fluids.
- HIV testing of exposed people and source if possible
- Provision of first aid in case of broken skin or another wound.

- Risk of HIV
    - Parenteral or mucous membrane exposure;
- Risks and benefits of HIV PEP
- Side effects
- Enhanced adherence counselling if PEP to be prescribed

- The PEP should be initiated as early as possible following exposure
- 28days prescription of recommended drugs
- Drug information
- Assessment of underlying comorbidities and possible drug-drug interactions

- 1st follow up with 72 hours (discuss again risks for infection and risks and benefits of PEP)
- HIV test at 3 months after exposure
- Link to HIV treatment if possible
- Provision of prevention intervention as appropriate

6.6.12 Clinical follow-up and counselling

HCW's who have had occupational exposure to HIV should receive follow-up counselling regardless of whether they received PEP (the infection control nurse should ensure follow-up is provided). It is essential to provide follow up for HCW's 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 for infection and the risks and benefits of the PEP.

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 seroconvert (acquires HIV infection), this will usually occur two to six weeks after exposure, accompanied by asymptomatic 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 practice safer sex (or abstain from sex) until serology is negative at three months' post-exposure. Female HCWs who are lactating should consult a specialist regarding cessation of breastfeeding while they are taking 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 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 maintained.

6.6.13 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.

6.6.14 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, seek expert advice.

6.6.15 Hepatitis C virus personal protection equipment

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.

6.6.16 Hepatitis B virus personal protection equipment

Childhood vaccination against hepatitis B is included in the expanded program on immunization. Hepatitis B immunoglobulin (HBIG) is currently not available in Tonga (at the time of writing this document), *Table 6.6c* summarises the recommended actions to protect HCWs against occupationally acquired hepatitis B.

6.6.17 Tetanus personal protection equipment

Tetanus prophylaxis should be recommended depending on the type of exposure and the exposed person's past history of tetanus immunization.

- If less than five years since immunization, then no tetanus immunoglobulin or tetanus toxoid is necessary.
- If 5–10 years since immunization, a tetanus toxoid booster is recommended.
- If more than 10 years since immunization, both tetanus immunoglobulin (if available) and tetanus toxoid is recommended.

Table 6.6c Post-exposure prophylaxis against hepatitis B infection where serological testing and hepatitis B immunoglobulin **are available**

	SOURCE PATIENT	
Healthcare worker	**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 doses	**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) if available 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 0.06ml/kg.

Hepatitis B vaccination is 20µg intramuscularly per dose and is administered at 0, 1 and 6 months.

6.7 Guidance for Tongan Healthcare workers- Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV).

This guidance outlines measures to be undertaken by health practitioners (practicing healthcare workers) and health practitioners' registration authorities to prevent transmission of major viral infection within health-care settings in Tonga.
The primary responsibility of health practitioners' registration authorities is to protect the health and safety of the public. The registration authorities have powers to ensure that the registered health practitioners ('health care workers') for whom they are responsible are competent and fit to practice both at the time of initial registration and on an ongoing basis.
This Guidance address primarily Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV).

Adherence to standard precautions and transmission-based precautions are the most effective means of preventing HBV, HCV and HIV transmission in health care settings is by strict adherence to standard (universal) precautions and established infection control practices. These decrease the opportunity of direct exposure to blood and body fluids for both health care workers and patients.

6.7.2 Guidelines in relation to HBV

HBV vaccination

- Immunization is a key means of protection against HBV.
- All health care workers and those studying to become health care workers should be encouraged to be vaccinated against HBV where appropriate (i.e. if not immune and not infected), and retested to confirm immunity following vaccination.

Health Care Workers who may have been exposed to HBV

- All Health Care Workers who may have been exposed to HBV through peri-natal or childhood exposure, exposure to blood products, or occupational accidents are strongly advised to seek testing in order to know their own serological status.
- All health care workers who may have been exposed to HBV should be offered appropriate post-exposure immunization or protection.

Health care workers who perform exposure-prone procedures

- All health care workers who perform exposure-prone procedures must know their HBV status by being tested to determine whether they: (a) have HBV infection, or (b) are susceptible to HBV infection, or (c) are already immune to HBV infection.

Health care workers not HBV infected and with low antibodies

- Health care workers who are not HBV infected i.e., HBsAg negative, and who fail to produce protective levels of antibody following vaccination (i.e., have an HBs antibody titre < 10 IU/L) should be:

(a) Referred for specialist advice e.g., consideration of alternative methods of vaccine administration and

(b) Offered HBV specific immunoglobulin following recognized episodes of exposure to HBV infection.

6.7.3 Health care workers with HBV infection

- Health care workers found to be HBV infected should be tested to determine whether they are highly infectious i.e., HBeAg or HBV DNA positive. The infected health care worker should not perform exposure-prone procedures until their level of infectivity has been clarified.
- Health care workers who have HBV infection and are HBeAg or HBV DNA positive *should not perform exposure-prone procedures. The decision to allow such a health care worker to perform exposure-prone procedures* should be taken by an expert panel after reviewing all relevant information.
- In view of the lower risks of transmission, health care workers who have HBV infection, but are HBeAg and HBV DNA negative, may be allowed to continue to perform exposure-prone procedures should only be made after consideration by an expert review panel and counseling of the health care worker by member(s) of that panel.

6.7.4 Mandatory screening for HBV

- Given the higher risk of transmission for HBV and the availability of immunization, mandatory screening of health care workers for HBV is recommended for those health care workers who perform, or may perform, exposure-prone procedures. Frequency of screening should include consideration of the health care worker's level of immunity and the risk of the activities undertaken by the health care worker.

6.7.4 Guidelines in relation to HCV and HIV

Health care workers who may have been exposed to HCV and HIV

- All health care workers who may have been exposed to HCV and HIV through personal risk behavior, exposure to blood products that are later identified as having been contaminated, or occupational accidents are strongly advised to seek testing in order to know their own serological status and, where appropriate, initiate post-exposure prophylaxis.

Health care workers who perform exposure-prone procedures

- Those health care workers who perform exposure-prone procedures must know their HCV and HIV status.

Mandatory screening for HCV and HIV

- Mandatory screening of health care workers for HCV or HIV is not recommended; in the present state of medical knowledge this is not justified by the very low risk of transmission from health care workers to patients.

Recommended screening frequency

- If screening is undertaken, frequency of screening should include consideration of the risk of the activities undertaken by the health care worker. For example, for those health care workers who perform exposure-prone procedures, screening could be prior to employment

and, for example, every one- two years thereafter. For those health care workers for whom the level of risk is lower, screening could be prior to employment and, for example, every five years thereafter.

6.7.5 Guidelines in relation to HBV, HCV and HIV Health care workers who may be infected with HBV, HCV or HIV

- A health care worker infected with HBV, HCV or HIV must not continue in clinical practice. It is unethical, and could be deemed professional misconduct, for a health care worker so infected to act in a way that puts a patient at risk.
- Health care workers who know or believe themselves to be infected with HBV, HCV, or HIV could put patients at risk and so must seek appropriate counsel and act upon that advice. This advice could include a requirement not to practice, or to limit practice in certain ways.
- Each registration authority should maintain a list of health care workers who are infected with HBV, HCV and HIV and provide qualified advisor (counselor) to advice on how they may need to limit their practice.

Duty to notify registration authority

- An advisor (counselor) or health care worker who has counseled a HBV-, HCV-, or HIV-infected health care worker to modify practice in order to safeguard patients, and who is aware that this advice is not being followed, must inform the appropriate registration authority that he or she has reason to believe that the infected health care worker is "unable to perform the functions required for the practice of his or her profession because of his or her mental or physical condition".
- The obligation to notify the registration authority also applies to any registered health practitioner, any organization that provides health services. Any employer of the infected health practitioner, or any medical officer of health, who is aware that an HBV-, HCV-, or HIV-infected health care worker has been advised to modify practice in order to safeguard patients and that this advice is not being followed.
- *If non-compliance continues, it may be necessary for the registration authority to exercise its statutory functions* to impose conditions on the health practitioner's scope of practice or suspend the practitioner's registration. Registration and limitations on practice
- HBV, HCV or HIV infection alone does not justify refusing registration of a health care worker, limiting their scope of practice or limiting professional duties. Limitations, if any, should be determined on a case-by-case basis after consideration of: (a) the virus the person is infected with; (b) the concentration of that virus in the person's blood: (c) the ability of anti-viral treatment to be able to control the person's viral load below levels of recognized risk of transmission in a clinical setting; (d) the nature of the procedures the person performs; and (e) other factors that may influence transmission risk, including inability or unwillingness to comply with infection control standards or functional impairment which interferes with professional performance.

- A health care worker, who has been advised that he or she should not perform exposure-prone procedures, may perform such procedures in a life threatening emergency where there is no other alternative practitioner or other adequately trained person available to carry out the procedure. Notify patients of infected health care worker
- A health care worker infected with HBV, HCV, or HIV is not required to inform patients that he or she is infected. Requiring infected health care workers to inform patients would only serve as a deterrent to their seeking voluntary testing and medical evaluation. A health care worker, like any other person, has a right to privacy and confidentiality where there is no risk to the public.

Students

- To increase public and practitioner safety, undergraduate courses for registered health practitioners must include adequate education in appropriate infection control and occupational health and safety techniques and procedures.
- Students contemplating careers as a registered health practitioner should be aware of their serological status with respect to HBV, HCV or HIV. Infection with these viruses may affect an individual's ability to practice in the future. In addition, entry to some university courses requires documentation of HBV and HCV status and infection with these viruses may result in exclusion from a training programme or modification of an individual's training programme.
- Early in their undergraduate courses, those studying to become registered health practitioners should be made fully aware of the risks to themselves and their patients of HBV, HCV and HIV infections.
- Under normal circumstances, a person in charge of an educational programme, which includes or consists of a course of study or training that is a prescribed qualification for a scope of practice of a health profession, is not required to report students with HBV, HCV or HIV infection to a registering authority.

6.7.7 Patients who may have been exposed to HBV, HCV or HIV

- All patients who may have been exposed to HBV, HCV or HIV through peri-natal or childhood exposure, personal risk-behavior, exposure to blood products that are later identified as having been contaminated, or occupational accidents should be advised to seek testing in order to know their own serological status and, where appropriate, initiate post-exposure prophylaxis.

7 INFECTIONS BY SELECTED DISEASES

This section and the next two sections are dedicated to selected diseases that are potential public health threats to Tonga and are of importance to healthcare settings.
The following diseases are discussed:

- COVID-19 Virus
- Dengue fever
- Leptospirosis
- Methicillin-Resistant Staphylococcus aureus (MRSA)

7.1 COVID-19 Virus

Coronavirus disease 2019 (COVID-19) is caused by SARS-CoV-, 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.

7.1.1 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; i.e., endotracheal intubation, bronchoscopy, open suctioning, administration of nebulized 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.

Incubation period
On the average 5–6 days but ranges 2-14 days.

Period of infectiousness
An infected person may start to be infectious 1-3 days before the onset of symptoms up to 14 days after the onset of symptoms.

7.1.2 IPC measures for COVID-19

For suspected or confirmed COVID-19 patients, standard precautions should be applied at all times with contact and droplet precautions and airborne precautions applied when performing Aerosol Generating Procedures (AGPs).

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 Person Protective Equipment (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 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.

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

- 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;
- Practise good respiratory hygiene by covering your mouth and nose with your bent elbow or tissue when you cough or sneeze, then dispose of the used tissue immediately.
- Effective use of personal protective equipment (PPE)
- Properly cleaning and disinfecting of environmental surfaces;
- Maintaining physical distance of at least 1 meter apart

Hand Hygiene

Hand hygiene is mandatory and includes hand washing with soap and water or the use of alcohol-based hand rub. The appropriate steps must be followed to achieve effective hand hygiene. This includes ensuring that the hand hygiene is followed for hand 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.

Respiratory hygiene

Healthcare facilities should promote respiratory hygiene by:

- Ensuring patients with fever and cough are seated away from others in common waiting areas (ideally at least 3 feet/1 meter 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;
- Making hand hygiene (e.g. dispensers of alcohol-based hand rubs) with instructions on how to use it 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 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;

7.1.3 IPC management for airway management

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.

<u>The following are considerations to minimise health care worker infection:</u>

- Intubation should preferentially be performed in a negative pressure room or if not available then a single room with open windows should be used. If no single rooms 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 main airway trolley to be taken into 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.

<u>Other considerations for procedures:</u>

- 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 that 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 only be carried out 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.
- Laryngoscope should be placed in a sealed bag immediately after use and sent for sterilisation (if not single use), or clean with detergent and water, dry, and wipe with 70% alcohol.

7.1.4 Personal Protective Equipment (PPE) ***(refer to figures 4.3a and 4.4b on sequence to follow to put on and remove PPE safely)***

PPE is required by healthcare workers caring for patients with suspected for 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 and its disposal and appropriate hand hygiene.
For suspected or confirmed COVID-19 cases the required PPE for staff are:

- Disposable long-sleeve, fluid-resistant gown,
- gloves,
- N95/P2 respirator mask for aerosol generating procedures (AGP) mask or surgical mask, and
- Eye wear (goggles or face shield).

The table below provides guidance for Healthcare workers on appropriate PPE selection in the context of COVID-19. Hand hygiene must always be performed.

Table 7.1a: Rational Use of PPE for Health Care Workers

IF I AM A…	WHAT PPE DO I NEED?
Nurse or Doctor who is NOT looking after a COVID-19 patient.	None. Standard precautions, no additional masks or gowns or eye protection required unless you think you are at risk of a body fluid exposures.
Nurse or Doctor providing direct care in an Isolation or Quarantine Facility (<1m away from patient for over 15 minutes).	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes).
Doctor or Nurse performing intubation or giving nebulizer.	Full PPE (N95 or FFP2 or FFP3 standard or equivalent mask, gloves, gown, apron, eye protection and closed shoes).
Part of the **case investigation or screening team** assessing patients suggestive of COVID-19	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes). **Provide mask to patient**
Driver of case investigation team or AMBULANCE with no direct patient contact.	Surgical mask.
Health care workers who enters a room with COVID-19 patient but stay over 1m from the patient with no contact.	Surgical mask and gloves.
Support worker in engineering, pharmacy or supply etc.	None. Practice hand hygiene and stay >1m away from people.
Office worker	None. Practice hand hygiene and stay >1m away from people.
Security directing traffic or people.	None. Practice hand hygiene and stay >1m away from people.
Cleaner in isolation, quarantine, or screening area.	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes).
Cleaner working in any other that IS NOT listed above,	Gloves, apron, closed shoes, eye protection for chemicals.
Waste collection person handling clinical or general waste.	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes).
Mortuary worker when handling dead body	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes).
Nurse looking after a patient with TB or MRSA.	Follow normal PPE for airborne and contact transmission.
Microbiology technician	Full PPE (i.e. gloves, gown, eye protection, surgical masks, and closed shoes).
Community member who has NO symptoms but is worried.	Wear fabric mask if community wide transmission and Practice hand hygiene and stay >1m away from people when possible.
Procurement officers when handling cargo supplies	Follow routine procedures Other forms of PPE to protect against the virus such as medical masks, gowns and disposable gloves are not required.

7.1.5 Environmental Cleaning (refer to appendix 1 for frequency of cleaning)

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 of environmental surfaces inside and outside of patient rooms as well as non-critical medical equipment's such as blood pressure cuffs, cardiac monitors, and highly touched surfaces such as tables, counter tops, light switches etc. are very important in preventing further transmission of the COVID-19 virus.

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.
- Cleaning equipment, such as 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 uses. In outbreak situations, it is recommended that disposable cloths are used

7.1.6 Waste and Laundry management

- All healthcare waste generated in a facility with COVID-19 patients is considered infectious and should be collected safely in a 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 sleeve 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, taking care to avoid splashing. Following this, the linen should be soaked in 0.05% chlorine for approximately 30minutes then rinsed with clean water and the linens allowed to dry fully, if possible in sunlight.

7.1.7 Handling of bodies of the deceased with Confirmed or suspected COVID-19

- Mortuary staff must be trained on PPE: putting on and removing 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. However, a dedicated area should be allocated within the mortuary refrigerator for COVID-19 bodies. The area dedicated for COVID can be separated with the use of 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 as containing COVID-19, such as 'Risk of COVID-19 – Handle with care'. If no body bag is available, wrap body in a sheet or cloth and attach label.
- Decontaminate the casket with sodium hypochlorite before issuing it to 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 to the next of kin.
- Family viewing should be arranged and allowance made for few 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 sanitizer.
- Regular cleaning of the mortuary must be carried out using a 2-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), allow to dry.

7.2 Dengue Fever and Leptospirosis

An awareness of dengue fever 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 within 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 preventative activities in hospitals during peak periods of the diseases mentioned below.

7.2.1 Dengue fever

Dengue is spread by mosquitoes belonging to the genus *Aedes*. The main species responsible for transmission of dengue fever and dengue haemorrhagic fever are *Aedes aegypti* and *Aedes albopictus*.

Aedes aegypti breeds inside and outside of 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 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 virus load in the mosquito's salivary gland is high).

7.2.2 Suspicion of a dengue outbreak

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

- High fever for 2 to 7 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 present with one or more haemorrhagic event (petechiae, epistaxis, gum bleeding, haematemesis or melena).
- Febrile patients remain ill despite drop in temperature; the clinical condition deteriorates with development of cold and/or clammy skin, drowsiness and restlessness.

7.2.3 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 which 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.
- 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 should include:

- Screening all windows.
- 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 include:

- Require use of (preferably insecticide-impregnated) mosquito nets by patients admitted to the healthcare facility in the acute phase of dengue infection.
- Encourage use of insect repellent preparations by staff and patients.
- Continuous repellent use is not recommended, to avoid toxicity.
- Repellent use should 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 patient admitted to a healthcare facility during dengue high risk periods should be counselled upon admission, and provided 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.

7.2.4 Leptospirosis

Leptospirosis is an acute febrile disease (with potentially lethal outcomes) caused by bacteria that affects humans and other animals. It is spread by contact with urine from cattle, dogs, mongooses, pigs, rats and from water or soil contaminated with the urine from these species. 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.

7.2.5 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) includes:

- High fever of sudden onset.
- Severe headache.
- Severe myalgia (especially in thighs, calves and loins).
- Conjunctival suffusion (red eyes).

7.2.6 Leptospirosis control and prevention activities

Measures to control and prevent leptospirosis include:

- Avoid swimming or wading in waters 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 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 of 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 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.
- Monthly pest control activities (e.g. setting out poison baits).

Outdoors, control measures include:

- 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.

7.3 Methicillin-Resistant Staphylococcus aureus (MRSA)

Methicillin-Resistant Staphylococcus aureus (MRSA) is a type of staphylococcus bacteria that is resistant to multiple antibiotics (penicillin's and cephalosporin's), in hospital settings making it difficult to treat when compared to other infections.

MRSA is commonly known as a hospital associated infection. However, there are strains of community acquired MRSA (CA MRSA) and there is often transfer of CA MRSA in hospital and mixes with hospital acquired (HA MRSA) strains.

Outbreaks of multi-resistant methicillin-resistant *Staphylococcus aureus* (MRSA) are becoming a concern for healthcare facilities, as strains are often resistant to several antibiotics and are often sensitive only to vancomycin and one or two other antibiotics.

There have also been reports of *Staphylococcus* that is resistant even to vancomycin (vancomycin-resistant *Staphylococcus aureus* or VRSA). MRSA can spread very rapidly to other patients once it is acquired in just one patient. Transmission of MRSA infection has been implicated through the contaminated surfaces and hands of healthcare staff and patients.

In many countries including Tonga, MRSA has emerged as a community acquired MRSA strain. Patients usually present with skin and soft tissue abscess infections and are usually diabetics with foot sepsis. Patients that are admitted are usually very sick and most need incision and drainage.
The prevention of MRSA in healthcare setting depends on timely identification of MRSA by the laboratory, isolation of the patients, strict adherence to hand hygiene, the application of standard and contact precautions including appropriate environmental cleaning and disinfection and decontamination of patient care equipment.

7.3.1 MRSA Reservoirs

- The most common reservoirs in healthcare settings are patients that are colonized and patients that are infected with MRSA. Colonization with MRSA usually occurs in the nose, moist areas of the skin (groin, perineum) and throat;
- MRSA can survive on environmental surfaces for weeks;
- Contaminated environmental surfaces with MRSA and share patient equipment are also reservoirs.

7.3.2 Mode of Transmission

- MRSA is transmitted mainly from person to person via direct contact transmission;

- Direct contact is more common and occurs via contaminated hands of health care workers and visitors;
- Indirect contact is when MRSA is transmitted via contaminated environmental surfaces e.g. door knobs, bedrails and other commonly touched areas and shared patient equipment.

7.3.3 Risk Factors for MRSA

- recent or current prolonged use of antibiotics;
- previous hospital admissions;
- immunocompromised patients;
- patients with open wounds
- patients with long term skin conditions such as ulcer on the leg or psoriasis
- patients with long term devices (IV or catheters);
- Patients who have large surgeries.

7.3.4 Screening for MRSA

According to the literature screening of all patients for MRSA is not recommended. However, the goal in MRSA surveillance is to identify patients who are either colonized or infected with MRSA, to facilitate isolation and standard and contact precautions to prevent further transmission to other high risk patients.

In Tonga the following screening criteria are recommended:

- History of MRSA (carrier or infection), screen only if the patient has not had a positive MRSA result within the last 3 months. There is no need to screen if the patient is positive for MRSA within 3 months;
- Recent admission in an overseas hospital
- Patients with long term indwelling devices e.g. Urinary catheter
- Frequent admissions to hospital;
- Chronic wounds;
- Patients that may have major surgeries by visiting teams (open heart etc.)

Screen Sites

- Cultures sites from: nose, perineum or groin plus wound or indwelling device. (Specimen label should indicate the site of collection and should state for MRSA screening). In addition, also label hospital number and name of patient etc.;
- When taking a wound swab, clean the wound first with saline before taking the swab.

7.3.5 Decolonization Treatment (South Australian Health 2016)

- Decolonization is given to MRSA colonized patients to eradicate or suppress carriage;
- Decolonization is usually recommended preoperatively (there are reported risks of mupirocin resistance)
- Treatment includes:
    - **Nasal decolonization**:
        - This method is only applied if the nostril swab is found positive for MRSA.

- Apply 2% mupirocin ointment into the surface of each nostril 2 or 3 times a day for 5 days prior to surgery;
- Wash hand before and after application of ointment.

- **Skin Decolonization**
  - Bath daily with 4% chlorhexidine or 1% triclosan for at least 5 days;
  - Wash hair with one of the antiseptics twice during the 5 days' course of decolonization (1st and 3rd days);
  - Change and wash clothing, beddings etc. at least twice in a week more throughout the treatment. (Patient's clothing can be washed using the normal washing cycle, soiled clothing or linen can be soaked in sodium hypochlorite 1% solution for twenty minutes' solution prior to washing. Dry clothes and linen in direct sunlight if possible or in a dryer using the hottest cycle suitable for the clothes).

MRSA Clearance

- More than 3 months have elapsed since the last positive specimen;
- No exposure to 4% chlorhexidine or 1% triclosan body wash for at least 2 weeks prior to screening;
- Consecutive negative swabs of screening sites (nose, perineum or groin plus wound) on 2 separate occasions greater than 3 weeks apart.

7.3.6 Confirmation of MRSA Patient in Hospital

- It is very important that upon laboratory confirmation of an MRSA patient, infection prevention and control measures must be immediately implemented to prevent potential transmission of MRSA to other patients;
- The microbiology technician/doctor must inform the following personnel in the hospital:
  - The treating doctor
  - The infection prevention and control staff;
  - The nurse in-charge of the ward/unit.

7.3.7 Infection Prevention and Control Measures in Caring for MRSA Patients

The main aim for implementation of Infection Prevention strategies is to prevent the transmission of MRSA from hands of staff and patients and contaminated environmental surfaces and equipment's to other susceptible patient in the hospital. Therefore, strict implementation of standard and contact precautions should be implemented. *(see section 4.11 for implementation of contact precautions).*

7.3.7.1 Management of patients in the Peri-operative, Theatre and Post Recovery Environment

- If surgical intervention is necessary, then it should be scheduled for the end of the operating list.

- If prophylactic antibiotics are to be utilized, nursing staff must allow an adequate time to administer vancomycin which has to be completely infused over duration of 1 hour before induction.

- Staff in the peri-operative area and theatre should be informed of the MRSA patient;

- As usual all patients should have a full shower and change into theatre suit prior to transfer to the operating room;
- Bed linen should be changed and patient surroundings cleaned upon return from shower;
- There should be attention to hand hygiene in the peri-operative area and theatre environment;
- Staff should wear long sleeve gown and gloves when transferring patient from the trolley to the operating table, this should be discarded after movement and hand hygiene performed.
- Equipment in the theatre could either be wiped with alcohol or sodium hypochlorite 1%;
- Similarly, anesthetic equipment should be wiped, bacterial/viral filters with single use anesthetics circuits should be changed between patients;
- Waste, equipment's and line should be treated as usual as per guideline;
- There should be designated area for this patient with a designated Nurse and equipment;
- If staff are required to take care of other patients, the PPE and gloves must be removed and Hand hygiene performed before attending to other patients;
- When the patient leaves the post-operative area, all patient equipment and surfaces contacted by the patient must cleaned with detergent and sodium hypochlorite.

7.3.7.2 Management of the MRSA Patient in the Dental, Emergency, Out-Patient and Radiology department

- Hand hygiene must be strictly adhered to before and after contact;
- If the patient has an open wound it should be dressed;
- If there will be close contact with the patient, a gown and gloves should be worn and if there is anticipated exposure to blood and body substances, eye protection and a mask should be worn;
- After the patient leaves, the patient equipment and all surfaces contacted by the patient including the wheelchair must be cleaned with detergent and sodium hypochlorite.

7.3.7.3 Transport of the MRSA Patient in the Ambulance

- Stand and contact precautions must be adhered to during transport of patients
- PPE (gloves, gown) should be worn by the HCW during transport;
- Hand hygiene must be performed after PPE removal;
- After the patient leaves the patient equipment and all surfaces contacted by the patient including the wheelchair must be cleaned with detergent and sodium hypochlorite.

7.3.7.4 Visitors

1. It is not necessary for visitors to wear PPE when visiting. However, they must be advised to perform hand hygiene before and after a visit;
2. PPE maybe required if the visitor provides direct and wishes to visit another patient.
3. The patient's clothes can be washed as usual and can be taken home in a plastic bag for washing.

Advice for Patients upon Discharge (see appendix 4 factsheet)

7.3.7.5 Care of the Deceased with MRSA

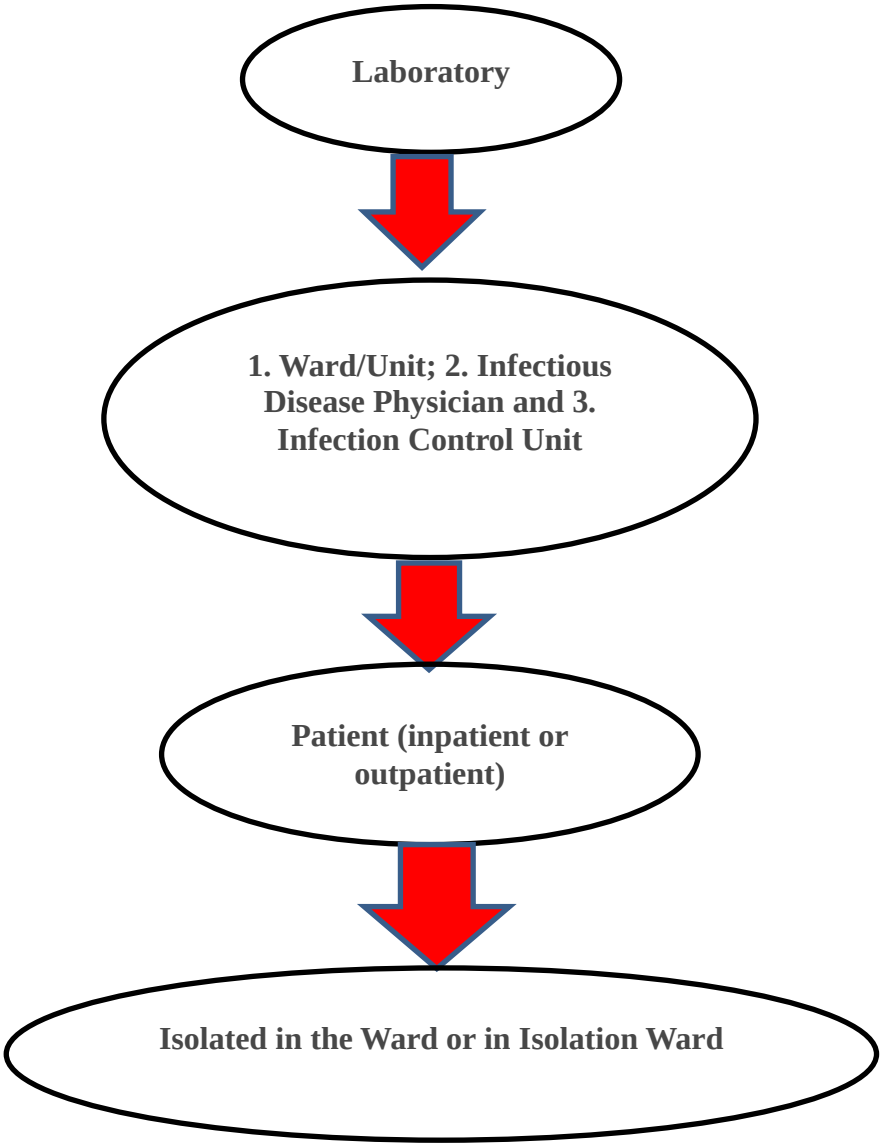
All blood and body substances of all deceased bodies are potentially infectious and standard precautions should be practiced at all times. In addition, for the deceased with MRSA, contact precautions must still be applied. This includes the use of gloves and a water resistant gown.
In Tonga, it is customary practice for the family of the deceased to request the assistance of a nurse to undertake the preparation of cleaning and dressing the body of the deceased. This is usually done with other members of the family. However, it is essential that family members are provided with gloves and a plastic apron or water resistant gown and advised on the precautionary measures below to minimize the risk of exposure to the MRSA bacteria.

- All used linen should be placed in a plastic bag for laundering;
- All wound, cuts and abrasions should be covered with a dressing;
- All body orifices should be packed as usual;
- Hand hygiene should be carried out upon removal of PPE;
- All environmental surfaces in the mortuary should be cleaned with detergent and sodium hypochlorite 1%.
- Family members should be advised not to kiss the deceased.

7.3.8 Strategies for Continuing Surveillance

- Implement a flagging system to identify previous patients diagnosed with MRSA, so that contact precautions can be immediately implemented if the patient is to be admitted;
- Implement a system within hospital transfers (e.g. x-ray) so that the receiving units can implement the necessary precautions.

Figure 7.3a Flow Chart of MRSA Notification



7.3.8.1 Notification of MRSA in the wards

- Once the ward has been notified, the doctor informed the patient about his/ her condition.
- The nurse allocated to care for the MRSA case must provide an MRSA fact sheet to the patient and the patient's attendant for information.
- The ward nurse allocated for the MRSA patient calls the Infection control nurse to perform surveillance and advise the MRSA patient with reference to the MRSA fact.

7.3.8.2 Placement of MRSA patients in the wards

- Transfer to **Isolation Ward** for full implementation of standard and contact precautions. **Treatment**
    - First-line treatment for mild abscesses is **incision and drainage**.
    - When the tests are run to determine that the staph bacteria isolated from a given patient are methicillin-resistant, these tests also provide information about which antibiotics can successfully kill the bacteria (its susceptibility profile), and treatment should change as soon as possible.
    - Bactrim and Vancomycin are currently used to treat MRSA infections in our hospital.
    - Chlorhexidine body wash and Mupirocin nostril ointment used for decolonization

7.3.8.3 Screening of staff for MRSA carriage

- It may be necessary to screen staff if there is an outbreak of MRSA within a ward or department. However, **screening of all staff for MRSA is not recommended.**

- For any HCW found positive with MRSA, once confirmed, he/she will have to stay home for 5 days due to duration of chlorhexidine body and hair wash to be completed, before resuming back to work.

7.3.8.4 Screening of patient's contact for MRSA carriage

- The ward nurse is responsible for screening the first contact of the patient based on doctor's request.
- All patients' contact should undergo chlorhexidine (4%) body wash at home.

8 SURVEILLANCE FOR IPC

WHO defines surveillance as a systematic collection, analysis and interpretation of health related data needed for the planning, implementation and evaluation of clinical practice.

Infection prevention and control programs have proven to be successful in lowering the incidence and spread of infectious diseases provided the programs are comprehensive and include surveillance. It is also important that a Physician responsible for infectious diseases work closely with the Infection Control Nurse/team to assist with hospital-acquired epidemiological surveillance and infection prevention and control supervision. However, for ILI and SARI surveillance, there is an existing syndromic surveillance in place under the authority of the Public Health Section, and it is not included in the IPC surveillance activities.

IPC surveillance can:

- Provide a baseline for HAIs on agents, host and environment from a range of sources;
- Serve as an early warning system for outbreaks and identifies the break-down in IPC work practices;
- Document the impact of an intervention or track progress towards specific goals;
- Make improvements to infection prevention and control program and strategies.

Active Surveillance is a core component of the IPC program and is normally performed by the Infection Control Nurse. However, it is not recommended to conduct facility wide surveillance for all areas of the IPC program. Therefore, 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.

8.1 Objectives of surveillance

A good surveillance program will include a written plan that outlines the goals and objectives of the program, and should be based on a framework that includes several well-defined practices.[6] A written plan also allows for strategic allocation of resources to enable effective and meaningful surveillance, decrease HAI rates, and improve patient safety. Surveillance programs should be evaluated periodically to ensure that they are effectively meeting the needs of the facility.

The specific objectives of a surveillance program include:

- To improve awareness of clinical staff and other HCWs (including administrators about HAI and AMR
- Identification of high-risk populations, procedures and exposures
- Monitoring of trends
- Identify possible areas of improvement inpatient care, and for further epidemiological studies
- Early detection of outbreaks
- Assessment of the impact of interventions

The following maybe considered for HAI surveillance in Vaiola Hospital:

- Specific sites of infection (e.g. bloodstream, post-operative surgical infection, indwelling urinary catheters) etc.;
- Specific population (e.g. HCWs occupational exposure to blood and body substances, neonates) etc.
- Specific organisms that can have severe outcomes (multidrug resistant organisms);
- Specific locations (Intensive care unit, neonatal intensive care units) etc.

A surveillance program should include:

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

HAI rates are developed by three elements:

- Numerator - number of persons developing an infection;
- Denominator - the exposed or at risk population;
- The time period involved.

Other surveillance/audits activities

- Hand hygiene audits for specific areas e.g. Intensive care units;
- Environmental audits
- Contact precautions audits
- Waste management audits;
- Audits on specific work practices such as:
- Use of surgical antimicrobial prophylaxis
- Aseptic manipulation of invasive devices, etc.

8.2 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
- Defies the national objectives of surveillance
- Establishes the priorities for surveillance of infections, pathogens and others
- Establishes what data should be provided to the MHMS and how
- Reports to interested parties on the national situation of HAI and special events
- Standardises:
  -case definitions
  -methods of surveillance
- Promotes the assessment of IPC practices and other relevant processes in a blame-free organisational culture

8.3 Healthcare facility surveillance

At the health service delivery level, IPC surveillance activities and responsibilities should include:

- Documents the situation of HAI and IPC processes in the healthcare facility
- Defines the local objectives of surveillance aligned with the national objectives
- Establishes the priorities for surveillance according to the scope of care in the facility
- Establishes the minimum registers necessary for medical records used for surveillance purposes and monitors compliance
- Conducts surveillance applying national standardised case definitions and methods of surveillance of infections
- Detects outbreaks and coordinates the response
- Reports HAI and events to the local interested parties and the MHMS as required by regulations
- Conducts the assessment of IPC practices and other relevant processes in an blame-free organisational culture

8.4 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., infection control 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. Even the most basic surveillance programs 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 will not have access to computerized data, other individuals 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 programs or procedures can also save time and resources; for example, SSI or ICU surveillance might be conducted for only three months each year instead of, recognizing that seasonal or other unexpected variation may be missed.
5. Analyse and interpret data. In smaller or more basic surveillance programs, 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 organizations 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 program meaningless.
7. Evaluate the program. Surveillance activities should be evaluated periodically in any surveillance program. At a minimum, assessment of the acceptability of the surveillance program, the quality of the data, and any changes in the patient population that impact the relevance of the surveillance program should be conducted.

8.5 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)
- Targeted surveillance (site, unit, priority-oriented)
- Appropriately trained investigators
- Standardised methodology
- Risk-adjusted rates for comparisons

8.5.1 Prevalence study

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

8.5.2 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 (Table 3). It is more effective in detecting differences in infection rates, to follow trends, to link infections to risk factors, and for inter-hospital and inter-unit comparisons.

This surveillance is more labour-intensive than a prevalence survey, more time-consuming, and 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., 3 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 an 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:

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

8.6 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:

- Percentage of antimicrobial resistant strains within isolates of a species, e.g. percentage of Staphylococcus aureus resistant to methicillin (MRSA)
- Attack rate (i.e. number of MRSA/100 admissions)
- 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 facilitates comparison. Either patient-day rates or device-associated rates can be used.

8.6.1 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.

8.6.2 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 colonization rather than infection (e.g. for surgical site infections, pneumonia). Laboratory reports are, however, reliable for urinary tract infection, bloodstream infections,
    - 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 colonization 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.

8.6.3 MRSA surveillance

Definition of new onset of MRSA Case (incidence rate): MRSA isolated from clinical culture obtained more than 72 hours after admission to the unit in a resident who had no signs or symptoms of infection on admission and who has no prior MRSA by culture or by history.

Calculation –

- Numerator is number of new cases
- Denominator is number of patient days in the unit for the period of study

$$\frac{\text{Number of new MRSA patients on a unit/month}}{\text{Number of number of admissions on the unit/month}} \times 100$$

This data can be done monthly and used to determine the population at risk of acquiring MRSA in the unit.

MRSA Prevalence

This data is used in baseline and in follow up for risk assessments.

$$\text{MRSA prevalence} = \frac{\text{Number of patients colonized and infection with MRSA in a unit}}{\text{Number of patients in the unit at a particular time}}$$

9 FOOD SAFETY

9.1 Introduction

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

- preventing outbreaks of food borne illness among patients;
- minimising microbiologic contamination of food by using appropriate food handling techniques during the preparation of food;
- protecting food from contamination by insects, rodents and moisture;
- Ensure that all food is received, stored and prepared according to best practice;
- Ensure that the kitchen operates in compliance with this IPC guideline.

9.2 Food services hygiene

During food preparation, all kitchen staff should wear clean uniform and appropriate protective clothing such as waterproof or fabric aprons, and hair covers, mask and plastic gloves when directly contact with food. If fabric aprons are used, the aprons should be changed after each task (e.g. after cutting meat) and before leaving the kitchen area.

Staff should also wear clean hats or hairnets that completely cover 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.

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
  - removing gloves
- Coughing and sneezing near food or dishes should be avoided. Where necessary, disposable tissue (rather than a handkerchief) should be used to cover the nose and mouth; hands should be washed immediately after use.
- 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 ladle or spoon used in food preparation. Utensils used for tasting should be replaced at each taste.
- 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 keep fingernails short and clean. Wearing jewelleries (necklace, ear ring, rings etc.) and nail polish are not allowed.
- Uncovered cuts hand during food preparation is not allowed. All cuts must be covered with Band-Aid and plastic gloves to be worn during food preparation. If more than just a cut, then this staff should be excluded from duty until completely recovered.
- Employees suffering from infectious diseases should be excluded from duty. *(Refer to Section 6.5 on staff work restrictions)*. If staffs with mild respiratory infections are allowed to work, they should wear surgical masks while preparing food.

9.3 Preparing and serving food

To prevent contamination of food during preparation and serving, the following are some important points to remember:

- Staff suffering from diarrhoea should be immediately removed from handling food and contact with patients until all symptoms are fully over for 24–48 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.
- Clean up benches and equipment properly before, during and after food preparation.
- Wash hands before and after handling any foods.
- All unused food returned to the kitchen after service should be discarded. Do not serve leftovers.
- Disposable gloves should be worn to handle foods that will not receive any further heat treatment (i.e. cooked meats/salad vegetables).

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

1. Wash hands thoroughly with soap and water before preparing and serving food. When available, wear gloves while handling food.
2. Minimise hand contact with food by providing suitable equipment for food preparation and serving.
3. Cut fruits and vegetables on a different surface than from that used for meat preparation.
4. Serve food as soon as possible after cooking.

9.4 Preventing contamination

To prevent contamination of food, the following procedures should be strictly carried out:

- Inspect food on delivery.
- Store food at the correct temperature (see below).
- Have separate 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 washing containers after emptying.

9.5 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 include the following:

- 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 5º C.
- Perishable food is any food that has not been pasteurised or contains moisture.
- All frozen foods should be stored at a temperature of -20º C.
- Store foods in their own respective 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 include:

- Enclosed rooms or cabinets.
- Adequate shelving.
- Leak-proof buckets (plastic or galvanised metal) with lids.

9.6 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.

9.7 Chilling hot food

Some important points to remember when chilling hot foods:

- Foods such as stews and soups that are pre-prepared for consumption at a later time should be rapidly chilled to 5º C 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.

9.8 Cleaning requirements

The frequency of cleaning food preparation equipment, surfaces and premises will depend 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 clean and disinfected with bleach after use.

9.8.1 Washing cooking and eating utensils

The following equipment is what 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.

9.8.2 Cleaning the kitchen and food storage areas

Daily 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.

10 ENSURING SAFETY OF WATER SUPPLY FOR HEALTH CARE FACILITIES

There are many factors that can significantly influence the transmission of a healthcare associated infection which includes the availability of water. Healthcare facilities need to have access among others to basic water and sanitation services, access to hygiene facilities, having satisfactory healthcare waste management practices and environmental cleaning procedures to ensure the prevention of healthcare associated infection. In the instance where there are no or limited access to safe/treated water there is a need for disinfection of the source or accessing alternative source of water. The following section will focus on ensuring safe and secure water supplies during emergencies.

10.1 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 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; and
- other cleaning activities to maintain a healthy environment.

10.2 Ensuring a safe and adequate water supply

10.2.1 Monitoring of water supply in healthcare facilities

The quality and safety of the water supply in healthcare facilities are monitored regularly by responsible personnel of the Health Ministry under the Public Health Team (i.e. Health Inspector/Environmental Health Officer/Sanitation Officer) as per requirements under existing national policies to ensure it is;

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

10.2.2 Water Safety Planning

If the water supply is likely to be contaminated, then source of contamination must be determined so it can be managed appropriately such as conducting disinfection or to identify an alternative safer source that can be supplied to the healthcare facility.

10.2.3 Water Treatment

Although disinfection can be an expensive exercise this is the ideal method of ensuring the 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 treating small quantities of water by chlorination are as follows.

Equipment's needed:

- Plastic bucket for mixing solution.
- Plastic containers, with cover, for storage of solution.
- Large plastic closed bucket with a tap or a pot.
- Tablespoon or measuring cup for measuring.
- Large stick for mixing.

Procedures for treating water are as follows.

1. Prepare a stock solution of 1% chlorine concentration according to the table below.
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 3 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 6 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 6 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 10a: 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 (30%) or Sodium hypochlorite (liquid bleach) (3.5%) (4.0%) (5.0%) Clorox (6.0%)	15 g 33 g 357 ml 313 ml 250 ml 210 ml

10.3 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.

10.3.1 Collecting rainwater using a roof catchment system

A rainwater collection and storage system consist 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 includes:

- Water tank with outlet tap
- Guttering
- Spouting
- Pipes
- Wire mesh screens

Procedures for collecting rainwater are as follows.

1. Only collect rainwater 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 also 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 entering the water tank.

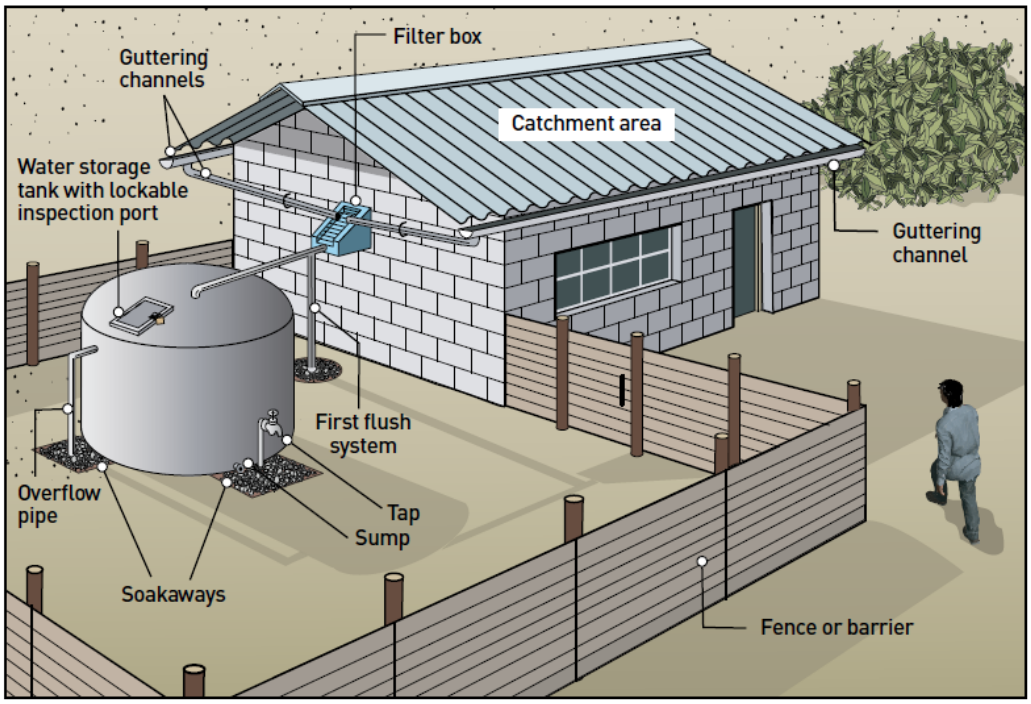
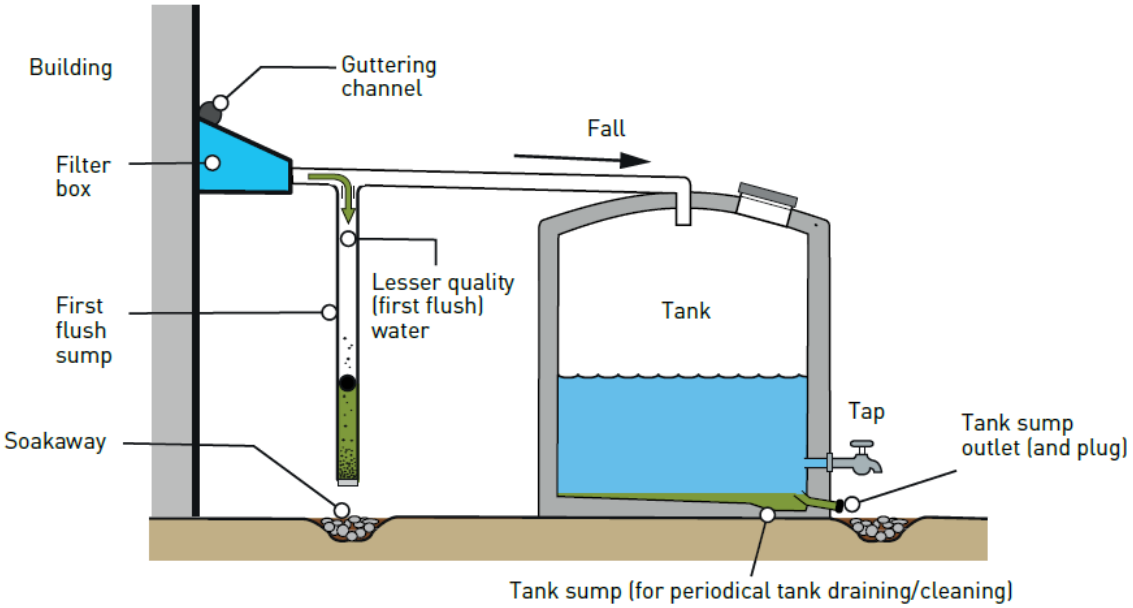


Figure 10a A common rainwater collection and storage system for drinking water (WHO, 2020, 'Rainwater collection and storage')

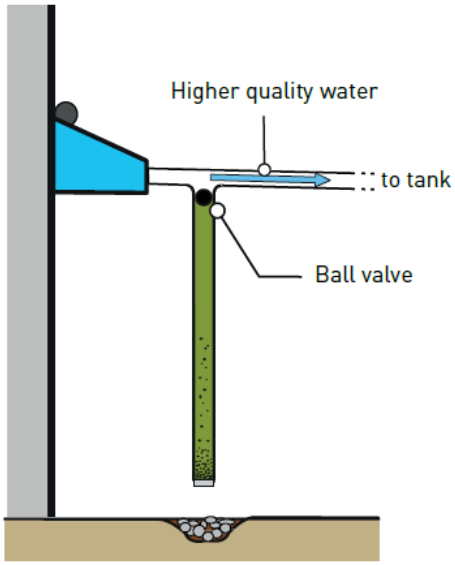
10.3.2 The First Flush System

One of the important components of the rain water collection and storage system is the first flush system. The first flush system (Figure 10a) 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).

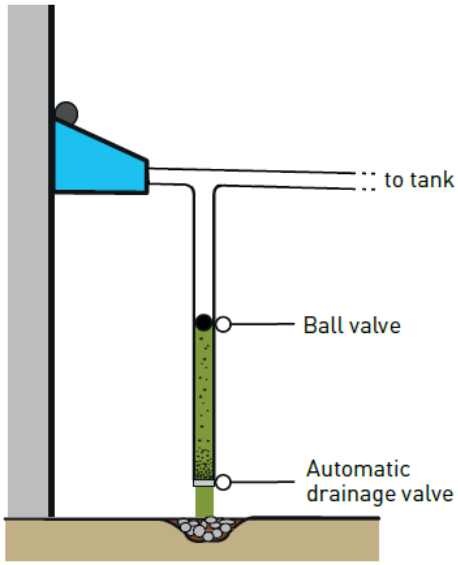
Ideally, the first flush system should drain automatically (e.g. via a drip valve) as opposed to manually, to minimize operational inputs from the user and the potential for contamination. The first flush system should be located downstream of the filter box to prevent larger debris entering/blocking 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 10b Typical "first flush" system for rainwater collection (WHO 2020, 'Rainwater collection and storage')

10.3.3 Providing protection to wells used for drinking water

The equipment needed to protect well water includes:

- Handpump suitable for the well depth
- Cement and reinforcement
- Tools for concrete construction and handpump installation
- Wire fence to protect from animals.

Procedures for protecting well water are as follows.

1. Select a handpump that is durable, easily maintained and suitable for local conditions.
2. Then mortar the upper two liner joint 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, to 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

11 DRESS CODE GUIDELINE FOR HEALTH CARE WORKERS

The purpose of this guideline is to guide HCWs in presenting a professional image and supporting safety through approved standard attire. It is fundamental that they present a professional image to the patients, clients and the public as well in donning appropriate outfits that thus, will enable them to perform their duties safely.

11.1 Principles

HCWs must present a workplace appropriate professional standard of dress.

HCWs must act in accordance with the IPC Guidelines and standards for their place of employment.

11.2 Standard of Dress

- Health care workers must wear their Identification (ID) badges at all times whilst on duty. The ID badge is the official method of identifying employees in the workplace.
- HCWs are not required to wear scrubs; they must wear the uniforms provided to them at all times whilst on duty.
- HCWs required to wear scrubs must don and doff them in the hospital building only if working at the Isolation Ward or caring for a patient/patients in an isolation room, with no exception. These clean scrub uniforms must be obtained from their workplace at the beginning of each shift and are to be returned to the hospital laundering unit at the end of each shift, whereby, they are to be laundered separately from the other hospital linens.
- HCWs at the frontlines of service must wear scrubs
- The scrub uniforms must be worn according to the colour code designed for each department signified to wear them.
- They must dress modestly to maintain respect and comfort from patients, clients and other staff. Uniforms should not be semi-transparent or transparent.
- PPE (gown) must not be worn over uniforms as a method of keeping warm.
- Where a uniform is not required to be worn (e.g. clinicians and other allied health care workers), individual HCWs should be aware of the following guides to maintain a workplace appropriate professional look:
    - Skirts must be at least knee length.
    - Shirts/ blouses/ tops – must allow free range of movement and make certain modesty when leaning forward or reaching upwards and should not be transparent or semi-transparent.
    - Casual or beachwear is not acceptable.
- Hosiery must not be patterned and should be skin coloured whilst socks must be white in colour for nurses and midwives and nurse practitioners.

11.3 Infection Prevention and Control

11.3.1 Bare below the Elbow policy

When providing clinical care or performing hand hygiene, HCWs must be "bare bellow the elbows" to meet their infection control and hand hygiene obligations. This means:

- Bracelets, wrist watches and rings with stones or ridges must not be worn when providing clinical care. A single flat ring/band may be worn but must not interfere with effective hand hygiene practice.
- Long ties and long sleeved shirts must not interfere with effective hand hygiene practice. Retractable (or similar) identification card holders are recommended in place of lanyards and should be cleaned regularly. Long sleeves must be rolled up above the elbow when providing direct patient care and during hand hygiene practice.
- Nails should be kept short and clean and nail polish should not be worn. Artificial nails (gel or acrylic) must not be worn by any staff member with direct patient contact.
- Any breached skin (cuts, dermatitis or abrasions) must be covered with a waterproof film dressing.
- Items that are not laundered daily (e.g., cardigans and vests) must not be worn during direct patient care.
- Protective barrier clothing (e.g. aprons, shoe covers) must be removed before leaving the workplace.
- Body piercings must not pose a safety risk and must be:
    - ✓ Removed for the duration of the shift, or
    - ✓ Covered with an appropriate dressing for the duration of the shift, or
    - ✓ Discreet in size and style.

11.3.2 Personal Hygiene

HCWs must keep up personal hygiene for the purposes of IPC and the comfort of patients, clients and other HCWs. Perfume and aftershaves must be kept to a minimum for patient comfort and to prevent triggering of allergies in susceptible patients and HCWs.

11.3.3 Hair

Hair must be above the collar, neat and clear of the face.
Hair accessories must be functional and kept to a minimum.
Beards should be neatly maintained to comply with policies and procedures (e.g. wearing of masks). Facial hair must not interfere with the effectiveness of personal protective equipment.

11.3.4 Footwear

Appropriate footwear must be worn that will both offer protection and minimal harm to the feet.
HCWs must contemplate the potential hazards of their work environment when choosing suitable footwear. This comprises the risk of spills of contaminated fluids onto foots, and the risk of heavy object falling on or being rolled over shoes.

Footwear should have an enclosed toe and heel (closed shoes) exceptional are shoes of Nurse who work at the Administrative Offices
Footwear for all clinical nurses must be white in colour with an alternative of a black colour during wet or rainy seasons.

11.3.5 Personal Protective Equipment (PPE)

HCWs must ensure that they wear the appropriate PPE during normal everyday practice, to avoid cross-contamination.
HCWs must also make sure that the appropriate PPE is worn during care or management of patients with infectious diseases.

11.3.6 Personal Pouches/ Mobile Phones

Personal pouches and mobile phones must not be carried around whilst on duty, to avoid or minimize the risk of being contaminated with pathogenic organisms.

11.3.7 Body Art/Tattoos

If an employee believes, or receives feedback from another source, that an employee's body art/tattoo is **inappropriate**, a discussion between the staff, the manager and HR team must take place to resolve the issue.

11.4 Responsibilities/Delegations

HCWs must ensure that they wear appropriate standard of dress in accordance with this guideline.
Managers must encourage their staff to be compliant with this guideline so that their attire reflects the principles of this dress code.

11.5 Audit and Compliance

Nurse unit managers and IPC nurses will monitor for compliance of this guideline including addressing the issues of breaches to this guidance through relevant processes. Appendix 3 will be utilized for documentation of compliance.

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APPENDICES

Appendix 1

Health-care setting: Recommended frequency of cleaning of environmental surfaces for suspected or confirmed COVID-19 patients

Patient area	Frequency	Additional guidance
Screening/triage area	At least twice daily	Focus on high-touch surfaces, then floors (last)
Inpatient rooms / cohort – occupied	At least twice daily, preferably three times daily, in particular for high-touch surfaces.	Focus on high-touch surfaces, starting with shared/common surfaces, then move to each patient bed; use new cloth for each bed if possible; then floors(last)
Inpatient rooms – unoccupied (terminal cleaning)	Upon discharge/transfer	Low-touch surfaces, high-touch, floors (in that order) waste and linens removed, bed thoroughly cleaned and disinfected.
Outpatient / ambulatory care rooms	After each patient visit (in particular for high-touch surfaces) and at least once daily terminal clean.	High- touch surfaces to be disinfected after each patient visit. Once daily low-touch surfaces, high-tough surfaces, floors (in that order); waste and linens removed, examination bed thoroughly cleaned and disinfected.
Hallways / corridors	At least twice daily	High-touch surfaces, including railings and equipment in hallways, then floors (last)
Patient bathrooms/ toilets	Private patient room toilet: at least twice daily. Shared toilets: at least three times daily	High-touch surfaces, including door handles, light switches, counters, faucets, then sink bowls, then toilets and finally floor (in that order) Avoid sharing toilets between staff and patients.

Appendix 2

Checklist - Steps for Cleaning Rooms for patients on Transmission based precautions

Areas for Cleaning	Yes	No
1. High dusting performed: • Use high duster/mop heads • Wipe ledges and wall shoulder high		
2. Damp Dust (shoulder high) with detergent first then sodium hypochlorite • Ledges • Door handles • Bedside table • Bedside cabinet		
3. Bathroom and Toilet **(all surfaces)** with detergent first then sodium hypochlorite • Sink • Ledges • Walls • Door handles • Shower • mirrors		
4. Empty General Waste Basket • Clean and disinfect • Carry clinical waste to utility area		
5. Sharps • Check level of Sharps • Replace and Carry to utility area		
6. Floor (mop) cleaning with detergent first then sodium hypochlorite • Start furthest from the door up to half way then: • Mop bathroom shower floor • Bathroom floor • Rest of the room		

Name of Housekeeping staff_____

Date_____
Time_____

Appendix 3

IPC Audit Forms

INFECTION PREVENTION AND CONTROL CHECKLIST			
Date: _____ Ward: _____ Assessment by: _____ **Points Scored: _____** **Name of Cleaner(s):_____**			
VISIBLE STANDARDS	**YES**	**NO**	**REMARK**
ODOUR (1 point)			
*The area smells fresh.			
BATHROOMS AND TOILETS (5 points)			
*The floor, countertop, tubs, showers and toilet seats are kept clean, dry and in good repair.			
*The area smells fresh with no unpleasant odour.			
*Bathrooms have to be checked every 2 hours, and kept clean and dry.			
*Room is well ventilated and dust-free.			
*Waste bin is available.			
DIRTY UTILITY ROOM (5 points)			
*Patient equipment e.g. bedpans, urinals, basins, etc. is washed with soaps and water after using of it.			
*The floor and countertops are kept clean and dry.			
*Dirty area is marked accordingly and clearly separated from clean area.			
*Soiled linens is properly put away in laundry bags or bins.			
*Clinical waste bin available, only in this room.			
OTHER WARDS CONSERN (6 points)			
*The walls are free of dust and marks caused by furniture and finger prints.			
*Floors are free of dust, marks, spots, scratches and traffic lines.			
*Ceilings, vents, fans and lights are free of dust, spots and cobwebs			
*Both external & internal windows, frames and ledges are clear of all marks and dust			
*Surfaces of furnishings are free from stains and spots.			
*Curtains to be drip dry monthly and washed			
STEPS, HALLWAYS and CORRIDORS (1 point)			
No dust, spots and bubble gum appeared on the floor			
GENERAL TIDINESS (2 points)			
*Areas appeared tidy and uncluttered.			
*Furniture is maintained in fashion which allows for			

cleaning.			

INFECTION CONTROL CHECKLIST			
Date:_____ Ward:_____ Assessment by:_____ Points Scored:_____			
PERSONAL HYGIENE (4 points)	**YES**	**NO**	**REMARK**
*Hair is neat and off collar.			
*Uniform should be at knee level for female staffs.			
* Must put on safety and comfortable footwear and should have an enclosed toe and heel.			
*Footwear for all clinical nurses must be white in colour with an alternative of a black colour during wet or rainy seasons.			
ENVIRONMENT MANAGEMENT (6 points)			
*Medical charts are not piled up at the staff reception area.			
*No signs of eating and drinking at the staff reception area.			
*Cleaning & carbolysing of discharged patient rooms must be carried out on a regular basis and to be checked by the nurse allocated to those particular patient rooms a			
*No visitor seen around during “No visiting hours”.			
*All attendants should have permission cards from their each ward manager.			
*No real flowers and pot plants allowed into patient areas or zones.			
LAUNDRY MANAGEMENT (5 points)			
*Linen room and cabinets are kept neat and clean at all times.			
*Doors to these rooms and cabinets are closed at all times.			
*Linen skips are used to transport linens from the patient’s room to sluice room.			
*No dirty laundry lying around but are placed into dirty laundry bin.			
*Linen tally records are maintained and updated regularly on a daily basis.			
RESOURCES RECORDS (3 points)			
*Instrument book is checked after every shift.			
*Inventory book is checked and updated on a monthly basis.			
*No broken item left at the premises.			
GENERAL TIDINESS (2 points)			
*Areas appeared tidy and uncluttered			
*Furniture is maintained in fashion which allow for cleaning.			

INFECTION CONTROL CHECKLIST			
Date: _____ Ward: _____ Assessment by: _____ Points Scored: _____			
MEDICATION MANAGEMENT AND PRACTICE (9 points)	**YES**	**NO**	**REMARK**
*Internal and external medications are stored separately and properly.			
*Medication room door should remain close at all time			
*Refrigerator is clean; left over medication should be labelled.			
*Supplies and equipment in medication room are stored above floor level and no unnecessary items are left out also no visible signs of uncleanliness.			
*Sterile solution is dated when opened and disposed after 24 hours.			
*The top of the IV drip preparation table is wiped and cleaned with an alcohol disinfectant prior performing injectable compounding work.			
*Proper waste segregation is practiced at the medication trolley, i.e. sharps and general wastes are disposed of into separate containers.			
*Patients with IV line: plaster should be clean and labelled and should be replaced every 72-96 hours.			
*SVM swabs are replaced after every 24 hours.			.
CLEANING AND DISINFECTING EQUIPMENT (2 points)			
*Equipment (e.g.O2 masks, nasal cannula, and nebulizer) is soaked in sodium hypochlorite (1%) according to the SPC Guidelines (i.e. Non-critical items, 1-10 minutes; Semi-critical items, 12-30 minutes).			
*The sodium hypochlorite (1%) solution should be changed after every 24 hours and is available at all times.			
AUTOCLAVED EQUIPMENTS (2 points)			
*Autoclaved equipment are not out of date (i.e. not>2 weeks from autoclaved date) and are stored in a separate clean cupboard.			
*Autoclaved equipment is stored in a separate clean and closed cabinet.			
WASTE MANAGEMENT (4 points)			
*Sharps, clinical wastes and general wastes are disposed of separately			
*Sharp bins are emptied when three – quarter full.			
*Waste containers are set on proper places.			
*Waste bins are colour coded and remain cleans every time.			
EMERGENCY TROLLEY (3 points)			
*Emergency trolley is clean, tidy and well organised.			
* No expired drugs.			
*Emergency trolley is well stocked and is checked in every shift.			

INFECTION CONTROL CHECKLIST

LAUNDRY

Date:_____ **Assessment by:_____**

LAUNDRY	**Assessment**	**Remarks**
1 Dirty Linen or Sorting Area * Hand washing sink is available * Liquid soap or paper towel provided		
2 Cleaning Area * Washing machines are clean and in good repair * The floor is clean and kept dry		
3 Folding Area * No object that can hinder cleaning are left out * Room is well-ventilated and dust-free		
4 Drying Area * Drying areas are clean, no dust or visible sign of uncleanliness		
5 Clean Linen Storage Area * The area is kept clean and tidy * The should be remain closed at all time		
6 Staff Area * Area is kept clean and tidy *No food is left out * All food and drinks must be placed in can or container and sealed * Personal belongings are stored properly and not on the floor		

RECORD OF NON-COMPLIANCE WITH BASIC INFECTION PREVENTION AND CONTROL PRACTICES

Name of Employee ……. Designation ……

Name of Line Manager …….. Designation ……...

Not adhering: …….

Action taken ……

Date of incidence: ……

Manager notified of non-compliance on: ……

Signed (employee) x…….. **Signed (manager)**

x……..

Date: …….. **Date:** …….

REFERENCES:

- DHHS Uniform Policy (Human Resources), Tasmania
- Corporate Uniform for Nurses and Midwives (Nursing and Midwifery Unit Website)

Appendix 4

MRSA Fact Sheet for Patients and Community Education

What is MRSA?
MRSA stands for: Methicillin-Resistant *Staphylococcus aureus*, is a type of dangerous bacteria (germ) that is resistant to certain antibiotics and can cause skin and other infections. It is difficult for doctors to know if you have MRSA unless your wound or skin specimen is tested and confirmed by the laboratory.

What is Staphylococcus Aureus?
Staphylococcus is a germ found on the skin or the mucous membrane (nose) of most people. It usually does not cause any harm unless you have a cut on your skin, then it can result in a boil, abscesses or cellulites.

What is Methicillin?
Methicillin is a type of penicillin used to fight Staph but unfortunately, MRSA has figured out how to resist the effects of penicillin and other commonly used antibiotics. This makes it difficult to treat some infections although there are still some antibiotics available to successfully treat MRSA.

What types of MRSA do I Have?

- MRSA colonization is referred to when the bacteria just sit on the skin and does not cause any problems. If you are in the admitted in the hospital with MRSA colonization you will be placed in the isolation unit even though you do not show any signs of infection and are not be on antibiotics. This is to prevent other sick patients who may have open wounds or are very sick to get MRSA from you.
- MRSA infection happens when there is a break in the skin and the MRSA germ enters and cause infections to part of the body. This may show up as very high fevers, a high white blood cell count, a wound infection, pneumonia etc.

What Happens at the Isolation Room?
The main reason for your isolation is to prevent MRSA from spreading to others. The following measures will be in place:

- Hospital staff will wear gowns and gloves to care for you;
- Visitors should report to the nurse's station for directions on what to do to enter your room.
- You will be taught about the importance of hand washing;
- Hospital staff will need to clean your room and bathroom every day as well as equipment, such as IV poles, with a disinfectant.

How did I get MRSA?

MRSA is commonly acquired in patients who are admitted in hospitals for a long time and are taking many antibiotics. MRSA is the result of many years of overuse and unnecessary use of antibiotics. Some MRSA strains are now also commonly found in the community, therefore, everyone has some risk of being colonized with MRSA.

Usually you get it from touching the skin (hands) of someone who is colonized with MRSA.

What happens when I Go Home and How Can My Family Be Prevented from Getting MRSA?

- MRSA is spread via skin to skin contact, therefore you must have good ventilation and live in a clean environment with no overcrowding;
- If you have a wound, your hands must be washed before and after the dressing (wounds must be kept covered); and wash your hands:
    - After using the toilet;
    - Before handling and eating food;
    - After coughing or blowing their nose and/or sneezing into their hands;
    - After changing soiled clothes or bed linen;
    - After handling pets or animals;
- Have daily shower with an antiseptic soap such as triclosan soap and wash hair more frequently;
- Reinforce the importance of not sharing: clothes, towels, tweezers, razors, nail cutters, scissors, bed linen, toothbrushes;
- Cloths can be washed with the household laundry and whenever possible linen and clothes should be dried in direct sun light;
- Dishes and cutlery can be washed as normal with hot water and detergent;
- The household environment should be cleaned daily with regular detergent;
- Discard waste especially from wounds in plastic bag then place in the bin;

What will happen if I'm back in the hospital or come back to clinic?

We want to prevent the spread of MRSA to others. If you come back into the hospital you will again be placed in isolation precautions. Cultures may be taken again to see if you still carry MRSA. When you come back for a clinic appointment, please tell the doctors and nurses you have MRSA so that they can take steps to avoid spreading it to others.

Appendix 5

OCCUPATIONAL EXPOSURE REPORT FORM

Hospital or workplace:_____

Report completed by:_____

Date & time of exposure:_____

Date & 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 sharp being disposed
- ❑ Over-filled sharps container
- ❑ Sharp in in-proper 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. Considered immune?

YES NO

15. Was physician on-call contacted?

YES NO

16. Was Hepatitis B immunoglobulin given?

YES NO

17. Is anti-retroviral therapy required?

YES NO

18. Baseline Serology (If performed/consented)

HBV

HCV

HIV

Other

Follow up required? YES NO

19. SOURCE FOLLOW UP

Source name (if known):_____

Source agreed to blood tests? YES NO

Appendix 6

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/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 7

WHO Surgical Safety Checklist