THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES FOR HEALTH CARE SERVICES IN TANZANIA

JUNE 2018

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ACRONYMS AND ABBREVIATIONS

ABHR	Alcohol-Based Hand Rub
AIDS	Acquired Immunodeficiency Syndrome
ACH	Air Change Per Hour
AMR	Antimicrobial Resistance
CDC	Centres For Disease Control And Prevention
CHMT	Council Health Management Team
CSSD	Central Sterilization And Supplies Department
CTC	Cholera Treatment Centre
CTU	Cholera Treatment Unit
EVD	Ebola Virus Disease
HBV	Hepatitis B Virus
HCAI	Health Care-Associated Infection
HCV	Hepatitis C Virus
HCW	Health Care Worker
HCWM	Health Care Waste Management
HEPA	High-Efficiency Particulate Air
HF	Health Facility
HIV	Human Immunodeficiency Virus
HLD	High-Level Disinfection/Disinfected
ICU	Intensive Care Unit
IPC	Infection Prevention And Control
IV	Intravenous
MOHCDGEC	Ministry Of Health, Community Development, Gender, Elderly, and Children
MRSA	Methicillin-Resistant *Staphylococcus Aureus*
NICU	Neonatal Intensive Care Unit
OCV	Oral Cholera Vaccine
OPA	Ortho-Phthalaldehyde
OPD	Outpatient Department

OR	Operating Room
ORS	Oral Rehydration Salts
PE	Protective Environment
PEP	Post-Exposure Prophylaxis
PPE	Personal Protective Equipment
QIT	Quality Improvement Team
PORALG	President Office Regional Authority Local Government
RHMT	Regional Health Management Team
RRT	Rapid Response Team
SARS	Severe Acute Respiratory Syndrome
SSI	Surgical Site Infection
TB	Tuberculosis
UTI	Urinary Tract Infection
VHF	Viral Haemorrhagic Fever
WASH	Water, Sanitation, And Hygiene
WHO	World Health Organization
WIT	Work Improvement Team

FOREWORD

The Ministry of Health, Community Development, Gender, Elderly, and Children (MOHCDGEC) is firmly committed to ensuring safe, quality health care services for the people of Tanzania and to providing protection from outbreaks of infectious diseases. The infection prevention and control (IPC) guidelines contained in this document are a reflection of this commitment.

Infection prevention is a critical component of quality health services, yet it has received insufficient attention in health care settings. Health care-associated infections (HCAIs) may be transmitted in different ways, either from a patient, relative, or staff member. They may also be transmitted through the air or contaminated water, food, drugs, medical equipment, and objects in the environment, such as furniture or dishes. In addition, the elevated rates of prevalence of highly infectious and potentially life-threatening diseases in Tanzania, such as HIV/AIDS, cholera, tuberculosis (TB), and bloody diarrheal diseases, also demand that special attention be placed on safe and effective infection prevention practices.

Also, antimicrobial resistance (AMR) in our health facilities (HFs) has been increasing at an alarming rate. This has made the MOHCDGEC develop an AMR action plan (2017-2022) to address the situation. Among the priority areas articulated in the action plan is IPC in health care. This means that the revised guideline is timely, given its potential for contributing to the efforts to control the spread of AMR in our health care settings. Therefore, all HFs need to implement the recommended practices and actions in this guideline to ensure patient and staff safety and prevent the spread of antimicrobial-resistant pathogens.

Implementation of this guideline is also pivotal in making HFs capable of handling threats from viral haemorrhagic fevers (VHFs), such Ebola virus disease (EVD). This revised guideline has provided a section in part IV, which provides guidance on the recommended IPC practices when handling suspected or confirmed cases of VHFs.

The purpose of this document is to provide all health care providers with basic IPC guidelines and safety precautions applicable to their day-to-day activities.

The MOHCDGEC is dedicated to strengthening and supporting these practices and to ensuring proper implementation through increased budgetary allocations to meet

the requirements for improved IPC. Likewise, the combined efforts of every health care worker (HCW) will ultimately result in improved quality of care for all patients and health personnel.

Dr. Mpoki M. Ulisubisya
Permanent Secretary (Health)

ACKNOWLEDGEMENTS

This document is the product of extensive and wide consultation among organizations and individuals with vested interests in providing quality services, especially in IPC for health care services in Tanzania. The MOHCDGEC wishes to extend sincere gratitude to all those who have contributed materially, physically, and technically toward the development of these important guidelines.

Special thanks goes to Dr. Joseph C. Hokororo, the Coordinator of IPC and Safety at the Ministry for his tireless efforts toward finalisation of this guideline. I would like to thank the Director of Health Quality Assurance, Dr. Mohamed A. Mohamed, and Assistant Director of Health Services Inspectorate and Quality Assurance Section, Dr. Eliudi S. Eliakimu, for their coordination role that has resulted in the finalisation of this guideline. Also, the Ministry would like to thank Medipeace Tanzania and KOICA for financial and technical support, in particular from the following staff: Sehyeon Kim, Dr. Nyambuli Jigabha, and Fatuma Salimu—they have made the review of the National IPC Guideline 2018 a success.

MOHCDGEC wishes to extend gratitude to USAID Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program (under contract number 7200AA18C00074), implemented by Management Sciences for Health, for printing and dissemination of these revised guidelines.

We would like to acknowledge and congratulate the experts who have devoted their time, energy, and knowledge to the development of these guidelines. Their names are given in appendix 2. These experts and medical colleagues were drawn from various divisions of MOHCDGEC, national and regional referral hospitals, council-level hospitals, Kairuki Memorial University, private hospitals, and the National Institute for Medical Research.

Finally, we would like to extend our cordial gratitude in advance to all those who, upon using these guidelines, will offer us their constructive criticism and comments aimed at improving the document.

Prof. Muhammad Bakari Kambi
Chief Medical Officer

HOW TO USE THIS MANUAL

IPC is multidisciplinary and requires compliance by all levels of health care providers. Infection prevention deals primarily with preventing the spread of infectious diseases through the air, blood or bodily fluids, faecal-oral, and food-borne routes. Such compliance is obligatory to prevent and control nosocomial and other infections in health care settings and in the community. These guidelines have been developed by the MOHCDGEC of Tanzania to aid health workers understand and use evidence-based infection prevention practices.

Expected users of this guideline include:

- Policy makers, health managers, and administrators
- Health care providers and trainers
- Programme officers
- Government and private HFs and training institutions
- Regional (RHMT) and council health management teams (CHMTs)
- People working at the community level to promote quality of health care
- Facility health management committees
- Individuals, groups, and international organizations engaged in health care service provision

These guidelines are made up of five parts as follows:

- Part 1. Introduction to Infection Prevention
- Part 2. Fundaments of IPC
- Part 3. Processes in IPC
- Part 4. Preventing Infection in Special Settings
- Part 5. IPC Management

PART 1. INTRODUCTION TO INFECTION PREVENTION AND CONTROL

1.1 Background

Infection prevention and control (IPC) is a scientific approach and practical solution designed to prevent harm caused by infection to patients and health workers. It is grounded in infectious diseases, epidemiology, social science and health system strengthening. IPC occupies a unique position in the field of patient safety and quality universal health coverage since it is relevant to health workers and patients at every single health-care encounter (WHO, 2018). One of the main components of health care and patients is prevention of Health care-associated infections (HAIs).

HAIs occur as a result of non-compliance with infection prevention and control (IPC) standards in health care facilities (HFs) or in the community. Infections can take place in all types of HFs and can be major causes of death or morbidity in many facilities worldwide. At any one time, over 1.4 million people worldwide suffer from infectious complications of health care. Health care workers (HCWs) may also be infected.

Transmission of infection continues to be a major problem in Tanzania with the burden of infectious disease very high, as reflected in the Tanzania HIV impact survey (THIS), a household-based national survey, conducted between October 2016 and August 2017 to measure the status of Tanzania's national HIV response:

- Prevalence of HIV among adults, aged 15 to 64 years in Tanzania is 5.0% (6.5% among females and 3.5% among males), which corresponds to approximately 1.4 million people living with HIV, aged 15 to 64 years.
- Annual incidence of HIV among adults aged 15 to 64 years in Tanzania is 0.29% (0.40% among females and 0.17% among males), which corresponds to approximately 81,000 new cases of HIV annually among adults aged 15 to 64 years.
- A total of 65,902 cases of all forms were notified in 2016, which is an increase of 5.6% or 3,507 cases compared to 2015. Among the cases notified, new and relapse cases were 64,404 (95.5%), of which 27,655 (39%) were bacteriological confirmed (TB programme 2016).

Furthermore, the world is facing the threat of emerging and re-emerging infections, such as Ebola, which, as indicated by the World Health Organization (WHO) in 2014, around

10,000 people were infected with Ebola.

Diarrhoeal diseases, which are preventable and treatable, are the second leading cause of death in children under 5 years old. Each year, diarrhoea kills around 525,000 children under 5. A significant proportion of diarrhoeal disease can be prevented through safe drinking water and adequate sanitation and hygiene. Globally, nearly 1.7 billion cases of childhood diarrhoeal disease occur every year. Diarrhoea is a leading cause of malnutrition in children under 5 (WHO, 2017).

WHO states that the emergence of life-threatening infections, such as severe acute respiratory syndrome (SARS) and VHFs (e.g., Ebola and Marburg), cholera, HIV and AIDS, as well as the increased magnitude of AMR, highlight the urgent need for efficient infection control practices in health care settings (WHO, World Health Organisation, 2018). Failure to apply infection control measures favours the spread of pathogens, and health care settings can act as amplifiers of disease during outbreaks, with an impact on hospitals and community health at large.

1.2 HCAIs

HCAIs refer to infections associated with the delivery of health care in health care settings, long-term care facilities, ambulatory settings, home care, and other settings. These unanticipated infections that develop during the course of medical or surgical treatment may result in significant patient illnesses and deaths (morbidity and mortality); prolong the duration of hospital stays; and necessitate additional diagnostic and therapeutic interventions, which generate added costs. The MOHCDGEC provides national leadership in surveillance, outbreak investigation, laboratory research, and prevention of HCAIs. The prevention and reduction of HCAIs is also a top priority for IPC programs to contribute to reducing AMR in the country and internationally.

1.2.1 Risk Factors for HCAIs

Preventing HCAIs is critical to patient safety. Every patient is at risk for developing HCAI, although there are certain factors that increase the risk of infection. These include, for example, patient characteristics, such as age or underlying diseases or conditions that may compromise the immune system; the presence of indwelling or invasive medical devices, such as catheters or breathing tubes; complications from surgical procedures; and antibiotic use. The risk of infection related to invasive devices increases the longer the device is in place.

Patients in the health care setting are also at increased risk of HCAIs from exposure to organisms that are transmitted between patients and HCWs. In addition, the congested physical settings that services are sometimes provided in increase the risk of infection.

Overuse of antibiotics also contributes to the problem of HCAIs by promoting the emergence of antibiotic-resistant organisms that cause HCAIs and are difficult to treat, limit treatment options, and may prolong a patient's length of stay. Up to 50% of antimicrobial use in hospitals is unnecessary and inappropriate and contributes to the growing problem of *Clostridium difficile* infections, which are at historically high levels. A commitment to the responsible use of antibiotics is often called antimicrobial stewardship.

1.2.2 HCAIs: Extent and Costs of the Problem

According to a 2011 WHO meta-analysis, Tanzania has an estimated 15 clients acquiring an HCAI among 100 clients receiving health care services (WHO, 2011). Also, the Centres for Disease Control and Prevention (CDC) HCAI prevalence survey provides an updated estimate of the overall problem of HCAIs in US hospitals. Based on a large sample of US acute care hospitals, the survey found that about 1-in 25 hospital patients have at least 1 HCAI. There were an estimated 722,000 HCAIs in US acute care hospitals in 2017 (CDC, 2017). About 75,000 hospital patients with HCAIs died during their hospitalizations. More than half of all HCAIs occurred outside of the intensive care unit (ICU). The direct and indirect costs of HCAIs are estimated at $97–147 billion annually.

1.2.3 Major Types of HCAIs

The four most common types of HCAIs are related to invasive devices or surgical procedures, which include:

1. Catheter-associated urinary tract infection (UTI)
2. Central line-associated bloodstream infection
3. Surgical site infection (SSI)
4. Ventilator-associated events

A variety of organisms are responsible for many different types of HCAIs, such as:

Table 1.1: Organisms Responsible for different types of HCAIs

- *Acinetobacter*
- *Burkholderia cepacia*
- *C. difficile*
- *Enterobacteriaceae* (carbapenem-resistant)
- Gram-negative bacteria
- *Klebsiella*
- Methicillin-resistant *Staphylococcus aureus (MRSA)*
- *Norovirus*
- *Pseudomonas aeruginosa*
- *Staph. aureus*
- *TB*
- *Vancomycin-intermediate Staph. aureus*
- *Vancomycin-resistant Staph. aureus*
- *Vancomycin-resistant Enterococci*

Source: (CDC, 2014)

1.3 Situation Analysis

A situation analysis of infection prevention practices in Tanzanian HFs revealed that IP practices are poor for the following reasons:

- **Lack of adherence to guidelines and standards for certain procedures:** Despite the availability of IPC guidelines and standards, HCWs and others who provide health care services do not adequately adhere to those guidelines and standards.
- **Inadequate knowledge and skills among health care service providers:** HCWs, especially those working at lower facilities, do not have adequate knowledge and skill for IPC basics.
- **Deficiency of equipment and materials:** Quantities of personal protective equipment (PPE) and supplies, such gloves, goggles, plastic aprons, and boots, are inadequate. The lack of PPE increases the risk of occupational infections among HCWs and clients. In recent years, there has been a progressive decline in providing equipment and materials to prevent infection.
- **Inadequate supportive supervision:** There is a shortage of qualified supportive supervisory staff; a lack of supportive supervision has been identified at all levels of health care service delivery.
- **Lack of renovation and maintenance of infrastructure:** Systems, such as electrical, water, and drainage are often not fully functional, and facility conditions are often overcrowded. These problems are due to a lack of awareness, inadequately qualified human resources, financial constraints, and the lack of involving frontline health workers in planning.

1.4 Rationale

These guidelines for prevention and control of infectious diseases were updated for the following reasons:

- Health care providers not receiving updated information, despite the fact that, over the past two decades, many changes have occurred due to the emergence of infections, such as, Ebola, HIV/AIDS and influenza
- Emerging and re-emerging infectious diseases, such as VHFs and influenza
- Availability of new scientific information that simplifies provision of safe and effective prevention and control measures
- Individuals' right to good health, which requires a safe health care environment for both providers and clients
- HIV/AIDS epidemic, which has increased the risk of transmitting infections in health care settings because of the various procedures conducted in these facilities
- Increased awareness of how risky it is to work in HFs

1.5 Importance of IPC

1.5.1 Patients/Clients

- HCAIs (nosocomial) infections are difficult and costly to deal with because they:
  - o Increase the length of hospitalization
  - o Require treatment with expensive, antimicrobial agents
  - o Increase the use of other interventions (laboratory, surgery, etc.)
  - o Increase drug resistance/AMR

1.5.2 Health Care Workers

Risk of infection from airborne, waterborne, and blood-borne pathogens, such as the hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV, is high.

1.5.3 Communities

- HCAIs may contribute to preventable morbidity and mortality in communities.
- AMR acquired in a hospital can spread to families and the community when colonized patients are discharged.
- Hazardous hospital wastes may carry microorganisms, and their disposal can pose serious risks for communities and the environment.
- Caretakers of infected persons at the household level need to observe basic IPC for household members' safety and patient protection

1.6 Goal and Objectives of IPC Guidelines

1.6.1 Overall Goal

The overall goal of IPC is to achieve safe, effective health care practices at all levels of HFs, with the aim of providing a comprehensive reference for all health care service providers in Tanzania.

1.6.2 Objectives

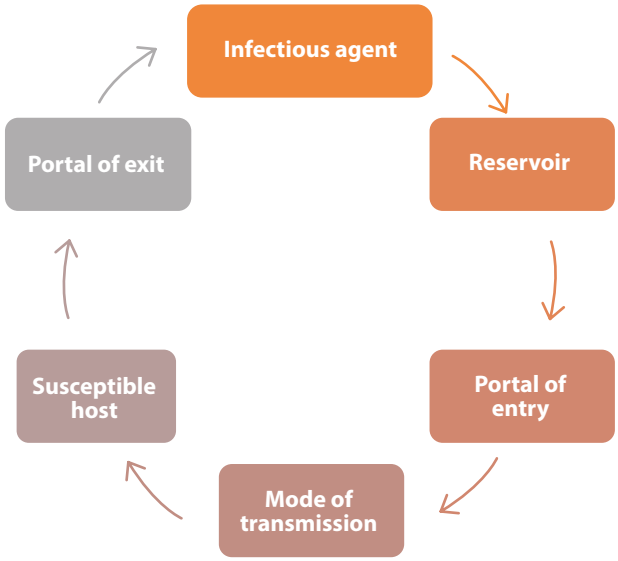
- To protect patients/clients from HCAIs
- To protect HCWs from occupational infections
- To protect communities from infectious diseases
- To prevent the environment from pollution

PART 2. FUNDAMENTALS OF IPC

2.1 INFECTIOUS DISEASE TRANSMISSION CYCLE

Infectious bacteria, viruses, and other microorganisms successfully survive and spread infections wherever favourable conditions exist. Essential factors in the transmission of disease-producing microorganisms from person to person are illustrated in figure 1.

Figure 2.1. Infectious disease transmission cycle



Adapted from: https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=84&printable=1

Table 2.1: Description of the components of disease transmission cycle

Infectious agent	Microorganisms that can cause infection or disease, e.g., bacteria, viruses, fungi, and parasites
Reservoir	Places where organisms grow and multiply: People, water and solutions, instruments and other items, equipment, soil, and air
Portal of entry	Where infectious agents can get into a susceptible host: Broken skin, puncture wound, surgical site, mucous membranes

Susceptible host	Any person who is liable to be infected: Clients/patients, service providers and auxiliary staff, community members
Portal of exit	Where infectious agents get out of the host, e.g., gastrointestinal tract, mucous membranes, skin, placenta, and respiratory, genitourinary, and vascular systems

2.1.1 Modes of Transmission

Direct contact transmission involves direct body surface-to-body surface contact and physical transfer of microorganisms between an infected or colonized person and a susceptible host by:

- Contact, e.g., VHF (Viral Haemorrhagic Fevers), enteric pathogens, Multi Drug Resistant (MDR) bacteria, HBV, HIV (blood)
- Droplets, e.g., influenza and rubella viruses, diphtheria
- Airborne, e.g., TB, chicken pox, and measles

Indirect contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles or dressings, or contaminated hands and gloves, usually involving:

- Faecal oral, common vehicles, e.g., food, water, salmonella, cholera, or diarrhoea
- Vector borne, e.g., malaria, dengue fever

2.1.2 Standard Precautions

Standard precautions are a simple set of effective practices (creating physical, mechanical, and chemical barriers) to protect HCWs and patients from infection from a range of pathogens, including blood-borne pathogens. The practices are used when caring for all patients, regardless of their diagnoses.

2.1.2.1 Purposes of Practicing Standard Precautions

- Prevent and reduce the risk of transmitting microorganisms from known or unknown sources of infection (e.g., patients, contaminated objects, used needles and syringes etc.) within the health care environment
- Prevent patients/clients from HCAIs or health care related infections
- Protect HCWs from occupational infections
- Protect communities from acquiring infectious diseases
- Prevent environmental pollution

2.1.2.1 Practicing Standard Precautions

Every HCW should:

- Consider every person (patients/clients and staff) as potentially infectious and susceptible to infection
- Use appropriate hand hygiene techniques, including routine hand washing, hand antisepsis, antiseptic hand rubs, and surgical hand scrubbing
- Wear PPE, which includes boots, aprons, gowns, gloves, masks, protective eyewear, and caps
- Wear scrub suits in theatre, ICU, labour ward, Emergency Medical Department (EMD), neonatal unit, and other functional areas. These should be worn only in that specific area.
- Appropriately handle sharps (do not recap needles)
- Practice proper patient placement and management
- Manage resuscitation equipment and environmental cleaning
- Safely dispose of infectious waste materials to protect those who handle them and prevent injury or spread to the community
- Promptly and carefully clean up spills of blood and other bodily fluids
- Process instruments by cleaning, sterilizing, or high-level disinfecting (HLD) following recommended procedures
- Introduce cough etiquette to patients, caregivers, and visitors with signs and symptoms of respiratory illness, including cough, congestion, rhinorrhoea, or increased production of respiratory secretions
- Triage to isolate patients and clients with respiratory problems

2.1.3 Transmission-Based Precautions

2.1.3.1 Contact Precautions

Contact precautions are used in addition to standard precautions to prevent transmission of infectious agents, including epidemiologically important microorganisms, which are spread by direct/indirect contact (passive transfer) of microorganisms to a susceptible host via an intermediate object, such as contaminated hands that have not been washed between patients, contaminated instruments, or other inanimate objects in the patient's environment.

Examples where contact precautions apply include clients/patients/residents with:

- *C. difficile*

- Gastroenteritis
- Undiagnosed diarrhoea
- Scabies
- Pediculosis (head lice)

Patient Placement

- The preferred accommodation in acute care for contact precautions is a single room with a dedicated toilet and patient sink.
- If single rooms are unavailable, clients/patients/residents may be cohorted with other clients/patients/residents who are infected with the same microorganism.
- Infection risk to other occupants of the room must be considered when selecting roommates.

Personal Protective Equipment

- Where patients or residents are placed in isolation rooms, a disposable gown and gloves must be worn on entering the patient's isolation room.
- Gloves must be removed and hands cleaned on exit from the room.
- Wear gloves and gown/apron only when there is bodily contact (i.e., HCW's clothing will have direct contact with the patient) or potentially contaminated environmental surfaces or equipment in close proximity to the patient.
- Remove and discard gloves before removing gown/apron.
- Clean hands after removing each PPE.
- Where there is no bodily contact, hand hygiene is to be practised according to 7 steps of hand hygiene.
- Remove gown before leaving the patient-care environment and perform hand hygiene immediately.

Environmental Control

- Clients/patients/residents care items, bedside equipment, and frequently touched surfaces are to be cleaned daily.
- Clean the environmental surfaces with nationally approved disinfectants for hospital use.
- All surfaces should be decontaminated with a minimal dilution of sodium hypochlorite disinfectant of 0.5% (or 5,000 parts per million available chlorine); for Multi Drug Resistant Organisms (MDRO) patients in a cubicle, the environment is best cleaned with sodium hypochlorite disinfectant with 2% available chlorine.

Patient-Care Equipment and Linen

- Where possible, dedicate the use of non-critical patient-care equipment and items, such a stethoscope, sphygmomanometer, or bedside commode to a single client/patient/resident (or cohort of clients/patients/residents infected or colonised with the pathogen) to avoid sharing between clients/patients/residents.
- If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use on another client/patient/resident.
- Contaminated linen should be handled as little as possible to prevent gross microbial contamination of the air.
- Linen from the clients/patients/residents' isolation room should be handled according to this guideline.

Moving Clients/Patients/Residents

- Moving or transporting clients/patients/residents from the room should be limited to essential purposes.
- If clients/patients/residents need to be transported out of the room, inform the receiving department of the need for contact precautions.
- Staff who accompany the client/patient/resident during the transportation are to discard gown and gloves and perform hand hygiene before leaving the room.
- They need not put on a gown/apron and gloves during transportation. This is to prevent environmental contamination that could occur through contaminated gloves and gowns/aprons.
- Clients/patients/residents who are respiratory dispersers should wear a surgical mask enroute.
- IPC precautions should be maintained to minimise the risk of transmission of microorganisms to other clients/patients/residents and contamination of environmental surfaces or other equipment.
- The linen trolley should be removed for washing after transfer of clients/patients/ residents.
- Clean or wipe the trolley/wheelchair with approved disinfectant.

Communication

- IPC staff should inform clinical staff via e-mail or phone call to update them on the contact precautions to be taken
- The need for contact precautions can be identified by using coloured stickers

in patient case sheets, 'O slot' vision outside the patient room, OT chit, and electronic tagging to inform all health care providers on the precautions to be taken.

2.1.3.2 Droplet Transmission

Droplets are generated from the source person primarily during coughing, sneezing, and talking or during the performance of certain procedures, such as resuscitation, suctioning, and bronchoscopy. Transmission occurs when droplets containing microorganisms generated by the infected person are propelled a short distance through the air and deposited on the host's conjunctivae, nasal mucosa, or mouth. For transmission to occur, the source and the susceptible host need to be within approximately 1 meter (3 feet) of one another.

Droplet Precautions

Droplet precautions, when used in addition to standard precautions, are intended to prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions.

Examples where droplet precautions are indicated include patients with the following infectious agents:

- *B. pertussis*
- Influenza virus
- Adenovirus
- Rhinovirus
- *N. meningitides*
- Group A *Streptococcus* (for the first 24 hours of antimicrobial therapy)

Patient Placement

- A single-patient room is preferred for patients who require droplet precautions.
- When a single-patient room is not available, consult with IPC personnel to assess the various risks associated with other patient placement options (e.g., cohorting, keeping the patient with an existing roommate).
- Spatial separation of at least 1 meter and drawing the curtain between patient beds is especially important in multi-bed rooms with infections that can be transmitted by droplet.
- Droplet precaution signage for the appropriate PPE to be worn should be placed

at the entrance to a patient's room to guide everyone on the precautions to be taken.
- Steps on appropriate PPE removal should also be displayed.

PPE and Hand Hygiene
- Health care personnel should wear a surgical mask for close contact with an infectious patient; the mask is generally donned upon entering the room.
- Patients on droplet precautions who must be transported outside of the room should wear a mask, if tolerated, and follow respiratory hygiene/cough etiquette.
- Staff should perform hand hygiene according to 7 steps of hand hygiene as explained in this guideline.
- After leaving the patient-care environment and removing the surgical mask, staff must perform hand hygiene immediately.

Environmental Control
- Patient-care items, bedside equipment, and frequently touched surfaces should be cleaned daily or as deemed necessary.
- Clean environmental surfaces with hospital-approved disinfectants.

Patient-Care Equipment and Linen
- Where possible, dedicate the use of non-critical patient-care equipment and items, such a stethoscope, sphygmomanometer, or bedside commode, to a single patient (or cohort of patients infected or colonised with the pathogen) to avoid sharing between patients.
- If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use on another patient.
- Contaminated linen should be handled as little as possible to prevent gross microbial contamination of the air.
- All linen from the patient's isolation room should be handled according to this guideline.

Patient Transport
- Patient movement and transport from the room should be limited to essential purposes.
- If a patient needs to be transported out of the room, inform the receiving department of the need for droplet precautions.

- Staff involved in the patient's transfer should wear appropriate PPE during transportation.
- The patient should wear a surgical mask and follow respiratory hygiene/cough etiquette to minimise the dispersal of droplet nuclei during transportation.
- IPC precautions should be maintained to minimise the risk of transmission of microorganisms to other patients and contamination of environmental surfaces or other equipment.
- The linen on the trolley should be removed for washing after transfer of patient.
- Clean or wipe the trolley/wheelchair with hospital-approved disinfectant.

Communication

IPC staff should inform clinical staff via e-mail or phone call to update them on droplet precautions to be taken. The need for droplet precautions can be identified by using coloured stickers in the patient case sheet, 'O slot' vision outside the patient room, OT chit, or electronic tagging to inform all HCWs on precautions to be taken.

2.1.3.3 Airborne Transmission

Airborne transmission occurs by dissemination of either airborne droplet nuclei (small particle residue) of evaporated droplets containing microorganisms that remain suspended in the air for long periods of time or by dust particles containing the infectious agent.

Microorganisms carried in this manner can be dispersed widely by air currents and may be inhaled by a susceptible host within the same room or over a long distance from the source patient, depending on environmental factors. Microorganisms transmitted by airborne transmission include:

- *Mycobacterium tuberculosis*
- Rubella
- Varicella viruses

Such transmission may result in an explosive outbreak.

Airborne Infection Isolation Precautions

Airborne precautions used in addition to standard precautions are intended to reduce the risk of airborne transmission of infectious agents (< 5 µm in size). An infectious person can generate minute infectious droplets during coughing,

sneezing, talking, or performing procedures (e.g., intubation). These droplets can remain suspended in air for long periods of time.

Airborne transmission is further classified as obligate or preferential.

Obligate airborne transmission occurs with pathogens that are transmitted only by deposition of droplet nuclei under natural conditions (e.g., pulmonary TB).

Preferential airborne transmission occurs with pathogens that can initiate infection by multiple routes but are predominantly transmitted by droplet nuclei (e.g., measles and chickenpox).

Patient Placement

Place patient in a special room that should meet the following ventilation standards:

- Minimum of 12 air changes per hour (ACH)
- Inward directional air flow from adjacent spaces to the room with negative pressure differentials of > −2.5 Pascal
- Clean air flows first to the area of the room where staff or visitors are likely to be present and then flows across the bed area to the exhaust
- Exhaust air directed to the outside or high-efficiency particulate air (HEPA)-filtered, if recirculated
- Room monitored on initiation of use and at least daily when in use
- Door kept closed at all times when not required for entry or exit

If a special room is not available, place the patient in an adequately ventilated single room or transfer them to a facility that has a special room available and apply proper PPE.

Note: *For more details, refer to Infection Prevention and Control for TB guidelines, Tanzania* (MoHCDGEC, 2017).

Aerosol-Generating Procedures

When aerosol-generating procedures associated with risk of pathogen transmission (e.g., Intubation, bronchoscopy) are performed, appropriate PPE should be used.

Personal Protective Equipment

- Airborne precautions are used in addition to standard precautions for patients known or suspected of having airborne-transmitted illnesses.
- Health care personnel should wear a fit-tested and approved N95 or higher-level respirator for protection before entering the room of a patient who requires airborne precautions.
- Perform user-sealed check of N95 mask or respirator each time it is being donned to minimise leakage around the face piece.
- Avoid touching or fiddling with the mask once it is properly applied.
- Change the respirator if wet or soiled. Remove N95 mask or respirator correctly outside the patient's room or in a changing room and ensure that the door of the patient room is closed.
- Discard respirator into appropriate waste bin and perform hand hygiene immediately.

Environment Controls: Equipment/Consumables

- Dedicated use of non-critical patient-care equipment and items, such as a stethoscope, sphygmomanometer, and thermometer are recommended.
- If use of common equipment or items is unavoidable, ensure adequate cleaning and decontamination of the equipment or items after and between patient uses.
- Contaminated linen should be handled as little as possible to prevent gross microbial contamination of the air.

Environment Controls: Dishware and Eating Utensils

- The combination of hot water and detergents used in dishwashers is sufficient to decontaminate dishware (e.g., dishes, glasses, cups) and eating utensils; therefore, reusable dishware and utensils may be used for patients.
- Disposable dishes and eating utensils may be used if there are no adequate resources for cleaning dishes and utensils.

Environment Cleaning

- Daily environmental and surface cleaning of the isolation room with an approved disinfectant is recommended.
- Pay special attention to cleaning frequently touched surfaces.

Personnel Restrictions

Whenever possible, susceptible HCWs should not enter the rooms of patients known or suspected of having measles (rubella), varicella (chickenpox), or disseminated zoster.

Visitors

Non-household contacts should be discouraged from visiting. They should be counselled about their risk and taught how to use an N95 respirator if they do visit.

Patient Transport

- Patient movement and transport from the room should be limited to essential purposes.
- If a patient needs to be transported out of the room, inform the receiving department of the need for airborne precautions.
- Health care personnel should wear an N95 mask or respirator during transportation of patients.
- Patients should wear a surgical mask, if tolerable, and follow respiratory hygiene/cough etiquette to minimise dispersal of droplet nuclei during transportation.

Communication

- Display an airborne precaution sign outside the isolation room to alert and guide HCWs on the wearing of appropriate PPE.
- Indicate on investigation or procedure request forms (e.g., radiology, physiotherapy, operation, etc.) that the patient is on airborne infection isolation precautions to alert HCWs to the infection risk.

Notify the receiving department or HF before transporting or transferring the patient to allow adequate preparation of IPC measures.

2.1.3.4 Common Vehicle Transmission

Common vehicle transmission applies to microorganisms transmitted by contaminated items such as:

- Foods, e.g., salmonella
- Water, e.g., shigellosis
- Injections/intravenous (IV) solutions, e.g., HIV, HBV
- Blood, e.g., HBV, HCV, HIV
- Equipment and devices, e.g., HIV, HBV

2.1.3.5 Measures for Control

- Provide and promote health education
- Practice food safety and food hygiene:
  - o Clean food preparation areas and kitchenware with soap and safe water/ chlorine or acetic acid (vinegar) and let dry completely before reuse.
  - o Wash hands before and after eating food.
  - o Wash fruits and vegetables with chlorine 0.001%.
  - o Observe food hygiene
  - o Cook food well, keep it covered, eat it hot, and peel fruits and vegetables.
  - o Be sure to cook seafood, especially shellfish, until it is very hot all the way through.
  - o Avoid raw foods other than fruits and vegetables you have peeled yourself.
  - o Clean up safely in the kitchen.

- Use safe water from onsite water treatment; if not available, do the following:
  - o Boil it or treat it with chlorine or household bleach to get concentration of 0.001% chlorine product.
  - o If boiling, bring the water to a complete boil for at least 1 minute.
  - o To treat water with chlorine, use one of the locally available treatment products and follow the instructions.
  - o If a chlorine treatment product is not available, treat the water with household bleach.
  - o Always store treated water in a clean, covered container.
  - o Piped water sources, drinks sold in cups or bags, or ice may not be safe and should be boiled or treated with chlorine.

- Practice hand hygiene as detailed in this guideline
- For blood-borne infections, observe precautionary measures
- Practice HF environmental cleaning, waste management, and safe last office procedures
- Obtain vaccinations

2.1.3.6 Vector-Borne Transmission

- Vector-borne transmission occurs when vectors, such as mosquitoes, flies, rats, birds, and vermin transmit microorganisms.
- Spread of these viruses from person-to-person can occur when a staff member

(physician, nurse, or housekeeping personnel) is exposed to the blood or bodily fluids of an infected person (e.g., needle-stick injury).

Measures for Control

- Chemical control: Manual space spraying of insecticides or indoor residual spraying
- Engineering control and barriers:
  - Screening of HFs
  - Use of treated bed nets
- Environmental management:
  - Destruction of breeding sites in HF areas
  - Improved environmental cleanness
  - Proper waste management
  - Use waterproof water storage containers

Protective Environment for Patients with Compromised Immune Systems

A protective environment (PE) is designed to accommodate patients with severely compromised immune systems to minimize the risk of exposure to fungal spores in the air and reduce the risk of invasive environmental fungal infections.

Patient Placement

- Place allogeneic-hematopioetic stem cell transplant patients or patients with absolute neutrophil count <500 cells/mL in a PE room
- There is no recommendation for placing patients undergoing solid organ transplantation or other immunocompromised patients in a PE.

Ventilation/Environmental Control

A PE room should meet the following ventilation/environmental control standards:

- HEPA filtration of incoming air, capable of removing 99.97% of particles ≥ 0.3 microns in diameter
- Directed room air flow with the filtered air supply on one side of the room; the air flows across the patient's bed and exhausts on the opposite side of the room
- Minimum 12 ACH
- Positive room air pressure in relation to the corridor with pressure differentials of > +2.5 Pascal
- Self-closing doors on all room exits

- Well-sealed room that prevents infiltration of outside air
- Proper construction of windows, doors, intake ports, and exhaust ports
- Ceilings are smooth, free of fissures, open joints, and crevices
- Walls sealed above and below the ceiling
- Differential pressure is monitored on initiation of use of the room and at least daily when in use
- Door kept closed at all times when not required for entry or exit

For patients who require both PE and airborne precautions (e.g., pulmonary or laryngeal TB, acute varicella-zoster), use an anteroom to ensure proper air balance relative to the corridor and the PE room.

- Provide an independent exhaust of contaminated air to the outside
- Place a HEPA filter in the exhaust duct, if air is recirculated
- No carpeting in patient rooms or hallways
- No upholstered furniture and furnishings; use smooth and non-porous surfaces and finishes that can be scrubbed or easily cleaned
- No fresh or dried flowers or potted plants

Personal Protective Equipment

- Implement standard precautions for patients who are on protective precautions.
- Gown, gloves, and mask are NOT required for HCWs and visitors for routine entry into the room.
- Practice good hand hygiene according to 7 moments for hand hygiene.
- Use appropriate PPE as indicated according to standard precautions or for suspect or proven infections for which transmission-based (contact, droplet, airborne) precautions are required.

Equipment/Consumables

- Dedicate the use of non-critical patient-care equipment and items, such as stethoscope, sphygmomanometer, and thermometer.
- If use of common equipment or items is unavoidable, ensure adequate cleaning and decontamination of the equipment or items after and between patient use.
- Check opened and unopened wound-dressing supplies (e.g., adhesive bandages, elastic adhesive tape) to detect mould contamination before using on patients to prevent subsequent cutaneous transmission.
- Discard all bandages and wound dressings that are expired, have damaged

packaging, or are visually contaminated by construction debris or moisture.

Environment Cleaning

- Avoid dusting methods that disperse dust.
- Wet mop all horizontal surfaces daily, including exhaust vent and window sill, using cloths moistened with hospital-approved detergent or disinfectant.
- Prohibit exposure of patients to vacuum cleaning that could cause aerosolization of fungal spores.
- Use vacuum cleaner equipped with HEPA filters when vacuum cleaning is necessary.
- Closed doors to patient rooms when vacuuming corridors.

Personnel Restrictions

- HCWs with diseases transmissible by air, droplet, and direct contact (e.g., Varicella Zoster Virus, infectious gastroenteritis, Herpes simplex virus lesions on lips or fingers and upper respiratory infections) should be restricted from patient contact and temporarily reassigned to other duties.
- HFs should have a policy regarding immunizations of HCWs to prevent transmission of vaccine-preventable diseases to severely immunocompromised patients.
- HCWs with blood-borne viral infections (e.g., HIV, HBV, HCV) do not need to be restricted from patient contact as long as they do not perform high-risk procedures that could result in patient exposure to the HCW's blood or bodily fluids.

Visitors

- Restrict visitors with communicable infectious diseases (e.g., upper respiratory infections, flu-like illnesses, and recent exposure to communicable diseases) from visiting severely immunocompromised patients.
- All visitors must be able to understand and follow appropriate hand hygiene, before and after patient contact.

Patient Transport

- Patient movement and transport from the room should be limited to diagnostic or therapeutic procedures that cannot be done in the room.
- Should severely immunocompromised patients (e.g., haematopoietic stem cell

transplant) be required to leave the PE, they are advised to wear a high-efficiency respirator (e.g., N95 mask), if tolerable, to prevent inhalation of fungal spores when there is construction, renovation, or other dust-generating activities in and around the HF.

- There is no recommendation for fit testing of patients who are using respirators.
- The use of masks or respirators by severely immunocompromised patients when they are outside of the PE for prevention of environmental fungal infections in the absence of construction or renovation has not been evaluated.
- Minimize the length of time that patients who require a PE are outside their rooms for essential purposes.

Communication

Display a protective precaution sign outside the isolation room to alert health care personnel. Notify the receiving department or HF before transporting or transferring a patient to minimize the length of time the patient is outside the PE.

2.2 WORKERS HEALTH AND SAFETY IN THE CONTEXT OF IPC

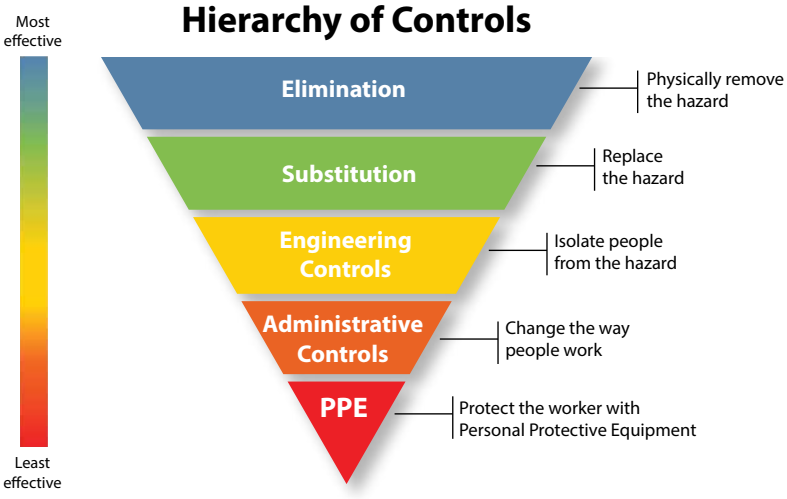
HCWs are exposed to a number of hazards in the HF, which include blood, other bodily fluids, and sharp objects, in the course of their routine work. Consequently, they are at risk of infection from blood-borne viruses, including HIV, HBV, and HCV. The risk of infection to HCWs depends on the nature and frequency of exposure. For more details on HF risks to workers, refer to National Guidelines for Workers Health and Safety in the Health Care Facility.

2.2.1 Occupational Exposure

Occupational exposure to blood and other bodily fluids can result from percutaneous injury (needle-stick or other sharp injury), mucocutaneous injury (splash of blood or other bodily fluids into the eyes, nose, or mouth), or blood contact with non-intact skin. The most common form of occupational exposure to blood and the most likely to result in infection is needle-stick injury. The most common causes of needle-stick injury are two-handed recapping and unsafe collection and disposal of sharps. HCWs in areas, such as operating rooms (ORs), delivery rooms, ICU, emergency rooms, and laboratories, have a higher risk of exposure. Cleaners, health care waste handlers, and others whose duties involve handling blood-contaminated items are also at risk.

2.2.1.1 Strategies to Protect HCWs from Occupational Exposure

Figure 2.2: Hierarchy of controls



Source: Adapted from https://www.cdc.gov/niosh/topics/hierarchy/default.html, Accessed on 30 August 2018

HCAIs are preventable by concurrently applying various control measures from most effective (elimination) to least effective (PPE):

- Workplace health and safety programs that identify all threats to staff health, including infectious diseases, and take measures to eliminate or mitigate risk (elimination)
- Implementation of standard precautions (substitution and engineering control)
- Good environmental cleanliness, waste management, facility design, and layout (engineering control)
- Improved water, sanitation, and hygiene (WASH) infrastructure and services (engineering control)
- Improved work environment that considers the need for differential-pressure rooms (e.g., negative-pressure rooms with anterooms) to isolate patients with infectious diseases, including airborne respiratory infections (engineering control)

- Good administrative structure that supports organisational IPC (administrative control)
- System for surveillance of key process and outcome indicators of IPC performance and dissemination of results (administrative control)
- Systems to communicate with staff, patients, and care givers (e.g., to provide information about HCAI and IPC policies) and surveys to assess the systems' efficacy (administrative control)
- Maintaining the health and well-being of HCWs and patients in HFs, including providing training on workplace improvement, recreational areas, eating areas, worker benefits, and good compensation (administrative control)
- IPC program that is part of a risk management system to identify, assess, mitigate, and communicate potential communicable disease threats to patients and staff (administrative control)
- Immunization of all health workers against HBV, tetanus, and other immunizable diseases (administrative control):
  - Conduct pre vaccination serological testing
  - Measure antibody levels at two to six months after the last dose
  - Maintain register of HCWs receiving vaccinations
  - Refer infected workers for appropriate care and treatment
  - Liaise with occupational health and safety focal person for workers benefits and compensation
- Provide post-exposure prophylaxis (PEP) (administrative control):
  - Clear policy guidelines and procedures posted in visible places
  - Orient HCWs on PEP procedure
  - Design exposure reporting procedures as per PEP guidelines
  - Conduct a thorough assessment of exposure risk
    - Type and severity of exposure
    - Blood-borne infection status of source person
  - Provide appropriate treatment, follow-up, and counselling of workers after exposure
  - Maintain confidentiality of exposed and source persons
  - Manage exposure training of health care personnel
  - Provide rapid access to clinical care
    - PEP
    - Testing of source patients/exposed persons

- Standard and transmission-based IPC precautions, including appropriate use of PPE (PPE control)

Successful implementation of these strategies requires an effective quality improvement or infection prevention, occupational health and safety, WASH, and health care waste management (HCWM) system with support from the health setting management team (Refer National Guidelines for workers health and safety in the health care facility).

2.3 HAND HYGIENE

Hand hygiene is the most important and effective procedure to prevent and control the spread of HCAIs. It is the responsibility of all HCWs to do this at the right moment during patient care. Effective hand hygiene kills or removes transient bacteria on the skin by the following two methods:

- Use of a 70% to 90% alcohol-based hand rub (ABHR) is the preferred method (when hands are not visibly soiled) for cleaning hands. Using easily accessible ABHR in health care settings takes less time than traditional hand washing and has been shown to be more effective than washing with soap (even using an antimicrobial soap) and water when hands are not visibly soiled.
- Hand washing with liquid soap and running water must be performed when hands are visibly soiled. The effectiveness of alcohol is inhibited by the presence of organic material. The mechanical action of washing, rinsing, and drying is the most important contributor to removing transient bacteria that might be present. If hands are visibly soiled and running water is not available, use a moistened towelette to remove the visible soil, followed by ABHR.

Hand hygiene includes care of hands, nails, skin, use of lotions, and surgical scrub.

2.3.1 Types of Hand Hygiene

2.3.1.1 Routine Hand Washing with Liquid Soap and Running Water

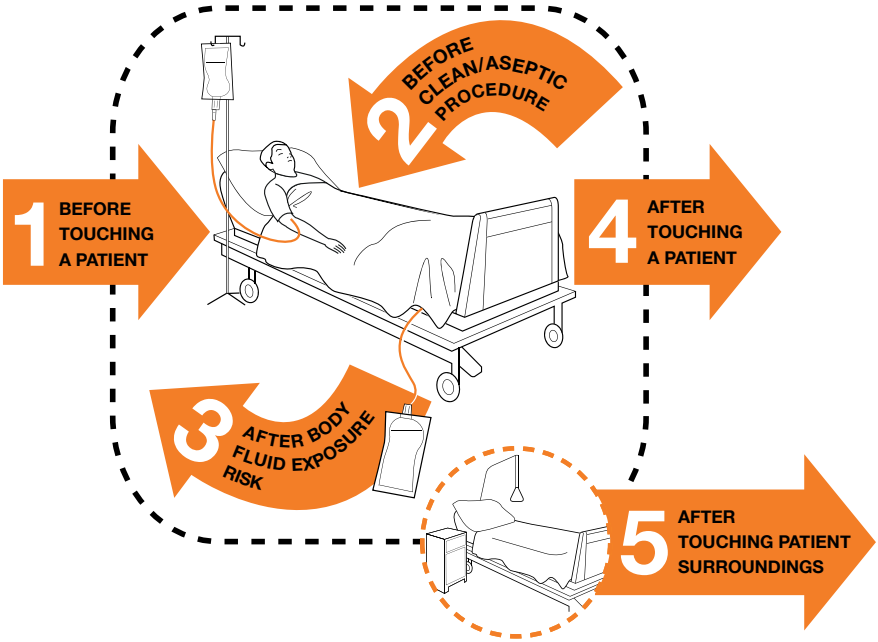
Every HCW should wash their hands:

- Immediately on arrival at work and before leaving work
- After using the toilet
- Before and after each patient contact
- Before and after donning and doffing gloves
- Before preparing, handling, serving, or eating food; before feeding a patient

- Before and after any clinical procedure
- Whenever there is a chance of contamination such as:
  - o Touching blood, bodily fluids, secretions, excretions, and exudates from wounds
  - o Contact with items known or considered likely to be contaminated with blood, bodily fluids, secretions, or excretions (e.g., bed pans, urinals, wound dressings) whether or not gloves are worn
  - o Attending to children's needs (after changing a diaper, helping them use a toilet, feeding, breastfeeding,) and after personal body functions such as using the toilet, wiping or blowing one's nose)
  - o Between all procedures done on the same patient where soiling of hands is likely to avoid cross-contamination of body sites

Ensure that all patients and family members are educated in proper hand washing.

Figure 2.3. Key important moments for hand washing

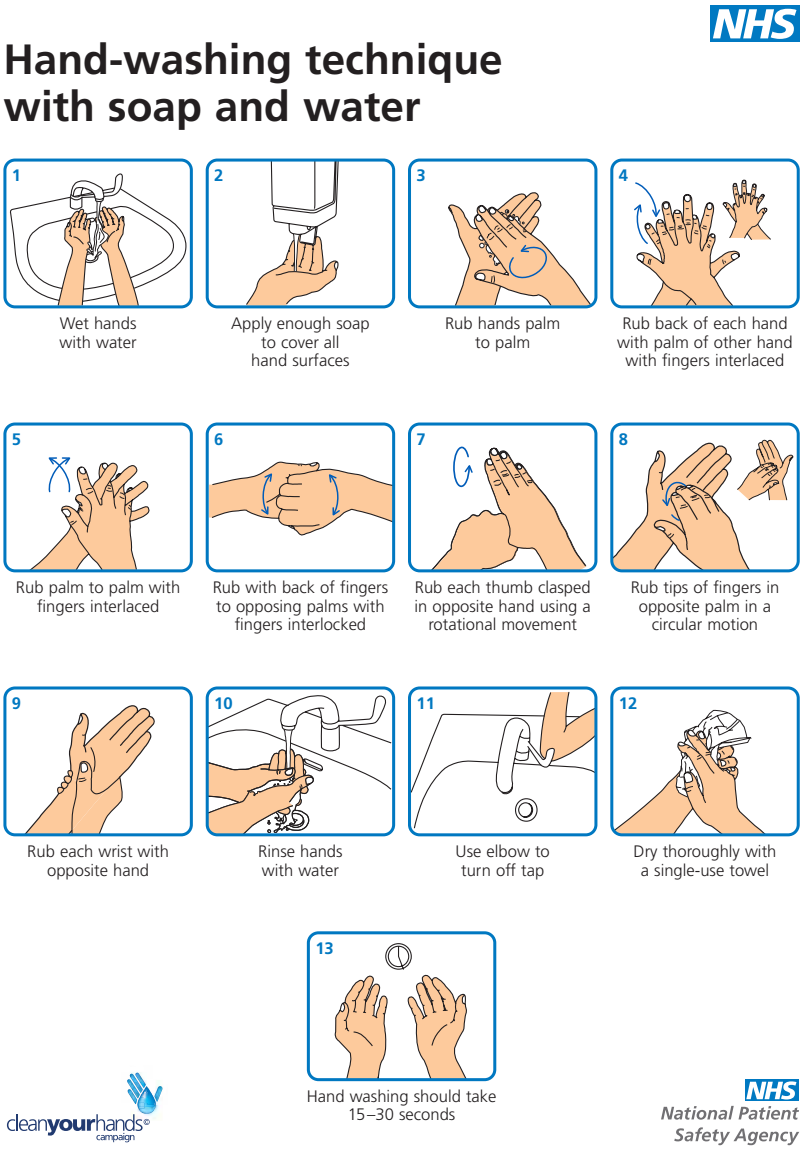


Source: Adapted from https://www.who.int/gpsc/5may/background/5moments/en/, Accessed on 30 August 2018

Standard Operating Procedure for Hand Washing

1) Turn on tap
2) Wet hands thoroughly under running water to at least 4 inches above the wrist
3) Soap hands adequately
4) Vigorously rub together all surfaces of lathered hands
5) Rub hands vigorously back and front, in between fingers, up to and including the wrist, followed by thorough rinsing under running water; do this for 10–15 seconds
6) Dry hands from tip of fingers to wrist with paper towel; if paper towels are not available, shake off excess water and allow hands to air-dry
7) Use the same paper towel to turn off tap if tap not elbow controlled

Figure 2.4: Hand washing technique with soap and water



Source:https://www.humber.nhs.uk/Downloads/Services/Infection%20prevention/Hand%20hygiene%20for%20patients%20and%20visitors%20leaflet.pdf Accessed on 30 August 2018

Important Notes

- Avoid immediate recontamination of the hands by touching sink fixtures with a paper towel to turn off taps.
- When running tap water is not available, use a bucket with a tap that can be turned on to wet hands, off to lather hands, and turned on again for rinsing. Design of the taps/sinks and the right purchase of the taps, e.g., elbow, are desirable.
- If a bucket with a tap is not available, a bucket/basin and pitcher can be used to create a running stream of water. A helper can pour water from the pitcher over the hands being washed.
- Hand washing should not be repeated in the same container of water.
- Dry hands with paper towels/sterile towels per procedure.

2.3.1.2 Hand Washing with Antiseptic and Running Water

This procedure removes transient microorganisms and dirt and kills or inhibits the growth of resident microorganisms. It also may reduce the risk of infections in high-risk situations such as:

- Where there is heavy microbial contamination before performing invasive procedures, (e.g., placement and care of intravascular devices, indwelling urinary catheters)
- Before contact with patients who have immune defects, damage to the integumentary system (e.g., burns, wounds), and percutaneous implanted devices
- Before and after direct contact with patients who have antimicrobial-resistant organisms

Recommended antiseptic agents: Povidone-iodine 7.5% surgical scrub or chlorhexidine 5% surgical scrub (undiluted)

2.3.1.3 Antiseptic (Alcohol) Hand Rub

- Kills or inhibits the growth of most transient and resident microorganisms, but does not remove organic matter
- Can be used when hand washing with soap and running water is not possible, as long as hands are not visibly soiled with dirt, blood, or other organic material
- Standard operating procedure for performing antiseptic hand rub is the same as normal hand washing

The use of an antiseptic hand rub is more effective in killing transient and resident flora than hand washing with antimicrobial agents or plain soap and water. It is

quick and convenient to perform and gives a greater initial reduction in hand flora (Girou, 2002). Antiseptic hand rubs also contain a small amount of an emollient, such as glycerine, propylene glycol, or sorbitol that protects and softens skin.

To be effective, an adequate amount of hand rub solution must be used. For example, by increasing the amount of hand rub from 1 mL to 5 mL per application (about 1 teaspoon), the effectiveness is increased significantly (Larson, 1988).

Note: Because antiseptic hand rubs do not remove soil or organic matter, hands that are visibly soiled or contaminated with blood or bodily fluids should be washed with soap and running water first.

Alcohol-Based Solution for Hand RubA non-irritating antiseptic hand rub can be made by adding glycerine,* propylene glycol, or sorbitol to alcohol (2 mL in 100 mL of 60-90% ethyl or isopropyl alcohol solution). Use 5 mL (about one teaspoon) for each application and continue rubbing the solution over the hands until they are dry (15-30 seconds).

*__Glycerine__ is often sold in cosmetic departments because it is used as a hand softener.

Preparation of Alcohol-Based Solution for Hand Rub with Hydrogen Formulation 1

To produce final concentrations of ethanol 80% v/v, glycerol 1.45% v/v, and hydrogen peroxide (H_2O_2) 0.125% v/v

Pour into a 1000-mL graduated flask:

1. Ethanol 96% v/v, 833.3 mL
2. H_2O_2 3%, 41.7 mL
3. Glycerol 98%, 14.5 mL

Top up the flask to 1,000 mL with distilled water or water that has been boiled and cooled; shake the flask gently to mix the contents.

Formulation 2

To produce final concentrations of isopropyl alcohol 75% v/v, glycerol 1.45% v/v, and hydrogen peroxide 0.125% v/v:

Pour into a 1,000 mL graduated flask:

1. Isopropyl alcohol (with a purity of 99.8%), 751.5 mL
2. H_2O_2 3%, 41.7 mL
3. Glycerol 98%, 14.5 mL

Top up the flask to 1,000 mL with distilled water or water that has been boiled and cooled; shake the flask gently to mix the contents.

Note: Only pharmacopoeia quality reagents should be used (e.g., *The International Pharmacopoeia*) and not technical grade products.

Figure 2.5: Guide to local production

PART A: GUIDE TO LOCAL PRODUCTION

Part A is intended to guide a local producer in the actual preparation of the formulation.

Materials required (small volume production)

REAGENTS FOR FORMULATION 1:	REAGENTS FOR FORMULATION 2:
• Ethanol 96%	• Isopropyl alcohol 99.8%
• Hydrogen peroxide 3%	• Hydrogen peroxide 3%
• Glycerol 98%	• Glycerol 98%
• Sterile distilled or boiled cold water	• Sterile distilled or boiled cold water

- 10-litre glass or plastic bottles with screw-threaded stoppers (1), or
- 50-litre plastic tanks (preferably in polypropylene or high density polyethylene, translucent so as to see the liquid level) (2), or
- Stainless steel tanks with a capacity of 80–100 litres (for mixing without overflowing) (3 , 4)
- Wooden, plastic or metal paddles for mixing (5)
- Measuring cylinders and measuring jugs (6 , 7)
- Plastic or metal funnel
- 100 ml plastic bottles with leak-proof tops (8)
- 500 ml glass or plastic bottles with screw tops (8)
- An alcoholometer: the temperature scale is at the bottom and the ethanol concentration (percentage v/v) at the top (9 , 10 , 11)

NOTE

- Glycerol: used as humectant, but other emollients may be used for skin care, provided that they are cheap, widely available and miscible in water and alcohol and do not add to toxicity, or promote allergy.
- Hydrogen peroxide: used to inactivate contaminating bacterial spores in the solution and is not an active substance for hand antisepsis.
- Any further additive to both formulations should be clearly labelled and be non-toxic in case of accidental ingestion.
- A colorant may be added to allow differentiation from other fluids, but should not add to toxicity, promote allergy, or interfere with antimicrobial properties. The addition of perfumes or dyes is not recommended due to risk of allergic reactions.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Source: (WHO, April 2010)

2.3.1.4 Surgical Hand Hygiene

This procedure involves hand washing with running water and soap and hand rubbing with ABHR and friction.

The purposes of surgical hand hygiene are to prevent:

- Wound contamination by microorganisms from hands and arms of surgeons and assistants
- Growth of microorganisms (rubbing with antiseptic before beginning surgical procedures)

Figure 2.6: Standard procedure surgical hand rubbing

Surgical Handrubbing Technique

- Handwash with soap and water on arrival to OR, after having donned theatre clothing (cap/hat/bonnet and mask).
- Use an alcohol-based handrub (ABHR) product for surgical hand preparation, by carefully following the technique illustrated in Images 1 to 17, before every surgical procedure.
- If any residual talc or biological fluids are present when gloves are removed following the operation, handwash with soap and water.

Put approximately 5ml (3 doses) of ABHR in the palm of your left hand, using the elbow of your other arm to operate the dispenser.

Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds).

Images 3-7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds).

Images 8-10: Now repeat steps 1-7 for the left hand and forearm.

Put approximately 5ml (3 doses) of ABHR in the palm of your left hand as illustrated, to rub both hands at the same time up to the wrists, following all steps in images 12-17 (20-30 seconds).

Cover the whole surface of the hands up to the wrist with ABHR, rubbing palm against palm with a rotating movement.

Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa.

Rub palm against palm back and forth with fingers interlinked.

Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement.

Rub the thumb of the left hand by rotating it in the clasped palm of the right hand and vice versa.

When the hands are dry, sterile surgical clothing and gloves can be donned.

Repeat this sequence (average 60 sec) the number of times that adds up to the total duration recommended by the ABHR manufacturer's instructions. This could be two or even three times.

World Health Organization

SUSP Surgical Unit-based Safety Program

Source: (Allegranzi, 30 September 2017)

2.3.2 Skin Care

- Frequent hand washing and gloving can irritate skin.
- Staff responsible for processing instruments who have open sores or cuts on their hands or forearms should not clean instruments until the lesions are healed, unless covered with waterproof dressings.
- Health care providers with dermatitis carry high numbers of microorganisms and may be at increased risk of exposure to blood-borne pathogens. Intact skin is a major defence against infection.
- Hand washing cannot reduce the bacterial counts of personnel with dermatitis.
- Lotion can ease the dryness resulting from frequent hand washing. It can also help prevent dermatitis from frequent glove use.
- Do not use personal hand creams at work as they may counteract the antiseptic properties in antiseptic preparations.
- Hand creams containing oil should be avoided as they may cause latex gloves to split.
- Provide alternative hand hygiene products for HCWs with confirmed allergies or adverse reactions to standard products used in the health care setting.

2.3.3 Other Issues and Considerations Related to Hand Hygiene

2.3.3.1 Use of Hand Lotions and Hand Creams

Several studies have shown that regular use (at least twice per day) of such products can help prevent and treat contact dermatitis (Tietjen L, 2003). In addition, moisturizers can prevent drying and damage to the skin and loss of skin fats. There is also biological evidence that emollients, such as glycerol and sorbitol, with or without antiseptics, may decrease cross-contamination because they reduce shedding of bacteria from skin for up to four hours.

2.3.3.2 Management of Lesions and Skin Breaks

Cuticles, hands, and forearms should be free of lesions (dermatitis or eczema) and skin breaks (cuts, abrasions, and cracking). Cuts and abrasions should be covered with waterproof dressings. If covering them is not possible, surgical staff with skin lesions should not operate until the lesions are healed.

2.3.3.3 Fingernails

Research has shown that the area around the base of the nails (subungual space)

contains the highest microbial count on the hand (McGinley K.J, 1998). In addition, several studies have shown that long nails may serve as a reservoir for gram-negative bacilli (*P. aeruginosa*), yeast, and other pathogens (Hedderwick, McNeil, Lyons, & Kauffman, 2000). Moreover, long nails, either natural or artificial, tend to puncture gloves more easily. As a result, it is recommended that nails be kept moderately short and not extend more than 3 mm (1/8 inch) beyond the fingertip.

2.3.3.4 Use of Artificial Nails

Wearing artificial nails is strictly forbidden. Artificial nails (nail wraps, nail tips, acrylic lengtheners, etc.) worn by HCWs can contribute to HCAI (Hedderwick, McNeil, Lyons, & Kauffman, 2000). In addition, because there is evidence that artificial nails may serve as a reservoir for pathogenic gram-negative bacilli, their use by HCWs should be restricted, especially by surgical team members, and those who:

- Work in specialty areas such as neonatal ICUs (NICUs)
- Care for patients highly susceptible to infection
- Manage patients who have infections with resistant organisms

2.3.3.5 Nail Polish

Wearing nail polish is strictly forbidden. Chipped nail polish supports the growth of larger numbers of organisms on fingernails compared to freshly polished or natural nails. Also, dark coloured nail polish may prevent dirt and debris under fingernails from being seen and removed.

2.3.3.5 Jewelry

Although several studies have shown that skin under rings is more heavily colonized than comparable areas of skin on fingers without rings (Jacobson, Thiele, McCune, & Farrell, 1985) at the present time, it is not known whether wearing rings results in greater transmission of pathogens. It is suggested that surgical team members not wear rings because it may be more difficult for them to put on surgical gloves without tearing them.

Table 2.2: Soaps and antiseptic/antimicrobial agents for hand washing

Products	Indications	Special considerations
Plain liquid soap	• For routine care of patients • For washing hands soiled with dirt, blood, or other organic material	• May contain very low concentrations of antimicrobial agents to prevent growth of microbial contamination in the product • **Bar soap and powder soap should not be used** for hand washing as it may cause cross contamination when the bar is touched
Waterless antiseptic agents: • Alcohol rinses • Alcohol foams • Alcohol wipes • Alcohol towelettes • Germicidal hand rinse (Hibistat®)	• Demonstrated alternative to conventional agents • For use where hand washing facilities are inadequate, impractical, or inaccessible (e.g., ambulances, home care, mass immunization) • For situations in which the water supply is interrupted (e.g., planned disruptions, natural disasters)	• Not effective if hands are soiled with dirt or heavily contaminated with blood or other organic material • Follow manufacturer's recommendations for use • Efficacy affected by concentration of alcohol in the product • Lotions should be readily available to protect skin integrity
Antiseptic/ antimicrobial agents: • Chlorhexidine gluconate scrub strengths: 2% aqueous foam or 4% liquid preparation • Povidone-iodine scrub strengths: 10%, 7.5%, 2%, 0.5%	• May be chosen for hand scrubs prior to performance of invasive procedures (e.g., placing intravascular lines or devices) • When caring for severely immunocompromised patients • Based on risk of transmission (e.g., specific microorganisms) • Critical care areas • Intensive care nurseries • Operating theatre hand scrub • When caring for individuals with antimicrobial-resistant organisms	• Antiseptic agents may be chosen if it is important to reduce the number of resident flora or when the level of microbial contamination is high • For use in high-risk areas, such as ICUs, neonatal units, operating theatres, labor and delivery rooms, isolation areas, and laboratory and dialysis units, for invasive procedures • Antiseptic agents should be chosen when persistent antimicrobial activity on the hand is desired; they are usually available in liquid formulations; antiseptic agents differ in activity and characteristics

Source: (MoHSW, 2007)

2.3.4 Hand Hygiene Strategy

All HFs should allocate resources to plan and implement an ongoing program to promote excellent hand hygiene practices by staff, patients, and visitors. A self-assessment on current hand hygiene activities is recommended using a standard hygiene self-assessment framework. This strategy includes the following: -

2.3.4.1 Build a Hand Hygiene Culture

Building a hand hygiene culture is a vital strategy for all HFs. Compliance with hand hygiene is only possible if the HF ensures an adequate infrastructure and if a reliable and permanent supply of hand hygiene products are provided at the right times and locations.

2.3.4.2 Training/Education

All HCWs require training and education on the importance of hand hygiene, the indication on the 7 moments and correct steps of hand hygiene. Clear and standardized messaging needs to be conveyed to all HCWs to ensure consistency in hand hygiene. In addition, this is also to encourage behavioural and cultural change.

2.3.4.3 Evaluation and Feedback

Evaluation and continual monitoring of a range of hand hygiene indicators and infrastructure, including knowledge and perception of the problem of HCAIs, are important aspects of assessing the effectiveness of the strategy.

2.3.4.4 Reminders in the Workplace

All HCWs should be reminded of the importance of hand hygiene and the 7 Moments. Patients and visitors should also be informed of the standard of care that they should expect from their HCWs in regard to hand hygiene. Reminders can be visual, such as posters, or audio, such as public announcements. Other initiatives can be in the form of patient educational leaflets, badges etc.

2.3.4.5 Health Facility Hand Hygiene Policy

HF management must make patient safety and improving hand hygiene a high priority at all levels.

Table 2.3: Proposed strategies to improve hand washing techniques and compliance

Obstacle	Strategy
Lack of knowledge	• Education with supportive literature, videotaped instructions, hand washing demonstrations; frequent involvement of personnel in education and feedback on infection rates
Lack of motivation	• Direct observation and feedback on a regular basis, role models; involvement of staff in studies; application of new technologies • Programmes on hand hygiene for patients and families
Unavailability of hand washing facilities	• Hand washing facilities conveniently located throughout the HF • Available running water • Hand washing facilities in or adjacent to rooms where health care procedures are performed • Accessible, adequate supplies of soap and disposable towels • Waterless antiseptic agents readily available in wall-mounted dispensers or in small containers for mobile care, such as home care and emergency responders
Non-acceptance of hand washing	• Availability of hand washing products that are highly acceptable to staff, taking into consideration appropriateness, cost, supply, etc.
Dermatitis	• Lotions to prevent skin dryness • Lotion supplies in small non-refillable containers • Compatibility between lotion and antiseptic products and effect on glove integrity • Lotions approved by the IPC committee

2.4 PERSONAL PROTECTIVE EQUIPMENT

Protective barriers, now commonly referred to as PPE, have been used for many years to protect patients from microorganisms present on staff working in health care settings. More recently, with the emergence of AIDS, viral hepatitis, VHF, and the resurgence of TB in Tanzania, use of PPE now has become important for protecting staff as well. As a consequence, hospital administrators, supervisors, and HCWs need to be aware of not only the benefits and limitations of specific PPE, but also of the actual role PPE plays in preventing infections so it can be used effectively and efficiently.

2.4.1 Types of PPE

PPE includes gloves, masks/respirators, eyewear (face shields, goggles, or glasses), caps, gowns, aprons, scrub suits, drapes, hoods, boots and other items.

2.4.1.1 Gloves

Gloves protect hands from infectious materials and protect patients from microorganisms on staff members' hands. They are the most important physical barriers for preventing the spread of infection. There are three categories of gloves:

- Surgical (sterile, single use)
- Examination (non-sterile)
- Heavy duty/utility/household

When to Use Gloves and Types of Procedures

- Gloves should be worn when contact with body and blood fluids is anticipated.
- Gloves should be worn as an additional measure, not as a substitute for hand washing.
- Examination gloves shall be worn:
  - o For examination and non-surgical procedures
  - o For contact with blood, bodily fluids, secretions and excretions, mucous membranes, draining wounds, or non-intact skin (open skin lesions or oxidative rash)
  - o For handling items visibly soiled with blood, bodily fluids, secretions, or excretions
  - o When the HCW has non-intact skin on his/her hands
  - o When inserting an IV line
- Surgical gloves shall be worn for surgical and invasive procedures.
- Utility gloves are used for cleaning equipment, floors, walls, furniture (such as beds), handling waste, etc.
- Gloves shall be changed between care activities and procedures for the same patient after contact with materials that may contain high concentrations of microorganisms.
- Gloves shall be removed before moving to another patient or after completion of a specific task.
- Hands shall be washed and dried immediately after removing gloves.
- With the exception of utility gloves, other gloves shall not be washed, decontaminated, and reused.

- Gloves shall not be worn while walking in corridors and traveling in elevators, unless in special circumstances, e.g., transporting laboratory specimens.
- Gloves are not required for routine care activities in which contact is limited to a patient's skin.

Double Gloving

The transmission of HBV and HCV from surgeon to patient and vice versa has occurred in the absence of breaks in technique and with apparently intact gloves (Davis, 2001). Even new, best quality latex rubber surgical gloves may leak up to 4% of the time. Moreover, latex gloves, especially when exposed to fat in wounds, gradually become weaker and lose their integrity.

Although double gloving is of little benefit in preventing blood exposure if needle sticks or other injuries occur, it may decrease the risk of blood-hand contact. For example, one recent study showed that surgeons wearing single gloves had a blood-hand contact rate of 14% while surgeons wearing double gloves had a rate of only 5% (Tokars J.I, 1998).

Based on this study, the following are reasonable guidelines for when to wear double gloves:

- When the procedure involves coming into contact with a large amount of blood or other bodily fluids (e.g., vaginal deliveries and caesarean sections)
- For orthopaedic procedures in which sharp bone fragments, wire sutures, and other sharps are likely to be encountered

2.4.1.2 Elbow-Length Gloves for Obstetrical Procedures

Blood contact with the skin and mucous membranes of providers occurs in 25% of vaginal deliveries and 35% of caesarean sections (Davis, 2001) hen the hand and forearm need to be inserted into the vagina (manual removal of a retained placenta) or deep into the uterus to deliver the infant's head (caesarean section), elbow-length, so-called "gauntlet"/gynaecological gloves help protect the provider from significant blood and amniotic fluid contamination.

2.4.1.3 Orthopaedic Surgical Gloves

These are designed for tough orthopaedic procedures and offer increased thickness and hydrogel coating.

2.4.1.4 Scrub Suits and Gowns

Scrub suits or cover gowns are worn over, or instead of, home dressings. The main use of cover gowns is to protect health providers' clothing. A scrub suit usually consists of drawstring pants and a shirt. A V-neck shirt must not be cut so low as to slide off the wearer's shoulders or expose men's chest hair.

Surgical gowns were first used to protect patients from microorganisms present on the abdomen and arms of the HCW during surgery. Surgical gowns made of fluid-resistant materials play a role in keeping blood and other bodily fluids off the skin of personnel, particularly in operating, delivery, and emergency rooms.

Lightweight cloth gowns offer little protection and do not provide an effective barrier because moisture can easily pass through them, allowing contamination. Jeans material (denim) or canvas is too dense for steam penetration (i.e., cannot be sterilized), is difficult to wash, and takes too long to dry. The HCW can wear a plastic or rubber apron underneath the gown to prevent contact of the skin with blood and bodily fluids. If large spills occur, the best thing to do is shower or bathe as soon after completing the procedure as possible.

Standard Operating Procedures for Gowns

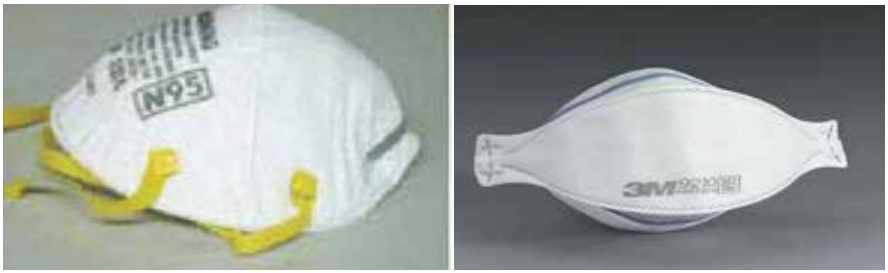
- Gowns shall be used for protective isolation. The unnecessary use of gowns is not recommended
- Gowns shall not be worn outside the area for which they are intended.
- Long gowns shall be worn to protect uncovered skin and to prevent soiling of clothing during procedures and patient care activities likely to generate splashes or sprays of blood, bodily fluids, secretions, or excretions.
- Plastic aprons are recommended where splashes are likely to occur. Clinical coats and scrub suits should remain in the work place; taking them home increases the risk of infection to the home environment.

2.4.1.5 Masks

Masks should be large enough to cover the lower face and all facial hair (to contain it). They are worn in an attempt to contain moisture droplets expelled as HCWs or surgical staff speak, cough, or sneeze (droplet precautions), as well as to prevent accidental splashes of blood or other contaminated bodily fluids from entering the HCW's nose or mouth. Unless the masks are made of fluid-resistant materials, they are not effective in preventing either very well.

Respirators are specialized types of masks, called particulate respirators (such as N95), which are recommended for situations in which filtering inhaled air is considered important (e.g., for the care of a person on airborne precautions). They contain multiple layers of filter material and fit the face tightly so that no air leaks around the mask when the HCW breathes.

Figure 2.7: Particulate N95 respirators



Source: (MoHSW, 2007)

There are four types of masks:

- The tieback mask, which has four ties to fasten the mask around the mouth and nose. The side of the mask with the flexible metal tab is worn away from the face with the metal tab placed above the bridge of the nose to help secure the mask and minimize air escaping from the sides (venting).
- The ear-loop mask is similar to the tieback mask except that it has two elastic bands used for fastening.
- Surgical masks have attached faced shields to provide a protective barrier against splashes and spatters of blood or other infectious material. These masks are fluid resistant, lightweight, and adequate for most procedures and isolation precautions.
- An N95 respirator is a protective device designed to achieve a very close facial fit and very efficient filtration of airborne particles. N95 means that the respirator blocks at least 95% of very small (0.3 microns) test particles. If properly fitted, the filtration capabilities of N95 respirators exceed those of face masks. However, even a properly fitted N95 respirator does not completely eliminate the risk of illness or death.

Note: *N95 respirators are not designed for children or people with facial hair. Because a proper fit cannot be achieved on children and people with facial hair, the N95 respirator may not provide full protection.*

Note: *A surgical mask becomes ineffective as a barrier if the integrity of the mask is damaged or if it becomes wet (i.e., from perspiration or if splashed with blood or other potentially infectious material). If this occurs, remove the mask and replace it with another.*

2.4.1.6 Caps

Caps are used to keep the hair and scalp covered so that flakes of skin and hair are not shed into the wound during surgery. Caps should be large enough to cover all hair. While caps provide some protection to the patient, their primary purpose is to protect the wearer from blood and bodily fluid splashes and sprays.

2.4.1.7 Protective Eye Wear

By covering the eyes, protective eyewear protects staff from accidental splashes of blood or bodily fluid. Types of eyewear are as follows:

- Plastic glasses with solid side shields
- Goggles
- Chin-length face shields

Standard Operating Procedure for Eye Wear

- Protective eye wear shall be worn where appropriate to protect the mucous membranes of the eyes during procedures and patient care activities likely to generate splashes or sprays of blood, bodily fluids, secretions, and excretions.
- Use protective eye wear that is appropriate for the particular procedure.
- To remove eyewear, hold goggles with one hand, lift the bottom strap from the back of the head to the front. If gloved hands are used for these procedures, the gloves should not be contaminated with blood or other potentially infectious material.

2.4.1.8 Boots (Footwear)

- Footwear is worn to protect feet from injury from sharps and heavy items, blood, and fluids.
- Rubber or leather boots are recommended because they protect better; they should be kept clean and free of contamination from blood or other fluid spills.

- Shoe covers in surgical areas are unnecessary if shoes are clean, closed-toe, and sturdy.

2.4.1.9 Aprons

The apron is made of rubber or plastic to provide a waterproof barrier along the front of the health worker's body. An apron should be worn when cleaning or during a procedure in which blood or body spills are anticipated.

2.4.1.10 Hoods

A hood is a covering for head and neck with an opening for the face, typically forming part of a coat or cloak. The material should be plastic or waterproof.

Figure 2.8: Hood

Source: (MoHSW, 2007)

2.4.1.11 Laminar Flow/Biological Safety Cabinet

This is a carefully enclosed bench designed to prevent contamination of biological samples or any particle sensitive materials.

2.4.1.12 Drapes

Surgical drapes (sterile) made of cloth can be placed around a prepared surgical incision to create a work area. Although this area is often called the "sterile field," it is **NOT** sterile. Cloth drapes allow moisture to soak through and can help spread

organisms from skin, even after surgical cleansing with an antiseptic agent, into the incision. Thus, neither sterile gloved hands nor sterile or HLD instruments and other items should touch drapes once they are in place. Using towel drapes to create a work area around the incision limits the amount of skin that needs to be cleaned and reminds the surgical team not to touch the patient.

Remember

- Once a sterile drape touches the patient's skin, it is no longer sterile.
- Sterile cloth drapes do not replace good aseptic technique.

2.4.2 General Procedure for Donning PPE

Steps for donning PPE vary depending on the procedure to be performed (donning for theatre, isolation, etc.)

- Always perform hand hygiene before donning PPE
- If wearing a gown, don the gown first and fasten in back accordingly
- If wearing a facemask or respirator:
  - Secure ties or elastic band at the back of the head and/or neck
  - Fit flexible band to nose bridge
  - Fit snug to face and below chin
- If wearing goggles or a face shield, put it on the face and adjust the fit
- If wearing gloves in combination with other PPE, don gloves last

2.4.3 General Procedure for Doffing PPE

Steps for doffing PPE vary depending on the procedure that has been performed, e.g., after exposure to infectious agents.

- Remove PPE before leaving the exam room or patient environment (except respirators which should be removed after exiting the room)
- Remove gloves:
  - Grasp the outside of the glove with opposite gloved hand; peel off
  - Hold removed glove in glove hand
  - Slide un-gloved fingers under the remaining glove at the wrist; peel off and discard
- Remove gown:
  - Remove in such a way to prevent contamination of clothing or skin
  - Turn contaminated outside surface toward the inside
  - Roll or fold into a bundle and discard if it is not reusable

- Remove facemask or respirator:
  - o Avoid touching the front of the mask or respirator
  - o Grasp the bottom and the ties/elastic to remove and discard
- Remove goggles or face shield:
  - o Avoid touching the front of the goggles or face shield
  - o Remove by handling the head band or ear pieces and discard
- Always perform hand hygiene immediately after removing PPE

Table 2.4: How PPE blocks the spread of microorganisms

Where micro-oganisms are found **Health care staff**	How microorganisms are spread	Barriers to stop spread of microorganisms	Who the barrier protects
Hair and scalp	Shedding skin or hair	Cap	Patient
Nose and mouth	Coughing, talking, and sneezing	Mask	Patient
Body and skin	Shedding skin or hair	Scrub suit, cover gown	Patient
Hands	Touching	Gloves, hand washing, or waterless antiseptic hand rub	Patient
Patient's mucous membranes and non- intact skin	Touching	Gloves	Patient and staff
Patient's blood and bodily fluids	Splashing or spraying	Gloves, eyewear, mask, drapes, apron	Staff
	Touching (contact)	Instrument processing	Patient, staff
	Accidental exposure with contaminated needles and scalpel blades	Utility gloves, protective footwear, decontamination and disposal; use a safe or neutral zone during surgery	Staff
	Infectious waste	Utility gloves, plastic bags, and disposal	Staff and community
Patient's unprepared skin	Touching	Skin preparation, drapes, gloves	Patient
Clinic or hospital environment	Touching	Gloves, hand washing, dressings	Staff and their family, staff and community

Source: (Tietjen L, 2003)

2.5 ANTISEPTICS AND DISINFECTANTS

2.5.1 Antiseptics

Antiseptics are chemicals that are applied to the skin or other living tissues to inhibit or kill microorganisms (both transient and resident), thereby reducing the total bacterial count.

Antisepsis: Process of reducing the number of microorganisms on the skin, mucous membranes, or other body tissues by applying an antimicrobial antiseptic agent.

> **Note:** Antiseptics should not be used on inanimate objects, such as instruments and surfaces. Although antiseptics are sometimes used as disinfectants (e.g., Savlon® or Dettol®) for processing instruments and other inanimate objects, they are not designed for this use. They do not have the same killing power as chemical disinfectants (e.g., glutaraldehydes, hypochlorite, and peroxides) and should not be used for this purpose (Rutala, 1996).

Antiseptic Agents

- Liquid soap
- Antiseptics, which include 0.5% chlorhexidine with or without glycerol, and povidone-iodine. These reduce both transient and resident flora on the hands.
- They also reduce the risk of infections in high-risk situations, such as:
  - o Heavy microbial contamination
  - o Before performing invasive procedures, (e.g., placement and care of intravascular devices and indwelling urinary catheters)
  - o Before contact with patients who have immune defects, damage to the integumentary system (e.g., burns, wounds), and percutaneous implanted devices
  - o Before and after direct contact with patients who have AMR organisms

2.5.1.1 Types and Selection of Antiseptics

Many chemicals qualify as safe antiseptics and are designed to remove as many microorganisms as possible without damaging or irritating the skin or mucous membranes.

Some antiseptic solutions have a residual effect (their killing action continues for a period of time). Hence, they are recommended for daily use:

- Alcohol-based solutions of iodine or chlorhexidine
- Alcohols (60–90% ethyl, isopropyl, or "methylated spirit")
- Chlorhexidine gluconate (2–4%) (e.g., Hibitane®, Hibiscrub®, Hibiclens®)
- Chlorhexidine gluconate and cetrimide, various concentrations at least 2% (e.g., Savlon)
- Iodine (3%); aqueous iodine iodophors (7.5–10%), various other concentrations (e.g., Betadine®)
- Chloroxylenol (para-chlorometaxylenol or PCMX) (0.5–3.75%), various other concentrations (e.g., Dettol)
- Ortho-phthalaldehyde (OPA)
- Triclosan (0.2-2%).**Table 2.5: Most frequently used antiseptics, their microbiologic activities, potential uses, and effectiveness**

GROUP	ACTIVITY AGAINST BACTERIA						POTENTIAL USES				
	Gram-Positive	Most Gram-Negative	TB	Viruses	Fungi	Endospores	Relative Speed of Action	Affected by Organic Matter	Surgical Scrub	Skin Preparation	Comments
Alcohols (60–90% ethyl or isopropyl)	Excellent	Excellent	Excellent	Excellent	Excellent	None	Fast	Moderate	Yes	Yes	Not for use on mucous membranes Not good for physical cleaning of skin, no persistent activity
Chlorhexidine (2–4%) (Hibitane, Hibiscrub)	Excellent	Good	Fair	Excellent	Fair	None	Intermediate	Slight	Yes	Yes	Has good persistent effect Toxicity to ears and eyes
Iodine preparations (3%)	Excellent	Excellent	Excellent	Excellent	Good	Fair	Intermediate	Marked	No	Yes	Not for use on mucous membranes Can burn skin so remove after several minutes
Iodophors (7.5–10%) (Betadine)	Excellent	Excellent	Fair	Good	Good	None	Intermediate	Moderate	Yes	Yes	Can be used on mucous membranes
Para-chloro-metaxylenol (PCMX) (0.5–4%)	Good	Excellent	Fair	Good	Fair	Unknown	Slow	Minimal	No	Yes	Penetrates the skin and should not be used on newborns
Triclosan (0.2–2%)	Excellent	Good	Fair	Excellent	None	Unknown	Intermediate	Minimal	Yes	No	Acceptability on hands varies

Adapted from: Boyce and Pittet 2002; Olmsted 1996.

Source: Tietjen L, B. D. (2003). Infection Prevention Guidelines for Healthcare Facilities with Limited Resources. Baltimore, Maryland: Jhpiego Corp, page 5-4

2.5.1.2 When to Use Antiseptics

- Before a clinical procedure involving skin, cervical, or vaginal preparation
- For surgical scrub
- For hand washing in high-risk situations, e.g., before, during, and after performing invasive procedures, touching a newborn or an immunosuppressed patient

2.5.1.3 Surgical Antisepsis

Postoperative wound infections (incisional and deep) remain a leading cause of HCAI in developing countries. The vast majority of postoperative incisional or superficial wound infections are caused by microorganisms (usually bacteria or sometimes fungi) normally found on a patient's skin or from mucous membranes adjacent to the site.

Note: *Surgical wound infections are less often caused by organisms from the nose, mouth, respiratory tract, hands of surgeons and assistants, and organisms from the Operating Room (OR).*

Preoperative surgical antisepsis consists of three processes:

- Hand hygiene
- Gloving
- Applying an antiseptic agent to the surgical site

Whether a postoperative wound infection occurs depends on several risk factors, the most important being the:

- Number of microorganisms entering the wound
- Type and virulence (ability to cause the disease) of the bacteria
- Patient's immunity
- External factors: preoperative hospital stay days or duration of the surgical technique or procedure and surgical environment

2.5.1.4 Skin Preparation Prior to Surgical Procedures

Although skin cannot be sterilized, applying an antiseptic solution minimizes the number of microorganisms around the surgical wound that may contaminate and cause infection.

Step 1: Do not shave hair around the operative site. Shaving increases the risk of infection 5-10 fold because the tiny nicks in the skin provides an ideal setting for microorganisms to grow and multiply. If hair must be cut, trim it close to the skin's surface with scissors immediately before surgery.

Step 2: Ask the patient about **allergic reactions** (e.g., to iodine preparations) before selecting an antiseptic solution.

Step 3: If the skin or external genital area is visibly soiled, gently wash it with soap and clean water and dry it before applying the antiseptic.

Step 4: Using dry, HLD forceps and new cotton or gauze squares and antiseptic, thoroughly cleanse the skin. Work from the operative site outward for several centimetres. (A circular motion from the centre out helps to prevent recontamination of the operative site with local skin bacteria.)

Step 5: Allow the antiseptic enough time to take effect before beginning the procedure. For example, when an iodophor is used, allow 2 minutes or wait until the skin is visibly dry before proceeding because the active agent (free iodine) is released slowly.

2.5.1.5 Instructions for Cervical or Vaginal Preparation

For cervical and vaginal antisepsis, prior to inserting a uterine elevator for a mini laparotomy or doing an endometrial biopsy, select an aqueous (water-based) antiseptic, such as an iodophor (povidone-iodine) or 2-4% chlorhexidine gluconate (e.g., Savlon, if properly prepared). Do not use alcohols or alcohol-containing preparations.

Step 1: Ask the patient about **allergic reactions** (e.g., to iodine preparations) before selecting an antiseptic.

Step 2: If the external genital area is visibly soiled, gently wash it with soap and clean water and dry the area before applying the antiseptic.

Step 3: After inserting the speculum, apply antiseptic solution liberally to the cervix and vagina (2 times).

Step 4: If an iodophor is used, allow time (2 minutes) before proceeding.

2.5.1.6 Storing and Dispensing Antiseptics

- Concentrated antiseptic solutions should be stored in a cool, dark area.
- Never store them in direct sunlight or in excessive heat (e.g., upper shelves in a tin-roofed building).

- Unless supplied commercially in small quantities, pour the antiseptic into a small, re-usable container for daily use
- Label reusable containers with the date each time they are washed, dried, and refilled
- Make sure the correct name of the solution is on the container each time it is refilled.
- **Do not store gauze or cotton wool in antiseptics because this promotes contamination.**
- Establish a routine schedule for preparing new solutions and cleaning reusable containers (solution is at increased risk of becoming contaminated). **Do not "top off" antiseptic dispensers.**
- Wash reusable containers thoroughly with soap and clean water and drip dry before refilling.

2.5.2 Disinfectants

Disinfectants are chemicals that kill or inhibit all microorganisms except bacteria endospores on inanimate objects.

2.5.2.1 Types of disinfectants

Table 2.6: Type of Disinfectants

Level of disinfection	Spectrum of activity of disinfectant	Active ingredients potentially capable of satisfying these spectra of activity	Factors affecting efficacy of disinfectant
High	• Sporocidal • Mycobactericidal • Virucidal • Fungicidal • Bactericidal	• Paracetic acid • Chlorine dioxide • Formaldehyde • Glucaraldehyde • Sodium hypochlorite • Stabilized hydrogen peroxide • Succinaldehyde (succinic aldehyde)	• Concentration • Contact time • Temperature • Presence of organic matter • pH • Presence of calcium or magnesium ions (for example, hardness of the water used for dilution) • Formulation of the disinfectant used
Intermediate	• Tuberculocidal • Virucidal • Fungicidal • Bactericidal	• Phenol derivatives • Ethyl isopropyl alcohol	
Low	• Bactericidal	• Quaternary ammonium • Amphiprotic • Amino acids	

Source: (Tietjen L, 2003)

High-Level Disinfectants

These are substances that kill all bacteria, viruses, fungi, and *M. tuberculosis*. Some high-level disinfectants are also chemical sterilants and, given sufficient time, will destroy bacterial endospores.

- Examples of disinfectants:
  - Sporicidin 2%
  - Chlorhexidine 4%, centrimide 5%
  - Hydrogen peroxide 6%
  - Chlorine 0.5%

Intermediate-Level Disinfectants

- Kill bacteria and most viruses
- Alcohols, for example:
  - Isopropyl 60-70%
  - Ethanol 70-90%
  - Methylated spirit 60-90%
  - Iodines and iodophor 10% solutions
  - Povidone-iodine 2.5%
  - Formaldehyde 8%

Note: *Recommended for use on blood and other potentially infectious materials. Small, non-lipid viruses, (e.g., enteroviruses) may be resistant. Used for some non-critical items or devices or on environmental surfaces.*

Low-Level Disinfectants

- Kills some bacteria and some viruses and fungi, but does not kill TB-causing microorganisms and bacterial endospores
- Examples are:
  - Hydrogen peroxide 3%
  - Phenolics 1-2%
  - Dettol
  - Lysol 5%
  - Carbolic acid 5%

Note: *Should be used only to decontaminate the environment (surfaces, floors, furniture, walls). They must not be used for processing instruments and other items.*

2.5.2.2 Factors Affecting Disinfection

- Nature of the items to be disinfected
- Number of microorganisms present (a higher number of microorganisms requires more time for disinfection)
- Resistance of microorganisms:
  - o Some microorganisms are more resistant to disinfection than others, e.g., bacterial spores, mycobacteria, hydrophilic viruses, fungi, vegetative bacteria, and lipid viruses in that order.
  - o Organisms flourishing in HF environments (*Pseudomonas aeruginosa*, antibiotic-resistant microorganisms) have inherent resistance to certain disinfectants.
- Types and concentration of disinfectant used
- Presence of organic soiling matter (blood, blood products, bodily fluids, and faeces containing significant amounts of proteins and proteins) inactivate or slow the action of disinfectants.
- Duration of exposure and temperature:
  - o The longer the duration of exposure, the higher the degree of disinfection achieved.
  - o Higher temperatures increase the killing power of most disinfectants whereas lower temperatures slow the killing power.
- Rough surfaces (with crevices, lumen, hinges) need a longer time for disinfection.

2.5.2.3 Choosing a Disinfection Method

Disinfectants chosen should be:

- Bactericidal not bacteriostatic
- Active against a wide range of microorganisms
- Not readily inactivated by organic matter (i.e., stable when in contact)
- Rapid acting
- Non-toxic
- Non-corrosive
- Non-damaging to equipment/substances treated
- Cost-effective and available

2.5.2.4 Guide on How to Use Disinfectants

- Check expiry date of the disinfectant.
- Follow the manufacturer's instructions AND ensure that the correct (optimum)

dilution is used.

- The date should be clearly marked on the container.
- Disinfectant containers must be thoroughly cleaned or sterilized before refill between uses. **NEVER TOP UP!!**
- Disinfectants must not be used to sterilize instruments or equipment (unless specified in the disinfectant policy, e.g., endoscopes).
- Disinfectants should be supplied, preferably ready for use from the pharmacy (new stocks to be supplied on receipt of empty containers). Do not discard empty containers or use them to store other solutions. Chemicals can be harmful when used in the wrong situations.
- Open containers of disinfectant should not be tolerated in any health care environment
- There is a serious risk of contamination with multiple antibiotic-resistant bacteria, such as *Pseudomonas* spp and spores.
- When disinfectants are indicated for use on surfaces, WIPE (do not wash, bathe or flood-wash).
- Always thoroughly decontaminate, then clean articles before disinfection, i.e., remove any substances, such as dirt and biological materials.
- The HF pharmacy should ensure that:
  - Containers are thoroughly cleansed, washed, and dried
  - Containers are clearly labelled with the type of contents, the in-use dilution, and the expiry date
  - None of the disinfectants are exposed to inactivating substances, i.e., cork, rubber caps, or incompatible detergents

Note: *Disinfectants should be diluted by knowledgeable personnel in manageable quantities, e.g. 5 litres or less, to reduce waste. Partially filled containers must not be left on the wards (prevent hoarding).*

2.6 HEALTH CARE WASTE

The aim is to provide technical guidance on safe HCWM and to ensure compliance with HCWM regulations, standards, procedures, and specifications to protect public health and safeguard the environment.

2.6.1 Health Care Waste Classification

2.6.1.1 Non-Hazardous Waste

Non-hazardous waste is waste that has not been in contact with infectious agents, hazardous chemicals, or radioactive substances and does not pose a sharps hazard. A significant proportion (about 85%) of all waste from HFs is non-hazardous and is usually similar to municipal solid waste. More than half of all non-hazardous waste from HF is paper, cardboard, and plastics and the rest is discarded food, metal, glass, textiles, plastics, and wood.

2.6.1.2 Hazardous Health Care Waste

Hazardous waste poses a potential threat to public health and the environment. It can be solid, liquid or gaseous. Hazardous waste is classified into the following:

- **Infectious wastes:** Theses are materials that may contain pathogens (bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. It includes waste contaminated with blood or other bodily fluids.
- **Highly infectious waste**: All waste materials containing, blood, fluids with viable biological agents from infected persons or artificially cultivated in significant elevated numbers; waste from infected patients in isolation wards, cultures, and stocks; dishes, and devices used to transfer, inoculate, and mix cultures of infectious agents. In case of notifiable, highly infectious diseases, i.e. VHFs, such waste materials should undergo extra treatment procedures.
- **Sharps:** These are items that could cause cuts or puncture wounds and infections. Sharps include needles, hypodermic needles, scalpels, and other blades, knives, infusion sets, saws, broken glass, and pipettes. Whether or not they are infected, such items are usually considered hazardous health care waste and should be treated as potentially infectious.
- **Pathological waste:** These wastes consist of tissues, organs, body parts, blood, bodily fluids, and other waste from surgeries and autopsies. It also includes human foetuses and infected animal carcasses.
- **Pharmaceutical wastes:** These include expired, unused, spilled, and contaminated pharmaceutical products, prescribed and proprietary drugs, vaccines, and blood sera that are no longer required; because of their chemical or biological nature, they need to be disposed of carefully. The category also includes discarded items heavily contaminated during the handling of

pharmaceuticals, such as bottles, vials, and boxes containing pharmaceutical residues, gloves, masks and connecting tubes.

- **Genotoxic wastes:** These include certain cytostatic drugs, vomit, urine, or faeces from patients treated with cytostatic drugs, chemicals, and radioactive material.
- **Chemical waste:** These consist of discarded solid, liquid, and gaseous chemicals; for example, from diagnostic and experimental work and cleaning and disinfecting procedures. Chemical waste from health care is considered hazardous if it has at least one of the following properties:
  - o Toxic (harmful)
  - o Corrosive (e.g., acids of pH <2 and bases of pH >12)
  - o Flammable
  - o Reactive (explosive, water reactive, shock sensitive)
  - o Oxidizing

Wastes from materials with a high heavy-metal content is a subcategory of hazardous chemical waste and are usually highly toxic. Mercury and cadmium are examples of highly toxic yet common substance in HFs. Mercury wastes are typically generated by spillage from broken clinical equipment (thermometers and aneroid blood pressure equipment) and dental amalgam; cadmium waste comes mainly from discarded batteries.

- **Radioactive waste:** These are materials contaminated with radionuclides. They are produced as a result of procedures such as in vitro analysis of body tissue and fluid, in vivo organ imaging and tumour localization, and various investigative and therapeutic practices, which include liquids, gases, and solids contaminated with radionuclides whose ionizing radiations have genotoxic effects. The ionizing radiation of interest in medicine includes X-ray, gamma rays, alpha and beta particles. An important difference between these types of radiation is that X-ray tubes emit only when generating equipment is switched on whereas gamma rays, alpha and beta particles emit radiation continuously. The type of radioactive material used in HFs results in low-level radioactive waste and concerns mainly therapeutic and imaging investigation activities where cobalt-60, technetium-99m, iodine-131, and iridium-192 are most commonly used.

2.6.2 HCW Minimization, Reuse, and Recycling

For efficient and effective minimization of health care waste, authorities, HFs, and other stakeholders shall establish and practice strategies for avoiding and reducing waste and reusing and recycling as follows:

- Minimizing health care waste shall include source reduction and use of medical procedures that reduce the volume of waste generated
- HFs should put in place mechanisms to restrict the purchase of supplies that produce a lot of health care waste

2.6.2.1 Recycling

- HFs should use separate colour-coded containers placed at the source of waste generation for recyclable materials.
- HFs should practice effective waste segregation at the point of generation to facilitate recycling.
- All recyclable health care waste must be properly treated before removing it from HFs.

Companied interested in recycling medical materials must register for the business with the Environmental Health Registration Board.

2.6.2.2 Reuse

- Surgical equipment and other items, which are designed for reuse and are sensitive to heat, shall be sterilized by approved procedures.
- Operating and waste treatment costs should be reviewed periodically to evaluate any fluctuations. Data shall be collected to allow comparisons between HFs and establish benchmarks.

2.6.3 Segregation of Health Care Waste

HFs shall segregate waste to protect personnel from injury and infection by preventing hazardous waste from entering inappropriate waste streams.

All standard operating procedures of health care waste segregation, packaging, and labelling shall be displayed in each department:

- Segregation of health care waste shall be done at the generation point and is the responsibility of the person/institution that generate it.
- Segregation receptacles must be placed as close as possible to the waste generator as this will avoid cross-contamination.

- Standard colour-coded receptacles for each category of waste shall be provided by HFs.
- Segregation of health care waste shall consist of separating different waste materials based on the type, treatment, and disposal or recycling options.
- The mixing of non-hazardous and hazardous waste is not permitted. If mixing occurs, all waste contained together shall be classified and treated as hazardous waste.
- Staff engaged in the segregation of health care waste shall wear appropriate PPE.

Table 2.7: Colour coding

Waste category	Type of waste	Colour of receptacles and liners
Non-infectious waste	Paper, packaging materials, plastic bottles, food remains, boxes, cartons	Black/blue
Infectious waste	Used gloves, dressing materials, specimen containers, infusion packages, catheters, urinal bags	Yellow
Highly infectious waste	Anatomical waste, blood, bodily fluids, pathological waste, culture materials, stocks, petri dishes, waste from isolation ward or camp	Red
Sharps waste	Used syringes and needles, surgical blades, scalpels, needles, prickers, blades, broken glass (e.g., pipettes, ampoules, vials)	Yellow safety boxes

Source: (MoHSW, 2007)

2.6.4 HCWM Procedures

2.6.4.1 Collection and Onsite Transportation of Health Care Waste

For efficient and effective collection and transport of health care waste, authorities or HF management shall:

- Provide standard equipment for collection and transport of health care waste
- Provide appropriate PPE
- Supervise staff to adhere to use of PPE
- Collect infectious waste on a daily basis
- Collect hazardous and non-hazardous waste on separate trolleys

- Use the most direct and shortest route from the collection point to the central storage facility or disposal point and avoid food preparation areas and heavily populated areas
- Be transported using colour coded/labelled transportation equipment that is not used for any other purpose
- Collect waste according to scheduled and reliable pick up times
- Not leave collected waste anywhere, even temporarily, other than at the designated central storage facility
- Not be transported by hands to avoid the risk of accident or injury
- Mark all bin liners and/or containers of waste to identify the unit/ward where the waste was generated
- Have spare trolleys/wheeled bins available in case of breakdowns and maintenance
- Clean and disinfect all trolleys and wheeled bins after every use
- Ensure that all waste bag seals are in place and intact at the end of transport
- There should be separate, secured storage rooms to maintain segregation of:
  - o Radioactive waste
  - o Waste containing mercury

2.6.4.2 Health Care Waste Storage

For efficient and effective storage of health care waste, authorities or HFs shall:

- Provide a secured and fenced health care waste storage bay
- The bay should have an impermeable, hard-standing floor with good drainage system, easy to clean and disinfect in line with standards and procedures for HCWM
- Ensure separate labelled storage compartments for various types of health care waste
- Provide a separate compartment for radioactive waste storage
- Not store infectious waste for more than 48 hours from the time of generation

2.6.4.3 Offsite Transportation

For efficient and effective off-site transportation of health care waste, authorities or HFs shall comply with the following:

- Before transportation of waste, dispatch documents should be completed.
- All arrangements should be made between consignor, carrier, and consignee.
- In case of trans-boundary movement, the consignee should have confirmed with the relevant, competent authorities that the waste can be legally transported.

- Transport on public roads should only be conducted by licensed companies.
- Transport vehicles and drivers must meet legal requirements for the transport of hazardous waste.

Note: *For more detailed information, refer to HCWM guidelines* (MoHCDGEC, 2017).

2.6.4.4 Health Care Waste Treatment

Health care waste should be treated before disposal. Methods for treatment depend on the waste's characteristics, technology, and environmental and safety factors. The five processes for treatment of hazardous health care waste are thermal, chemical, irradiation, biological, and mechanical. The choice of treatment system depends on local conditions and involves consideration of:

- Available resources including technical expertise
- Waste characteristics and volume
- Technical requirements for installation, operation, and maintenance of the treatment system
- Safety and environmental factors
- Cost considerations

Notes on mercury and radioactive waste:

- Radioactive materials and mercury require special treatment methods and special supervision with technical expertise.
- Radioactive waste materials should be managed under the supervision of and recommendations by the Tanzania Atomic Energy Commission.
- Mercury-containing medical devices should be stored and collected centrally for further disposal using internationally accepted disposal options.

2.6.4.5 Disposal Methods

The MOHCDGEC recommends the following disposal options for non-hazardous and hazardous waste that requires direct disposal.

Burning Chamber

Rural health centers and dispensaries can burn waste in a burning chamber as per MoHCDGEC HCWM guidelines.

Open burning of contaminated waste is not recommended because it is hazardous.

Incineration

- Incineration, which is a dry oxidation process, is used to reduce organic and combustible waste into inorganic incombustible matter at high temperature.
- Incineration provides high temperatures and destroys microorganisms and therefore is the best method for disposal of contaminated wastes.
- Having centralized incineration is acceptable if the HF is not capable of managing incineration by itself.
- Ashes from the incinerator should be disposed in an ash pit.
- Health care waste that cannot be reused, recycled, or dumped in a landfill site should be incinerated.
- There should be an efficient monitoring system for proper functioning of incinerators.

Non-Hazardous Waste Disposal

- Non-hazardous waste shall be disposed of at public, designated disposal sites.
- In case there is no public disposal site, the authority shall establish a designated disposal site for non-hazardous waste that meets public health and environmental requirements.
- Open burning is strictly not allowed for all types of waste.
- The designated disposal site should be fenced and secured against unauthorised access.

Hazardous Waste Disposal Options

Hazardous waste must be treated before final disposal. MoHCDGEC recommends the following disposal options for various types of hazardous waste.

Pathological Waste Disposal

- Every HF should have a standard, designated placenta pit within the facility premises.
- Other pathological waste must be treated, incinerated, or buried.
- In case of human remains, they must be cremated or buried in a public cemetery.

Disposal of Hazardous Ash

Fly ash and bottom ash from incineration is generally considered hazardous because of the possibility that it contains heavy metals, dioxins, and furans.

- Hazardous ashes should be disposed of in centralized sites designed for hazardous wastes.
- In the absence of designated disposal sites, HFs should construct a standard ash pit within or offsite the facility premises.

Sharp Waste Disposal

Even after sterilization, sharp waste may still pose physical risks. HFs should do the following:

- Sterilized sharp waste can be disposed of in safe sharp pits on the HF premises or encapsulated by mixing waste with immobilizing material like cement before disposal.
- If recycling opportunities exist, sharp waste should be sterilized and taken to licenced companies for recycling.
- Sharps can be incinerated if a high technology incinerator exists; needles can be smelted and the ash disposed of by burial.

Disposal Options in Emergency Situations

- The authority should take appropriate health care waste management practices in line with the type of waste generated.
- Appropriate disposal options and procedures must be followed, including interim minimal disposal practices.
- Open dumping of boxes/bagged waste should be avoided.

Liquid Waste Management

There should be adequate, accessible, and appropriate toilets for patients, staff, caretakers, and people with special needs. Wastewater produced should be treated and disposed of safely to protect workers and the environment:

- For facilities with onsite sanitation, if it involves emptying the sockaway pit, the content should be treated in sedimentation ponds.
- For facilities connected to a sewage system, the liquid waste from HFs should be treated before being discharged into sewage or the receiving body
- Note that sludge and sewage from HFs generated by a basic wastewater management system should never be used for agricultural or aquacultural purposes. Effluents should meet required Biological Oxygen Demand (BOD) standards.
- Liquid pharmaceuticals in vials (but not cytotoxic materials) can be crushed

in a closed bucket, mixed with sawdust, and the solid mass incinerated or encapsulated.

Special Waste Classes

Chemical wastes contain heavy metals (mercury), Unintentional Persistent Organic Pollutants (UPOPs), pharmaceutical and cosmetic waste, radioactive waste, and e-waste (refer to HCWM guidelines for management and disposal).

- Pharmaceutical waste and chemical waste should be stored until a safe disposal option has been identified (refer to guidelines for pharmaceutical disposal).
- Equipment or instruments containing mercury should be replaced with non-mercury instruments/equipment.

2.7 WASH IN HEALTH CARE FACILITIES

WASH services provide for water availability and quality, presence of sanitation facilities, and availability of soap and water for hand washing. Adequate WASH is an essential component of providing basic health services. Providing WASH in HFs serves to prevent infections and spread of disease, protect staff and patients, and uphold the dignity of vulnerable populations, including pregnant women and the disabled. Many HFs in low-resource settings have no WASH services, severely compromising the ability to provide safe and people-centered care and presenting serious health risks to both health care providers and those seeking treatment.

2.7.1 Water Supply

Water Quality

Water for drinking, cooking, personal hygiene, medical activities, cleaning, and laundry are safe for the purpose intended. Water free from coliform bacteria meets the national drinking water quality guideline. All HFs should treat water with chlorine to meet drinking water standards. The purpose is to provide microbial safety. If the HF is dealing with a diarrheal epidemic, the level of residual chlorine should be increased to 1 mg/L at end points. However, for other emergencies, the free chlorine residual after each contact time should be between 0.5 and 1.0 mg/L (WHO, 2011).

Sufficient water collection points and water use facilities are available in all service

areas to allow convenient access to and use of water. Sources of water for drinking, food preparation, personal hygiene, hand washing, bathing, and laundry should be clearly identified.

Note: HFs should monitor water quality quarterly.

Water Quantity

HFs must ensure that sufficient quantities of water are available to meet all the minimum daily requirements for IPC and medical activities, drinking, laundry, bathing, hand washing, and cleaning. This may require interventions to repair the water supply or power supply, if the water system requires power to function. It may also involve installation of temporary water storage facilities, such as demountable steel water tanks, bladder tanks, or polyethylene tanks. It is recommended that minimum water quantities needed during emergencies are stored.

Table 2.8: Water requirements for specific needs in HFs

Area	Quantity of Water Required
Health centres and hospitals	5 litres/outpatient 40-60 litres/inpatient/day Additional quantities may be needed for laundry, flushing toilets, etc.
Cholera centres	60 litres/patient/day 15 litres/carer/day
Therapeutic feeding centres	30 litres/inpatient/day 15 litres/carer/day
Public toilets	1-2 litres/user/day for hand washing 2-8 litres/cubicle/day for toilet cleaning
All flushing toilets	20-40 litres/user/day for conventional flushing toilets connected to a sewer 3-5 litres/user/day for pour-flush toilets
Anal washing	1-2 litres/person/day

Source: (Tietjen L, 2003)

Emergency Water Supply Planning

To determine how much water supply (quantity and quality) will be required during an emergency, the HF should first carry out a water use audit, which will involve:

- Estimating the quantity and quality of water required for various functions to meet emergency demands
- Identifying which functions are essential to protect patients' health and safety and should remain in operation; this could include functions such as medical gas and suction for ventilator patients if compressors are water cooled. Identify functions that can be temporarily restricted or eliminated (e.g., elective surgery, routine outpatient visits) in the event of an interruption in the facility's water supply.
- Determining the steps required to temporarily restrict or eliminate some functions; for example, this could include transferring new acute patients to unaffected facilities
- Finding the locations of other available alternative water supplies
- Identifying emergency water conservation measures, including an emergency water restriction plan

Table 2.9: Recommended minimum water quantities for HFs in emergencies

Activity	Quantity of water required
Inpatient	40-60 litres/patient/day
	15 litres/carer/day
Operating theatre or maternity unit	100 litres /intervention
Staff	5 litres/consultation
Outpatients	5 litres/consultation
Dry / supplementary feeding centre	0.5–5 litres/consultation (depend on waiting time)
Wet supplementary feeding centre	15 litres/consultation
Inpatient therapeutic feeding centre	30 litres/patient/day
	15 litres/carer/day
Cholera treatment centre (CTC)	60 litres/patient/day
	15 litres/carer/day

Activity	Quantity of water required
Acute respiratory or isolation ward	100 litres/patient/day
	15 litres/carer/day
VHF isolation ward	300–400 litres/patient/day
	15 litres/carer/day

Source: (WHO, 2015)

Availability of Sufficient Number of Toilets for Users

It is recommended that there should be at least 1 toilet available for every 20 users in inpatient HFs and for every 25 users in outpatient settings. It is recommended that urinal units be provided in addition to toilets in all male toilet blocks. Provision of urinals should consider the number and frequency of users, appropriateness of urinal designs, availability of water, and maintenance arrangements. For inpatients, HF bedpans should be available for seriously sick persons or children.

2.7.2 Specific Excreta Disposal Requirements

Demand for sanitation services should be determined by the level of the facility. In accordance with the sanitation adequacy criteria outlined above, each level of HF will have excreta disposal facilities (types and number) depending on the number of clients and staff and the services it provides as well as the existing infrastructures, such as blocks and departments.

Table 2.10: Excreta disposal guidelines for HF levels

Facility level	Number and types of excreta disposal facilities
Dispensary	1) 2 Staff toilets (separate for males and females) 2) 2 Toilets for male and female clients 3) Male toilets should include urinal units 4) At least 2 latrines for people with disabilities; 1 for males and another for females together 5) Additional latrine(s) may be provided next to reproductive and/or child health clinics (RCH) facility depending on the building layout and specific needs in an area 6) Flush and/or pour-flush toilets with water seals are the recommended latrine options for dispensaries. Ventilated improved pit latrines may be provided in areas with critical water shortages and for interim use. 7) Placenta pit with cover is recommended.
Health centers	The following facilities should be provided at the outpatient (OPD) or/and client reception areas: 1) 2 Staff toilets (separate for males and females) 2) 4 Toilets (separate) for male and female clients 3) Urinals should be provided in all male toilet blocks. 4) 2 Toilets for people with disabilities for males and females 5) Additional to the toilets at the OPD or/and client reception area at least one toilet for each ward, service unit and a set of male and female accommodations for staff and clients in office blocks. A health centre should provide no less than 12 latrine/toilet units in total, inclusive of providing for people with special needs. 6) Flush toilets, pour-flush latrines, and other advanced water-based options provided with adequate water supplies are recommended for installation in health centres. 7) Excreta disposal and bathing facilities should be provided specifically for delivery clients. Toilets at the delivery unit must be flush toilets with water seals. 8) Bed pans as per HF requirements 9) Health centres must be provided with a conventional sewage system onsite or offsite for effective liquid waste transportation and disposal. The sewage systems must be properly maintained and monitored. 10) Placenta pit with cover is recommended.

Facility level	Number and types of excreta disposal facilities
District hospitals	1) Excreta disposal infrastructure should include at least 2 staff toilets (separate for males and females), 4 toilets (2 each for male and female clients), and 2 toilets for people with disabilities to be used by males and females in each of the facility's functional blocks or departments. 2) Actual number of toilets and urinals should be designed based on the number of clients being attended. 3) At least 1 toilet for each ward, service unit, and a set of male and female accommodations for staff and clients in office blocks and client reception areas should be provided. 4) Excreta disposal facilities (including urinals) for hospitals must be water-based with flushing systems that adhere to high quality standards. 5) No pit latrines (even improved) are allowed in a hospital setting. 6) Excreta disposal facilities for hospitals must be provided with sufficient water for regular operations and maintenance all the time. 7) Sufficient sewage system onsite or offsite (connected to public sewer) should be provided to support excreta disposal systems in accordance with the type of sanitation infrastructure. 8) Excreta disposal and bathing facilities should be provided specifically for delivery clients. Toilets at the delivery unit must be flush toilets with water seals. 9) High temperature incinerator and placenta pit with cover is recommended.
Regional referral hospital	1) At least 2 staff toilets (separate for males and females), 4 toilets for male and female clients, and 2 toilets/latrines for people with disabilities to be used by males and females in each facility's functional block or department. 2) Actual number of toilets and urinals should be designed based on the number of clients being attended. 3) At least one toilet for each ward, service unit and a set of male and female accommodations for staff and clients in office blocks and client reception areas should be provided. 4) Adequate quantities of mobile receptacles (wheel chairs with receptacles) and bed pans should be allocated in each ward. 5) Facilities for excreta disposal, waste water, solid waste management, and environmental cleanliness for regional referral hospitals should adhere to minimum requirements as provided for hospital level. 6) Excreta disposal and bathing facilities should be provided specifically for delivery clients. Toilets at the delivery unit must be flush toilets with water seals. 7) High-temperature incinerator and placenta pit with cover is recommended.

Facility level	Number and types of excreta disposal facilities
Specialized zonal and national referral hospitals	1) At least 2 staff toilets (separate for males and females), 2 toilets for male and female clients, and 4 toilets for people with disabilities to be used by males and females in each of the facility's functional blocks or departments. 2) Actual number of toilets and urinals should be designed based on the number of clients being attended. 3) At least 1 toilet for each ward, service unit, and a set of male and female accommodations for staff and clients in office blocks and client reception areas should be provided. 4) Adequate quantities of mobile receptacles (wheel chairs with receptacles) and bed pans should be allocated in each ward. 5) Excreta disposal and bathing facilities should be provided specifically for delivery clients. Toilets at the delivery unit must be flush toilets with water seals. 6) High-temperature incinerator is recommended.

Landscaping, Gardening, and Outdoor Spaces

Outdoor spaces play a critical role in the creation of dignified environments for treatment, as well as a key role in IPC. Landscaping should be considered and integrated into any facility design to produce a well-planned exterior environment.

Durable and appropriate furnishing can be easily integrated into the landscape to create comfortable and low-cost outdoor gathering areas that contribute to IPC as well as staff and patient comfort (details can be found in National HCWM guidelines (MoHCDGEC, 2017).

2.7.3 Hand Washing Facilities and Specifications for HFs

2.7.3.1 Hand Washing Facilities and Specifications

Hand washing facilities and materials are important for promotion of hand hygiene practices. Each HF should have access to hand washing facilities and materials with acceptable WHO specifications as presented in table 11.

Table 2.11: Recommended specifications for hand washing facilities in HFs

Hand washing facility	Specifications
Hand washing basin	• Non-porous material, round shape inside with dimensions of 25 cm by 35 cm depth and without overflow • Elbow/sensor operating taps, uPVC traps and plastic gadgets • Wall-mounted basin fixed at 120 cm above floor
Soap/detergents dispenser	• Auto sensor dispenser
Hand drying equipment/ materials	• Centred feed hand towel dispenser • Drying material should be a disposable towel (tissue papers)
Water supply	• Both hot and cold, which meets WHO and Tanzania water quality standards
Sanitizer	• Used for hand hygiene when hands are not visibly soiled
Waste bin	• Round black pedal bin of 12 L (340 mm height × 270 mm diameter)
Hand washing basin for disabled people	• Wheel chair accessible hand wash basin, wall mounted with dimensions of 510 mm length by 685 mm width

2.7.3.2 Surgeon Scrub Sinks

These are plumbing fixtures well equipped to enable medical personnel to scrub their hands prior to surgery. A surgical scrub sink is essentially used in the operating theatre and is designed to promote proper hand washing practices and reduce any possible contamination since all operating procedures are sterile procedures. The sinks are provided with hot and cold water, which is activated by a knee-action mixing valve or by wrist or foot control as shown in figure 9.

Figure 2.9: Surgical scrub sinks

Source: (MAC Medical, Inc, 2018)

For maintaining the required hygiene practices, the surgery scrub sink should have the following characteristics:

- Made of vitreous china, stainless steel, or a material whose durability and imperviousness are equivalent to vitreous china
- Adequate size and design to permit the scrubbing of both hands and arms without having to come in contact with any surface
- Sized and shaped to prevent splashing of the user
- Non-swivel faucet that provides adequate flow for quick rinsing
- Hands free operation (electric eye or knee/foot operation) and be designed to prevent contamination of the hands when water is activated
- Manual adjustment of water temperature
- Seam-free backsplash integrated with the sink that extends at least 60 cm above sink level

- Backsplashes covering the areas under the paper towel dispenser and soap dispenser

2.7.3.3 Paper Towels

Paper towels are used for drying hands. They are more effective, safer, and faster than other methods of hand drying because they more quickly remove bacteria and are less likely to lead to cross-contamination. Paper towels also do not need electrical power. To use paper towels effectively, HFs will have to do the following:

- Provide paper towel dispensers in all areas where hand washing facilities are available
- Mount towel dispensers such that access is free and splashing or dripping onto adjacent wall and floor surfaces is minimized
- Provide single-use paper to turn off faucets to avoid hand recontamination
- Provide paper towels for use on exit door hardware
- Waste bins for used towels should be located near the exit door
- Avoid use of hot air dryers because warm air currents dry hands slowly and can be used by only one individual at a time, resulting in queues and the temptation to dry hands on clothing
- Provide lidded, lined, foot-pedal-operated waste bins with waste bags in close proximity to each hand washing sink
- Ensure that waste paper receptacles are made of corrosion-free material and wide mouth design; space should be allowed for the placement of waste bins in close proximity to the hand

2.7.4 Hand Hygiene Sink Usage

These precautions should be taken to ensure proper use of hand hygiene sinks:

- Hand hygiene sinks should not be dedicated to any other purpose as each sink will be used for a specified purpose.
- Hand washing sinks should be cleaned on a regular basis.
- Hand washing sinks should be regularly inspected to ensure they are maintained in good condition.
- Paper towels and liquid soap should be provided at each hand washing sink.
- A current hand washing guide should be posted at each hand washing sink to promote correct washing methods.

2.7.5 Recommended Hand Washing Facilities for HFs

Tables 12 and 13 provide the WHO recommended numbers of hand washing facilities and their locations within Health Facilities (WHO, 2009).

Table 2.12: Recommended number of hand washing facilities per level of facility and locations

S/ N	HF level	Location of hand washing facility in the HF	Number of hand washing basins
1	**Dispensary**	• OPD consultation room • Injection room • RCH section • Pharmacy • Laboratory • Dressing room • Labour room • Sluice room	8 (1 in each section)
		• Patient toilets (Male and female)	2 (1 in each toilet)
		Staff changing including shower and wash room (male and female)	2 (1 in each toilet)
		Patient toilet for disabled (for both sexes)	1
2	**Health centre**	2 ODP consultation rooms, laboratory, dressing room, injection room, labour room, eye care, dental section, RCH section, CTC, mortuary, pharmacy, and sluice room	13 (1 per each section or room)
		Inpatient department (male and female)	2 (1 per each ward)
		Public toilets (male and female) for able-bodied people	2 (1 per each toilet)
		Public toilets (male and female) for disabled	2 (1 per each toilet)
		Staff changing, including shower and wash room (male and female)	2 (1 per each toilet)

S/ N	HF level	Location of hand washing facility in the HF	Number of hand washing basins
3	**Hospital**	OPD consultation rooms, laboratory, dressing room, injection room, labour room, eye care, dental section, RCH section, CTC, theatre, nutrition room, mental health (psychiatric) section, central sterilization and supplies room, pharmacy, mortuary, and sluice room	Minimum: 19 Maximum: 19+, depending on number of OPD rooms for clinicians (1 per each section/ room)
		• Inpatient department (male and female) • Internal medicine • Surgical ward • Obsy/gyne ward • Paediatric ward	6 (2 per each)
		• Patient toilets (male and female)	2 (1 per each toilet)
		• Labour ward	1
		• Catering area	2
		• Patient toilet for disabled	1 (for both sex)
		Staff changing, including shower and wash room (male and female) of labour ward, internal medicine, obsy/gyne, paediatric, OPD and surgical ward	9 (1 hand washing for each changing room should be provided adjacent to the toilet)

S/ N	HF level	Location of hand washing facility in the HF	Number of hand washing basins
4	**Referral Hospitals**	OPD consultation rooms, laboratory, dressing room, injection room, labour room, eye care, dental section, RCH section, CTC, theater, nutrition room, mental health (psychiatric) section, central sterilization and supplies room, pharmacy, mortuary and sluice room	Minimum: 20 Maximum: 20+ depending on number of OPD rooms for clinicians (1 per each section/ room)
		• Inpatient department (male and female) • Internal medicine • Surgical ward • Obsytetrics/gynaecology ward • TB ward • Postnatal ward	9
		• Patient toilets (male and female)	2 (1 per each toilet)
		• Patient toilet for disabled (male and female)	2 (1 per each toilet)
		• Labour ward	1
		• Neonatal ward • ICU	1 (for neonatal) 1+ (for ICU)
		Catering	2
		Staff changing including shower and wash room (male and female) of OPD section, labour ward, internal medicine, obsy/gyne, paediatric, TB ward, postnatal ward and surgical ward	12 (1 hand washing per each changing room should be provided adjacent to the toilet)
		Administration (facility in charge, matron and patron)	3 (1 for each room)

Table 2.13: Hand washing specifications for specialized/ consultant hospitals

Provisions	Location (directorate/department/section)	Number of hand washing basins
• Hand washing basin • Soap/detergent dispenser • Hand drying equipment or drying material • Waste bin • Soap • Detergents • Sanitizers • Water supply • Standard operating procedure for hand washing	**Medical Services Directorate**	
	OPD	
	• Causality/emergency	18
	• ICU critical	13
	• Referral	8
	• NHIF	8
	• Internal medicine	19
	• CTC services (TB/HIV)	2
	• Pediatric clinic	12
	• Physiotherapy	4
	• Psychiatric clinic	6
	• Staff washroom/ bathroom (male and female)	2
	• OPD pharmacy	1
	• Cardiovascular centre	
	• Super specialty services	21
	• General medicine	15
	• Nutrition centre	1
	• Phlebotomy room	1
	Surgical Services Directorate	16
	• 8 Surgical wards + 8 washrooms	
	• 2 Staff bathroom/wash room (male/ female)	2

Provisions	Location (directorate/department/section)	Number of hand washing basins
	• Emergency medicine theatre	6 (2: theatre, 4: office)
	• ENT clinic (with 3 offices)	3
	Oral health clinic	
	• Radiograph	1
	• Dental room	2
	• Specialist room	4
	OPD eye clinic	
	• Ophthalmologist room	4
	• Other offices	4
	Anaesthesia services	
	• 7 Service rooms	7
	Nursing Services Directorate	
	Block 1 (wards and services)	
	• 8 Wards with 8 offices	16
	• 8 Bathroom/washroom (patients) + 2 disabled (male and female)	10
	• 2 Staff bathroom/ washroom (male and female)	2
	• Clinic	1
	Block 2 (wards and services)	
	• 8 Wards with 8 offices	16
	• 8 Bathroom/washroom (patients) + 2 disabled (male and female)	10
	• 2 Staff bathroom/ washroom (male and female)	2

Provisions	Location (directorate/department/section)	Number of hand washing basins
	Block 3 (wards and services)	
	• 6 Wards with 6 offices	12
	• 6 Bathroom/washroom (patients) + 2 disabled (male and female)	8
	• 2 Staff bathroom/ washroom/ cloak room (male and female)	2
	Psychiatric block (wards and services)	
	• 2 Wards (male and female) with 2 attached staff rooms + 2 bathrooms/washroom	6
	• Acute ward with a staff room +2 bathrooms/ washroom (male and female)	4
	• Private ward with a staff room +2 bathrooms/ washroom (male and female)	
	• Clinic with staff office +2 bathrooms/washroom (male and female)	4
	• 2 staff bathroom/ washroom/cloak room (male and female)	2
	Emergency medicine block	
	• 4 Resuscitation room	4
	• 7 Treatment room	7
	• Triage room	1
	• 2 Staff bathrooms/washrooms/cloak rooms (male and female)	2
	• 2 Patient bathrooms/washrooms (male and female)	2
	Paediatric complex block	
	• Wards, theatre, all other internal medicine rooms	17

Provisions	Location (directorate/department/section)	Number of hand washing basins
	• Patients bathroom/washroom (male/ female)	2
	• Staff bathroom/washroom (male/ female)	2
	Maternity block	
	• 7 Wards and 7 staff offices	14
	• 7 Patient bathrooms/washrooms	7
	• 2 Staff bathrooms/bathrooms (male/ female)	2
	Obstetric theatre (rooms)	
	• OP rooms 1 and 2	
	• Receiving and recovery rooms	2
	• Staff bath/wash/changing room (male/ female)	2
	Main theatre (rooms/sections)	
	• OR	1
	• Receiving, recovery and packing rooms	3
	• Staff bath/wash/changing room (male/ female)	2
	Emergency theatre	
	• OR	1
	• Receiving, recovery and packing rooms	3
	• Staff bath/wash/changing room (male/ female)	2
	ICU (sections/rooms)	
	• 60 rooms for running clinic	
	• 1 Acute Paediatric Care Unit (APCU) and 4 ICU	5
	Catering services	
	• Dining room, kitchen area, staff shower/cloak/toilet	3

Provisions	Location (directorate/department/section)	Number of hand washing basins
	Clinical Support Services Directorate	
	• Haematology	1
	• Microbiology/immunology	1
	• Parasitology/entomology	1
	• Clinical chemistry	1
	• Histopathology/cytology	1
	• Mortuary	1
	• Administrative pathologist	1
	• Radiology (X-ray, ultrasound)	1
	• Special X-ray	1
	• Infusion	1
	• Pharmacy	2

2.7.6 Bathroom Hygiene

Bathrooms are important infrastructures for controlling and reducing transmission of diseases from workers who handle patients. To improve hygiene practices within HFs, it is necessary to have adequate showers with respect to the level of bed capacities and staffing levels. In accordance with WHO, the minimum requirements for bathrooms for each level of HF are provided in tables 14–16.

Whatever level of facility, installation or construction of bathrooms should follow minimum standard guidelines, which will include:

- Separate bathrooms for HCWs and patients clearly labelled to identify the type of users and sex
- Well-drained floor
- Minimum surface area of 3.25 m^2 for a standard bathroom
- Ratio of patient per bathroom of 6:1
- Wall mounted seat in patient bathrooms
- Shower facilities with mixture taps for both cold and hot water
- Functional emergency alarm call system
- There should be enough free room for wheelchair manoeuvring in the bathroom
- Good lighting for extra safety

Table 2.14: Dispensaries and health centre bathrooms

Facility type	Location	Description (number/user)	Specifications as per user (applies to urban and rural settings unless otherwise specified)
Dispensary	Delivery room	1 (for delivering mothers)	• Shower: hand shower (rural: hand shower or clean bucket and small jack) • Shower tap: mix tap for cold and hot water • Soap dish: plastic • Hanger: stainless steel • Room size: o Width 150 cm o Length 200 cm • Water quality: adequate, meets WHO standards • Gall trap: plastic at the bath floor • Sitting chair: bed like (flexible) with smooth washable materials • Water heater: electric heater (rural: electric heater/cooker) • Wall/floor material: tile (rural: tile/cement)
Health center	Delivery room (sluice room)	1 (for delivering mothers)	• Shower: hand shower (rural: hand shower or clean bucket and small jack) • Shower tap: mix tap- cold/ hot water • Soap dish: plastic • Hanger: stainless steel • Room size: o Width 150 cm o Length 200cm • Water quality: adequate, meets WHO standards • Gall trap: plastic at the bath floor • Chair: bed like (movable and flexible) with smooth washable materials • Water heater: electric heater (rural: electric heater/cooker) • Wall/floor material: tile (rural: tile/cement)

Facility type	Location	Description (number/user)	Specifications as per user (applies to urban and rural settings unless otherwise specified)
	Cloak room	4 (for staff, 2 male, 2 female)	• Shower: overhead shower • Shower tap: mix tap for cold and hot water • Soap dish: plastic • Hanger: stainless steel • Room size: 1. Width 150 cm 2. Length 200 cm • Water quality: adequate, meets WHO standards • Gall trap: plastic at the bath floor • Water heater: electric heater (rural: electric heater/cooker) • Wall/floor material: tile (rural: tile/cement)
	Inpatient department (male and female wards)	4 for patients (2 male, 2 female)	• Shower: overhead shower • Hand shower (for disabled) • Shower tap: mix tap for cold and hot water • Soap dish: plastic • Hanger: stainless steel • Room size: o Width 150 cm o Length 200cm • Water quality: adequate, meets WHO standards • Gall trap: plastic at the bath floor • Chair: movable, with smooth washable materials • Water heater: Electrical heater (rural: electric heater/cooker) • Wall/floor material: tile (rural: tile/cement)

NB: Provisions for all facilities: Shower, soap dish, towel/cloth hanger, water supply, walls, adequate room size, water heater, gall trap, sitting facility, detergents

Table 2.15: District and referral hospital bathrooms

Level of HF	Provisions	Location	Description (number/user)
Hospital	• Shower • Soap dish • Towel/cloth hanger • Water supply • Material for walls • Adequate room size • Water heater • Gall trap • Sitting facility • Detergents	Delivery room (Sluice room)	1 (for delivering mothers)
		Cloak room	4 for staff (2 male, 2 female)
		• Inpatient department (male and female wards) • Internal medicine • Obsy/gyne • Surgical	14 for patients (2 male, 2 female for each ward)
Referral hospital		Delivery room (sluice room)	1 (for delivering mothers)
		Cloak room	4 for staff (2 male, 2 female)
		• Inpatient department (male/ female wards) • Internal medicine • Obsy/gyn • Surgical • TB ward • Postnatal ward • Mental health	26 for patients (2 male, 2 female for each ward)

Table 2.16: Bathrooms for specialized hospitals and consultant hospitals

Provisions/structure	Location	
	Directorate	**Department/section**
• Shower • Soap dish • Towel/cloth hanger • Water supply • Material walls/floors • Adequate room size • Water heater • Gall trap • Sitting facility • Detergents	Medical Services Directorate	**OPD**
		• Staff bathroom
		• Patients' bathroom
		• Disabled patients' bathroom
		• Staff bathroom
	Nursing Services Directorate	**Block 1 wards**
		• Patients bathroom
		• Disabled patient's bathroom
		• Staff bathroom
		Block 2
		• Patients' bathroom
		• Disabled patients' bathroom
		• Staff bathroom
		Block 3
		• Patients' bathroom
		• Disabled patients' bathroom
		• Staff bathroom
		Psychiatric block
		• Patients' bathroom (male/female)
		• Acute ward bathroom
		• IPPM ward bathroom
		• Staff bathroom
		Emergency block
		• Staff bathroom
		• Patients' bathroom
		Pediatric complex block
		• Staff bathroom
		Maternity block
		• Staff bathroom
		• Patients' bathroom

Provisions/structure	Location	
	Directorate	Department/section
	Surgical Services Directorate	**Main theatre (rooms/sections)**
		• **Staff bathroom**
		Emergency theatre
		• Staff bathroom
		ICU
		• Bathrooms of 60 units
	Clinical Services Support Directorate	**Catering services**
		• Bathroom for male and female
		• Bathroom for staff of clinical service support sections
		• Bathroom for staff of mortuary and pathologist

2.8 LAUNDRY SERVICES IN HFS

HFs' soiled linens harbour pathogenic microorganisms; hence the risk of actual disease transmission from soiled linen is inevitable.

HF laundries should be well designed with good drainage systems, be easy to clean, and must conform to standards and procedures for HCWM, and hence must have the following minimum qualities.

2.8.1 Structure, Design and Layout of HF Laundry Facilities

The following criteria should be considered in design and layout of laundry structures in a health care setting:

- Hospitals and health centres must have washing machines. For dispensaries, a washing slab may be constructed within the facility premises, but it must have drainage.
- If the laundry is built in a multi-story building, linen and laundry services should be located on the ground floor.
- The area to be used must be specifically designated as a laundry and no other activities can be carried out in the same premises.
- The laundry must not be located in a site that is directly accessible to the kitchen.

- The laundry layout must provide for adequate and safe activity flow. It should have a separate entry for dirty linen, a separate area for sorting dirty linen, and an exit for clean linen.
- There shall be a separate area for drying washed linen.
- There should be areas for ironing, folding, repairing, and storing clean linen within the laundry facility.
- Linen will be separated according to department.
- There should be a changing room for staff.
- A separate hand hygiene sink for staff with wall-mounted dispensers for soap and paper towels should be provided.
- An industrial tumble dryer and washing machine with a sluice and disinfection cycle must be available. The dryer should be vented externally.
- The door to the laundry room should be wide enough to admit heavy machinery and trolleys. The room should be high enough to allow installation and repair.
- The room should have smooth, washable walls and ceiling; edges, corners, and projections should be covered with glazed ceramic tiles up to 8 inches in height. Walls and floors should be impervious and properly sealed.
- The room should have adequate ventilation and natural and artificial light.
- Plastic fluid-repellent aprons and household gloves must be provided for laundry staff.
- The laundry room should not be used for eating or smoking.
- All workers at the laundry will be vaccinated against HBV.

Figure 2.10: An example of the design of a hospital laundry

2.8.2 Laundry Personnel

- The laundry manager shall have appropriate knowledge of the potential infectious hazards of soiled linen.
- When linen management is outsourced, the designated HCWM must provide close supervision.
- Laundry staff must be provided with regular information on potential infectious hazards and techniques to prevent the spread of microorganisms in the environment to finished linen and to themselves, as well as safe and appropriate handling procedures for soiled and clean linen.
- An orientation/training module designed for laundry staff is to be implemented in the facility as part of IPC training.
- Key staff members are fully trained in appropriate laundry skills and technology; those skills should be maintained by on-going training and supervision; only appropriately trained personnel should handle and store chemicals.
- Instruction should be provided to staff on personal hygiene, particularly the need for hand washing after handling soiled linen or removal of protective clothing.
- Other laundry personnel include senior housekeeper, dhobi, sweeper, tailor (who may be a part-time housekeeper).
- All personnel must have a medical record kept upon employment. The record should contain the following:
  1. Presence or absence of symptoms attributable to TB, viral hepatitis, mumps, measles, rubella, sexually transmitted infections, and past history of any of those infections
  2. Complete physical examination
- Periodic evaluations may be done as indicated for job reassignment, on-going programs, or evaluation of work-related problems.
- The staff needs to report all infections, such as gastroenteritis, dermatitis, pustules, skin lesions, and boils and seek immediate medical attention.
- Occupational exposures, including needle-stick injuries, should be immediately reported to the supervisor and/or IPC officer of the facility. A sharps container should be available in the sorting and wash area. The occupational exposures protocol should be available.
- Immunization requirements for linen and laundry personnel are based on immunization recommendations, i.e., HBV.

2.8.3 Specifications of Required Laundry Services in HFs

Table 17 lists the recommended specifications for laundry services in each category of HF. However, it should be noted that the size of the laundry facility depend on the number of beds in the HF. The normal standard is that 1 patient requires 2.5 kg of linen per day.

Table 2.17: Specifications for Laundry Services at Different Levels of HFs

HF category/level	Provisions/structures	Specifications
Consultant hospital	Quality water, soap, washer extractor, dryer, sinks, folding table diapers, mop heads, cleaning rags and supplies.	8,400 sq ft for 570 beds 58,947 sq ft for a national hospital with 4,000 beds
Regional and district hospital		8,400 sq ft for 570 beds
Health centre		
Dispensary		

2.8.4 Planned Preventive and Maintenance of a Laundry Facility

Simple preventative maintenance practices on washer-extractors and tumble dyers helps extend the life of the equipment. Hence, it is important that the following preventive practices be done as recommended:

- Create a working schedule for daily, weekly, and monthly cleaning of the laundry
- Develop a monthly laundry assessment tool to determine any damage to the laundry facility and plan for replacements and repair
- Wipe down the door seals at least once a day to make sure they are dry and clean
- Check all visible hoses, paying close attention to the water inlet valve hose connection at the back of the machine as well as any chemical connections
- Clean the lint compartment and screen daily; this allows electrical components to blow, maintains proper air flow, and avoids overheating
- Check the cylinders daily for debris to avoid damage to the linens and equipment
- Wipe down the outside surfaces of washer-extractors and tumble dryers each day

2.8.5 Processing Linen

Laundry service is responsible for providing an adequate, clean, and constant supply of linen to all users. The basic tasks include sorting, washing, extracting, drying, ironing, folding, mending, storage, and delivery.

2.8.5.1 Sorting Linen from the Wards or Sections

- Soiled, used, or contaminated linen must be sorted before it is sent to the laundry.
- Do not rinse or sort linen in patient care areas (sort in appropriate area).
- Each ward or section area must have three colour-coded buckets with covers, hampers, or plastic bags for keeping linen; for example, red for highly infectious, yellow for infectious, and black/blue for non-infectious.
- All used linen must be removed from the wards or area of use within 24 hours.

Note: *Soiled linen should be rinsed and then decontaminated with an approved disinfectant in the laundry, i.e., 0.05% chlorine for 20 minutes.*

2.8.5.2 Transporting Linen

- Dirty and clean linen should be transported in different trolleys, bins, bags, or other transport means, including vans or other motor vehicles. If this is not practicable, then trolleys, bins, bags, or other transport means that were used to transport soiled linen should be thoroughly cleaned/rinsed and decontaminated with hospital-approved disinfectant and dried before being used for transporting clean linen.
- Bags containing soiled linen should be handled carefully to avoid damage and the release of possible contaminated aerosols into the air.
- Workers should not carry wet, soiled linen close to their bodies, even if they are wearing a plastic or rubber apron.

2.8.5.3 Unloading and Storage of Soiled Linen at the Laundry

- Soiled linen shall be processed for washing within 24 hours of collection.
- Soiled linen shall be stored in an area separated by a barrier wall from where clean linen is stored or dispatched.
- Sorting soiled linen for washing is one of the most important operations in the laundry process.
- Staff should handle dirty linen with care to prevent contamination of their uniform/clothes, equipment, and the environment and to avoid injury.
- **Inspect linen and remove** foreign and in some cases dangerous objects (e.g., sharps or broken glass), from soiled linen before transporting to laundry and washing.
- This step is extremely important because soiled linen from the OR or clinic

occasionally contains sharps (e.g., scalpels, sharp-tipped scissors, hypodermic and suture needles, and towel clips).

- Sorting shall be according to soil quantity and nature of the linen and segregation according to highly infectious and infectious (table 18).

Table 2.18: Segregation of used linen

Bag colour	Linen type
Yellow	Infectious (dry linen)
Red	Highly infectious; fouled (soiled with blood or bodily fluids) infectious, isolation, and cytotoxic (attach a cytotoxic label) (wet or soiled linen)
	Clean linen from laundry to wards or from linen room to wards

Source: (MoHSW, 2007)

2.8.6 Laundering the Linen

Prewashing

Linen, which is heavily soiled with blood, other bodily fluids, or other fluids must be rinsed with clean water disinfected with an appropriate disinfectant before placing in the machine.

Thermal Disinfection

- Soiled linen that is to be thermally disinfected shall be washed so that the temperature of the load is maintained at a minimum of 70 °C for not less than 25 minutes or 90 °C for 10 minutes (WHO, 2004)
- It is known that 60 °C for 30 minutes kills HIV, 70 °C for 10 minutes kills vegetative microorganisms, and 98 °C for 2 minutes kills HBV.
- If the thermal stability of the soiled linen is such that temperatures above 71 °C are permissible, the time for disinfection may be appropriately reduced.
- The loads in the machines should be as specified by the manufacturers' recommendations. The proper function of the machines, such as the time and temperature of cycles, should be checked regularly with calibrated instruments.
- Any sensing elements should be placed so that they measure the actual wash temperature (i.e., the temperature of the water in contact with the load).
- As it will take time for heat to penetrate the load, a time allowance for mixing and load level shall be made to ensure that the load is maintained at the correct

temperature for the minimum time period.

- For low loading, 4 minutes shall be allowed, and for high loading, 8 minutes, The minimum time/temperature combinations are therefore:
  - o 70 °C maintained for not less than 25 minutes; minimum cycle time is 14 minutes for low loading or 18 minutes for high loading
  - o 71 °C maintained for not less than 3 minutes; minimum cycle time is 7 minutes for low loading or 11 minutes for high loading
- Steam or gas may be used to heat the laundry.

Chemical Disinfection

- Soiled linen that is heat sensitive and cannot be thermally disinfected shall be washed using a wash cycle and appropriate chemicals registered with the Tanzania Food and Drug Administration, e.g., chlorine 0.05% for 20 minutes.
- Wash used linen (sheets, cotton blankets) in hot water (70–80 °C) for 3 minutes; use detergent, rinse, and dry, preferably in a dryer or in the sun.
- Heavy-duty washers/dryers are recommended for hospital laundry.

Radioactive and Radiation Contaminated Linen

Linen contaminated with radiation or any radioactive material shall be handled, stored, transported, or otherwise disposed of in accordance with the laws, standards, and implementing rules and regulations of the Tanzania Atomic Energy Commission.

Note:

- Some textile items (e.g., surgical drapes and reusable gowns) must be sterilized before use and therefore require steam autoclaving after laundering.
- Use hygienically clean linen (i.e., laundered but not sterilized) in NICUs.
- Burn unit linen need not be sterilized (unless specified by institution-specific policy) but should at least be hygienically clean.

2.8.7 Hand Washing Linen

Step 1: Decontaminate linen in 0.05% chlorine solution for 20 minutes to aid ..... cleaning and bactericidal action. This should be done after rinsing to ..... remove blood, faeces, and vomitus.

Step 2: Use warm water; wash heavily soiled linen separately from non-soiled items.

Step 3: Wash the entire item in water with liquid soap to remove all soil, even if not visible. Add soap (a mild acid agent) to prevent yellowing of linen, if ..... desirable.
Step 4: Check the item for cleanliness. Rewash if it is still dirty or stained.
Step 5: Rinse the item with clean water.

2.8.7.1 Detergents for Hand Washing Linen

- Alkali for soil removal and suspension
- Liquid surfactant or detergent for removal of soil and to prevent re-soiling
- Chlorine bleach/peroxide bleach for disinfection and whitening
- Neutralizer for souring/neutralizing after bleaching
- Fabric softener (optional)

The recommended wash cycle is as follows:

- Prewash
  - o Wetting (flushing)
  - o Prewash 1 (alkali)
  - o Prewash 2 (rinsing)
- Main wash (using detergent or surfactant) with minimum temperature and wash time (see thermal requirements)
- Rinsing cycle
  - o Rinse 1 (with bleach)
  - o Rinse 2 (water)
  - o Rinse 3 (neutralizer and/or fabric softener)
- Water extraction
- Separation
- Drying; tumble drying is preferred over other methods

Hand washing linen should only be done in rural dispensaries where there is no electricity

2.8.8 Storage of Clean Linen

It is highly recommended that HFs maintain at least 4 sets or rotations of linens: 1 set in use, 1 set in the laundry, and 2 sets as reserve stock
Cleaned linen should be stored in a clean, dry place such that it is:

- Distinctly separated from soiled linen
- Protected from contamination (e.g., by aerosols, dust, moisture, and vermin) and stock can be rotated, so that the oldest stock is used first

- Stored on non-porous, clean shelves and, if necessary, wrapped in a protective covering

Unused linen shall be reprocessed after 3 months.

2.8.8.1 Packing and Delivery

Depending on the size of the delivery and the nature of the items to be delivered, cleaned linen which is to be returned to the client should be packed (either loose or tied in bundles) into clean trolleys, bins, baskets and covered to prevent soilage or into clean bags and securely fastened.

- Clean linen should be stored in closed cupboards, dedicated covered trolleys, or designated covered storage areas with good ventilation and adequate lighting.
- Washed linen is placed in clean containers or on clean surfaces.
- Carts, marked trolleys, or other leak-proof containers are cleaned before taking clean linen back to the wards.
- Clean linen is covered or wrapped during transportation.

2.9 FOOD HYGIENE FOR WARD/UNIT KITCHENS PROCEDURE

2.9.1 Introduction

- It is essential that food and drinks provided in a health care environment are handled and managed so that patients and staff are not put at any risk.
- All staff involved in the food chain must ensure good food hygiene practices at all times. Failure to do so could result in a serious outbreak of food poisoning and potential loss of life.
- The serving of food is an important part of the food chain when preventing food poisoning. It is here that good food hygiene practices, including adherence to temperature and time controls, is essential.
- Sources of bacteria that may cause food poisoning include people (food handlers), raw food, pests (insects, rodents, cats, and birds), refuse, and waste food.

2.9.2 Ward/Unit Kitchens

- The design of a kitchen area should provide the minimum practicable equipment necessary for the satisfactory operation of the area. This will reflect the nature of activities to be carried out.

- All internal finishes must be intact and capable of being cleaned.
- All food preparation surfaces must be smooth, impervious, easy to clean, and durable.
- Backsplash should be provided at the rear of sinks, work surfaces, and hand wash basins.
- A lidded waste bin should be provided for the disposal of kitchen waste.
- Any equipment that does not stand on work surfaces should be mobile or wall mounted to facilitate cleaning.
- A supply of drinking water should be provided to the sink. This supply should be marked "drinking water."
- Every kitchen should display a notice that clearly sets out the following key information:

  001. The name of the unit manager who is responsible for the maintenance of . food hygiene standards in the area

  002. Who is allowed to use the area

  003. What activities are permitted in the area

  004. The cleaning tasks within the area together with a clear statement of who is responsible for their satisfactory completion.

2.9.3 Regeneration Points (where relevant)

Regeneration points should be sited in the main kitchen. If that is not possible and they must be sited elsewhere, it should not be next to toilets, bathrooms, dirty utility rooms, or other sources of contamination.

The regeneration area must have the following facilities:

- A hand washing basin with a backsplash, soap dispenser, and paper hand towels.
- Ventilation
- Cleanable/impervious wall surfaces
- A non-slip easy to clean floor
- Foot-operated waste bin
- Electricity

2.9.4 Personal Hygiene

- Always wash your hands before touching food and after using the toilet. Nails must be kept short.
- Hand washing basins must be provided with hot and cold running water, liquid

soap, and paper towels; they should not be used for any other purpose. Access to the hand wash basin must be kept clear at all times.

- Smoking in any kitchen, food storage area, or while delivering or receiving food is prohibited by law.
- Disposable aprons must be worn during the serving of meals; clean clothing is essential.
- Cuts and sores on hands must be covered with a clean, waterproof, high-visibility plaster.
- Staff must not handle food if they have even minor infectious conditions, especially those with any form of skin sepsis or gastrointestinal upset.

2.9.5 Guidelines on How to Clean Food Areas

All ward kitchens and refrigerators are bound by legal requirements and therefore must conform to food hygiene regulations.

The local authority environmental health officer has open access and can inspect food preparation areas at any time.

2.9.5.1 Refrigerators

- Refrigerators must be maintained at a temperature of 5 °C or below and must only be used for short-term storage.
- Contents of the refrigerator should be checked daily, and out-of-date food discarded.
- Perishable food must be kept covered and stored in the refrigerator. Food must be labelled with the individual patient's name and dated with that day's date. Food must be discarded when it reaches its expiry date.
- The temperature must be checked at least once per day and recorded in a log book. Adjustments must be made if the refrigerator temperature is outside the acceptable range (5 °C or below). The temperature must be rechecked after a suitable time period to ensure that adjustments have taken effect.
- Blood, drugs, and specimens MUST NOT be stored in kitchen refrigerators and freezers.
- Freezers should only be used in areas where there is a clearly defined need.
- Temperatures should be monitored and recorded daily. The operating temperature of the freezer should be –18°C. If the unit is unable to maintain the required temperature, it should be replaced.
- Blood, drugs, and cold compresses MUST NOT be stored in the freezer.
- Food should be subject to stock rotation.

2.9.5.2 Dry

- Dry food must be stored in washable pest and moisture-proof containers in a clean, dry cupboard or larder, not under the sink.
- Care must be taken to ensure that breakfast cereals, hot drinks, and therapeutic supplement feeds are used in strict rotation, with those closest to their expiry date used first, avoiding over ordering and stock piling of supplies.
- Expiry dates must always be checked before each use. It is illegal to provide patients with food that is out of date.

2.9.5.3 Microwave Ovens

- Microwaves must not be used for reheating patients' meals.
- They may also be used to heat drinks and cereals for patients.
- The manufacturer's instructions must be followed at all times in relation to use, cleaning, and maintenance.

2.9.5.4 Water Coolers

- These must be installed and used in accordance with the manufacturer's instructions.
- Machines should be plumbed into a drinking water supply. Machines that require manual filling are not recommended. Milk should be available in either individual containers or in minimal quantities.
- Fresh milk that is left out at room temperature should be disposed of after a maximum of one hour.
- Containers and jugs for milk should be thoroughly washed before refilling.
- If breakfast is served buffet style, jams and spreads must be available in individual portions.

2.9.6 Temperature Control

- Ensure that food is served immediately and never reheated. Kitchen staff confirm that the food has reached the required temperature (above 63 ºC) by using the appropriate temperature probe.
- Ensure patients eat food promptly.
- If patients are away from the unit at meal time, the hot meal must never be retained for longer than 30 minutes. If the patient is likely to be away for longer, then a meal will need to be arranged for them on their return.

Note: *Safety depends on strict control of time and temperature at ALL stages.*

2.9.7 Preparation of Supplement Drinks and Food

Patients who have an inadequate calorific intake or require encouragement with their diet may require supplement drinks to boost their calorific intake. If supplement drinks are recommended, it is the responsibility of the nursing staff to prepare and distribute them in a safe manner that prevents contamination. The following recommendations therefore apply.

Single Fluid Cartons

- These need not be refrigerated before use if they are in a sealed container. Refer to the instructions on the packet.
- Check that the date on the carton has not expired before opening.
- Once a carton has been opened, it should be consumed within 4 hours or refrigerated. They should be labelled with the date and time of opening before placing in the refrigerator.
- After 24 hours of refrigeration, they must be discarded.

Powdered Sachets

- Before preparing, ensure that hands are washed well and implements used for mixing are clean and dry before use.
- Sachets should be mixed according to the manufacturer's instructions with cold, freshly drawn tap water, freshly boiled water, or cold milk directly from the refrigerator.
- Sachets that have already been opened should not be used.
- These drinks should be prepared in the designated kitchen/kitchen area.
- Once mixed, any drink should be consumed within 4 hours; if it is not, it must be discarded.
- No opened packets should be brought from home.

Patients/Relatives

- The manager controls patient/relative access.
- Patients/relatives are not permitted to prepare their own meals in the kitchen.
- If preparing meals is considered part of a patient's therapy, then they must be supervised by a member of the staff.
- If patients are permitted to have their own food, it should be labelled with the patient's name and dated, placed in sealed containers, and stored for a maximum of 24 hours, then discarded. It should never be reheated.

Cleaning

- All food surfaces and utensils must be thoroughly cleaned after use with clean and safe (chlorinated) water.
- When possible, crockery, cutlery, water jugs, and food containers must be washed in the ward dishwasher, if provided.
- Cleaning equipment and materials for the kitchen must be kept separate from other cleaning equipment. Colour coding of equipment, i.e., cloths must be adhered to.
- Store cleaning chemicals away from food at all times. These should be kept in their original containers and NEVER decanted into other bottles.
- Do not allow refuse to accumulate in kitchens.
- Place trash in bins/receptacles immediately and empty frequently.

Maintenance

- Report all faults or defects to the facilities and estates team for that area.
- There should be a regular, planned maintenance programme in place for equipment, e.g., water coolers.

2.9.8 Procedure for Food Poisoning Incidents

This will require careful investigation and the following should be carried out:

- Isolate symptomatic patients in a single room. Advice must be sought from the quality improvement team (QIT) or the on-call microbiologist via the switchboard after normal working hours.
- A stool specimen must be provided, even if the patient is vomiting, but does not diarrhoea, i.e., passing normal stool.
- If staff are affected, they must go off duty and provide a stool specimen via the Occupational Health Department or their own clinician.
- If food poisoning is confirmed, a full investigation will be carried out by the catering manager and the IPC department in conjunction with other relevant staff/organisations as required.

Reporting Illnesses

- Personal illness MUST be reported because food poisoning bacteria can be carried on/in the body and thereby passed to food.
- Always report diarrhoea and vomiting immediately to your manager and the Occupational Health Department.

- Septic conditions and skin infections must also be reported to your manager and the Occupational Health Department.

Manager's Responsibilities

Managers need to be aware that the regulations relating to food safety legislation apply to all premises and sites where food services are provided. They apply to all areas where food or drinks are supplied for consumption by patients, staff, and visitors.

Guidelines for Kitchen Services

- HF kitchens should be well designed with a good drainage system and ventilation, be easy to clean, and conform to standards and procedures for running a food establishment.
- All windows should have screens to control flies and other insects.
- The food store should be clean and free from vectors.
- There should be a separate changing room for male and female kitchen staff.
- There should be adequate hand washing facilities with running water and liquid soap.
- Food handlers should be screened every six months (medical examination, pre- and regular).
- There should be a smoke chimney to control air pollution.
- There should be adequate waste bins.

When kitchen services are outsourced, they should be closely supervised by a designated health officer. Conditions for outsourcing kitchen services should necessarily include appropriate business registration and license, registration with the Tanzania Food and Drug Administration, and acceptable environmental cleanliness of the business premises.

2.9.9 Distribution of Food

- Distribution of food involves getting food from preparation point to point of service.
- Food should be put in individual serving containers at the preparation point before being distributed to patients to avoid double handling.
- Food should be delivered to the patient in containers/trolleys that preserve temperature.

2.10 MORTUARY HYGIENE

Mortuary hygiene includes general cleaning and laundering, disinfection of essential post-mortem/autopsy equipment, functioning refrigerators, availability of formalin, appropriate PPE, vaccinations, accidental exposure to blood or bodily fluids, and HCWM and washing facilities.

2.10.1 General Cleaning and Laundering

This includes cleaning different areas, such as preparation tables, chairs, lights, doors, cupboards, floors, walls, washing sinks, washrooms, and windows. The general cleaning procedures in the mortuary should be as follows:

- Cleaning is carried out every day in the morning, after every service, or whenever necessary.
- All parts of equipment and furniture that were used to provide mortuary services should be cleaned by using disinfectants mixed with soap.
- Linen and mackintosh after post-mortem examination should be changed.
- Single-use gloves should be worn when handling contaminated, re-useable linen. These should be placed in a laundry bag for routine laundering.
- Cleaning equipment, such as mops and brushes, should be cleaned after use. If they are solid, they have to be washed, soaked in chlorine solution 0.05% for 10 minutes, and then dried.

2.10.1.1 Cleaning and Disinfection of Essential Post-Mortem/Autopsy Equipment

When cleaning and disinfecting essential equipment for post-mortem and autopsy, the following aspects should be seriously taken into account:

- Cleaning instruments must be done in a dedicated sink and not the normal hand washing sink.
- PPE should be worn while cleaning.
- Instruments used on intact skin may be cleaned and stored in a dry place, but instruments that penetrate the skin must undergo cleaning and sterilization.
- Used items should be removed from their transport containers and sorted according to the appropriate cleaning method.
- If cleaning cannot be performed immediately, then instruments should be covered in warm water to prevent soils from becoming fixed, which would make cleaning difficult.
- Instruments should be cleaned and then subject to HLD or sterilized.

- Disinfectant solutions should be labelled appropriately (with the name, date, and dilution strength)
- Chemical disinfection should be used only for items for which sterilization and thermal disinfection are not suitable, for example, items that cannot be immersed in water (thermal) or that cannot withstand high-pressure gradients (sterilization).
- A 0.5% chlorine solution is sufficient for disinfection. These items should then be rinsed with distilled water before being dried and stored.
- Chemical disinfectant solutions should be discarded immediately after use.
- The container should have a close-fitting lid.

2.10.1.2 Other Essential Aspects in Maintaining Mortuary Hygiene

In addition to the above guidelines, other critical hygiene practices, which each HF should ensure are properly addressed in the mortuary environment, are outlined in table 19.

Table 2.19: Other critical aspects in maintaining mortuary hygiene

Aspect	Precautionary measures
Appropriate PPE	• Mortuary staff and relatives should wear PPE (gloves, plastic aprons, gowns, protective eye wear, face masks that cover the mouth and nose, boots) when handling dead bodies. • PPE should be removed after handling the dead body; immediately wash hands with liquid soap and water. • Placement of boots and procedures for discarding or washing clothing must be clearly designated and displayed . • Single-use PPE must be disposed of as infectious waste.
Thermal disinfection	• This should only be used for items that can be fully immersed in water at high temperatures. All items must be fully immersed for the entire time once the water boils. • Additional items must not be added during the boiling stage.
Body storage	• Bodies should be stored in a functioning refrigerator and must be maintained at a temperature between 2 to 6 °C. • If long-term storage is required, the body should be maintained at approximately –20 °C. • A body suspected of harbouring infectious diseases or that exhibits decomposition, trauma, or suspicious death should be contained within a durable body bag that is impermeable to bodily fluids.
Embalming chemicals	• There should be embalming chemicals, e.g., formalin, to temporarily prevent decomposition and restore a natural appearance for viewing a body after death.
Washing facilities	• Changing rooms with shower facilities must be available in the mortuary.
Vaccination	• HBV vaccination should be provided to all mortuary staff.
Accidental exposure to blood or bodily fluids	• In case of percutaneous injury or mucocutaneous exposure to blood or bodily fluids from the dead body, the injured or exposed areas should be washed with copious amounts of water. • All incidents of percutaneous or mucocutaneous exposure should be reported to the supervisor for proper wound care and post-exposure management.
HCWM	• Items classified as health care waste must be handled and disposed of according to HCWM guidelines.

2.10.1.3 Equipment and Supplies Needed for Keeping the Deceased in Mortuary

- Running water
- Soap/antiseptic
- Disinfectant
- Syringes and needles
- Glycerine formaldehyde and paper tissues
- Wheeled trolley
- Refuse bins and bags
- Translucent plastic body bags
- Wall charts/whiteboard/blackboard
- Morgue refrigerator (cold room)

2.10.2 Procedure for Caring for the Deceased at Mortuary (Embalming)

- Identifying the deceased
  - o Mortuary receives the deceased from the ward
  - o Check if identification tags are in place with correct information
  - o Adhere to principles of respecting privacy and dignity
  - o Check if the deceased is in own nightwear or hospital gown and wrapped with two sheets
  - o Check if the mortuary pillow is placed under the deceased's head when transferring to the mortuary

- Embalming the deceased
  - o Transfer the deceased body from the concealment trolley onto the tray
  - o Untie the deceased's bandages and sheets
  - o Check if the deceased body has fluid leakage
  - o Assist in embalming (preserving) the deceased body from decomposing by injecting formalin
  - o Pad all body orifices to prevent fluid leakage
  - o Apply glycerine to the deceased's whole body to prevent fungal and mould growth
  - o Wrap the body with a clean sheet and in a good position
  - o Secure sheet with tape
  - o Tie a tag around the ankle for identification
  - o Wrap the deceased body with a second sheet and fasten securely

- Do NOT tie the neck too tight because it will cause facial disfigurement
- Fold sheets appropriately to cover the head and feet, ensuring that all limbs are held securely in position
- Fix with bandages and/or safety pins
- Tape a second identification tag to the outside of the sheet (or into a clear pocket at the head of the body bag)
- Place the deceased in a body bag if there is evidence of fluid leakage
- Place the deceased body in the morgue refrigerator and close it properly

- Procedure for decontamination after caring for the deceased
- Adhere to standard precautions on IPC
- Remove PPE, e.g., gloves and apron
- Decontaminate used equipment
- Disinfect the trolley/carrier used to transport the deceased body with disinfectant
- Document deceased's particulars
- Write the deceased's particulars on the whiteboard/chalkboard

2.10.3 Mortuary Layout

- For the purpose of IPC, the facility must comprise clean activity areas, transit areas, and dirty activity areas.
- The workflow should be planned to minimize and obviate, where possible, the need for movement of people and materials from potentially dirty activity areas to clean activity areas.

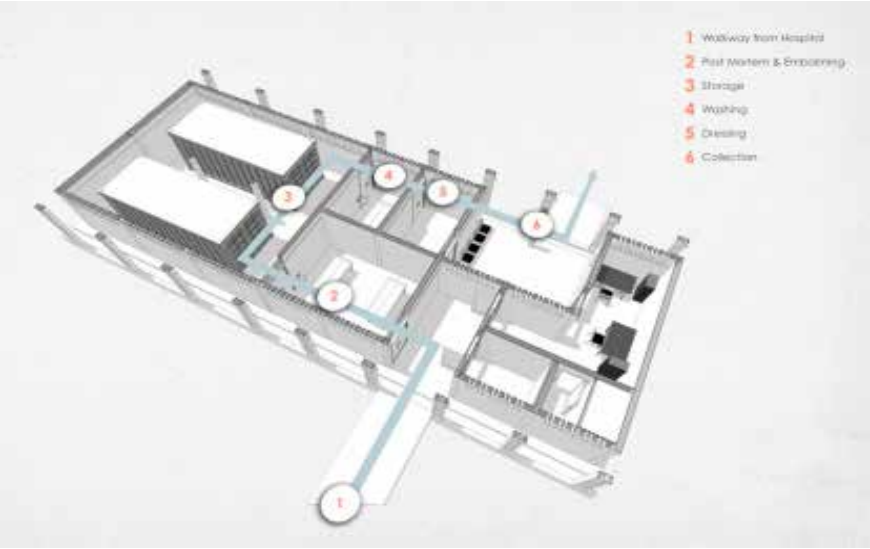
Dirty activity areas include the:

- Post-mortem room
- Dirty utility room/instrument store
- Body stores

Clean activity areas include the:

- Reception area
- Waiting room(s)
- Interview/counselling room(s)
- Viewing room(s)
- Bier room(s)

Figure 2.11: Layout of mortuary



Source: Adapted from *https://tesseractproject.files.wordpress.com/2014/04/3dlayout-2.jpg?w=414&h=292 Accessed on 30 May 2018*

2.10.3.1 Entrances

- The number of entrances will be determined by whether the building is freestanding or connected to other hospital buildings.
- If the building is free-standing, three entrances are required: one for staff, one for the delivery of bodies from the hospital or community (if appropriate) and for collection by undertakers, and one for visiting relatives and friends.
- If the building is connected, the number of entrances required will depend on whether staff, relatives, and the arrival of bodies from the hospital share a common approach and then follow separate traffic routes to the individual entrances to the relevant parts of the mortuary, or whether there is direct access from a hospital street to the different parts of the mortuary.
- In either case, an entrance will be needed for collection of bodies by undertakers and, if appropriate, bodies arriving from outside the hospital.

2.10.3.2 Body Viewing Room

- This should comprise, at the very least, a separate entrance, a waiting room, an interview/counselling room, access to sanitary facilities, a viewing room, and a bier room.

- In the waiting room, interview/counselling room, viewing room, and bier room, a serene and reassuring environment is desirable.

2.10.3.3 Interviewing Room

- The interview/counselling room should contain comfortable chairs and a small table.
- Coroner's officers or mortuary staff may use the room to explain findings from post-mortems or to comfort relatives of the deceased.

2.10.3.4 Viewing Room

- The viewing room should connect to both the waiting room and bier room. The wall adjacent to the bier room should incorporate a sliding viewing window at a suitable height to allow wheelchair users to touch and view the body.
- There should be 6 functional windows covered by easily drawn curtains or blinds.

2.10.3.5 Bier Room

- The bier room should adjoin the body handling area and the viewing room. A body to be viewed may be prepared in the body handling area and laid out on a draped bier trolley, which will then be wheeled into this room.
- Connecting doors between the two should allow easy, noiseless passage of the trolley and, while viewing is in progress, be kept securely shut.
- Flooring in the bier room should be washable and continuous with that of the body handling area or the connecting link between the two.

NB: *Both the viewing room and the bier room should be capable of minor adaptation to suit the needs of all religious beliefs and for devising more appropriate arrangements for viewing the bodies of infants.*

2.10.3.6 Body Store and Body Handling Area

A refrigerated body store is required to:

- Maintain bodies and/or fluids in a condition whereby the maximum scientific information can be obtained from a post-mortem and subsequent analytical investigations
- Limit tissue decomposition while burial or cremation arrangements are being made
- Hold bodies and the occasional specimen for longer periods in secure conditions

Body Handling Area

- Body handling area should be adjacent to the post-mortem room and adjoin the bier room.
- Body weighing facilities are required. A body may be weighed on either a separate weighing machine or on a trolley that incorporates a weighing mechanism.
- Space is required in the body handling area for parking and manoeuvring trolleys.
- Space is also required for receiving bodies on trolleys from the hospital.
- Space is also required for:
  - The labelling or identification of bodies and entering details in a record book or computer,
  - The placing of shrouds on bodies,
  - The transfer of bodies to the refrigerated body store,
  - The removal and transfer of bodies from the body.

2.10.3.7 Body Storage Room

- The body store consists of a number of labelled compartment bays (refrigerated at approximately 4 °C), each containing three to five racks for holding body trays upon which bodies are stored.
- Individual compartment bays may be physically separated from one another or may be open between one another in a continuous run.

o The former may be used to store radioactive and other high-risk bodies.

o Compartment bays may have a door at one end or may be double-ended in the case of pass-through fridges; the latter, although more expensive, are preferable for reasons of hygiene and efficiency. Pass-through fridges require additional space on the post-mortem side to allow for extraction of bodies.

o Depending on the size of the installation, a number of the compartment bays should be deep-frozen, and extra wide compartment bay(s) should be provided to accommodate obese bodies.

2.10.3.8 Specification for Post-Mortem Table/Slab

- Post-mortem tables should be easily cleanable and free from traps for potentially infected material.
- Each table should have a hot and cold water supply and a waste outlet of about 75 mm in diameter, fitted with a suitable, readily accessible trap and drain pipe.

- They should be fixed to the floor, located over a drain, and be supplied with water at low pressure.
- The dissecting bench should have raised edges and slope to a sink(s), which should be deep enough wash organs.
- There should be provision for running water over the bench.
- A sluice is required for opening intestines and disposal of contents. A low-pressure water pipe should be provided, preferably in the wall of the sink(s).
- A standing waste bin with a filter trap is required.

2.10.4 Preparation of Deceased for Post-Mortem

2.10.4.1 Equipment and Supplies Needed for Post-Mortem

- Metal ruler
- Dissecting kit
  - o Dissection knife
  - o Strong forceps
  - o Two scalpel handles (one for cutting, one for burning organ surfaces before taking a microbiology sample)
  - o Stout scissors (for cutting bones) and fine scissors for dissection
- Handsaw
- Lab supplies
- Syringes and needles to obtain samples for serology, haematology, or cytology
- Clean glass slides for collecting smears and containers for keeping specimens

2.10.4.2 Preparation of a Deceased for Post-Mortem

Before post-mortem

- Wash hands
- Wear PPE
- Clean and disinfect equipment, instruments, and surfaces of the post-mortem room
- Lay out all surgical instruments and lab supplies, and ensure that they are in good working order

During post -mortem

- Identify the deceased for post-mortem by name using name tags and the registration book

- Remove the deceased from the freezer or refrigeration unit
- Place the body on the post-mortem table
- Remove mortuary linen from the deceased
- Lay out all surgical instruments
- Hand the needed equipment to the mortician
- Handle containers for specimens
- Put specimen for autopsy and investigation into an appropriate container
- Cover the deceased with mortuary linen
- Return the body to storage

Care of the equipment and supplies after post-mortem

- Remove dirty linens
- Soak dirty linens, rinse, and dry
- Disinfect the post-mortem table and equipment
- Wash the post-mortem table and equipment
- Store equipment
- Send laboratory specimens, if needed
- Remove PPE
- Wash hands

2.10.5 Preparation of Deceased for Burial at the Mortuary/Household

2.10.5.1 Relevant Documents Needed for Burial of Deceased

- For non-infectious bodies
  - o Burial permit
  - o Various bill receipts according to HF regulations
- For Police cases
  - o Police form no. 3 (PF3) for deaths that require an investigation or police report
  - o Burial permit
  - o Seek advice before interfering with anything that might be relevant to establishing the cause of death
- All information attached to the wrist or ankle of the deceased
- Details of what happened leading up to the death written by the person who pronounced life extinct
- For infectious bodies
  - o Burial permit

- Infectious verification notes
- Notifiable note

2.10.5.2 Equipment and Supplies Needed for Preparation of Deceased for Burial

- Screen for privacy
- Gloves for protection against infection
- Scissors for cutting bandages
- Apron for protection
- Identification tags
- Kidney dish/container for gauzes
- Galipot/container for cotton swabs
- Cotton wool for packing orifices of the deceased
- Sinus forceps for packing cotton wool into the orifice of the deceased if in the mortuary
- Dissecting forceps for removing soiled dressing, if any, in the mortuary
- Plaster for securing gauze in case of wound
- Antiseptic soap for washing hands
- Disinfectant for preventing infection
- Deodorizer for combating foul smell
- Paper towels for drying hands
- Suture thread and needles, if in the mortuary
- Plastic or nylon bags if needed
- Protective clothing and shoes (surgical gowns, caps, masks, etc.)
- Running water for washing the deceased
- Good natural ventilation
- Wheeled trolley for transporting deceased within the mortuary
- Refuse bins and bags for used items
- Translucent plastic body bags, if needed

2.10.5.3 Procedure for Preparation of Deceased for Burial

- Wash hands
- Prepare equipment
- Put on PPE
- Identify the deceased to be prepared and verify
- Take the deceased out of the refrigerator

- Bring the deceased to the washing place
- Unwrap the deceased
- Check the condition of the deceased to determine swelling, bruises, wounds, or leakage
- Dress each wound and any incisions made by applying very strong glue
- Wash the body with cold water and soap and dry thoroughly
- Close eyelids with small sutures on the top and bottom lids, if needed
- Close the mouth using sutures in both lips made from the inside, if necessary
- If it is a police case remove all IV cannulas and lines in situ, IV infusions, and catheters
- Wash the body and mouth after investigation
- Dress deceased according to religion or culture
- Assist the family in applying cosmetics, when necessary
- Place the deceased in the coffin supporting the head higher than the rest of the body
- Lift the coffin onto the trolley
- Move the coffin to the viewing room and hand it to the person responsible for the last respects or religious activities
- Ensure all relevant documents are present
- Ensure all bills have been settled, if applicable
- Document all information as required in the register
- Clean the room and the trolley following the IPC protocol
- Continue using universal infection prevention measures to protect people and the scene from contamination
- Wash hands with soap

Note: Preparation for the deceased depends much on the cause of death.

2.10.5.4 Assisting the Family at the Household Level to Prepare the Body for Burial

- Assist family in following personal hygienic measures when handling a dead body:
  - o Avoid direct contact with blood or bodily fluids from the dead body
  - o Put on gloves
  - o Make sure any wounds, cuts, and abrasions are covered with bandages or dressings

- Observe hand hygiene
- Make sure the body is clean and dry

- Assist the family in preparing the dead body for burial:
  - Preparation of a deceased for a burial depend on the needs, personal life, culture, and religion of the deceased.
  - During preparation, the deceased should be treated with dignity and respect.
  - Regardless of what type of disposition the family chooses, bathing and disinfecting the body are important.
- This is done not only for the safety of the funeral home staff, family, and friends, but also for the dignity and respect of the deceased.
- A human body starts to change immediately after death occurs and bathing and disinfecting are necessary:
  - Prepare the body safely.
  - Be aware of the family's cultural practices and religious beliefs.
  - Help the family understand why some practices cannot be done because they place the family or others at risk for exposure.
  - Counsel the family about why special steps need to be taken to protect the family and community from illness.
  - Identify a family member who has influence with the rest of the family and who can make sure family members avoid dangerous practices, such as washing or touching the body without gloves.
  - After bathing, consider clothing and other mementos. such as jewellery and glasses.
  - Options will vary depending on religious beliefs.

Clothing and Other Articles

- The deceased can be dressed in simple garments or particular outfits.
- Clothes previously worn by the individual may be used.
- Jewellery and mementos, such as wedding rings, glasses, tie clips, etc. can be removed before final disposition takes place.
- These items can be temporary for viewing purposes or they can be left with the individual indefinitely.
- The final step is preparing the body for private or public viewing.
- Environmental control:
  - Advise the family to buy disinfectant, such as household sodium hypochlorite (JIK).

- Assist the family with disposing all used materials.
- Make sure that all linen contaminated with blood or bodily fluids is soaked in freshly prepared household bleach for 30 minutes before washing.

2.10.5.5 Educating Relatives on Self-Protection when Handling an Infectious Deceased

Diseases that can be transmitted as a result of improper handling of an infectious body:

- HBV
- HBC
- Cholera
- Ebola
- Anthrax
- Meningococcal meningitis
- Rift Valley fever
- Yellow fever

Categories of Deceased Based on the Risk of Infection

- Infectious deceased are those who died due to one of the following:
  - HIV
  - HCV
  - Meningococcal meningitis
  - SARS
  - Avian influenza
  - Cholera
  - Rabies

- Highly infectious deceased are those who died due to one of the following:
  - Anthrax
  - Plague
  - Ebola
  - VHFs
  - Rift Valley fever

- The risks of infection can occur at any stage of handling and disposal of human remains, including:

- Initial collection of remains
- Transport of remains from initial collection point
- Storage of remains prior to burial or cremation
- Hygienic preparation or laying out
- Post-mortem examination
- Embalming
- Laundering, cleaning instruments, and disposal of waste used by a deceased
- Exhumation

Methods of Protecting Self and the Contacts of Infectious Deceased

- Adopt all safety standards for the handling of deceased because not all cases of infection will have been identified before death.
- Adhering to standard precautions is the single most important element in preventing the spread of infection from the deceased individual.
- Standard precautions include hand hygiene, wearing PPE, and careful handling of sharp instruments.
- For infectious deceased: Use gloves, water-resistant gown/plastic apron, and surgical mask; use goggles or a face shield to protect eyes, if splashing might occur.
- For very infectious deceased: Use water-resistant gown/plastic apron, surgical mask, eye protection (goggles or face shield), double gloves, and shoe covers/ boots.
- Transport the deceased from the HF in a sealed coffin.
- During ritual/religious preparation, discourage viewing, touching, and preparation of the body by the family.
- Burial should take place as soon as possible to minimize the risk of spreading the infection.
- Dispose of contaminated, valueless material used by the deceased by burning, burying, or throw in a pit latrine.
- Disinfect valuable materials.
- Wash hands immediately after handling the deceased or his/her belongings.
- Avoid direct contact with blood or bodily fluids from the deceased.
- Make sure any wounds, cuts, and abrasions are covered with waterproof bandages or dressings.
- Do not smoke, drink, or eat during handling of deceased.
- Do not touch the eyes, mouth, or nose after handling infectious deceased.

- Avoid sharps injury, both in the course of examining the deceased and afterwards in dealing with waste disposal and decontamination.

Educating Contacts on Self-Protection when Handling an Infectious Deceased

Assess relatives' emotions to decide their readiness to accept education.

- Identify a family member who has influence with the rest of the family and who can make sure family members avoid dangerous practices, such as washing or touching the body.
- Counsel the family about why special steps need to be taken to protect the family and community from illness.
- Make sure community leaders understand the importance of hand washing, decontamination of surfaces, careful laundering of clothes and bedding, and other home IPC measures.
- Educate the relatives on protecting themselves from the infectious dead body; concentrate on the following:
  - o Hand washing immediately after handling the dead body or his/her belongings
  - o Use of gloves and plastic aprons
  - o Importance of transporting the dead body in a sealed coffin
  - o Discourage viewing, touching, and preparation of the body by the family/ mourners
  - o Avoid contact with blood and bodily fluids
  - o Bury as soon as possible to minimize the risk of spreading the infection
  - o Dispose of contaminated valueless material used by the deceased by burning, burying, or throw in a pit latrine.
  - o Disinfect valuable materials

- Accidental exposure to blood or bodily fluids
  - o In case of percutaneous injury or mucocutaneous exposure to blood or bodily fluids of the dead body, the injured or exposed areas should be washed with copious amount of water.
  - o All incidents of percutaneous or mucocutaneous exposure should be reported to the supervisor.
  - o The injured person should immediately seek medical advice for proper wound care and post-exposure management.

2.11 POST-EXPOSURE PROPHYLAXIS (PEP)

PEP is generally understood to mean the medical response to prevent the transmission of blood-borne pathogens, including HIV, after exposure to blood and other bodily fluids. For more details, refer to National Guidelines on Post-Exposure Prophylaxis Following Occupational and Non-Occupational Exposures to Blood and Other Body Fluids (MoHSW, 2014).

2.11.1 Types of Exposures

Exposures to blood and other bodily fluids or tissues can be categorized as occupational or non-occupational. Table 20 lists the individuals who are potentially at risk for each type of exposure.

Table 2.20: Individuals at risk by type of exposure

Occupational	Non-occupational
HCWs	Victims of sexual assault
Emergency rescuers	People who share needles or sharps (e.g., IV drug users, females who have undergone genital mutilation, and males who have undergone unsafe circumcision procedures)
Waste disposal workers	Individuals who have consensual sex
Law enforcement personnel	Victims of human bites
Fire fighters	Victims of accidents (e.g., road traffic accidents)

2.11.1.1 Risk Classification Associated with Different Types of Occupational Exposures to Blood and Other Bodily Fluids

Different types of occupational exposures are associated with different levels of risk of transmission of blood-borne pathogens.

Table 1.21: Levels of risk according to type and severity of occupational exposures

Risk classification	Type of exposure
High-risk exposure (occupational PEP should be recommended)	• Exposure to a large volume of blood or potentially infectious fluids • Exposure to blood or bodily fluids contaminated with HIV from a source with a high viral load • Injury from a large-bore hollow needle • Injury from a device used in an artery or vein • Injury from a blood-stained device • Deep and extensive injuries • Confirmed drug resistance in the source person • Source person has symptomatic HIV infection, AIDS • Known high viral load, or is in a window period
Low-risk exposure (occupational PEP should be recommended)	• Exposure to a small volume of blood or potentially infectious fluids • Injury with a solid needle • Injury with small needle • Any superficial injury or mucocutaneous exposure • Bite from a patient with visible bleeding in the mouth that causes bleeding in the exposed worker • Exposure to non-intact skin (e.g., dermatitis, chapped skin, abrasion, or open wound) with blood, visibly bloody fluid, or any other potentially infectious material • Source has asymptomatic HIV infection or known low viral load (<1,500 RNA copies/mL), in the absence of other risks (for example, high risks); below is a list of factors that increase risk for the above exposure events: o Source person is known to be HIV-infected with a high viral load o Source person has drug-resistant HIV and AIDS o Source person is in a window period o Deep skin penetration
No risk (occupational PEP is not warranted)	• Exposure to solid-bore needles or sharps not in recent contact with blood • Bite from a patient with visible bleeding in the mouth that causes bleeding in the exposed worker

2.11.1.2 Risk Factors for Occupational HIV Transmission

The likelihood of HIV infection following exposure is affected by the presence of certain factors:

- Type of contact, intact skin or broken skin
- Quantity of blood
- Disease status of source patient
- Increased risk with terminal illness and acute (or recent) infection
- Host defences
- PEP

Post-Exposure Site Management

- Wounds and puncture sites should be washed with soap and water
- Exposed mucous membranes should be flushed with water
- Post-exposure evaluation should be done (type of bodily fluid involved)
- Type of exposure should be determined (percutaneous, mucosal, intact skin, etc.)
- Severity of exposure should be assessed–quantity of blood, duration of contact

2.11.1.3 HIV Risk Classification

Low Risk Exposure

- Exposure to a small volume of blood contaminated with fluid from an asymptomatic HIV patient with low viral titre
- Following an injury with a solid needle
- Any superficial injury or mucocutaneous exposure

High-Risk Exposure

- Exposure to a large volume of blood or potentially infections fluids
- Exposure to blood or fluid contaminated with blood from a patient with a high viral titre
- Injury with a hollow needle
- Deep and extensive injuries
- Confirmed drug resistance in source patients

2.11.1.4 Source Patient Evaluation

- Clinical status assessment
- Screening for HIV status of the patient after consent
- Treatment should not wait for the test result and should commence within 24 hours after exposure

2.11.1.5 Baseline and Follow-Up Testing

- Baseline testing of HIV antibody should be done to establish sero status of the HCW at time of exposure
- Repeat testing should be done at 6 and 12 weeks and 6 months post-exposure, regardless of the use of PEP
- A pregnancy test should be given to all female workers of reproductive age if their pregnancy status is unknown.

2.11.1.6 Counselling the HCW

HCWs should be counselled about their personal risk and recommendation made to start PEP. Discuss the following:

- Efficacy of drugs
- Side effects of drugs or toxicity
- Possible resistance to drugs
- History of the health worker (this will influence choice of drugs); possibility of pregnancy or other pre-existing medical conditions
- Recommend a specific regimen and discuss the rationale for choosing that regimen; emphasize adherence
- Encourage exposed HCWs to seek medical advice for any unusual developments, such as acute illness or drug reaction
- Encourage them to adopt safer sex practices, not to donate blood, and discontinue breast-feeding
- No need to modify his/her work
- Consider getting HBV vaccination, if not already vaccinated

2.11.1.7 Prophylaxis Regimens

The two-drug PEP regimen as it appears in the current National Guidelines for Management and Care of HIV and AIDS (April 2012) is no longer recommended. The only indication for dual therapy is if the third drug has been stopped for reasons of tolerability. Monotherapy of any kind is not recommended and is now obsolete.

Table 1.22: Recommended regimen for HIV PEP following occupational and non-occupational exposures

HIV PEP (ARV) regimen	Current MOHCDGEC recommendations	Comments
Tenofovir 300 mg, once daily Lamivudine 300 mg, once daily Efavirenz 600 mg once daily,	Preferred first option for HIV PEP	Compared to zidovudine-containing regimen, current evidence shows that this combination is better, not only in terms of tolerability, but also efficacy in preventing post-exposure transmission of HIV infection. Studies have shown increased rates of adherence and regimen completion when tenofovir and lamivudine are used as components of HIV PEP regimen.

Note: For alternatives regimens, see the National Guidelines on Post-Exposure Prophylaxis Following Occupational and Non-Occupational Exposures to Blood and Other Body Fluids ((MoHSW, 2014)

2.11.2 Risk Classification Associated with Different Types of Non-Occupational Exposure to Blood and Other Bodily Fluids

For non-occupational exposure, such as injuries or accidents that involve contact of blood and other bodily fluids with the skin, the risk categorization is similar to that of occupational exposure, as presented in table 23. However, for other types of non-occupational exposure, table 23 summarizes the risk classification.

Table 2.23: Risk classification associated with different types of non-occupational exposure

Risk classification	Type of exposures
High-risk exposure (non-occupational PEP should be recommended)	• Unsafe receptive and inserted vaginal or anal intercourse • Rape or assault involving multiple perpetrators • Rape or assault involving anal penetration • Rape or assault in which there is obvious trauma to the genital areas • Rape or assault in which one of the perpetrators is known to be HIV-positive • IV drug users sharing needles (who never shared needles) • Condom spillage or breakage during consensual sex • Rape or assault with no obvious trauma to genital areas • Injuries with exposure to blood or other potentially infected fluids from a source person known to have symptomatic HIV infection, AIDS, high viral load, unknown HIV status (including needle sticks with a hollow-bore needle, human bites, accidents) or is in a window period • Injury in which source person has drug-resistant HIV strain
Low-risk exposure (non-occupational PEP should be recommended)	• Oral-vaginal contact (receptive or insertive) • Oral-anal contact (receptive or insertive) • Receptive penile-oral contact with or without ejaculation • Insertive penile-oral contact with or without ejaculation • Rape or assault involving vagina or mouth • Penetration (with no obvious injuries/trauma) • Bite from a person with visible bleeding in the mouth that causes bleeding in the exposed person • Injuries resulting from trauma cases involving mass casualties--when there is significant cross-contamination with blood and other bodily fluids (e.g., motor traffic accidents) • Injury in which source has asymptomatic HIV infection or known low viral load (<15,000 RNA copies/mL) in the absence of other risks (e.g., high risks) • Below is a list of factors that increase risk for the above exposure events: o Source person is known to be HIV-infected with a high viral load o Source person is in a window period o An oral mucosa that is not intact (e.g., oral lesions, gingivitis, wounds) o Oral mucosa is not intact (e.g., oral lesions, gingivitis, wounds) for oral sex exposure o Lack of male circumcision, cervical ectopy o Blood exposure; it is important to note that blood exposure can be minimal and therefore not recognized by the exposed person. If the exposed person reports frank blood exposure, PEP would be indicated. o Presence of genital ulcer disease or other STIs o Lack of condom use

Risk classification	Type of exposures
No risk (non-occupational PEP not warranted)	• Kissing • Oral-to-oral contact without m§ucosal damage (mouth-to-mouth resuscitation) • Human bites not involving blood • Exposure to solid-bore needles or sharps not in recent contact with blood • Mutual masturbation without skin breakdown or blood exposure

2.11.3 HBV Post-Exposure

Several studies have demonstrated that, in susceptible persons (i.e., negative hepatitis B surface antigen [HbsAg] test and no history of receiving immune serum globulin), giving hepatitis B immune globulin (HBIg) is better than conventional serum immune globulin G (SIgG), or by inference doing nothing, in preventing acute hepatitis B and sero-conversion.

The suggested steps for managing an injury are as follows:

Step 1: Treat the exposure site appropriately (e.g., an open wound or cut).

Step 2: Give tetanus immunization or booster if indicated (e.g., >10 years since ..... immunization).

Step 3: Assess the risk of HBV exposure and determine the immune status of the . patient (i.e., history of jaundice, hepatitis, or previous immunization with ..... HBV vaccine). If status is unknown, continue assessment.

Step 4: Collect a specimen from the source person (the carrier or person suspected of being infected) if possible and from the patient for HBsAg testing. If testing is not possible, base the HBV status of the infected person on clinical history and clinical findings

Step 5: Give HBIgG (5 mL IM) as soon as possible and within 7 days of exposure, ... and also give the first dose of HBV vaccine, which should be repeated at 1 and 6 months. If active immunization with HBV vaccine is not possible, a second dose of HBIG should be given 1 month later.

2.11.4 HCV Post-Exposure

There is no post-exposure vaccine or drug prophylaxis for HCV. Preventing exposure, therefore, is the only effective strategy for preventing HCV.

The institutions should consider for follow-up of health workers exposed to HCV-

positive blood or other bodily fluids:

- Baseline testing of the source patient (if available and a consent form is signed) for anti-HCV antibody (if the test is available)
- Baseline and 6-month follow-up testing of exposed health worker for anti-HCV antibody and liver function screen
- If available, treatment of early HCV infection with pegylated interferon alfa before significant liver damage occurs

2.12 IPC PRACTICES IN THE OPERATING DEPARTMENT

2.12.1 Overview

The following guidelines are recommended for operating department staff when invasive procedures are carried out to protect patients and staff. Every procedure carried out in the operating department should be assessed in terms of blood or bodily fluid loss, and precautions taken accordingly.

Operating Room

The operating theatre is a room specifically for use by the anaesthesia and surgical teams and must be not used for any other purpose.

The OR requires:

- Good lighting and ventilation
- Dedicated equipment for procedures
- Equipment to monitor patients as required by the procedure
- Drugs and other consumables for routine and emergency use
- Supplies for cleaning and disinfection of surfaces

Samples should be collected from different areas of the theatre for culture and sensitivity every six months.

Ensure that standard operating procedures are established for the correct use of the OR and all staff are trained to follow them.

- Keep all doors to the OR closed, except as needed for the passage of equipment, personnel, and patients.
- Store some sutures and extra equipment in the OR to decrease the need for people to enter and leave the OR during a case.

- Keep the number of people allowed to enter the OR to a minimum, especially after an operation has started.
- Keep the OR uncluttered and easy to clean.
- Between cases, clean and disinfect the table and instrument surfaces. ·
- At the end of each day, clean the OR: start at the top and continue to the floor, including all furniture, overhead equipment, and lights, use a liquid disinfectant at the dilution recommended by the manufacturer.
- Sterilize all surgical instruments and supplies after use and store them protected and ready for the next use.

2.12.2 Theatre Layout and Design

Theatre managers, QIT, surgeons, and anaesthetists should be involved in the planning of the theatre design/layout. Ideally, the operating theatre suite should be a purposely built, independent complex located away from the main flow of traffic but in an area easily accessible to the critical care, surgical, and maternity wards and the supporting service departments, e.g., CSSD, laboratory, and X-ray. The traffic within the operating suite must be controlled via a security lock system, which only allows access to staff, patients, and equipment from different entrances and exits. There should be no thoroughfare through the operating theatre.

2.12.2.1 Walls and Ceiling

It is recommended that all surface materials be hard, nonporous, fire resistant, waterproof, stain proof, seamless, and easy to clean. In addition, the corners of the walls and the floor should be coved (round) and smooth for easy cleaning. Washable epoxy resin paint for the walls is ideal because it lasts a long time and can withstand daily washing. Cheaper paint has a tendency to break off and may fall into an open surgical wound. Tiles are generally not recommended because they are difficult to clean and collect dust easily.

The walls and ceiling often are used to mount essential devices and equipment to reduce crowding the floor; therefore, the walls must be solid and robust enough to carry the weight of equipment. The ceiling may be used for mounting an operating microscope or an electrosurgical unit, in addition to the operating light. The walls must be fitted with outlets for oxygen, other medical gases, and vacuum and where possible, an anaesthetic gas scavenging system should be fitted at floor level. The walls must also have multiple electric outlets.

2.12.2.2 Floors

Floors should be smooth, continuous without cracks and breaks, and made of materials that will reduce static and should not endanger the safety of personnel.

The surface of the floor shall provide a path of moderate electrical conductivity between all persons and equipment making contact with the floor to prevent the accumulation of dangerous electrostatic charges. The floor covering should be specified, such as continuous, thick, tough vinyl, and the manufacturer's guidelines for cleaning and maintaining the floor must be available in the cleaning policy. The floor covering should be curved up the wall to 2.5 cm, thus ensuring that edges are coved and easier to clean than right-angled floors. The floor surface must be suitably hard, nonporous, and appropriate for frequent cleaning, and there should be no cracks. The floors should have a nonslip surface to prevent staff from slipping and injuring themselves. When floors are being cleaned, a warning "wet floor" sign should be put up to warn personnel.

2.12.2.3 Doors

Ideally, sliding or swing doors (self-closing) should be used in the operating theatre. Sliding doors, which must remain closed at all times, are recommended, particularly during an operation because the microbial count in the air rises every time doors swing open from either direction.

There must be a clear glass viewing window in the door to prevent frequent opening and closing of the door.

The doors of the operating theatre require baffle plates to balance air flow.

2.12.2.4 Lighting

Most operating theatre lights are white fluorescent because they cast minimal shadow. Lighting should be evenly distributed throughout the room. The anaesthetist must also have sufficient light.

The overhead operating light must:

- Be near daylight in colour and free of shadow
- Give contrast to the depth and relationship of all anatomic structures; the light may be equipped with an intensity control mechanism. The surgeon may ask

for more light when needed, therefore a reserve light (e.g., a mobile operation light) should be available.

- Provide the diameter light pattern of a focus appropriate for the size of the incision; these are adjusted with controls mounted on the light fixture.
- Be freely adjustable to any position or angle; most overhead operating lights are ceiling mounted on mobile fixtures. It can be positioned so that light is directed into a single incision or two concurrent operative sites.
- Be spark-proof where anaesthetic gases are used
- Produce minimum heat to prevent injury to exposed tissues, ensure the comfort of the sterile team, and minimize airborne microorganisms
- Be easily cleaned; tracks recessed within the ceiling virtually eliminate dust accumulation. Suspension-mounted tracks (booms) or a centrally mounted fixture must have smooth surfaces easily accessible for cleaning.

A source of light from a circuit separate from the usual supply must be available in case of power failure. In case one of the bulbs is not working, it should be replaced as soon as possible to provide sufficient lighting at all times during an operation. NO oil, for example, liquid paraffin, should be put on the operating light.

2.12.2.5 Ventilation

The ventilating system in the operating theatre must be mechanical, supplied from an independent air handling unit, which ensures a controlled, filtered, clean air supply. Air changes and circulation provide fresh air and prevent accumulation of anaesthetic gases in the room.

Different Modes of Ventilation in Operating Theatre

There are usually two types of ventilation in operating theatres:

- In a **conventional operating theatre,** 20-24 ACH are delivered via mechanical ventilation ducted into the room and removed via an exhaust system. This is the more common type of ventilation available for conventional operating theatres for general surgery.
- In an **ultra-clean or laminar flow operating theatre,** 80% of extremely clean air is recirculated via a canopy above the operating area, and this unidirectional air flow can be up to 300 meters/second, forming a curtain of air. This type of operating theatre is used for ultra-clean operations, such as implant surgery.

Wall mounted or floor-standing air conditioners are not appropriate for providing clean air in a sterile environment; they only cool the air and are strongly discouraged. Fans are also strictly discouraged. The filters clog up easily with dust, which comes in directly from the outside and need frequent changing. They do not remove stale air from the operating theatre, which increases the risk of infection.

2.12.2.6 Air Flow

In the operating theatre, there should always be positive pressure, which enters the operating theatre suite in the preparation or layup room, to ensure safety of the surgical instruments when the trolleys are being laid up for surgical procedures. The layup and operating theatres should have the highest positive air pressure, which flows outward to the scrub areas and sub-sterile rooms. Positive pressure forces air out of the room.

Air conditioning units may be a source of microorganisms that pass through the filters, which must be changed at regular intervals to prevent this, and the ducts must be cleaned regularly according to the manufacturer's recommendations. If air conditioners must be used, the position of the air conditioning units should be determined in consultation with hospital engineers, surgeons, IPC staff, and other relevant cadres. Wall-mounted air conditioners (which do not regulate the contamination of the delivered air) should be replaced by conventional air flow systems.

Temperature and Humidity

The temperature should be maintained at 21 ± 3 °C inside the operating theatre at all times with a corresponding relative humidity of 50-60%. Appropriate devices to monitor and display these conditions inside the operating theatre may be installed.

Moisture provides a relatively conductive medium, allowing static to leak to earth as fast as it is generated. Sparks form more readily with low humidity and fires are a potential hazard.

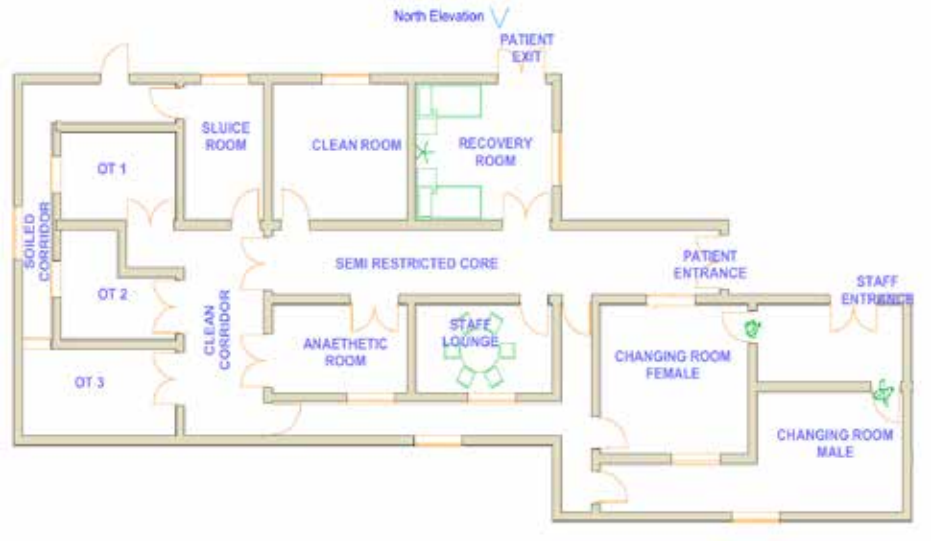
Gas Scavenging System for Anaesthetic Explosive Gases

In most countries, an anaesthetic gas scavenging system is put in place to avoid major explosions. Since most anaesthetic gases are heavy, they sink to the bottom and there is danger of fire or explosion should a spark be produced. The latter can

happen if the humidity is below 45% or with diathermy machines.

2.12.3 Theatre Layout (Structure)

Figure 2.12: Theatre layout



Source: Adapted from 2012 Cairo International Biomedical Engineering Conference (CIBEC) Cairo, Egypt, December 20-21, 2012

2.12.3.1 Unrestricted Area (Where Staff, Patients, and Materials Enter the Surgical Unit)

Unrestricted areas need no special traffic flow. This area is the entrance from the main corridor and is isolated from other areas of the surgical unit. This is the point through which staff, patients, and materials enter the surgical unit.

Post or display signs in each area to clearly indicate the appropriate environmental control and surgical attire.

2.12.3.2 Transition Zone (Where Staff Put On Surgical Attire)

This area consists primarily of dressing rooms and lockers. It is where staff put on surgical attire that allows them to move from unrestricted to semi-restricted or restricted areas in the surgical unit. Only authorized staff should enter this area.

2.12.3.3 Semi-Restricted Area

This is a peripheral area of the surgical unit that includes preoperative and recovery rooms, storage space for sterile and HLD items, and corridors leading to the restricted area. Semi-restricted areas should allow only authorized staff and patients. Activities (e.g., instrument processing and storage) for the OR occur here.

- Set and display rules and protocols of procedural area.
- Limit traffic to authorized staff and patients at all times.
- Have a work area for processing clean instruments; have storage space for clean and sterile or HLD.
- Store supplies on enclosed shelves to minimize dust and debris collecting on stored items.

2.12.3.4 Restricted Area (OR and Scrub Sinks)

- Limit traffic to authorized staff and patients at all times.
- Keep the door closed at all times, except during movement of staff, patients, supplies, and equipment.
- Scrubbed staff must wear full surgical attire and cover head and facial hair with a cap and mask.
- Staff should wear clean, closed shoes that will protect their feet from fluids and dropped items, especially sharps.
- Masks are required when sterile supplies are open and scrubbed staff are operating.
- Patients entering the surgical unit should wear clean gowns or be covered with clean linen and have their hair covered.
- Patients do not need to wear masks during transport (unless they require airborne precautions).

2.12.4 Theatre Attire

Theatre attire is necessary for identification of theatre personnel and is designed to minimise the potential transfer of microorganisms between theatre staff and patients. This uniform also presents a professional image, hence:

- All personnel and visitors entering an operating theatre should wear scrub tops and trousers, provided freshly laundered. These must be changed daily and whenever visibly soiled.
- Footwear should be antistatic and washable and should be worn only in the theatre department, if possible. Shoes should be fully enclosed to provide

protection from spillage and accidentally dropped equipment. Each staff member is responsible for cleaning their own shoes.

- Hair should be completely covered by a disposable or washable hat that should be donned before scrubs to prevent contamination of clean scrubs by staff hair.
- Jewellery is not allowed—it can harbour bacteria and be a hazard in theatres.
- Plain wedding bands are permitted, although it is recommended that they be removed before hand antisepsis (scrubbing) wherever possible.
- Earrings should not be worn because they could potentially fall into a wound.
- Fingernails should be kept clean, short, and free from nail polish.
- Short nails are less likely to puncture gloves or harm a patient during transfer.
- False nails are not to be worn because they can harbour microorganisms, even after hand washing, and inhibit effective hand washing.
- Theatre staff with open cuts, wounds, or skin breaks should cover them with a waterproof dressing.
- If staff have on-going skin conditions, such as eczema or similar, they should be referred to the Occupational Health Department before participating in exposure-prone procedures.
- Personal hygiene must be of a high standard.
- All visitors to the theatre department must report to reception or the theatre coordinator prior to entering any restricted area.
- All people entering the theatre (staff and non-staff) are required to comply with the dress code of the theatre.
- All theatre clothes, including hats and masks, must be removed prior to leaving the theatre department, and shoes changed if visibly stained.
- Theatre attire should not be worn in unrestricted areas.

2.12.4.1 Hand Preparation and Attire for Scrub Staff

- Surgical hand antisepsis is an extension of hand washing and is undertaken prior to gowning and gloving and before taking part in a surgical procedure.
- Staff participating in a surgical procedure are required to use recommended antiseptic agents during their hand wash.
- If the current antimicrobial agents supplied by the department irritate staff skin conditions, then they should be referred to the Occupational Health Department so that an alternative product can be sourced.
- Soap and water alone are not acceptable for surgical hand antisepsis, as soap has no antimicrobial properties.

- Soap can be used if staff also use an alcohol solution or gel afterwards.
- Hand washing should take place for a minimum of 2 minutes.
- Scrub brushes are not recommended for use on the skin as they can lead to skin damage and an increase in skin cell shedding.
- Hands should be held higher than elbows, so that the water drains away from the hands, and should be rinsed from fingertips to elbows using water flow only.
- Vigorous shaking of the hands to dispel water should be avoided.
- Splashing of surgical attire should be avoided as wet clothing can compromise the protection offered by the gown.
- Unless proceeding directly from one case to the next, hand antisepsis should be the same as the initial scrub.
- ABHR gels can be used between cases, when following one case directly with another, unless hands are visibly soiled.
- Double gloving is recommended for both staff and patient safety for every procedure, especially if staff are involved with procedures that involve sawing, drilling, or wiring.
- Surgical gowns are supplied in different sizes and resilience to liquid strike through.
- Other PPE should be worn as indicated by the risk of bodily fluid splashes. These might include masks with or without visors/goggles to protect the wearers' face from splashes, etc.
- Lead aprons should be worn for all procedures where using X-rays are anticipated.
- Goggles are provided when procedures include the use of lasers and should be worn to protect the eyes.

2.12.5 Theatre Traffic Flow and Activity Pattern

- All staff will endeavour to maintain a professional demeanour within the theatre at all times; treat your colleagues with courtesy and respect, and provide the best possible care for all patients who enter the OR.
- Limiting the numbers and movement of staff through the operating theatre environment minimises transfer of bacteria from one theatre to another, reduces noise pollution, and is less disturbing to the surgical team.
- Talking in operating theatres must be kept to a minimum and at a low tone to avoid disruption unless there is a medical emergency.
- To prevent disruption of air flow and minimize the risk of cross-infection, staff must restrict their movement in and out of each theatre environment.

- Visitors to the theatre department must report to reception staff or the theatre in-charge/coordinator to entering any semi-restricted or restricted area. They must dress in surgical attire.
- To maximise ventilation, all doors should remain closed when not in use because it helps maintain the air pressure, temperature, and humidity for that theatre.
- If it is necessary to visit another theatre, staff must remove PPE and wash hands before leaving the theatre.

2.12.6 Additional Precautions for Specific Cases

- For those whose infectious status is known, a number of additional precautions are advised, depending on the mode of transmission.
- In all known infectious cases, unnecessary equipment should be removed from the theatre before arrival of the patient.
- Someone should be appointed the clean runner, who will have no contact with the patient, any infected linen, or equipment. This runner will fetch any equipment or consumables required by the scrub team during the case.
- If airborne transmission is likely, a clean outside runner should also be appointed to fetch any extra equipment needed for the case intra-operatively. This staff member should not come into the theatre during the case, but should wait outside.
- Induction and recovery of highly infectious cases should take place within the theatre, and the number of staff should be limited as much as possible.
- Put infectious cases last on the operation list, wherever possible.
- Label any specimens and microbiology/histology forms using 'danger of infection' stickers, and seal them in a clear plastic bag.
- Theatre personnel in contact with the patient should wear a disposable plastic apron and gloves. This is not necessary for staff who are only collecting the patient.
- Bed/trolley linen should be changed in the operation theatre by staff wearing gloves and aprons and put into the contaminated linen hamper with an alginate liner.
- All surfaces, e.g., trolley, bed, operating table, door handles and stretchers, having contact with a patient should be wiped with disinfectant after cleaning.
- Soft materials, e.g., blood pressure cuffs, must be thoroughly wiped with disinfectant after cleaning.
- Disposable tourniquets must be used.

- A theatre bacterial and fungal sterility check should be done at least quarterly.
- The theatre environment and equipment should be cleaned with detergent and disinfected.
- If chlorine solution is used, it needs to be rinsed off equipment afterward. Chlorine is unsuitable for some surfaces, depending on its components, therefore, health personnel should check manufacturers' guidelines.
- Alcohol Based Hand Rub (ABHR) gel should not be used to decontaminate hands if there is visible bodily fluid or contaminants. Staff must wash hands using soap and water, and apply ABHR gel afterward.
- Endoscopes should be flushed with a litre of water to ensure there is no blockage to hamper sterilisation. They are then dismantled and soaked in OPA 0.3% solution for 12 minutes or according to the manufacturer's guideline.

2.12.6.1 Before Surgical Procedures

Prepare the following containers or buckets:

- A clean, covered container filled with clean water or enzymatic detergent or non chlorine disinfectant for cleaning used instruments
- A container of 0.5% chlorine for surface use
- A container of 0.05% chlorine for soaking infected linen

Use other locally available and approved disinfectants for decontamination of instruments and other items.

Prepare three standard colour-coded waste bins or leak-proof plastic bags:

- One bin for contaminated waste items (cotton gauze, old dressings)
- A second bin for non-contaminated items (food remains, paper, water bottle)
- A third bin for highly contaminated waste (placenta, blood, and body tissues)
- Place a puncture-resistant container or safety box for the safe disposal of sharps (e.g., suture needles, hypodermic needles and syringes, and disposable scalpel blades) at the point of use but without contaminating the sterile field.
- Place a leak proof, covered waste container for soiled linen away from sterile items.

In addition:

- Organize all items in theatre according to the work flow, well labelled, easy to see, take, and return (practice of 5S-KAIZEN-TQM approach)

- Organize tables and Mayo and ring stands side-by-side in an area away from the traffic pattern and at least 45 cm (18 inches) from walls, cabinets, and other non-sterile surfaces.
- Place a clean sheet, a lift sheet, and an arm board cover on the OR bed.
- Check and set up suction, oxygen, and anaesthesia equipment.
- Place supplies and packages that are ready to open on the tables, not on the floor.
- Cover the Mayo stand and other non-sterile surfaces used during the procedure with a sterile draper.

2.12.6.2 During Surgical Procedures

- Limit the number of staff entering the OR only to those necessary to perform the procedure and to patients.
- Make the surgical team self-sufficient so that outside help is not required.
- Keep the doors closed at all times, except during movement of staff, patients, supplies, and equipment.
- Keep the number of people and their movement to a minimum; the number of microorganisms increases with activity.
- Keep talking to a minimum in the sterile field.
- Use monofilament sutures to minimize infections.
- Scrubbed staff should wear full surgical attire, including:
  - o Sterile surgical gowns on top of the scrub suit
  - o A clean surgical cap that covers the head
  - o Clean boots that protect the feet from fluids or dropped items
  - o Surgical gloves, protective eye wear, and mask covering the mouth, nose, and any facial hair
  - o Face shield and plastic or goggles, plastic or rubber apron

1. Scrubbed staff should keep their arms and hands within the operative field at all times and touch only sterile items or areas.

- Non-scrubbed staff should:
  - o Stay at the periphery of the OR
  - o Keep their distance from sterile areas
  - o Not lean or reach over the operative field

Table 2.24: Handling spillage of blood, vomitus, urine, faeces, or contaminated debris

Action	Rationale
Put on disposable apron and gloves (wear facial protection if there is a risk of splashing the face)	Protect against risk of contamination
Cover spill with disposable, absorbent paper towels	Prevent further handling by others and risk of contamination
Collect blood and vomitus from the floor	Discard the spills into clinical (infectious) waste
Wipe with paper towel or reusable cloth to soak up the majority of the spill	Minimize the spread of infection
Pour 0.5% chlorine solution on the floor surface as promptly as possible and leave for 5-10 minutes after soaking the majority of the spill	Disinfect the floor
Dry the area with disposable or reusable cloth	Leave the place clean
Discard all used materials into appropriate waste bag (see above); remove protective equipment and discard in waste bag	Prevent contamination
Wash hands thoroughly	Prevent transmission of infection

Source: (WHO, 2004)

Note: *Do not pour chlorine solution on the spillage as it does not kill microbes and can spread infection.*

2.12.6.3 After Surgical Procedures

Non-scrubbed staff wearing utility gloves should:

- Collect all waste and remove it from the room in closed leak proof containers
- Close and remove puncture-resistant containers when they are three-quarters full
- Remove covered containers with a 0.5% chlorine solution
- Remove instruments and surgical gloves from the room
- Remove soiled linen in closed, leak-proof containers
- Remove waste, soiled linen, soiled instruments and equipment, and leak-proof, covered waste container. (Be sure that these items do not enter the restricted area.)

Note: Never store instruments and other items in the OR. Control movements of staff and the use of surgical attire, which might increase chance of infection as one moves from unrestricted to restricted areas. Staff with respiratory or skin infections or uncovered open sores should never be allowed to work in any area of the surgical unit unless they can use appropriate protective gear. Displaying a signboard in Swahili to limit the entry of unauthorized persons might work in some facilities.

2.12.7 Environmental Cleaning and Decontamination (Cleaning between Patients)

- Each case should be assessed individually, and all items that have been in contact with the patient cleaned with either detergent wipes or a detergent solution.
- Any bodily fluid spills should be cleaned immediately and then disinfected with a solution of chlorine or other disinfectants according to manufacturer instructions.
- Floors and equipment should be cleaned if visibly soiled or if contact with the patient has taken place.

2.12.7.1 Daily and Weekly Cleaning Schedule

- Cleaning of all theatre furniture and equipment should take place at the end of daily operation list.
- Operating tables should be thoroughly cleaned and should be raised to their full height so bases can be thoroughly cleaned, then lowered again afterward.

2.12.7.2 Pre-Planned Annual Cleaning and Maintenance

Conduct pre-planned, annual cleaning and maintenance which includes deep cleaning of walls, ceilings, etc., painting walls, changing ventilation filters, general maintenance, and inspection of fixtures, fittings, and lights.

2.12.7.3 Standards of Environmental Cleanliness

- The OR and accompanying rooms, i.e., anaesthetic room, prep area, etc., should be kept free of unnecessary equipment and clutter to facilitate cleaning.
- Theatres should be free of visible dust.
- Sterile equipment and consumables should be stored above waist level.
- Ventilation grills should not be obstructed or occluded.

- Storage of consumables, supplies, etc., should be kept to a minimum in theatre, and stock should be rotated to ensure there is no build-up of dust or bio-burden.
- Theatres should be kept in a good state of repair. Any chipped paintwork, or defects in floors and tiles or fabrics should be reported and dealt with promptly.

2.12.7.4 Eating and Drinking by Staff in the Theatre Environment

- All food and drink should be consumed in appropriate areas only, e.g., staff coffee room.
- Hands should be washed with soap and water before returning to the theatre.

PART 3. PROCESSES IN IPC

3.1 TRAFFIC FLOW AND ACTIVITY PATTERNS

The process of IPC requires specific interventions when caring for patients with evidenced-based actions. The process involves facilities and HCWs having the ability to execute duties and comply with recommended best patient-care practices. Adhering to IPC standards when caring for patients is an important measure to improve quality of care and reduce risks and HCAIs.

Regulating the flow of visitors, patients, clients, and staff plays a central role in preventing disease transmission in HFs. The number of microorganisms in a designated area tends to be related to the number of people present and their activities. Microbial contamination is expected and is found to be high in areas such as the waiting room and places were soiled surgical instruments and other equipment are initially processed. Contamination can be minimised by reducing the number of people permitted into an area and restricting the activities that occur there.

3.1.1 Procedural Area

The following guidelines apply to areas where HCWs perform procedures on patients:

- Set and display rules and protocols of procedural area, i.e., theatre, labour ward, CSSD, ICU, etc.
- Permit only the patient and staff performing and assisting with procedures in the procedure room. The number of people should be kept to a minimum.
- Patients or clients must wear HF clothes/uniform when admitted, and patients undergoing major surgical procedures must wear facility-provided hospital clothes.
- Staff should wear attire and PPE appropriate for the procedure they are performing.
- A covered container filled with disinfectant should be available for the immediate decontamination of instruments and other items after they have been used; however, do not use chlorine.
- A leak-proof, colour-coded, three-bin (with covers) waste container system must be available for the disposal of contaminated waste items.
- A puncture-resistant container or safety box should be available for the safe

disposal of sharps at the point of generation.

- Clean, HLD, and sterile supplies should be stored and available in procedure rooms.
- All items from the procedural area must be well-organized in a "can see, can take, can return" manner (practice of 5S-KAIZEN-TQM approach).
- Equipment and furniture should be organized according to the work flow.

3.1.2 Space Requirements

The space, equipment, and need for well-defined traffic flow and activity patterns becomes more complex and may differ from lower- to higher-level HFs. However, for secondary (district and designated hospital) and tertiary (regional referral and national referral hospitals) HFs, the types of surgical procedures range from general surgery and obstetrics to open heart surgery. Requirements include the following:

- Changing room and scrub area for clinic staff
- Preoperative area where clients are examined and evaluated prior to surgery
- OR
- Recovery area for patient observation after surgery (may be combined with preoperative area)
- Processing area for cleaning and sterilizing or HLD of instruments and other items
- Space for storing sterile packs, HLD containers of instruments, and other items

3.2 CENTRAL STERILIZATION SUPPLY DEPARTMENT

The Central Sterilization Supply Department (CSSD) is where instruments and equipment are processed. CSSD staff should be specially trained in handling, processing, and storing instruments, equipment, and other clean, sterile, or HLD items.

3.2.1 Structure of a CSSD/Unit

The CSSD may be laid out in various configurations, depending on the size of the population it serves, the number of operations it has to support, and the distance from service delivery to the point of use. The most effective and appropriate layout should be chosen on the basis of the level of HF, workload, staffing, and financial resources, but the basic functioning and integrity of the department must not be compromised.

Advantages of CSSD

- **Efficiency:** Staff of all levels, knowledge, and experience are maximized, thus improving productivity.
- **Economy:** The initial outlay for capital equipment is high, but processing can be used optimally and improve cost effectiveness.
- **Safety:** Upgrading and modernizing can improve patient safety.
- **Validation:** This allows processing systems to be standardized, resulting in an improved quality assurance programme.

3.2.2 Layout of CSSD

Figure 3.1: Layout of CSSD

Source: Adapted from (WHO, 2016)

Note: Ideally, CSSDs should be divided into areas that are physically separated with a clear unidirectional movement workflow from dirty to clean.

There should be physical barriers, such as walls or double-door (pass through) sterilizers, between the packing and the sterile storage areas. There should be no crossover of staff or devices, unless specifically indicated, such as returning devices that have not been properly cleaned. The space must be designed to ensure a one-way movement of staff and devices from contaminated to clean areas to minimize bioburden and particulate contamination.

Basic Criteria for CSSD

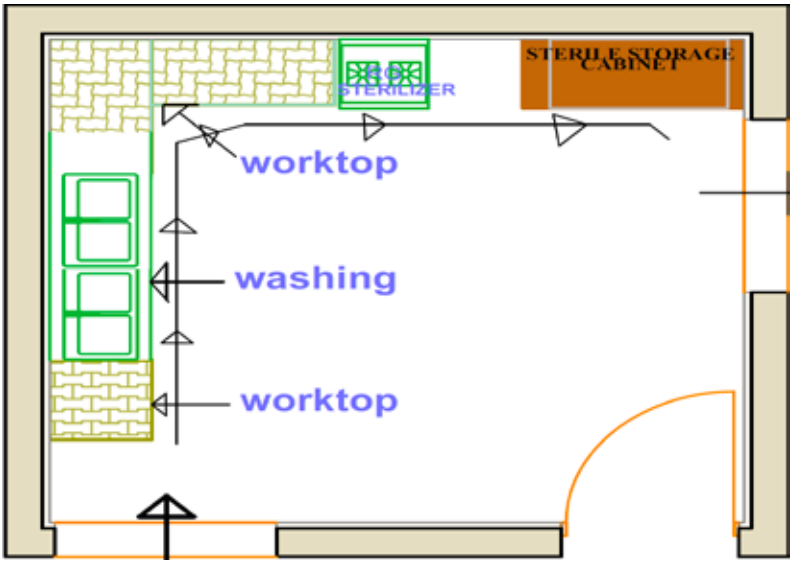
- Entrance and corridors (public areas)
- Gowning points for staff to don PPE prior to entering work areas
- Dirty area receiving for used medical devices (dirty area)
- Inspection, assembly, and packing (clean)
- Sterilization area (sterilizers)
- Sterile store (cooling and short-term storage)
- Administration and staff rest and changing areas (essential to be away from work areas)
- Storage for devices, chemicals, and packaging stores (raw material and CSSD products).

Smaller Specialized Sterilization Units

Smaller units may be decentralized and could be located in operating theatres, endoscopy units, or diagnostic departments. A theatre sterile services unit is no longer accepted practice unless there are specific reasons, such as remotely located operating theatre suites with limited devices, surgical trays, processing equipment, and resources, including transportation. However, if such smaller units do exist, they must be well controlled with complete systems of validation in place as in larger SSDs.

Layout of Smaller Sterilization Units

Figure 3.2: Design for a small, low-service volume clinic with minimal space



Source: Adapted from (WHO, 2016)

The CSSD is a semi-restricted area, so all recommendations for traffic patterns and surgical attire described above should be followed. A CSSD consists of four areas:

- Dirty receiving/clean-up area
- Clean work area
- Cleaning equipment storage area
- Sterile or HLD storage area

Dirty Receiving/Clean-Up Area

In this area, soiled items are received, disassembled, washed, rinsed, and dried. This area should have:

- A receiving counter
- Two sinks, if possible (one for cleaning and one for rinsing), with a clean water supply
- A clean equipment counter for drying

Clean Work Area

In the clean work area, cleaned items are:

- Inspected for flaws or damage
- Packaged (if indicated) and either sterilized or subject to HLD
- Sent for storage as packaged or air dried and placed in a sterile or HLD container

The clean work area should have:

- A large work table
- Shelves for holding clean and packaged items
- A high-pressure steam sterilizer, a dry-heat oven, and a steamer or a boiler

Cleaning Equipment Storage Area

Store clean equipment in this area on shelves (preferably enclosed); have an office desk for record keeping. CSSD staff should enter the through this area.

Sterile or HLD Storage Area

- Store sterilized packs and covered sterile or HLD containers in this area, which should be separate from the central sterile supply area.
- Limit access to the storage area and/or store items in closed cabinets or shelves.
- Enclosed shelves or cabinets are preferred as they protect packs and containers from dust and debris. Open shelves are acceptable if the area has limited access, and housekeeping and ventilation practices are controlled.
- Keep the storage area clean, dry, dust-free, and lint-free by following a regular housekeeping schedule.
- Store packs and containers with sterile or HLD items 20-25 cm (8-10 inches) off the floor, 45-50 cm (18-20 inches) from the ceiling, and 15-20 cm (6-8 inches) from an outside wall.
- Do not use cardboard boxes for storage because they shed dust and debris and may harbour insects.
- Date and rotate the supplies (first in, first out). This process serves as a reminder that the package is susceptible to contamination and conserves storage space, but it does not guarantee sterility.
- Remember that packs will remain sterile as long as the integrity of the package is maintained, and that sterile or HLD containers remain so until they are opened.
- Dispense sterile and HLD articles from this area.

Note: Medical devices processed outside the CSSD cannot be controlled and are considered unsafe unless these processes are under the supervision of highly-trained staff of a similar caliber to those in the CSSD.

3.2.3 Shelf Life

The shelf life of a packaged sterile item is event- and time-related. An event can compromise the integrity and effectiveness of the package. Events that can compromise or destroy package sterility include multiple handling, loss of package integrity, moisture penetration, and airborne contamination. Sterility is lost when the package wrapper is torn, gets wet, is dropped on the floor, has dust on it, or is not sealed.

Factors that can destroy sterility or compromise the efficiency of the packaging material to act as a bacterial barrier are:

- Dust
- Moisture
- Holes, breaks, rupture of seals
- Opening the package

Also, sterile items stored more than seven days are considered contaminated even though there is no break in the package. These items should be re-sterilized.

Note: Share information with other staff by displaying rules and regulations of CSSD by using labels, safety signs, colour coding, or zoning.

3.2.4 Handling and Transporting Instruments and Other Items before Use

- Keep clean and HLD or sterile instruments and other items separate from soiled equipment and waste items. Do not transport or store these items together.
- Transport HLD and sterile instruments and other items to the procedure or OR in a closed container with a cover to prevent contamination.
- Remove supplies from all shipping cartons and boxes before bringing such supplies into the procedure room, the OR, or the clean work area of the CSSD (shipping boxes shed dust and harbour insects that may contaminate these areas).
- Transport soiled supplies and instruments to the receiving/clean-up area of the CSSD in leak-proof, covered waste containers.
- Transport contaminated waste to the disposal site in leak-proof, covered waste containers.

3.3 PROCESSING INSTRUMENTS AND EQUIPMENT

Health workers need to consider the following issues to prevent transferring infection from instruments and equipment:

- Presence of microorganisms, the number and virulence of these organisms
- Type of procedure that has been performed (invasive or non-invasive)
- Body site where the instrument has been used (penetrating the mucosal or skin tissue or used on intact skin)

3.3.1 Decontamination

3.3.1.1 Decontamination of Reusable Equipment According to the Spaulding Classification

The risk of transmission is classified according to the site where the instrument has been used. Contact sites for instruments may be classified as:

- **Critical:** Instruments or devices that are introduced directly into the blood stream or normally sterile areas of the body. These will require sterilization, i.e., surgical instruments, implants.
- **Semi-critical:** Instruments or devices that come into contact with intact mucus membranes but do not penetrate the blood barrier may be either sterilized or HLD, i.e., non-invasive flexible and rigid fiber optical endoscopes, endotracheal tubes, and anaesthesia breathing circuits
- **Non-critical**: Instruments or devices that do not touch the patient or touch only intact skin. Those items can be cleaned and then disinfected with intermediate-level disinfectant, sanitized with low-level disinfectants, or cleaned with soap and water; includes blood pressure cuffs, bed pans, linens, furniture, floors, and other medical accessories.

Table 3.1: Spaulding classification

Risk category	Recommended level of decontamination	Examples of devices
High (critical): Items are involved with a break in the skin or mucous membrane or entering a sterile body cavity	Sterilization	Surgical instruments, implants/ prostheses, rigid endoscopes, syringes, needles
Intermediate (semi-critical): Items in contact with mucous membranes or bodily fluids	Disinfection (high level)	Respiratory equipment, non-invasive flexible endoscopes, bed pans, urine bottles
Low (non-critical): Items in contact with intact skin	Cleaning (visibly clean)	Blood pressure cuffs, stethoscopes

Source: (WHO, 2004)

3.3.1.2 Levels of Decontamination

The meaning of decontamination according to Occupational Safety and Health Authority (OSHA), is "the use of physical or chemical means to remove, inactivate, or destroy blood-borne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface of an item is rendered safe for handling, use, or dispose."

Table 3.2: Levels of decontamination

Cleaning	The physical removal of body materials, dust or foreign material. Cleaning reduces the number of microorganisms and soil, therefore allowing better contact with the surface being disinfected or sterilized and reducing the risk of soil being fixed to the surface. Removal of soil reduces the risk of inactivation of a chemical disinfectant and the multiplication of microorganisms. Cleaning is accomplished manually with cleaning chemicals (detergent) and water, brushing or flushing, or by using ultrasonic and or washer disinfectors to remove foreign material.
Disinfection	The destruction or removal of microorganisms at a level that is not harmful to health and safe to handle. This process does not necessarily include destruction of bacterial spores. General disinfection is accomplished by wiping surfaces with disinfectant solution.
HLD	A process that eliminates all microorganisms, except some bacterial endospores from inanimate objects. Processes include boiling, steaming, or using chemical disinfectants.

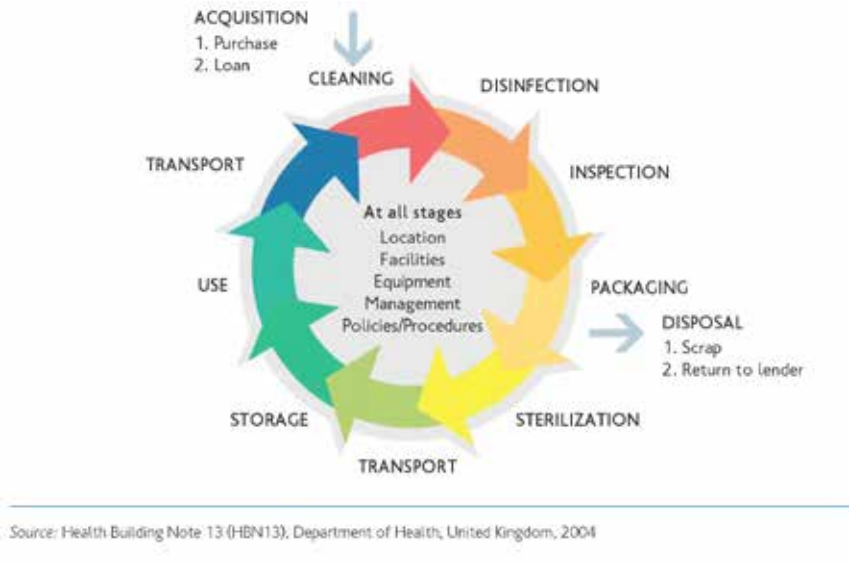
Sterilization	The complete destruction or removal of microorganisms, including bacterial spores. Sterilization validated process used to render a product free from viable microorganisms. Processes include high-pressure steam (autoclave), dry heat, chemical sterilant or radiation (UV-light).

Source: (WHO, 2004)

3.3.2 Processing Instruments and Other Items

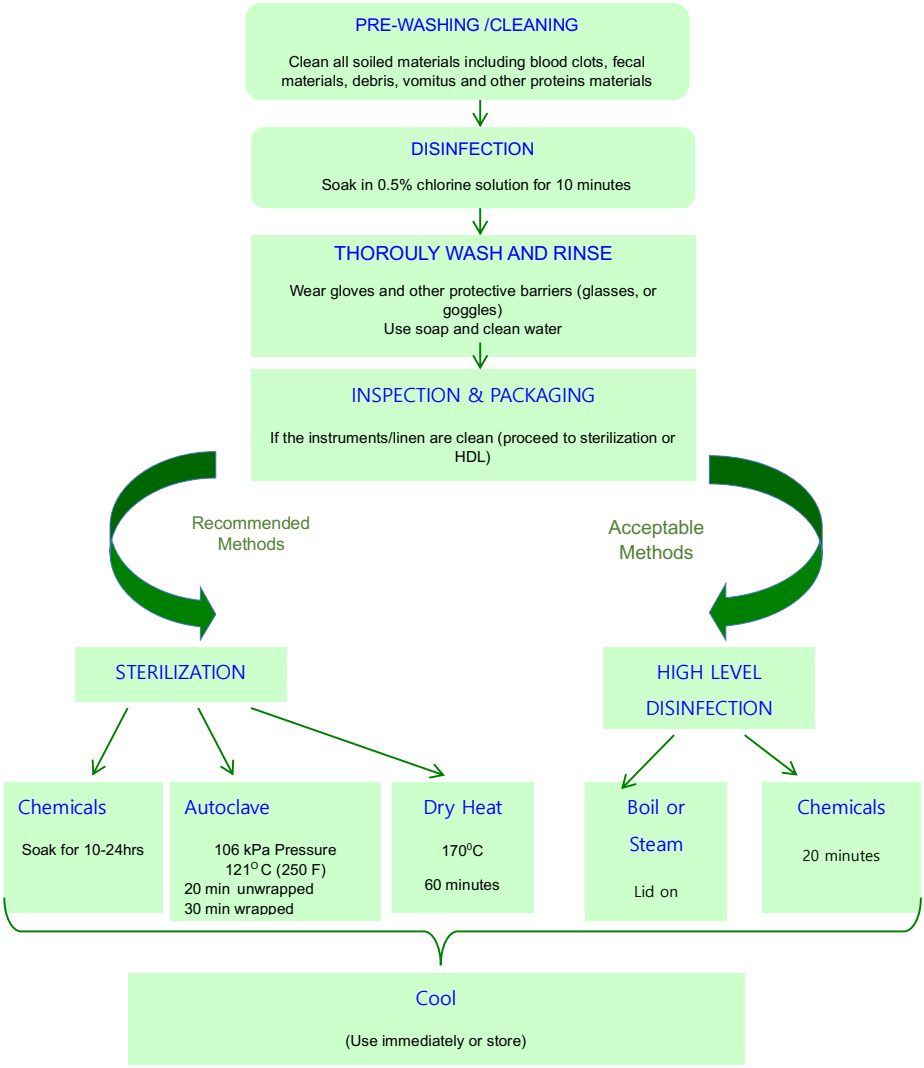
Instruments processing is a very important in ensuring that the instruments are processed in cyclical manner as clarified in figure 3.3.

Figure 3.3: The d0econtamination life cycle



Source: Health Building Note 13 (HBN13), Department of Health, United Kingdom, 2004

Figure 3.4: Steps for instruments processing



Source: Adapted from (Tietjen L, 2003)

Sterilization

- Chemical: Soak in 0.3% OPA (Cidex OPA) for 12 minutes
- Autoclave: 106 Kp (15 lbs/msq) 121 °C (250 °F) 20 minutes unwrapped or 30 minutes wrapped
- Dry heat: 170 °C for 60 minutes

High-Level Disinfection

- Boil or steam for 20 minutes
- Chemical: Soak in 0.3% OPA (Cidex OPA) for 12 minutes

3.3.3 How to Dilute Chlorine

When preparing disinfectants and antiseptics, one should:

- Wash hands before and after each procedure
- Read the manufacturer's guide
- Follow the dilution formula
- Measure the required amount of water, antiseptics and disinfectant

Formula for Making Chlorine Solution from Dry Powder

- Check concentration (% concentrate) of the powder being using
- Determine grams of bleach powder needed
- Grams/litre = $\frac{\text{(\% desired dilution)}}{\text{(\% Manufacturer concentrate)}} \times 1000$
- Mix measured amount of bleach powder with 1 litre of water

Example: To make a 0.5% chlorine solution from calcium hypochlorite powder containing 35% active chlorine:

- $\frac{(0.5\%)}{(35\%)} \times 1000 = 0.0143 \times 1000 = 14.3\text{g}$
- Therefore, dissolve 14.3 g of calcium hypochlorite powder in 1 L of water to get a 0.5% chlorine solution.

Note: When bleach powder is used, the resulting chlorine solution is likely to be cloudy (milky).

Source: AVSC International. (1999). Infection Prevention Curriculum, Teachers Manual. New York, pg. 267.

Source: (AVSC International, 1999)

Preparing Dilute Chlorine Solutions from Liquid Bleach (Sodium Hypochlorite Solution)

- Chlorine in liquid bleach comes in different concentrations. Any concentration can be used to make a dilute chlorine solution by applying the following formula:
- Total parts (TP) of water = (% manufacturer concentrate) – 1
- (% desired dilute)

Example 1: Make a 0.5% chlorine solution from 3.5% bleach

- TP water = $\frac{\text{(\% manufacturer concentrate)}}{\text{(\% desired dilute)}} - 1$
- $\frac{(3.5\%)}{(0.5\%)} - 1 = 6$
- Take 1 part concentrated solution, add 6 parts boiled (filtered, if necessary) water to make a 0.5% chlorine solution

Example 2: Make a 0.1% solution from 5% concentrated solution

- Calculate TP water = $\frac{(5.0\%)}{(0.1\%)} - 1 = 50 - 1 = 49$

Take 1 part concentrated solution and add to 49 parts boiled (filtered, if necessary) water to make a 0.1% solution.

Source: (AVSC International, 1999)

Preparation of Chlorine Solutions from Tablet Formulations

- Using chlorine-releasing tablets to get chlorine solutions:
  - Follow the manufacturer's instructions since the percentage of active chlorine in these products varies.
  - To prepare the intended concentration, consult the pharmacist.

Table 3.3: Preparation of different chlorine solutions from tablet formulations and examples of their uses

	Hand washing and cleaning of linen in Ebola viral disease (EVD)	**Surfaces, boots, beds, utensils and equipment contaminated with blood and other bodily fluids spills of EVD**	**Spills, excreta in EVD**
Concentration required, expressed in available chlorine	0.05% = 500 ppm	0.5% = 5,000 ppm	2% = 20,000 ppm
NaDCC (1 g available chlorine/tablet)	1/2 tab/litre water	5 tab/litre water	20 tab/litre water
NaDCC tablets (1.5 g of available chlorine/tablet)	½ tab/litre	4 tablets/litre	16 tabs/litter

Note: *Chlorine tablet formulations are recommended for making chlorine solutions.*

WHO Recommendations

Soaking instruments in 0.5% chlorine solution or any other disinfectant before cleaning is *not recommended* for the following reasons:

1. It may damage/corrode metallic instruments.
2. The disinfectant may be inactivated by blood and bodily fluids, which could become a source of microbial contamination and formation of biofilm.
3. Transportation of contaminated items soaked in chemical disinfectant to the decontamination area may pose a risk to HCWs and result in inappropriate handling and accidental damage.
4. It may contribute to the development of AMR to disinfectants.

Table 3.4: Guidelines for processing instruments

Instruments	Decontamination	Cleaning	Sterilization	HLD
Airways (plastic)	Soak in 0.5% chlorine solution for 10 to 20 minutes after cleaning and then rinse and wash immediately	Wash with soap and water, rinse with clean water, air or towel dry	Not necessary	
Ambu bag and CPR face mask	Wipe exposed surfaces with gauze pad soaked in 60B 90% alcohol or 0.5% chlorine; rinse immediately			
Aprons (heavy plastic, rubber)	Wipe with 0.5% chlorine solution, rinse with clean water between each procedure, or each time they are taken over			

3.3.4 Cleaning during Decontamination

Cleaning

Cleaning is the removal of organic materials and debris from used items by washing with soap and water and friction.

- Cleaning that follows decontamination can remove up to 90% of microorganisms (bacteria, viruses, fungi, and parasites) and is the best way to reduce the number of endospores, which cause tetanus and gangrene.
- Cleaning should be done under water using liquid soap or enzymatic detergent and friction to remove all organic material from instruments.
- After cleaning, rinse items in clean water until no detergent remains.
- Air dry items whenever possible.
- Use heavy-duty gloves for cleaning instruments.
- Wash hands after removing gloves.

Care of All Instruments

- Instruments with moving parts should be lubricated after drying.
- Avoid oils that may protect bacteria during autoclaving.
- Water-soluble lubricant is recommended (Karl Zsort or Olympus instrument oil).
- Never use steel wool or abrasive powders on stainless steel instruments.
- Never label surgical instruments with masking tape.
- Staining/spotting of instruments can be caused by moisture or water.
- When instruments do stain in spite of all the good care taken, they can be cleaned by using a commercially available rust and stain remover.

New Instruments

- All new instruments are supplied without lubrication. It is recommended that all be carefully washed and dried and any moving part lubricated.
- Whenever cleaning, regardless of method, keep ratchets unlocked and box joints open.
- When instruments are no longer new, avoid as far as possible contact between stainless steel instruments and any of the following substances: barium chloride, aluminium chloride, and bromide- and iodine-containing compounds.

Manual Cleaning of Soiled Instruments and Equipment

- When an operation is in progress, do not drop instruments into a holding solution of disinfectant. If the instruments are not cleaned first, disinfectants, such as chlorine, act as fixatives of any organic material present, making it difficult to remove.
- Instruments should not be soaked in saline, as they will become pitted.
- Dilute detergent properly as per supplier's directions.
- Completely dismantle all items and leave instruments open.
- Use warm water, detergent, and a hard brush to completely remove blood, tissue, food, and other residue, paying special attention to small teeth of instruments and joints.
- Finally rinse with clean water to remove traces of detergent.
- Dry properly. Failure to remove water from trapped areas will cause corrosion.
- Consider the item contaminated when packaging is torn, damaged, wet, dropped on the floor, and when the expiry date has passed.

3.3.5 High-Level Disinfection

HLD is the process that eliminates all microorganisms (including bacteria, viruses, fungi, and parasites), but does not reliably kill all bacterial endospores, which cause diseases, such as tetanus and gas gangrene. HLD is suitable for instruments and items that come in contact with broken skin or intact mucous membranes.

Note: *Sterilization kills all microorganisms, including bacterial endospores; it is preferable to HLD instruments and other items that will come in contact with the bloodstream or tissues under the skin. If sterilization is not available, HLD is the only acceptable alternative.*

HLD can be performed by boiling, soaking in chemicals, or steaming.

3.3.5.1 HLD by Boiling

Step 1: Clean all items to be boiled.

- Open all hinged items and disassemble those with sliding or multiple parts.
- Completely submerge all items in the water in the pot or boiler.
- Place bowls and containers upright, not upside down, and fill with water.

Step 2: Cover the pot or close the lid on the boiler and bring the water to a gentle rolling boil.

Step 3: When the water comes to a rolling boil, start timing for 20 minutes.

- Use a timer to make sure to record the time that boiling begins.
- From this point on, do not add or remove any water and do not add any items to the pot or boiler.

Step 4: Lower the heat to keep the water at a gentle, rolling boil.

Note: If the water boils too vigorously, it will evaporate and the items may become damaged if they bounce around the container and hit the sidewalls and other items being boiled. Lower heat also saves fuel or electricity.

Step 5: After 20 minutes, remove the items using dry, HLD pickups (lifters, cheatle forceps). Place the items on an HLD tray or in an HLD container away from insects and dust.

Step 6: Allow air-drying before use or storage.

Step 7: Use items immediately or keep them in a covered, sterile or HLD container for up to one week.

Note: Never leave boiled items in water that has stopped boiling; they can become contaminated as the water cools down.

Tips for HLD by Boiling

- Items must be completely covered with water. Open all hinged instruments and disassemble items with sliding or multiple parts.
- Always boil for 20 minutes. Start timing when the water reaches a rolling boil. If you forget to start timing the procedure, start timing at the point at which you realize this.
- Do **not** add **anything** to or remove **anything** from the boiler once boiling begins.

3.3.5.2 HLD by Steaming

After instruments and other items have been decontaminated and thoroughly cleaned, they are ready for HLD by steaming.

Step 1: Place instruments, plastic MVA cannulas and other items in one of the steamer pans with holes in the bottom. To make removal from the pan easier, do not overfill the pan.

Step 2: Repeat this process until up to three steamer pans have been filled. Stack the filled steamer pans on top of a bottom pan containing water for boiling.

A second empty pan without holes should be placed on the counter next to the heat source.

Step 3: Place a lid on the top pan and bring the water to a full rolling boil. (When water only simmers, very little steam is formed and the temperature may not get high enough to kill microorganisms.)

Step 4: When steam begins to come out between the pans and the lid, start the timer or note the time on a clock and record the time in the HLD log.

Step 5: Steam items for 20 minutes.

Step 6: Remove the top steamer pan and put the lid on the pan that was below it (the pan now on top). Gently shake excess water from the pan just removed.

Step 7: Put the pan just removed onto the empty pan. Repeat until all pans are restacked on this empty pan and the top pan is covered with the lid. (This step allows the items to cool and dry without becoming contaminated).

Step 8: Allow items to air dry in the steamer pans (1-2 hours) before using.

Step 9: Using HLD forceps, transfer the dry items to a dry, high-level disinfected container with a tight-fitting cover. Instruments and other items can also be stored in the stacked and covered steamer pans as long as a bottom pan (no holes) is used.

Note: *Both boiling and steaming share some advantages and disadvantages over chemical HLD, which is the only other method of HLD.*

3.3.5.3 HLD by Chemicals

Step 1: Clean, and thoroughly dry all instruments and other items to be processed. Water from wet items will dilute the chemical solution, thereby reducing its effectiveness.

Step 2: When using OPA solution: Prepare the 0.3% solution according to the manufacturer's instructions. Ideally, an indicator strip should be used each time the solution is used to determine if the solution is still effective. After preparing the solution, place in a clean container with a lid. Mark the container with the date the solution was prepared and the date it expires. Fresh solution should be made each day or more often if the solution becomes cloudy. Put the solution in a clean container with a lid.

Note: *Use chlorine solution with boiled water and not tap water.*

Step 3: Open all hinged items and disassemble those with sliding or multiple parts. The solution must contact all surfaces to achieve HLD. Completely submerge all

items in the solution. All parts of the items should be under the surface of the solution. Place any bowls and containers upright, not upside down, and fill with the solution.

Step 4: Cover the container and allow the items to soak for 20 minutes. Do not add or remove any instruments or other items once timing has begun.

Step 5: Remove the items from the solution by using dry, HLD pickups (lifters, cheatle forceps).

Step 6: Rinse thoroughly with sterile or boiled water to remove the residue that chemicals leave on items. This residue is toxic to skin and tissue.

Step 7: Place the items on an HLD tray or in an HLD container and allow to air dry before use or storage. Use items immediately or keep in a covered, dry HLD container and use within one week.

Tips for Chemical HLD

- Items must be completely covered with solution.
- Open all hinged instruments and disassemble items with sliding or multiple parts.
- Soak for 20 minutes. If you forget to start timing, start at the point you remember.
- Do not add or remove anything once timing begins.
- Rinse items thoroughly with boiled water.
- Antiseptics should **never** be used for HLD.

3.3.6 Sterilization

Sterilization protects patients by eliminating all microorganisms (bacteria, viruses, fungi, and parasites), including bacterial endospores, from instruments and other items. Sterilization is recommended for instruments and other items that will come in contact with the bloodstream or tissues under the skin, as well as on draped and some surgical attire. Sterilization can be performed using dry heat (oven), high-pressure steam (autoclaving), and soaking in chemicals (cold sterilization).

Heat (autoclaving/steam and dry heat) is the most effective method of sterilization and reliable if monitored carefully. It is also cheaper than chemical methods. It should be considered first for all medical equipment that can withstand heat. Chemicals are the alternative where heat cannot be used, e.g., ethylene oxide and glutaraldehyde.

3.3.5.4 Sterilization by Dry Heat

Time/temperature:

- 1 hour at 170 ° C (340 °F)
- 2 hours at 160 °C (320 °F)
- 21/2 hours at 150 °C (300 °F)
- 3 hours at 140 °C (285 °F)

3.3.5.5 Sterilization by Steam

- Time 20 minutes (or 30 minutes if wrapped)
- Temperature 121 °C (250 °F)
- Pressure 106 KPA (15 lbs/sq inch)

3.3.5.6 Sterilization by Chemicals

Chemical sterilization method is used for instruments and other items that are heat-sensitive or when heat sterilization is not available.

Step 1: Clean and thoroughly dry all instruments and other items to be sterilized. Water from wet instruments and other items dilutes the chemical solution, thereby reducing its effectiveness.

Step 2: Prepare the glutaraldehyde or other chemical solution by following the manufacturer's instructions or use a solution that was prepared previously, as long as it is clear (not cloudy) and has not expired. After preparing the solution, put it in a clean container with a lid. Always mark the container with the date the solution was prepared and the date it expires.

Step 3: Open all hinged instruments and other items and disassemble those with sliding or multiple parts; the solution must contact all surfaces to achieve sterilization. Completely submerge all instruments and other items in the solution. Place bowls and containers upright, not upside down, and fill with the solution.

Step 4: Follow the manufacturer's instructions regarding the time necessary for sterilization to be achieved. In general, if the solution contains glutaraldehyde, cover the container and allow the instruments and other items to soak for 10 hours. Do not add or remove any instruments or other items once timing has begun.

Step 5: Remove the instruments and other items from the solution by using large, sterile pickups (lifters, cheatle forceps).

Step 6: Rinse thoroughly with sterile water to remove the residue that chemicals . leave on instruments and other items; this residue toxic to skin and tissues.

Step 7: Storage: Place the instruments and other items on a sterile tray or in a sterile container and allow to air dry before use. Use the instruments and other items immediately or keep in a covered, dry, sterile container and use within one week.

Step 8: After processing, items should be used immediately or stored in such a way that they do not become contaminated. Proper storage is as important as proper processing.

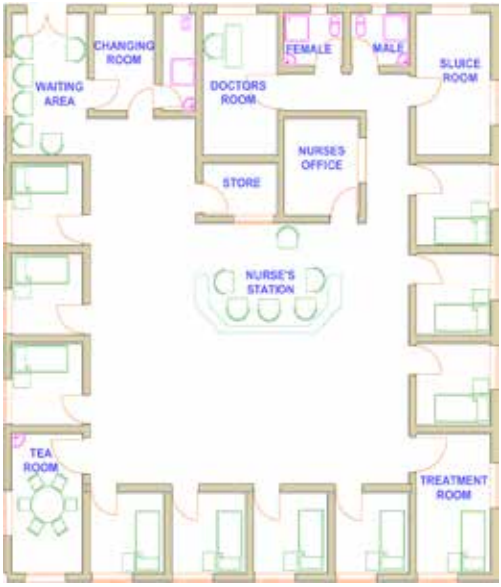
3.4 IPC PRACTICES IN ICU

3.4.1 Overview

The ICU must be a structurally and functionally separate unit in a health care organization; it must have easy access/connectivity with the emergency department/casualty, operating theatre complex, radiology and imaging, laboratory, and blood bank. It should have a single entry and exit point. More than 20% of all nosocomial infections are acquired in ICUs. These infections account for substantial morbidity, mortality, and expense. Improving IPC in critical care acts as a catalyst for improvement in the rest of the hospital.

3.4.2 Layout for ICU

Figure 3.5: Layout for ICU



Adapted from: https://www.slideshare.net/sandykaur1829/pediatrics-intensive-care-unit Accessed on 20 July 2018

Common Types of Infections in ICU

- Blood stream infections
  - o Central venous catheter/ peripherally inserted central catheter (PICC)
  - o Umbilical catheter-associated blood stream infections
- Ventilator-associated pneumonia
  - o Large impact on neonatal morbidity, hospital costs, and length of stay
  - o Premature birth, repeated and prolonged intubation, and genetic diseases increase frequency of ventilator-associated pneumonia
- Device-associated infections

Factors Contributing to Infections in ICU

- Patients in ICUs have more chronic comorbidities and more severe acute physiologic derangements.
- The high frequencies of use of catheters provide a portal of entry for organisms into the bloodstream. The use and maintenance of these catheters necessitate frequent contact with HCWs, which predispose patients to colonization and infection with nosocomial pathogens.
- Multidrug-resistant pathogens, such as MRSA and vancomycin-resistant enterococci, are isolated with increasing frequency in ICUs.

3.4.3 Prevention Strategy for ICU Infections

- Regular surveillance of infections
- Vaccination of HCWs
- Appropriate visitation policies
- Avoiding overcrowding and limit movement of staff
- Regular evaluation of devices to minimize HCAIs

3.5 HOUSEKEEPING

3.5.1 Overview

Housekeeping refers to the general cleaning of hospitals and clinics, including the floors, walls, certain types of equipment, furniture, and other surfaces. Cleaning entails removing dust, soil, and microbial contaminants on environmental surfaces because they are the potential source of HCAIs. Effective and efficient cleaning methods and schedules are therefore necessary to maintain a clean and healthy environment in health care settings.

The purposes of general housekeeping are to:

- Reduce the number of microorganisms that may come in contact with health workers, clients, or members of the community who visit the facility
- Reduce the risk of incidence by preventing accidents, such as falls
- Ensure a pleasant atmosphere for health workers and patients/clients

Targeted prevention efforts can reduce the rate of some HCAI by 70%. Health care personnel play a critical role in targeted prevention efforts.

Table 3.5 Survival of select pathogens on environmental surfaces

Pathogen	Survival time
Bacteria	
C. difficile	≥ 1 year
MRSA	7 days-7 months
VRE	5 days-4 months
Viruses	
Hepatitis B	≥ 1 month
Norovirus	8 hours-7 days

Source: (Kramer, Schwebke, & Kampf , 2006)

In high-risk areas where heavy contamination is expected, such as toilets and latrines, or for blood or bodily fluid spills, collect all blood or bodily fluid, then wipe with 0.5% chlorine solution; 1% phenol should be added to the cleaning solution (Fawzi, 2011) sing a disinfectant in addition to soap and water is also recommended in other high-risk areas, such as ORs, pre- and postoperative recovery areas, and ICUs.

If the purposes of housekeeping are to be achieved, it is important that housekeeping staff be trained to perform their assigned tasks and are supervised on a regular basis.

As part of their training, it is important that housekeeping staff:

- Understand the risk of exposure to contaminated items and surfaces when performing environmental cleaning procedures
- Follow recommended policies and guidelines, including the use of appropriate PPE

3.5.2 Definitions of Terms

Housekeeping

Housekeeping is the art of maintaining an HF and managing duties involved in the running of a household, such as cleaning, cooking, home maintenance, and laundry.

Cleaning

- This process removes foreign materials (soil, blood, bodily fluids, and microorganisms) from an object. Usually running water and soap are applied
- Accumulation of dust, soil, and microbial contaminants on environmental surfaces is aesthetically displeasing and a potential source of HCAIs.
- Effective cleaning methods and schedules are therefore necessary to maintain a clean and healthy environment in health care settings.
- Every functional area should have colour-coded cleaning equipment and a specific area for storage.
- Cleaning equipment should be decontaminated immediately after use.

Cleaning Solution

Any combination of soap (or detergent) and water, with or without a chemical disinfectant, used to wash or wipe down environment surfaces, such as floors, chairs, benches, walls, and ceilings.

Disinfectants

Chemicals that destroy or inactivate microorganisms. Disinfectants are classified as low, intermediate, or high level, depending on their ability to kill or immobilize some (low or intermediate level) or all (high level) microorganisms (but not all spores).

- Phenols, chlorine or chlorine-containing compounds, and quaternary ammonium compounds (QUATs) are classes of disinfectants frequently used to clean non-critical surfaces, such as floors, walls, and furniture
- Disinfectant cleaning solutions are products that are a combination of a detergent (soap) and a chemical disinfectant. Not all detergents and disinfectants are compatible. Several combinations are available commercially or can be prepared, such as alkaline detergents with chlorine compounds, alkaline detergents with QUATs or other non-ionic surfactants, and acid detergents with iodophors.

- Environmental controls are standards specifying procedures to be followed for the routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces.

Sanitizers

These include chemicals that reduce the number of bacterial contaminants to safe levels on inanimate objects based on public health requirements (i.e., a chemical that kills 99.999% of the specific test bacteria in 30 seconds under the conditions of the test).

Soaps and Detergents (Terms Used Interchangeably)

These are cleaning products (liquid, leaflet, or powder) that lower surface tension, thereby helping remove dirt, debris, and transient microorganisms from hands. Plain soaps require friction (scrubbing) to mechanically remove microorganisms; antiseptic (antimicrobial) soaps kill or inhibit the growth of most microorganisms.

3.5.3 General Principles for Cleaning Hospitals, Clinics, and Other HFs

- Scrubbing (frictional cleaning) is the best way to physically remove dirt, debris, and microorganisms.
- Cleaning is required prior to any disinfection process because dirt, debris, and other materials can decrease the effectiveness of many chemical disinfectants.
- Cleaning products should be selected on the basis of their use, efficacy, safety, and cost.
- Cleaning should always progress from the least soiled areas to the most soiled areas and from high to low areas, so that the dirtiest areas and debris that fall on the floor will be cleaned up last.
- Dry sweeping, mopping, and dusting should be avoided to prevent dust, debris, and microorganisms from getting into the air and landing on clean surfaces. Airborne fungal spores are especially important because they can cause fatal infections in immunosuppressed patients
- Mixing (dilution) instructions should be followed when using disinfectants. (Too much or too little water may reduce the effectiveness of disinfectants.)
- Cleaning methods and written cleaning schedules should be based on the type of surface, amount and type of soil present, and the purpose of the area.
- Routine cleaning is necessary to maintain a standard of cleanliness.
- Schedules and procedures should be consistent and posted (Tietjen L, 2003).

Source: (Tietjen L, 2003)

3.5.4 How to Select Disinfectants and Cleaning Products

When selecting a disinfectant or other cleaning product, consider that the manufacturer's instructions need to be closely followed. The master label provides more details about the product, including pathogen(s) targeted, required contact time, and safety precautions.

Selecting Disinfectants

Not all products target the same pathogens require the same contact times, and need the same safety precautions. Multiple products might need to be used to optimize disinfection. Disinfectants should be selected based on an institution's current needs and situation.

Preparing Disinfectants

To optimize safety and efficacy, the manufacturer's label should always be followed when preparing and using disinfectants; commonly used formulations include concentrates and premoistened wipes.

- Concentrates require adding water and are most often used by environmental services.
- Premoistened wipes are ready to use and are most commonly used by direct care providers.
- Personnel should never mix disinfectants together to try to target a broader spectrum of pathogen because this practice does not improve efficacy.
- Contact time is the time it takes for disinfectants to kill a particular pathogen, which occurs when the surface is wet and the pathogen is in direct contact with disinfectants.
- Products have varying contact times, ranging from 1 to 10 minutes.
- Agent that targets likely pathogens and has a contact time matching the process and cleaning time should be selected.
- If a product requires a long contact time but dries quickly, repeat applications might be needed.

Different types of cleaning products are available: liquid soap and detergents, disinfectants, combinations (detergent and disinfectant), and sanitizers. Each type has different properties.

An ideal cleaning product should accomplish the following:

- Suspension of fats (suspend fats in water)
- Saponification of fats (make fats water soluble)
- Surfaction (decrease surface tension of water and allow greater penetration of the agent into the dirt or soil)
- Dispersion (break up of soil into small particles)
- Protein destruction (break-up protein)
- Water softening (removal of calcium and magnesium)

How to Prepare Disinfectant Cleaning Solution

Although chlorine-containing solutions are excellent, inexpensive disinfectants, do not mix them with cleaning solutions containing an acid, ammonia, or ammonium chloride. Doing so will release chlorine gas and other by products that can be toxic. A 0.5% chlorine solution is ideal for cleaning purposes. Alternatively, 1–2% phenol or 5% carbolic acid can be used as a disinfectant for the purpose of cleaning. Adding enough detergent to these disinfectants will make a mild, soapy cleaning solution.

Most commonly used supplemental technologies for health care environment disinfection are "no-touch" technologies:

- Ultraviolet germicidal irradiation, which kills pathogens by exposing them to ultraviolet irradiation
- Hydrogen peroxide systems, which kill pathogens by exposing them to vaporized hydrogen peroxide

Note: *Cleaning a health care environment should not be considered the same as cleaning house. All personnel need to have a basic understanding of health care cleaning/disinfection and the techniques involved. Use of experts should be maximized, whether to address questions or to educate about product or process. Personnel should be engaged in initiatives to promote a desire to learn more, know, more, and be better.*

3.5.5 Cleaning Methods

Cleaning should start with the least soiled area and move to the most soiled area and from high to low surfaces.

Wet mopping is the most common and preferred method to clean floors.

- Double-bucket technique: Two different buckets are used, one containing a cleaning solution and the other containing rinse water.
- The mop is always rinsed and wrung out before it is dipped into the cleaning solution.
- The double-bucket technique extends the life of the cleaning solution (fewer changes are required), saving both labour and material costs.
- Triple-bucket technique: The third bucket is used for wringing out the mop before rinsing, which extends the life of the rinse water.

Flooding followed by wet vacuuming is recommended in the surgical suite, if possible. This process eliminates mopping, thus minimizing the spread of microorganisms and increasing the contact time of disinfectants with the surface to be cleaned. But it is necessary to leave the floor wet for several minutes. (Flooding is best done at night or at times when foot traffic is minimal.)

Dusting is most commonly used for cleaning walls, ceiling, doors, windows, furniture, and other environmental surfaces.

- A clean cloth or mops are wetted with cleaning solution contained in a basin or bucket.
- The double-bucket system minimizes the contamination of the cleaning solution.
- Dry dusting should be avoided, and dust cloths and mops should never be shaken to avoid the spread of microorganisms.
- Dusting should be performed in a systematic way, using a starting point as a reference to ensure that all surfaces have been reached.

Note: *When doing high dusting (ceiling tiles and walls), check for stains that may indicate possible leaks. (Leaks should be repaired as soon as possible because moist ceiling tiles provide a reservoir for fungal growth.)*

Principles for Cleaning

- Because scrubbing is the best way to remove dirt and microorganisms, it should always be done.
- It is important to always wear gloves while cleaning, especially heavily contaminated areas, such as toilets and areas with blood and bodily fluids spills.

- Use a damp cloth for walls and floors.
- Dry sweeping should be avoided because the particles spread dust, debris, and microorganisms.
- Use separate equipment, such as cloths and brushes for cleaning high-risk environments and others for low-risk environment.
- Change cleaning solutions when absolutely dirty.
- Clean and dry mops, dusters, cloths, and other cleaning equipment when cleaning is completed.
- When washing walls, wash from top to bottom, and when cleaning surfaces, clean from less dirty to very dirty areas.
- When using disinfectants, follow the manufacturer's instructions about diluting the chemicals, their storage, and disposal.

Table 3.6: Equipment and Essential Materials for Cleaning

Equipment and supplies	Materials
• Basins • Dusting buckets • Trolley • Step ladder • Hard broom squeezer • Soft brush • Long sponge sweeper • Gloves • Cobweb remover • Boots • Hazard signs • Apron • Mop bucket and handle	• Soap and disinfectant • Water • Detergent • Paper towels • Disinfectant

3.5.6 Cleaning Procedure for Different Departments in HFs

Routine Cleaning of Patient Rooms

Assessment

- Check for additional precaution signs and follow the precautions
- Check through the room to determine what needs to be replaced (e.g., toilet paper, paper towels, soap, ABHR, gloves, sharps container) and whether any

special materials are required; this may be done before or during the cleaning process.

Assemble Supplies

- Ensure that an adequate supply of clean cloths is available.
- Prepare fresh disinfectant solution according to manufacturer's instructions.
- Clean and dry hands and put on gloves.

Cleaning the Room

- Work from clean to dirty and high to low areas of the room.
- Use a fresh duster for cleaning each patient's bed.
- If a bucket is used, do not double-dip duster(s).
- Do not shake out duster(s).
- Change the cleaning duster when it is no longer saturated with disinfectant and after cleaning heavily soiled areas, such as the toilet and bed pan cleaner.
- If there is more than one patient bed in the room, use a fresh duster for each bed and complete the cleaning in each bed space before moving to the next.
- Start by cleaning doors, door handles, the push plate, and touched areas of the door frame.
- Check walls for visible soiling and clean if required.
- Clean light switches and thermostats.
- Clean wall-mounted items, such as ABHR dispenser and glove box holder.
- Check and remove fingerprints and soil from low-level interior glass partitions, glass door panels, mirrors, and windows with glass cleaner.
- Check privacy curtains for visible soiling and replace if required.
- Clean all furnishings and horizontal surfaces in the room, including weighing scales, chairs, window sill, television, telephone, computer keypads, night table, and other tables or desks.
- Lift items to clean the tables.
- Pay particular attention to high-touch surfaces.
- Wipe equipment on walls, such as the top of a suction bottle, intercom, and blood pressure manometer as well as the drip stand.
- Clean bedrails, bed controls, and call bell.
- Clean floors.
- Clean bathroom/shower.

Disposal

- Place soiled duster in designated container for laundering.
- Check sharps container and change when ¾ full (do not dust the top of a sharps container).
- Remove soiled linen if bag is full,
- Place obvious waste in receptacles.

Remove Waste

- Remove gloves and wash hands with soap and water.
- Replace supplies as required (e.g., gloves, ABHR, soap, paper towels).
- Clean hands with ABHR.

Cleaning Bathrooms and Toilets

- Run all taps for at least 5 minutes and sign the record sheet.
- Fill buckets with cold water.
- Put out hazard signs at entrances.
- Put on disposable gloves and apron.
- Pull flush of toilet to ensure clean water in base.
- Using the toilet brush, push water backwards down the U-bend to reduce the amount of water in the bowl.
- Spray around the rim and bowl of the toilet with disinfectant; let it activate for a few minutes.
- Damp dust walls/tiles starting at the highest point to the lowest point.
- Damp dust all surfaces, fixtures, and fittings, including doors and door handles.
- Spray inside of sink and bath with disinfectant and let it activate for a few minutes.
- Clean under the sink with brush.
- Clean inside toilet bowl with toilet brush.
- Wet a clean piece of paper roll and wipe flush handle, toilet seat base and rim
- Pull the flush, cleaning the toilet brush and holder in the running water; dry holder.
- Pull flush again.
- Empty bin and clean frame.
- Mop floor with bucket and mop.
- Remove utility gloves.
- Clean out all buckets and dry thoroughly.

- Remove disposable gloves and wash hands thoroughly.
- Put on clean gloves, remove mop head, place in a clear bag, and put out for laundry.
- Remove disposable gloves and apron and wash hands thoroughly.
- When the floor is dry, return the hazard signs to the cleaning cupboard.

Cleaning the Sluice Room

- Fill buckets with cold water and detergent.
- Put mop head onto mop handle.
- Put out hazard signs at entrances.
- Wash hands and dry.
- Put on apron, disposable gloves, and utility gloves.
- Pull flush of sluice pan to ensure clean water in base.
- Spray around the rim and bowl of the sluice pan with disinfectant; let it activate.
- Damp dust walls/tiles starting from the highest point to the lowest point.
- Clean sink, removing all body fats.
- Clean under sink well.
- Clean sides of macerator with white paper towel.
- Clean inside sluice pan with toilet brush.
- Dampen a clean piece of paper towel and wipe flush handle, base and rim
- Pull flushes again.
- Empty bin and clean frame.
- Remove utility gloves.
- Mop floor with bucket and mop handle.
- Remove mop head and place in clear bag.
- Clean out all buckets and dry thoroughly.
- Remove disposable gloves and apron and wash hands thoroughly.
- When the floor is dry, return the hazard sign to the cleaning cupboard.

Consultation/Clinicians Rooms and Corridors

- Fill damp dusting buckets with cold water and detergent.
- Fill mop bucket with warm water and detergent.
- Put clean mop on the handle.
- Put hazard signs at entrances.
- Put on disposable gloves.
- Damp dust all walls. fixtures, fittings, and ledges starting from the highest point.

- Damp dust tops of desks at the nurses station.
- Damp dust outside of any cupboards.
- Empty bin if necessary.
- Mop floors, giving extra attention to corners and edges.
- Wet mop half the corridor at a time, ensuring that there is a dry walkway for pedestrians to use.
- Clean out buckets and leave clean and dry.
- Remove mop head and place into clear bag; put into yellow bin or laundry collection area.
- Remove dirty mop from handle and place in black bag.
- Remove gloves and wash hands thoroughly.
- Put hazard signs into cleaning cupboard.

PART 4. PREVENTING INFECTIONS IN SPECIAL SETTINGS

4.1 PREVENTING NOSOCOMIAL INFECTIONS

Nosocomial infections, or hospital-acquired infections, are those that a patient develops within 24 hours of admission to a hospital or that a patient is incubating at the time he or she comes to the hospital. HCAIs are a significant problem throughout the world and are increasing. Although the exact data for the transmission of HCAIs in Tanzanian HFs have yet to be determined, these infections are important contributors to morbidity and mortality. HCAIs are an important focus of infection prevention in all countries, especially in developing countries.

The most important HCAIs are:

- Maternal and newborn infections
- Infections following surgery
- Infections related to intravascular interventions
- UTIs
- Pneumonia
- Infectious diarrhoea

The organisms causing most HCAIs usually come from the patient's own body (endogenous flora). They also can come from contact with staff (cross-contamination), contaminated instruments and needles, and the environment (exogenous flora). Key contributing factors are:

- Inadequate standards and practices for operating blood transfusion services
- Increasing use of invasive medical devices (e.g., mechanical ventilators, urinary catheters, and central IV lines) without proper training or laboratory support and contaminated IV fluids, especially in hospitals that make their own IV solutions
- Antibiotic resistance due to overuse of broad-spectrum antibiotics
- Unsafe and frequently unnecessary injections
- Increasing numbers of people in HFs, overcrowding in wards, sharing beds
- More frequent impaired immunity (age, illness, and treatments)
- New microorganisms, such as HIV, SARS, and Ebola

4.1.1 Impact of Nosocomial Infections

HCAIs add to functional disability and emotional stress and, in some cases, lead to disabling conditions that reduce the quality of life. In addition, HCAIs have now become one of the leading causes of death. The impact of HCAIs takes on even more significance in resource-poor countries, especially those affected most by HIV/AIDS; recent findings strongly suggest that unsafe medical care may be an important factor in transmitting HIV.

HCAIs increase the cost of health care in the countries least able to afford it through increased:

- Length of hospitalization
- Treatment with expensive medications (e.g., antiretroviral drugs for HIV/AIDS and antibiotics)
- Use of other services (e.g., laboratory tests, X-rays, and transfusions)

4.1.2 Preventing Nosocomial Infections

Isolation Precaution Guidelines for Hospitals

Isolation guidelines issued by CDC in 1996 involved a two-level approach (Garner, 1996):

- Standard precautions that apply to all clients and patients attending HFs
- Transmission-based precautions that apply primarily to hospitalized patients

Note: *In all situations, whether used alone or combined, transmission-based precautions must be used in keeping with standard precautions* (Garner, 1996).

4.1.2.1 Airborne Precautions

Airborne precautions are designed to reduce the nosocomial transmission of particles that can remain in the air for several hours and be widely dispersed. They are used in addition to standard precautions for a patient known or suspected to be infected with microorganisms transmitted by the airborne route, such as TB.

4.1.2.2 Droplet Precautions

Droplet precautions reduce the risk of nosocomial transmission of pathogens spread by droplets. Examples of pathogens include viruses, such as influenza, rubella (German measles), and mumps, and bacteria, such as *Mycoplasma pneumoniae*,

Corynebacterium diphtheriae (diphtheria), *Hemophilus pertussis* (whooping cough), *Pasteurella pestis* (pneumonic plague), and *Streptococcus pharyngitis* (sometimes causes scarlet fever).

Note: *Droplet infections are simpler to prevent than airborne precautions because particles remain in the air for a short time and travel only a few feet. Therefore, contact with the source must be close for a susceptible host to become infected.*

4.1.2.3 Air Borne Precautions

Airborne transmission occurs by dissemination of either airborne droplet nuclei or small particles in the respirable size range that contain infectious agents that remain infective over time and distance (e.g., spores of *Aspergillus* spp and *M. tuberculosis*). Microorganisms carried in this manner may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room with) the infectious individual.

Preventing the spread of pathogens by the airborne route requires the use of special air handling and ventilation systems (e.g., airborne infection isolation rooms (AIIRs) to contain and then safely remove the infectious agent. Infectious agents to which this applies include *M. tuberculosis*, rubeola virus (measles), and varicella zoster virus (chickenpox). In addition to AIIRs, respiratory protection with NIOSH certified N95 or higher respirator is recommended for health care personnel entering the AIIR to prevent acquisition of airborne infectious agents, such as *M. tuberculosis*.

For certain other respiratory infectious agents, such as influenza, rhinovirus, and even some gastrointestinal viruses (e.g., norovirus and rotavirus), there is some evidence that the pathogen may be transmitted via small particle aerosols under natural and experimental conditions.

4.1.3 Prevention and Control of Hospital-Acquired Infection for Influenza A (H7N9) Virus

These technical guidelines are intended to guide health care providers in preventing and controlling hospital acquired infection with influenza A (H7N9) virus, lowering the risk of H7N9 nosocomial infections, and standardizing the behaviours and services of medical staff.

Basic Requirements

Health care providers should/must

- Establish an early warning system, an emergency preparedness plan, and workflow based on the sources of infection, pathways of transmission, susceptible populations, and real, local conditions
- Provide training for medical staff to improve early detection, diagnosis, isolation, and reporting
- Enhance monitoring for hospital-acquired infections
- Standardize disinfection, isolation, and protection policies to provide sufficient, necessary, and qualified disinfection and protection equipment to the medical staff to ensure that all disinfection, isolation, and personal protection measures are sufficiently and efficiently implemented
- Properly clean and disinfect medical equipment, contaminated items, item surfaces, and floor in accordance with the specifications for instrument processing and disinfection (refer to section 3.3 of this guideline)
- Manage and dispose of medical wastes from the diagnosis and treatment of patients with human H7N9 virus according to the Healthcare Waste Management Guidelines of Tanzania.

Source of Infection

The source of infection remains unclear. According to previous experiences and the epidemiological investigations of cases, birds carrying H7N9 avian influenza virus and their secretions or excretions may be the source of infections.

Route of Transmission

The virus may be transmitted through the respiratory tract or by exposure to the secretions or excretions of infected birds. Direct exposure to the virus can also result in infection. It does not appear to transmit easily from person to person and sustained human to human transmission has not been reported.

High-Risk Populations

Currently, high-risk populations include individuals who are involved in the slaughter, processing, and sale of poultry products and those who have been exposed to birds one week before disease onset.

4.1.3.1 Prevention and Control of Hospital-Acquired Infections

Fever Clinic

- A workflow consisting of isolation, transfer, and management of suspected and confirmed cases should be established. The building layout and workflow design should meet the requirements in Best Medical Management Practices for Isolation. Adequate hand washing facilities must be provided at the entry and exit of a fever clinic.
- The medical staff should follow standard prevention principles during diagnosis. They must wear surgical masks when contacting each patient and implement strict hand hygiene measures. When contacting a suspected or confirmed patient, the medical staff must wear medical protective masks.
- Medical staff must be aware of the epidemiology and clinical features of human infection with influenza A (H7N9) virus and take immediate isolation measures for suspected or confirmed patients; every case must be reported in a timely manner. After a patient is transferred out, terminal disinfection should be performed according to the Technical Specifications for Implementing Disinfection in Hospitals.
- Medical staff must put on or take off protective equipment correctly as required when entering or leaving a fever clinic.
- Patients and their caregivers (if conditions allow) must wear surgical masks.

Emergency

- A triage system must be established. A contingency plan covering the transfer out and rescue of critically ill patients should be established and updated and strictly implemented.
- A specific isolation zone should be established to allow on-site isolation and management of suspected/confirmed patients.
- The medical staff must carry out personal protection and hospital environment management in strict accordance with standard prevention principles.
- Diagnosis and treatment zones must have good ventilation conditions and be cleaned and disinfected regularly.

General Wards

- Contingency isolation rooms should be available in general wards to isolate and manage suspected/confirmed cases, and relevant working policies and workflow should be established. Sufficient disinfection facilities and PPE for

managing acute respiratory infections should be available in these rooms.

- When a suspected or confirmed case is found in the ward, the relevant contingency plans and workflow must be initiated immediately to provide timely and effective isolation and secure the patient.
- The suspected or confirmed patient should be managed and cared for by a special team of medical staff. Medical staff who are not directly involved in the management should be restricted from entering the ward. If condition allows, the patients should be treated in negative pressure rooms or transferred to a special hospital with appropriate isolation or treatment capabilities.
- After a patient is transferred out, terminal disinfection should be performed according to the Technical Specifications for Implementing Disinfection in Hospitals.

4.1.3.2 Special Wards for Patients with Suspected or Confirmed Human Infection with Influenza A (H7N9) Virus

- The building layout and workflow design should meet the requirements of the Best Medical Management Practices for Isolation.
- All suspected or confirmed patients should be immediately isolated, and suspects and cases should be placed in separate rooms. The suspects should be isolated in a single room. Etiologically confirmed patients with the same disease type can be placed in the same room.
- According to the transmission pathways of influenza A (H7N9) virus, contact or droplet precautions should be taken in addition to the standard preventive measures. These measures may include:
  - Putting on and removing PPE correctly according to the Best Medical Management Practices for Isolation when entering or leaving an isolation ward
  - Restricting patients' activities to within isolation wards; if a patient needs to leave the isolation ward or isolation zone, the patient must take appropriate protective measures (e.g., wearing a surgical mask) to avoid cross-infection
  - Using a stethoscope, thermometer, blood pressure monitor, and other medical devices for suspects and cases in a patient-specific manner; if medical devices are not used in a patient-specific manner, they must be thoroughly cleaned and disinfected
  - Visiting policies must be strictly implemented; in principle, no caregiver is allowed to visit

4.1.3.3 Protection of Health Care Staff

- Health care staff should take contact and droplet precautions based on the transmission pathways of the infection, in accordance with the standard protection principles.
- Health care staff must perform hand hygiene before and after each contact with patients in accordance with the standard for hand hygiene for HCWs.
- Health care staff must take appropriate protective measures according to the level of risk for infection. Health care staff must:
  - Wear non-sterile gloves when contacting contaminated items and blood, other bodily fluids, secretions, excretions, and vomit of patients and wash their hands after taking off gloves
  - Wear surgical masks (or respirators), goggles, and gowns when there is a risk of spraying/splattering of blood, other bodily fluids, excretions or secretions
  - Wear medical protective masks, goggles, and gowns when performing endotracheal intubation for suspects or cases
  - Change individual protective equipment, such as surgical masks, medical protective masks, goggles, and gowns that have been contaminated by patients' blood, other bodily fluids, and/or secretions
  - Properly put on and remove individual protective equipment; after taking off gloves or gowns, health care staff must wash or disinfect hands immediately
  - Protect themselves from being accidently stabbed by sharps

Used medical equipment and instruments must be properly cleaned and disinfected according to the specifications for disinfecting and sterilising instruments (Section 3.3)

4.1.3.4 Patient Management

- Suspects and cases must be isolated quickly and be specifically guided to enter isolation wards via an assigned route.
- If the condition allows, patients must wear surgical masks. Patients should be instructed to cover nose and mouth with a tissue when coughing or sneezing. After contacting respiratory secretions, patients must wash hands with regular detergent or disinfect hands with hand disinfectant. After a patient is discharged or transferred out, terminal disinfection should be performed according to the Specifications for Disinfecting and Sterilising Instruments (Section 3.3)
- The corpses of deceased patients must be handled quickly. The corpse should

be bound in double-layer fabric, wrapped in a double-layer plastic bag, and then sent directly by a special vehicle to a designated place for cremation. If cremation is not feasible because of ethnic or religious concerns, the corpse should be buried deep as required after being handled as described above.

4.2 PREVENTING MATERNAL AND NEWBORN INFECTIONS

Pregnant women in developing countries are at a much higher risk for HCAIs following delivery than their counterparts in developed countries. Caesarean section is the most important factor (10 times) compared to vaginal delivery in postpartum infection. The rate of post-operative infection after caesarean is high (15–60%). With the emergence of HIV, up to 12% of pregnant women have been found to be HIV seropositive. As a result, pregnant women in developing countries are at a higher risk for acquiring HCAI following delivery.

Other than maternal tetanus toxoid immunization during pregnancy and treatment to prevent congenital syphilis, few other preventive measures to protect the foetus and newborn are routinely available. For example, with the exception of prenatal HIV testing and antiretroviral treatment in a few countries, screening and treatment for infectious diseases (e.g., gonorrhoea and chlamydia) are not available because of cost and lack of laboratory capability.

4.2.1 Definition of Terms

Endometritis: Acute postpartum infection of the lining (endometrium) of the uterus that extends into the smooth muscle wall (myometrium). Clinical features include fever (usually developing on the first or second postpartum day), uterine tenderness, lower abdominal pain, and foul-smelling vaginal discharge (lochia).

Episiotomy: Surgical cut made in the perineum just prior to delivery. The purpose is to facilitate delivery of the presenting part and minimize the risk of injury to the perineal area.

Intra-amniotic infection syndrome (IAIS) also referred to as amnionitis orchorioamnionitis: Acute detectable infection in the uterus and its contents (foetus, placenta, and amniotic fluid) during pregnancy. It is usually related to colonization of the uterine cavity with organisms present in the cervix and vagina after prolonged ruptured membranes and obstructed labour.

Invasive group B streptococcal sepsis: Newborn infection characterized by bacteremia, pneumonia, meningitis, and death in up to 25% of infants with the

infection. It occurs most commonly following IAIS.

HCAI in newborns: Infection occurring after birth but excluding those infections known to have been transmitted across the placenta, such as congenital syphilis, cytomegalovirus, rubella, varicella (chicken pox), and the protozoan parasite *Toxoplasmosis gondii.*

HCAI in obstetrical patients: Infection that is neither present nor incubating at the time the patient is admitted to the hospital. Most UTIs and endometritis are nosocomial even though the causative organism may be endogenous (i.e., present in the maternal lower genital tract prior to delivery).

Septic pelvic thrombophlebitis: Thrombosis (blockage) of the deep pelvic veins due to inflammation and blood clots. Predisposing factors include caesarean section after prolonged labour, premature rupture of membranes, difficult delivery (forceps or vacuum extraction), anaemia, and malnutrition.

4.2.2 Epidemiology

4.2.2.1 Maternal Infections

Caesarean section is the most important factor contributing to both the frequency and severity of postpartum infection. Patients who have caesarean sections are at least 10 times more likely to become infected than patients who deliver vaginally.

Predisposing Factors for Wound Infection

Women who:

- Have bacterial vaginosis (*Gardnerella vaginalis*) isolated from the endometrium
- Have a caesarean section during the second stage of labour
- Nosocomial UTI and pneumonia, septicaemia and breast infections

Maternal factors

- Diabetes mellitus
- Malnutrition
- Immunodeficiency
- Anaemia
- Infection of foetal membranes (chorioamnionitis) diagnosed prior to delivery

4.2.2.2 Foetal and Newborn Infections

Foetal and newborn infections are classified based on whether they were acquired in utero (transplacentally), during passage through the birth canal (vertical transmission), or during the neonatal period (i.e., first 28 days following birth). Strictly speaking, only newborn infections acquired during passage through the birth canal or in the neonatal period are considered nosocomial. Determining whether an infection is nosocomial or was present or incubating prior to admission to the hospital is extremely difficult and often not useful.

4.2.3 Microbiology

4.2.3.1 Causes of Maternal Infections

Most postpartum infections are caused by indogenous flora—microorganisms that are normally present in the genital tract but usually cause no disease until labour, delivery, or postpartum. Nearly 30 types bacteria have been identified as being present in the lower genital tract (vulva, vagina, and cervix) at any time. While some of these, including several fungi, are considered nonpathogenic under most circumstances, at least 20, including *Escherichia. coli, Staph. aureus, Proteus mirabilis,* and *Klebsiella pneumoniae*, are pathogenic.

4.2.3.2 Colonization and Infection in Newborns

Most infants are delivered from a sterile environment inside the uterus. During and after birth, however, they are rapidly exposed to numerous microorganisms that colonize their skin, nasopharynx, and gastrointestinal tract. Sick newborns, subjected to multiple invasive procedures (e.g., endotracheal tubes or umbilical artery catheters), may be colonized at multiple sites with numerous other organisms, particularly gram-negative bacteria.

The skin of the newborn is a major initial site of bacterial colonization, particularly for *Staph. aureus*, which is most often acquired from within the nursery rather than from the mother.

Any break or cut in the skin provides an opportunity for infection to develop from this pathogenic organism. Therefore, to minimize the risk of infection in the newborn period, all sites must be cared for using aseptic technique.

Although severe infection in a full-term infant is uncommon, when it occurs, it is often secondary to group *B. streptococci, E. coli, Listeria monocytogenes, Citrobacter diversus,* salmonella, chlamydia, herpes simplex virus, or enteroviruses. All of these organisms can be transmitted to other infants in the nursery on the hands of hospital staff unless standard precautions are strictly followed, especially those for handwashing (or use of antiseptic hand rub) and gloves.

4.2.4 Preventing Foetal and Newborn Infectious Diseases

Prevention against most foetal and newborn infectious diseases has been achieved through improved maternal immunization, antenatal treatment of maternal conditions, and prophylactic use of medications, e.g., postnatal eye drops to prevent conjunctivitis and, recently, using antiretroviral drugs to prevent mother-to-child transmission of HIV.

Reducing the Risk of Maternal and Newborn Infections

To minimize the risk of exposure to HIV and other blood-borne viruses during labour, childbirth and resuscitation of the baby, strict use of standard precautions, especially hand washing and use of gloves, face shields, and plastic or rubber aprons, is mandatory.

Factors Increasing the Risk of Infection during Labour and Vaginal Childbirth

Vaginal deliveries are associated with a number of factors that increase a woman's risk of endometritis or UTI. These include:

- Prolonged ruptured membranes (more than 18 hours)
- Trauma to the birth canal (episiotomy, vaginal, or perineal lacerations and urethral tears)
- Manual removal of the placenta due to retained placenta or placental fragments
- Prolonged labour

4.2.4.1 Decreasing the Risk of Infection during Vaginal Childbirth

Step 1. To decrease the risk of maternal infection before and during childbirth, make sure the following items are available:

- Two pairs of surgical gloves
- Pair of clean gloves for washing the perineum
- Basin of clean warm water, soap, a face cloth, and clean dry towel

- Plastic or rubber apron and face shield (or a mask and goggles)
- Waterless, ABHR or antiseptic solution (e.g., 2%)
- Chlorhexidine gluconate or 10% povidone-iodine
- HLD or sterile blunt scissors (Mayo)
- HLD or sterile cord clamp or cloth to tie off the cord
- Injectable oxytocin (with or without egormetrine)
- Sterile syringe and needle
- Sterile urinary catheter
- Package of gauze squares
- Clean basin for the placenta
- Clean drape or cloth for wrapping the baby
- Second clean drape or cloth for wrapping the baby
- Clean perineal pads
- Light source (a flashlight or lamp), if needed
- Puncture-resistant sharps container (within arm's reach if possible)
- Plastic bag or leak-proof, covered waste container for disposal of contaminated waste items

Prior to Childbirth

Step 2: Wear protective equipment, including a plastic or rubber apron and face shield (or a mask and goggles), because splashing of blood and blood-tinged amniotic fluid can be expected.

Step 3: Once the patient is positioned for childbirth, put examination gloves on both hands and wash the perineal area (vulva, perineum, and anal region) with soap and clean water.

- Use a downward and backward motion when washing the perineal area so that fecal organisms will not be introduced into the vagina.
- After cleaning the perineal, place the washcloth or towel in a plastic container.
- Shaving perineal (pubic) hair prior to delivery is discouraged since it increases the risk of infection.

Step 4: Immerse both gloved hands in 0.5% chlorine solution, remove gloves by inverting, and place them in the plastic bag or leak-proof, covered waste container.
Step 5: Thoroughly wash hands, especially between the fingers, and forearm up to the elbows with soap and clean water and dry with a clean, dry towel or air dry.

Step 6: Put sterile (or HLD) surgical gloves on both hands.

During Childbirth

If resuscitation of the infant is required, use a Dee Le mucus trap or mechanical suction, if available, to avoid backflow of newborn secretions.

If manual removal of the placenta is required, use elbow-length gloves, if available, or improvise by using a second pair of fingerless surgical gloves, which should be used to avoid contaminating the forearm with blood.

After Childbirth

Step 7: Before removing gloves, put the placenta in the clean basin and place all waste items (e.g., blood-stained gauze) in the plastic bag or leak-proof, covered waste container.

Step 8: If an episiotomy or vaginal or perineal tears require surgical repair, use forceps to hold the suture needle and then place sharps (suture needles) in the puncture-resistant sharps container.

Step 9: Used drapers should be decontaminated and laundered for use.

Note: It is recommended to use disposable sheets (underpass) during delivery.

4.2.5 Minimizing the Risk of Infection during Caesarean Section

Caesarean sections should be performed using the same standards for any general surgical procedure. The following procedures should be observed:

- The surgeon and assistant should wear a face shield (or mask and goggles) and a plastic or rubber apron over their scrub suits because splashing of blood and blood-tinged amniotic fluid can be expected.
- Double gloving is recommended.
- Prophylactic antibiotics should be given before caesarean section when infection is suspected.
- The health worker receiving the infant should wash her/his hands and put on clean examination gloves before handling the baby.
- The baby should be placed on a clean towel after being passed to the health worker caring for the infant.
- Change surgical gloves before manually removing the placenta. (If available, use elbow-length surgical gloves or a combination of fingerless gloves and a new

pair of surgical gloves.)

- With prolonged ruptured membranes or with documented intra-amniotic infection syndrome (chorioamnionitis), avoid spillage of amniotic fluid into the abdominal cavity.
- Do not explore the peritoneal cavity unless absolutely necessary, and then only after closure of the uterine incision and surgical gloves have been changed
- To minimize postoperative wound infections:
  - Patients should not be shaved prior to surgery (if it is necessary to remove pubic or abdominal hair, clip the hair with scissors just prior to surgery).
  - Make sure skin incision is done with a scalpel rather than electrocautery.
  - Whenever possible, do not place drains in the subcutaneous layer.
  - Apply a sterile dressing and care for the wound.

4.2.6 Postpartum Care of the Mother following Caesarean Section

Minimizing the risk of nosocomial infection in mothers during the postpartum period includes the following:

- Ensure urine is flowing and the urine collection system is intact.
- Follow the "Tips for Preventing Infections" in section 4.6.3.1.
- Remove the catheter as soon as possible within 24 hours.

4.2.7 Postnatal Care of the Newborn

- Wash hands before holding or caring for the infant. Alternatively, a waterless, ABHR can be used.
- Wear gloves and plastic or rubber apron when handling the infant until blood, meconium, or amniotic fluid has been removed from the infant's skin.
- Careful removal of blood and other bodily fluids using a cotton cloth, not gauze, soaked in warm water, followed by drying the skin, may minimize the risk of infection.
- Bathing or washing the newborn should be delayed until the baby's temperature has stabilized (usually about six hours).
- Cover gowns or masks are not required when handling infants.
- The following general instructions for cord care can be applied:
  - Wash hands or use an antiseptic hand rub before and after cord care.
  - Keep the cord stump clean and dry.
  - Do not cover the cord stump with a dressing or bandage.
  - Fold a diaper or baby napkin below the cord stump.

- o If the cord stump gets soiled or dirty, gently wash it with boiled soapy water, rinse with boiled water, and dry with a clean cloth.
- o Explain to the mother that if the cord stump becomes red or is draining pus or blood, she should bring the baby to a clinic or hospital equipped to care for new-borns as soon as possible.

4.2.8 Management of Outbreaks in the Nursery or NICU

If an epidemic or outbreak of a particular disease, such as diarrhoea, is suspected, the first step is to assess it promptly and carefully to:

- Identify the source of the diarrhoea (e.g., patients, staff, or visitors) and the means of transmission (e.g., contamination via hands of staff, parents, or visitors)
- Decide on the type of control measures required to prevent the spread of the infection and determine the need for laboratory or epidemiologic studies (if available)

4.3 PREVENTING SSIs

Despite improvements in OR practices, instrument sterilization methods, better surgical techniques, and the best efforts of infection prevention practitioners, SSIs remain a major cause of HCAIs, and rates are increasing globally.

To reduce the risk of nosocomial SSIs in developing countries, a systematic but realistic approach must be applied with awareness that this risk is influenced by characteristics of the patient, operation, health care staff, and hospital.

Among surgical patients, SSIs are the most common nosocomial infection, accounting for about a third of all such infections. On average, having an SSI increases a patient's hospital stay by 7-10 days, with organ/space and deep incisional SSIs accounting for the longest stays and highest costs.

Exogenous sources of SSI pathogens are occasionally responsible. These include:

- Organisms from members of the surgical team (e.g., hands, nose, or other body parts)
- Contaminated surfaces in the OR, even the air
- Contaminated instruments, surgical gloves, or other items used in the surgery
- Primarily aerobic staphylococci or streptococci species (with the exception of tetanus endospores)

4.3.1 Definition of Terms

SSI: Either an incisional or organ/space infection occurring within 30 days after an operation or within 1 year if an implant is present

Superficial SSI: Involves only the incised body wall

Organ/space SSI: Any part of the body other than the incised body wall parts that were opened or handled during an operation

4.3.2 Classification of Surgical Wounds

Class 1: Clean

Uninfected operative wound with no inflammation and in which the respiratory, gastrointestinal, genital, and urinary tracts were not entered; clean wounds are closed at surgery and, if necessary, drained with closed drainage.

Class 2: Clean contaminated

Wound in which the respiratory, gastrointestinal, genital, or urinary tract was entered under controlled conditions but without unusual contamination or spillage of contents

Class 3: Contaminated

Open, fresh accidental wound or an operation with a major break(s) in aseptic technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract; also included are incisions in which acute, non-purulent inflammation is found

Class 4: Dirty or infected

Old wounds with dead tissue and those that involve existing clinical infection or a perforated bowel, suggesting that the pathogens causing the postoperative infection were present in the wound before surgery

4.3.3 Pathogenesis

By the end of an operation, bacteria and other microorganisms contaminate all surgical wounds, but only a small number of patients actually develop a clinical infection. Infection does not develop in most patients because their defence mechanisms effectively eliminate the contaminating organisms at the surgical site. Whether a potential infection occurs depends on several important factors including:

- Number of bacteria entering the wound
- Type and virulence (ability to cause infection) of the bacteria
- Host defence mechanisms (e.g., effectiveness of inflammatory response and

status of the immune system)

- External factors, such as being in the hospital several days before surgery or the operation lasting more than four hours

4.3.4 Predisposing Factors

Obesity increases the risk substantially when the subcutaneous abdominal fat layer exceeds 3 cm (1.5 inches) (Nyström, Carlsson, Leander, Faire, Hellenius, & Gigante, 2015). The risk is increased by the need for a larger incision, decreased circulation to the fat tissue, or the technical difficulty of operating through a large fat layer.

Infection at another site may increase the risk of spreading infection through the bloodstream.

Immunocompromised patients (e.g., those with HIV/AIDS and chronic corticosteroid use, such as occurs with asthma and heavy smokers or users of other tobacco products) are at significantly greater risk of SSIs.

Malnutrition may or may not be a contributing factor. Unfortunately, most studies have not been conducted in developing countries where severe malnutrition is more common.

Age, race, socioeconomic status, and chronic diseases, such as diabetes and malignancy, are difficult to assess because they are frequently associated with other factors that independently contribute to risk. For example, being older than 70 may be accompanied by decreased defence mechanisms, poor nutrition, and anaemia.

Note: *When possible, the effects of conditions that might complicate surgical recovery should be corrected or stabilized preoperatively.*

Remember: Wash hands or use an antiseptic hand rub before putting on gloves and after taking them off to avoid exposure to blood and other potentially infected bodily fluids and to decrease the risk of cross-contamination.

4.3.5 Other Factors

These factors, coupled with the experience and skill of the surgeon and assistant, reduce the risk of SSIs.

Prolonged preoperative hospitalization exposes patients to hospital flora, including multidrug-resistant organisms. Completing pre-surgical evaluations

and correcting underlying conditions before admission to the hospital decreases this risk. Also, performing elective surgery, where feasible, in ambulatory surgery centres rather than acute care hospitals decreases the risk of exposure to hospital flora.

Preoperative hair removal should be avoided if it is unnecessary. If hair must be removed, clip it with scissors just before the surgery. Shaving is a proven risk factor for SSIs.

Wide prepping of the proposed incision site with antiseptic solution preoperatively helps keep microorganisms from migrating into the wound (breakthrough) if site towels or drapes become wet during surgery.

Good surgical technique minimizes tissue trauma, controls bleeding, eliminates dead space, removes dead tissue and foreign bodies, uses minimal sutures, and maintains adequate blood supply and oxygenation. Specifically, it is important to:

- Handle soft tissue gently to avoid crushing that can result in tissue death (necrosis)
- Use electrocautery sparingly to control bleeding because it leaves behind dead tissue that is more likely to become infected
- Use absorbable sutures whenever possible because permanent sutures, especially silk sutures, have a higher risk of infection.
- Use closed suction drains that exit through a separate stab wound to help prevent accumulation of tissue fluid in the dependent portion of the wound; preventing this is especially important in obese patients and may reduce SSIs (Fry, 2003) (Passive drains, such a Penrose drain, exiting through the bottom of the incision should not be used.)

Increased length of surgical procedures is associated with increased risk of SSIs. It is estimated that the infection rate nearly doubles with each hour of surgery.

Prompt discharge postoperatively, provided patients are able to return home care, reduces the risk of infection as well.

Note: *Putting topical antibiotic ointments on closed skin incisions does not decrease the risk of SSIs* (Fry, 2003)*Healthy tissue growth is damaged when dry gauze is removed; moisten the dry gauze with sterile normal saline before removing it.*

4.3.6 Antibiotic Prophylaxis in Surgery

Using antibiotics preoperatively can reduce the rate of infection, particularly wound infections, after certain operations. The benefit, however, must be weighed against the risks of toxic and allergic reactions, the emergence of resistant bacteria, drug interactions, super infection, and cost (Nichols, 1981). For example, it is estimated that 5% of patients receiving an antibiotic will have a serious reaction to the drug. In general, antibiotic prophylaxis is recommended only for procedures with high infection rates and those in which the consequences of infection are especially serious.

4.3.7 Guidelines for Choosing a Prophylactic Antibiotic

Ideally prophylactic drug(s) should be directed against the most likely infecting organisms, but need not kill or inactivate all pathogens.

Because of frequent development of drug resistance, the following are recommended:

- Use drugs with a moderately long half-life
- Use drugs with broad-spectrum activity
- Avoid the use of drugs for prophylaxis when it is in use for post-op treatment
- Use drugs according to the sensitivity pattern of the area or HF

In most instances, a single IV dose of an antibiotic completed 30 minutes or less before the skin incision provides adequate tissue levels throughout the operation. If surgery is prolonged (more than four hours), if major blood loss occurs, or an antibiotic with a short half-life is used, one or more additional doses should be given during the procedure.

4.4 PREVENTING INTRAVASCULAR DEVICE USE-RELATED INFECTIONS

The use of intravascular devices, both venous and arterial, to deliver sterile fluids, medications, and nutritional products, as well as for central monitoring of blood pressure and other hemodynamic functions, has dramatically increased during the past decade, creating a large population at risk for local and systemic blood stream infections.

Intravascular devices inserted into the venous or arterial bloodstream bypass the normal skin defence mechanism and provide a way for microorganisms to enter the bloodstream

from:

- The device at the time of insertion
- Subsequent contamination of the device or attachments (e.g., tubing connected to the blood monitoring apparatus or the fluids being administered)
- Pathogens on the skin surrounding the insertion site

4.4.1 Microbiology

Both gram-negative bacteria and staphylococci are primary causes of catheter-related infection; however, with the advent of the HIV/AIDS epidemic, infections with fungi are increasingly being reported (Jarvis W R, 1991). Some microorganisms especially coagulase-negative *Staphylococus aureus,* pseudomonas, and acinetobacter species, adhere to the fibrin film that forms on the inside of catheters within days after insertion. As a consequence, infection with these organisms is quite common, especially if the infection occurs within 10 days of insertion (Raad I, 1993). For devices left in place longer than 30 days (e.g., tunnelled CVCs), bloodstream infections are more likely due to contamination of the hub of the catheter, especially if frequent handling of the hub occurs (Schaberg, Culver, & Gaynes, 1991).

4.4.2 Risk Factors

Individual-Related Factors

- Burns
- Surgical wounds
- Malnutrition
- Immunocompromised (by HIV/AIDS or chronic corticosteroid treatment)

Person-to-Person Contact-Related Factors

- Cross-contamination with other infected areas of the patient's body, either by the patient or on the hands of the health worker
- Cross-contamination from another patient via the hands of the health worker
- Cross-contamination from the patient when the health worker comes in contact with the patient's blood during insertion, care of the insertion site, or removal of a catheter
- Poor insertion or dressing change technique

Device-Related Factors before Insertion

- Cracks in infusion bottles
- Punctures in plastic containers
- Contaminated infusion fluid or additives
- Leaky IV administration sets with multiple connections
- Non-sterile preparation of IV infusion fluid

During Use

- Multiple changes of IV fluid containers while using the same IV administration set
- Multiple injections and irrigations of the system
- Central venous pressure measurement apparatus

4.4.2.1 Reducing the Risk of HCAI with Intravascular Devices

Hand Hygiene and Gloves

- Wash hands thoroughly with soap and running water before touching any IV set components.
- Put on examination gloves just before touching the insertion site or the hub of the needle or catheter.
- Wash hands with soap and running water after removing gloves.

Site Care and Dressings

- If the site for inserting the catheter is dirty, wash it with soap and clean water and dry it before applying skin antiseptic.
- If using povidone-iodine as the antiseptic agent, allow it to dry after applying or wait at least 2 minutes before insertion.
- Use transparent, adherent dressings to allow inspection of the site.
- Leave dressings in place up to 72 hours as long as they are dry. (They should be changed immediately if they get wet, soiled, or loose.)
- Change gauze and tape dressings if an inspection of the site is necessary.
- Gently palpate the catheter or needle site daily to check for tenderness.
- Inspect the insertion site if the patient develops tenderness or fever without an obvious cause (Soule, 1996).

4.4.2.2 Peripheral Catheters (Venous and Arterial)

Site Selection and Change

- For adults, hand veins are preferred over arm veins, and arm veins over leg and foot veins. (Needles and catheters inserted in leg and foot veins are more likely to cause inflammation at the insertion site, or phlebitis.)
- Changing sites at 72–96 hours will reduce phlebitis and local infection. Cannulas are preferred over steel needles because they are less likely to perforate the vein with movement.
- If only short-term (less than 48 hours) IV infusion is planned, straight or butterfly needles are less irritating than plastic catheters and have lower rates of infection.
- Because straight and butterfly needles frequently infiltrate, they should not be used with solutions that could cause tissue necrosis.

4.4.2.3 Central Venous Catheters

Site Care and Dressings

- If the site for inserting the catheter is dirty, wash it with soap and clean water and dry it before applying the skin antiseptic.
- Use 2% chlorhexidine gluconate, 10% povidine iodine, or 60–90% alcohol for skin preparation.
- Insertion should be done using full barrier precautions (sterile gloves, gown, mask, and site drape) in a procedure area, not at the bedside.

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.
- Infusion (administration) sets should be changed whenever they are damaged and routinely at 72 hours. If the tubing becomes disconnected, wipe the hub of the needle or plastic catheter with 60–90% alcohol and connect it to a new infusion set.
- Tubing used to administer blood products or lipid emulsions should be replaced within 24 hours (Soule, 1996).

4.4.2.4 Insertion, Maintenance, and Removal of Peripheral Venous Lines

Insertion Procedure for Establishing an IV Line

Step 1: Make sure all items are available:

- IV solution bag or bottle
- Straight or butterfly needle or plastic catheter (steel needle inserter covered with soft plastic tubing that is left in place after the needle is withdrawn)
- Antiseptic solution (e.g., 2% chlorhexidine, 60–90% alcohol or 10% povidone–iodine) and sterile or clean gauze squares (2 × 2 or cotton swabs)
- Surgical tape or transparent dressing
- Clean tourniquet
- Clean arm board
- Towel to place under patient's hand or forearm
- IV pole (drip stand)
- Clean pair of single-use examination gloves
- Basin of clean warm water, soap, face cloth, and clean dry towel
- Plastic bag or leak-proof covered waste container for disposal of contaminated items

Step 2: Explain the procedure to the patient.

Step 3: Prior to starting the procedure, identify the best vein(s) for inserting IV needle or plastic catheter.

Step 4: If the venepuncture site is dirty, first wash it with soap and clean water and dry with a clean cloth before applying a skin antiseptic.

Step 5: Wash hands with soap and clean water and dry with a clean dry towel.

Step 6: Check the IV solution (bottle or plastic bag) to be sure it is the correct infusion.

Step 7: Open the infusion set and assemble the parts using aseptic technique (e.g., don't touch the ends of tubing).

Step 8: Insert the infusion set into solution bottle or bag

- Remove the protective cover from the solution bottle or bag without touching the opening.
- Remove the protective cap covering the insertion spike without touching the spike and insert the spike into the stopper of the IV bottle or opening of the IV bag.

Step 9: Fill the infusion tubing.

- Compress the drip chamber and release.
- Remove the protective cover of the IV tubing and release the roller clamp to allow fluid to fill the tubing; close the roller clamp and replace the protective cover. (Check to be sure tubing is clear of air bubbles.)

Step 10: Put clean examination gloves on both hands.

Step 11: Cleanse insertion site with antiseptic solution using a circular motion outward from the insertion site. (If using povidone-iodine, allow it to dry about 2 minutes because it releases free iodine, the active antiseptic agent, slowly.)

Step 12: Insert the needle or catheter with the bevel up using the dominant hand. Look for blood return in the tubing and carefully advance the needle or butterfly until the hub rests at the venepuncture site. (With catheters, after getting blood return, advance the needle about 1 cm (1/2 inch), withdraw the inner insertion needle, and then advance the plastic catheter to the hub.)

Step 13: While stabilizing the needle or catheter, release the tourniquet and roller clamp to permit a rate of flow sufficient to keep the IV line open.

Step 14: Secure the needle or catheter by placing a narrow piece of tape (1 cm or 1/2 inch) under the hub with the adhesive side up and cross-tape it over the hub. Then place a second piece of narrow tape directly across the hub of the needle or catheter.

Step 15: Place a sterile gauze square (2 × 2) over the venepuncture site and secure it with two pieces of tape. (Alternatively, place a transparent dressing over the venepuncture site.)

Step 16: Prior to removing gloves, place any blood-contaminated waste items (cotton or gauze squares) in a plastic bag or leak-proof, covered waste container.

Step 17: Remove gloves by inverting and placing them in a plastic bag or waste container.

Step 18: Wash hands or use antiseptic hand rub as above.

Step 19: Secure the wrist or forearm to the arm board by applying two strips of tape directly across wrist or forearm. (To minimize discomfort when removing the arm board, attach a shorter piece of tape to the longer piece, adhesive side to adhesive side that will cover the wrist or arm.)

Step 20: Adjust the flow rate to the correct number of drips per minute.

4.4.2.5 Maintenance of IV Lines

Step 1: Check the line every 8 hours for phlebitis or evidence of infection.

Step 2: Change the infusion site at 72-96 hours, when practical, to reduce the risk of phlebitis and local infection.

Step 3: The infusion (administration) sets (including the piggybacks) should be changed whenever they are damaged and routinely at 72 hours.

Step 4: If the tubing becomes disconnected, wipe the hub of the needle or the plastic catheter with 60–90% alcohol and connect to a new infusion set.

Step 5: Mark the site on the plaster with time and date of insertion of the IV line and make sure the site is dry.

4.4.2.6 Removal Procedure

Step 1: Make sure all items are available:

- Clean pair of examination gloves
- Antiseptic solution (2% chlorhexidene gluconate, 60-90% alcohol, or 10% povidone-iodine)
- Gauze squares (2 × 2) and surgical tape or a sterile, wide (1 inch) band aid
- Puncture-resistant sharps container within arm's reach if a straight or butterfly needle will be used
- Plastic bag or leak-proof, covered waste container for disposing of contaminated items

Step 2: Wash hands with soap and running water.

Step 3: Stop the infusion by closing the roller clamp.

Step 4: Put clean examination gloves on both hands.

Step 5: Remove the dressing and discard it in a plastic bag or leak-proof, covered waste container.

Step 6: Check the patient's hand or wrist for phlebitis or evidence of an infection (an area of swelling, redness, warmth, and tenderness of the skin around the site where the intravascular catheter comes out of the skin, the exit site). If phlebitis is associated with other signs of infection, such as fever or pus coming from the exit site, it is classified as a clinical exit site infection.

Step 7: Carefully remove the needle or the plastic catheter with one hand and with the other hand cover the insertion site with a sterile gauze square (2 × 2).

Step 8: Press firmly for about a minute, or alternatively place two pieces of narrow tape, about 1 cm or ½-inch wide, directly across the gauze square. Or alternatively, after pressing on the gauze square, remove it and cover the insertion site with a

sterile bandaid.

Step 9: Prior to removing gloves, discard the needle or plastic catheter in a sharps container and place the IV tubing and any blood-contaminated waste items (cotton/gauze square) in a plastic bag or leak-proof covered waste container.

Step 10: Remove gloves by inverting and placing them in either a plastic bag or a leak- proof, covered waste container.

Step 11: Wash hands with soap and running water.

4.4.2.7 Injection Safety Best Practices

A safe injection does not harm the client or patient, does not expose the health care provider to any avoidable risk, and does not result in any waste that is dangerous for other people.

Eliminating unnecessary injections is the highest priority for preventing injection-associated infections. When injections are medically indicated, they should be administered safely. The following best practices are measures that have been determined, through scientific evidence or expert consensus, to effectively protect patients, health care providers, and communities.

4.4.2.8 Use Sterile Injection Equipment

- Use a sterile syringe and needle for each injection and to reconstitute each unit of medication.
- Use new, quality controlled disposable syringes and needles.
- Inspect packaging for breaches in barrier integrity; discard a needle or syringe if the package has been punctured, torn, or damaged by exposure to moisture.
- Use single-use syringes and needles.

4.4.2.9 Prevent Contamination of Injection Equipment and Medication

- Prepare each injection in a clean designated area where blood or bodily fluid contamination is unlikely.
- Use single-dose vials rather than multi-dose vials.
- If multi-dose vials must be used, always pierce the septum with a sterile needle. Avoid leaving a needle in place in the stopper of the vial.
- Select pop-open ampoules rather than ampoules that require the use of a metal file to open them.
- If using an ampoule that requires a metal file to open, protect fingers with a

clean barrier (e.g., small gauze pad) when opening the ampoule.
- Inspect medications for visible contamination or breaches of integrity (e.g., cracks, leaks); if any are found, discard the medication.
- Discard a needle that has touched any non-sterile surface.

4.4.2.10 Prevent Needle-Stick Injuries to Health Care Providers

- Anticipate and take measures to prevent sudden patient movement during and after injection.
- Avoid recapping and other hand manipulations of needles.
- Collect used syringes and needles at the point of use in a sharps container that is puncture and leak-proof and can be sealed when 3/4 full.

4.4.2.11 Prevent Access to Used Needles

- Seal sharps containers for transport to a secure area in preparation for disposal. After closing and sealing sharps containers, do not open, empty, reuse, or sell them.
- Manage sharps waste in an efficient, safe, environment-friendly way to protect people from voluntary and accidental exposure to used injection equipment.

4.4.2.12 Other Practice Issues

Provider's Hand Hygiene and Skin Integrity

Perform hand hygiene (wash or disinfect hands) prior to preparing injection material and after injections. The need for hand hygiene between each injection will vary based on blood or bodily fluids. Avoid giving injections if skin integrity is compromised by local injection or skin condition (e.g., weeping dermatitis, skin lesions, and cuts). Cover any small cuts.

Gloves

Gloves are not needed for injections. Single-use gloves may be indicated if excessive bleeding is anticipated.

Swabbing Vial Tops or Ampoules

Swabbing vial tops or ampoules with antiseptic or disinfectant is not necessary. If swabbing with an antiseptic is done, use a clean, single-use swab and maintain product-specific recommended contact time. Do not use cotton balls stored wet in a multi-use container.

Skin Preparation Prior to Injection

Wash skin that is visibly soiled or dirty. Swabbing clean skin prior to giving an injection is not necessary. If swabbing with an antiseptic is done, use a clean, single- use swab and maintain product-specific recommended contact time. Do not use cotton balls stored wet in a multi-use container.

Engineered Technology

Whenever possible, use devices designed to prevent needle-stick injuries that have been shown to be effective for patients and health care providers. Auto-disable syringes should be used to prevent reuse of injection equipment, including immunization services.

4.5 PREVENTING NOSOCOMIAL PNEUMONIA

Pneumonia is a complex infection that is often difficult to distinguish from other lung diseases, especially adult respiratory distress syndrome, bronchitis, emphysema, and congestive heart failure. Most commonly accepted criteria for nosocomial pneumonia include fever, cough, decreased breath sounds or dullness in a specific area of the lungs, and production of purulent (infected) sputum in combination with X-ray evidence suggestive of an infection.

Nosocomial pneumonia is the infection most likely to be fatal and is the most expensive to treat.

Most nosocomial pneumonias occur by aspiration of bacteria growing in the back of the throat (oropharynx) or stomach. Intubation and mechanical ventilation greatly increase the risk of infection because they:

- Block the normal body defence mechanisms—coughing, sneezing, and the gag reflex
- Prevent the washing action of the hair (cilia) and mucus-secreting cells lining the upper respiratory system that provides a direct pathway for microorganisms to get into the lungs

Other procedures that may increase the risk of infection include oxygen therapy, intermittent positive pressure breathing treatment, and endotracheal suctioning.

Most nosocomial pneumonias occur after surgery, especially if mechanical ventilation is needed postoperatively, and most reported cases of nosocomial pneumonia are due to bacteria. The combination of severe illness, the presence of multiple invasive devices (IVs, urinary catheters, and mechanical ventilators), and frequent contact with the hands of personnel often lead to cross-contamination.

4.5.1 Risk Factors

Many risk factors for nosocomial pneumonias are not alterable, e.g., age over 70, chronic lung disease, severe head injuries with loss of consciousness, and other serious medical conditions, such as end-stage renal disease, cirrhosis, cigarette smoking, alcoholism, obesity, major cardiovascular or pulmonary surgery, and patients with endotracheal tubes or on ventilators. Although it is impossible to change these risk factors, knowing about them is valuable in terms of anticipating problems and limiting the use of invasive devices (e.g., IV lines and urinary catheters) as much as possible.

4.5.2 Reducing the Risk of Nosocomial Pneumonia

Pre-Operative Pulmonary Care

HCWs should:

- Limit the use of narcotics (to a short duration)
- Prevent colonization and infection with new organisms
- Prevent transfer organisms among hospitalized patients
- Prevent cross-contamination from health care staff to patients
- Teach patients about deep breathing, moving in bed, frequent coughing, and early ambulation

Minimizing Contamination of Respiratory Therapy Equipment

To minimize cross-contamination when suctioning patients on ventilators:

- Wash hands or use an ABHR before putting on gloves
- Wear clean examination gloves and a protective face shield or mask
- Remove gloves immediately after therapy and discard them in a plastic bag or leak-proof, covered waste container

Suction catheters should be decontaminated, cleaned, and HLD by boiling or steaming.

Note: *Mechanical ventilation should be used only when necessary and only for as long as necessary.*

To reduce the risk of contamination and possible infection from mechanical respirators and other equipment:

- Drain and discard any fluid in the tubing, taking care not to allow the fluid to drain toward the patient
- Use small nebulizer bulbs because they produce aerosols that can penetrate deep into the lungs (large volume nebulizers are associated with gram-negative pneumonia and should not be used)
- Decontaminate, clean, and HLD breathing circuits by steaming or soaking in a chemical high-level disinfectant

Reprocess resuscitation devices, such as Ambu bags, promptly.

Preventing Gastric Reflux

- Avoid prolonged use of nasal gastric tubes for feeding.
- Feed small, frequent amounts rather than large amounts.
- Raise the patient's head on the bed so that the patient in a semi-sitting position.

Postoperative Management

Surgical units should have effective plans for:

- Optimizing the use of pain medication to keep the patient comfortable enough to cough effectively
- Regularly moving and exercising patients
- Encouraging deep breathing in the immediate postoperative period and for the next few days

4.6 PREVENTING UTIs

Nosocomial UTIs are the infection of any part of the urinary tract, ranging from the urethra all the way to the kidney when it is acquired in health care settings. UTIs are the most common type of nosocomial infections, accounting for 40% of all infections in hospitals every year (Kamat, Fereirra, Amonkar, Motghare, & Kulkarni, 2009).

Organisms attacking any portion of the urinary system cause UTIs: the kidneys

(pyelonephritis), bladder (cystitis), prostate (prostatitis), urethra (urethritis), or urine (bacteriuria). Once bacteria infect any site, all other areas are at risk.

4.6.1 Microbiology

Most nosocomial UTIs are caused by gram-negative coliform bacteria, particularly *E. coli*, pseudomonas species, and organisms from the enterobacter group. Collectively, they account for more than 80% of culture-positive UTIs (Haley RW, 1985).

Although the most common organism is *E. coli*, infections with fungi, such as the candida species, have increased with the advent of HIV/AIDS and widespread use of broad-spectrum antibiotics.

Factors that can lead to bacteriuria and UTIs include:

- Passage of organisms from the urine bag to the bladder (retrograde contamination) that occurs in patients with indwelling catheters (i.e., those left in place for several days or weeks)
- Ability of some organisms to grow on the outside or inside of the tubing and even in the urine itself

4.6.2 Reducing the Risk of Nosocomial UTIs

Except for the end of the urethra or penis, the urinary system is normally sterile. The ability to completely empty the bladder is one of the most important ways the body has to keep the urine sterile and prevent UTIs. If the bladder empties completely during the voiding process, bacteria do not have the chance to infect tissue or grow and multiply in the bladder. Therefore, the normal defences against a UTI are an unobstructed urethra, the voiding process, and normal bladder mucosa. The insertion of a catheter, however, bypasses these defences, introduces microorganisms from the end of the urethra or penis, and provides a pathway for organisms to reach the bladder.

Organisms may reach the bladder in two ways: through the inside of a catheter (i.e., the backward flow of urine) or by traveling up the space between the outer surface of the catheter and the urethral mucosa. Therefore, once the catheter is inserted, any back-and-forth movement of the catheter (e.g., raising the collection bag above the level of the bladder) or allowing urine to be collected in an open

drainage system (bag or container) should be avoided because each of these activities potentially enables organisms to enter the bladder.

The backward flow of urine in the catheter is the more common infection in men.

Organisms migrating into the bladder along the outside of the catheter is more common in women, in part because of their shorter urethra. As a consequence, women are more likely to develop a UTI from organisms located in the vagina .

Placement of an indwelling catheter should be performed only when other methods of emptying the bladder are not effective, and it is particularly important to limit the duration as much as possible.

Other methods for management of urinary tract problems include intermittent catheterization using a sterile straight catheter, condom catheters for male patients, adult diaper pads, bladder retraining, and the use of drugs to stimulate urination. Loss of control (incontinence) or inability to void (retention) may be managed better by straight (in and out) catheterization several times daily rather than by putting in an indwelling catheter.

4.6.3 Procedures for Insertion, Removal, and/or Replacement of Urinary Catheters

Before inserting a catheter, check to be sure that it is being inserted for the right reason. For example, if a catheter is being inserted because of urinary retention, ask the patient if she/he has voided and the time of voiding and measure the height of the bladder. Also, before removing a catheter, check to be sure the doctor's orders are correct to avoid an error.

Indications for Catheterization

The indications for catheterization include, but are not limited to, the following:

- For short-term (days) management of incontinence (the ability to control urination) or retention (the inability to pass urine) not helped by other methods
- To measure urine output over several days in critically ill patients
- To instil medications
- For treatment of urinary outlet obstruction (blockage of the tube leading from the bladder to the outside, the urethra)

- For postoperative management of surgical patients with impaired bladder function (the most common routine use)

Insertion Procedure

Step 1: Make sure that all of the following items are available:

- A sterile indwelling urinary catheter with a closed continuous drainage system or an HLD or sterile straight catheter and a clean urine collection container
- Sterile syringe filled with boiled or sterile water for blowing up the balloon of an indwelling catheter
- Pair of sterile gloves
- Antiseptic solution (2% chlorhexidene gluconate or 10% povidone-iodine)
- Sponge-holding forceps with gauze squares (2 × 2) or large cotton applicators
- Single-use packet of lubricant
- Light source (flashlight or lamp), if needed
- Basin of clean warm water, soap, a face cloth, and paper towels
- Plastic bag or leak-proof covered waste container for disposal of contaminated items

Step 2: Prior to starting the procedure, have:

- Women separate their labia and gently wash the urethral area and inner labia
- Men retract their foreskin and gently wash the head of the penis and foreskin

Step 3: Wash hands with soap and clean water and dry with a clean paper towel. Apply about 1 teaspoon of a waterless ABHR to both hands and vigorously rub hands and between the fingers until dry.

Step 4: Put surgical gloves on both hands.

Step 5: Use a small a catheter as consistent with good drainage.

Step 6: Health workers who are right-handed (dominant hand) should stand on the patient's right side and on the left side, if left-handed.

Step 7: For women: Separate and hold the labia apart with the non-dominant hand and prep the urethral area two times with an antiseptic solution using either cotton applicators or sponge forceps with gauze squares.

For men: push the foreskin and hold the head of the penis with the non-dominant hand; then prep the head of the penis and urethral opening two times with an antiseptic solution, using cotton applicators or a sponge forceps with gauze squares.

Step 8: If inserting a straight catheter, grasp the catheter about 5 cm (2 inches) from the catheter tip with the dominant hand and place the other end in the urine collection container.

Step 9: For women, gently insert the catheter until urine flows. For children, insert only about 3 cm (1.5 inches).

For men, gently insert the catheter about 18-22 cm (7-9 inches) or until urine flows. For children, insert only about 5-8 cm (2-3 inches).

Step 10: If inserting an indwelling catheter, push another 5 cm (2 inches) after urine appears and connect to the urine collection tubing if not using a closed system.

Step 11: For an indwelling catheter, inflate the balloon, pull out gently until resistance is felt and secure the indwelling catheter properly to the thigh or lower abdomen.

Step 12: For straight (in and out) catheterization, allow the urine to slowly drain into the collection container and then gently remove the catheter.

Step 13: Place soiled items, including the straight catheter if it is to be disposed, in a plastic bag or leak-proof, covered waste container.

Step 14: Alternatively, if a straight catheter is to be reused, place it in 0.5% chlorine solution and soak for 10 minutes to decontaminate.

Step 15: Remove gloves by inverting and place them in either a plastic bag or waste container.

Step 16: Wash hands or use an antiseptic hand rub as above.

Removal and/or Replacement

Step 1: Make sure all items are available (as step 1 above if replacing an indwelling catheter):

- Pair of examination gloves
- Empty sterile syringe for removing fluid from the catheter balloon
- Sponge-holding forceps with gauze square (2x2) or large cotton applicators
- Plastic bag or leak-proof, covered waste container for disposal of contaminated items

Step 2: Have the patient wash the urethral area (women) or the head of the penis (men), or do it for them wearing a pair of clean examination gloves.

Step 3: Wash hands with liquid soap and running water.

Step 4: Put clean, single-use examination gloves on both hands.

Step 5: With the empty syringe, remove the water from the catheter balloon.

Step 6: For women, separate and hold the labia apart with the non-dominant hand, then wipe the urethral area twice with antiseptic solution using cotton applicators or a sponge forceps with gauze squares and gently remove the catheter.
For men, push back the foreskin and hold the head of the penis with the non-dominant hand, then wipe the head of the penis and the area around the catheter two times with an antiseptic solution, using cotton applicators or sponge-holding forceps with gauze squares and gently remove the catheter.
Step 7: If you are just removing the catheter, then follow steps 13 to 16 of the insertion procedure above.
Step 8: If you are replacing the indwelling catheter, follow steps 1 through 16 of the insertion procedure

4.6.3.1 Tips for Preventing Infections in Catheterized Patients

- Remove the catheter as soon as possible within 24 hours.
- The catheter collection system should remain closed and not be opened unless absolutely necessary for diagnostic or therapeutic reasons.
- Caution the patient against pulling on the catheter.
- Urine flow through the catheter should be checked several times a day to ensure that the catheter is not blocked.
- 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.
- Urine drainage (collection) bags should be emptied aseptically; touching the tip of the emptying tube to the side of the collection bag or permitting the tip to touch the urine in the vessel should be avoided. Replace bags with new or clean containers when needed.
- If the drainage tubing becomes disconnected, do not touch the ends of the catheter or tubing. Wipe the ends of the catheter and tubing with an antiseptic solution before reconnecting them.
- Wash the head of the penis and urethral opening (men) or the tissue around the urethral opening (women) after a bowel movement or if the patient is incontinent.
- If frequent irrigation is required, the catheter should be changed.
- Never re-use disposable catheter materials.

4.7 INFECTION PREVENTION FOR HAEMODIALYSIS PATIENTS

4.7.1 Overview

- Infections (including those affecting the bloodstream) are the second leading cause of death among haemodialysis patients.
- Infections acquired in dialysis units can kill, disable, hospitalize, and/or prolong illness in patients while disrupting lives and increasing the cost of treatment.
- Dialysis-related infections can occur in many body locations, including the bloodstream, bones, lungs, and skin.
- There are many reasons patients receiving dialysis have a high risk of infections, including the close proximity of patients to each other, fast patient turnover between dialysis sessions, and poor health of the person receiving dialysis.
- The immune system of patients with chronic kidney disease often does not work well, which impairs their ability to fight infection.
- Some of the medicines may also affect the immune system, which can increase the risk of getting an infection.
- Frequent admissions to a hospital may also expose patients to infections, such as central line-associated bloodstream infections, MRSA, and catheter-associated UTIs.

4.7.2 What Patients Can Do

- Clean fistula site with soap and water before every dialysis treatment.
- Clean hands with soap and water or waterless alcohol-based sanitizer before you start your dialysis session and after you leave.
- If you have a catheter, wear a mask while the nurse is hooking you up to the dialysis machine to prevent germs from your mouth from falling or spraying onto the catheter.
- If you do not have a permanent fistula, but will need dialysis for your lifetime, discuss the early placement of a fistula with your doctor before the need for dialysis.
- Get the flu vaccine every year.
- Get the HBV vaccine. The cornerstone of preventing HBV infection and its sequelae is vaccination, which is recommended for all patients undergoing chronic haemodialysis and health care providers who care for them.

4.7.3 Prevention and Management of HIV Infection

Routine testing of haemodialysis patients for HIV infection for infection control purposes is not necessary or recommended. However, patients with risk factors for HIV infection should be tested so that, if infected, they can receive proper medical care and counselling to prevent transmission of the virus. Infection control precautions recommended for all haemodialysis patients are sufficient to prevent HIV transmission between patients. HIV-infected patients do not have to be isolated from other patients or dialyzed separately on dedicated machines. In addition, they can participate in dialyzer reuse programs. Because HIV is not transmitted efficiently through occupational exposure, reprocessing dialyzers from HIV-positive patients should not place staff members at increased risk for infection (CDC 2001).

Patients infected with HTLV-III/LAV can be dialyzed by either haemodialysis or peritoneal dialysis and do not need to be isolated from other patients. The type of dialysis treatment (i.e., haemodialysis or peritoneal dialysis) should be based on the needs of the patient.

In addition to standard precautions, isolation (separate room) for HBsAg-positive patients is standard practice in haemodialysis facilities.

It is critical to screen patients with renal failure very early for latent TB infection. CDC recommends (and CMS requires) that all haemodialysis patients be screened for TB at baseline and whenever exposure is suspected.

What Patients Can Do

Get your shots:

- Tetanus: A dose of dT which contains diphtheria toxoid (d) and tetanus toxoid (T) in combination with other antigens should be given every 10 years;
- Tetanus, diphtheria, pertussis (Tdap) can be substituted for those under 65 years of age, assuming the patient has completed a primary series. If not, this should be done.
- If you will receive IV fluids, request that they do not use the bag for other patients or set up the IV tubing until they are ready to administer fluid to you.
- Notify a nurse or doctor if the area around the central line is painful or inflamed, secreting (pus), or if the bandage becomes wet or unclean.
- Seek medical attention immediately if you develop symptoms, such as fever,

uncommon fatigue, loss of appetite, nausea, vomiting, and/or changes in mental activity. Sometimes patients on dialysis do not develop a fever when they have an infection, so all symptoms are important.

What Patients Can Ask

- Ask for a HCV blood test before starting dialysis treatment, and then on a routine basis. Infection control techniques to prevent HCV transmission in dialysis centres are primarily centred on safe injection practices, hand hygiene, and adequate cleaning of environmental surfaces and equipment between patients. Although patients with HBV infection are isolated, CDC and the Kidney Disease Outcomes Quality Initiative do not recommend isolating patients with HCV (CDC, 2017).
- Before receiving an injection, ask if the needle and syringe have been newly opened for you because syringes and needles must be used one time only.
- Ask doctors and nurses to explain why a central line is required, how long it will need to be in, and if you can use a fistula or graft for dialysis treatment.
- Ask if the dialysis staff put a new external (transducer) filter on the dialysis machine for every patient and replace the filter when it is soaked with blood. This prevents blood from contaminating the inside of the dialysis machine and prevents patient exposure to contaminants.
- Ask if the water used for dialysis is routinely tested for bacteria and what is the policy if levels are higher than acceptable.
- Ask if your dialysis caregiver has received the flu vaccine this year.

What Patients Should Observe

- Check to see if dialysis staff have cleaned their hands before and after they touch you or your dialysis machine.
- Make sure your nurse wears a mask during initiation and discontinuation of treatment with a catheter.
- Observe if the dialysis staff cleans the skin of your fistula well with an antiseptic before hooking you up to the dialysis machine.
- Observe if the chair, table, and machine are cleaned between each patient use.

What Family Members and Visitors Can Do

- Wash hands or use an ABHR before and after visiting the patient.
- Wear gloves and a clean cover gown to prevent contamination of clothing.
- Keep wounds covered with a bandage.

- Avoid sharing personal items and clothing.

What HCWs Should Do

Certain products and principles are recommended that optimize environmental cleaning in health care settings, including haemodialysis facilities. The dialysis nurse or technician typically perform the following tasks:

- Store cleaner/disinfectant separately from skin antiseptics/patient supplies (separate shelves and below patient supplies to avoid potential contamination).
- Perform hand hygiene before and after cleaning the patient station.
- Don gloves when using cleaner/disinfectants.
- Use one set of cleaning cloths or disposable germicidal wipes for each patient station.
- Use microfiber cloths and mops if possible (more effective cleaning products than regular cotton cleaning cloths).
- Clean all frequently touched or "high touch" surfaces in the "patient zone" between patient treatments (chairs, armrests, counters, drawers/cupboard handles, exterior surfaces of haemodialysis machines). Note that some of these high-touch surfaces may be right outside the patient zone (e.g., computer stations) and must also be cleaned between patient treatments.
- Clean the top of an object first and work down to avoid soiling surfaces just cleaned. If using cleaning cloths instead of disposable germicidal wipes:
  - o When using a disinfectant cleaner, wet the surface, use friction to clean, and allow to air dry
  - o Fold the cleaning cloth in a series of squares to provide a number of potential cleaning surfaces; a wadded cloth does not clean efficiently
  - o Replace cloth as needed; more than one cloth may be required for a patient station
  - o Never use the same cleaning cloth for more than one patient unit
  - o Never re-dip a used cloth into clean disinfectant solution
- Dispose of items taken into an individual haemodialysis patient station after use, dedicate them for use on a single patient, or clean and disinfect before taking to a common clean area or used on another patient.
- Non-disposable items that cannot be comprehensively cleaned and disinfected (e.g., adhesive tape, cloth covered blood pressure cuff) should be dedicated for use on a single patient.
- Change external venous and arterial pressure transducer filters/protectors after

each patient treatment and not reused. Internal transducer filters do not need to be changed routinely between patients.

- When reprocessing or disposing of dialyzers, cap dialyzer ports and clamp tubing. Used dialyzers should be placed in a leak-proof container for transport from the patient station to the reprocessing area. At a minimum, wear gloves. Wear a gown if there is any risk of contamination of clothing.
- All equipment, including the front of the dialysis machine, should be considered contaminated after a patient dialysis session.
- Non-disposable instruments (scissors, hemostats, clamps, etc.) that have no contact with sterile tissue or mucous membranes may become contaminated during the procedure. To facilitate thorough cleaning of the hinges and joints, submerge and clean with enzymatic detergent, rinse thoroughly, and then soak in an appropriate disinfectant according to manufacturer's instructions; typically, a low-level disinfectant is used, unless the instruments are visibly contaminated with blood; a tuberculocidal disinfectant should then be used.
- Alternatively, send the instruments to the sterile processing department, if available, for reprocessing. Wiping with a cloth saturated with disinfectant may not be adequate to thoroughly clean hinged or jointed instruments.

4.7.4 Interior Disinfection of the Dialysis Machine

- Disinfection of the internal pathways of the dialysis machine between patients is not required. Dialysis machines are engineered so that the pathways segregate blood and dialysate.
- However, in the event of a blood leak outside of the blood pathway, the CDC recommends internal disinfection before using the dialysis machine on the next patient.

Additional cleaning functions are typically performed by housekeeping staff at the end of the day:

- Wet mop the floor.
- Clean patient/staff bathrooms and restock paper products/hand hygiene supplies.
- Check and refill all hand hygiene product dispensers at nursing and patient stations (soap, paper towels, lotion, ABHR).
- On a routine basis, dust walls and do high dusting.

Note: Consult the *Haemodialysis guidelines* for details (CDC, 2001).

4.8 PREVENTING VHFS

Ebola and Marburg VHFs are zoonotic diseases that cause severe and life-threatening viral diseases, including haemorrhagic syndrome in humans. They have been widely reported in parts of Africa, South America, the Middle East, and Eastern Europe. Among an estimated 2.5 billion people at risk globally, about 60% reside in sub-Saharan Africa. The East and Central Africa states of Sudan, Uganda, and Democratic Republic of the Congo, which neighbours Tanzania, have reported cases since 1976. Given its geographical location, level of sanitation, and high mobility of people, Tanzania will continue to be threatened by Ebola and Marburg outbreaks.

4.8.1 Prevention and Control

Good outbreak control relies on applying a package of interventions, namely case management, surveillance and contact tracing, good laboratory service, safe burials, and social mobilisation. Community engagement is key to successfully controlling outbreaks. Raising awareness of risk factors for Ebola and protective measures (including vaccination) that individuals can take is an effective way to reduce human transmission. Risk reduction messaging should focus on several factors.

Reducing the risk of wildlife-to-human transmission from contact with infected fruit bats or monkeys/apes and the consumption of their raw meat. Animals should be handled with gloves and other appropriate protective clothing. Animal products (blood and meat) should be thoroughly cooked before consumption.

Reducing the risk of human-to-human transmission from direct or close contact with people with Ebola symptoms, particularly their bodily fluids. Gloves and appropriate PPE should be worn when taking care of ill patients at home. Regular hand washing is required after visiting patients in hospital and after taking care of them at home.

Reducing the risk of possible sexual transmission, based on further analysis of ongoing research and consideration by the WHO Advisory Group on the Ebola Virus Disease Response, WHO recommends that male survivors of EVD practice safe sex and hygiene for 12 months from onset of symptoms or until their semen tests negative twice for Ebola. Contact with bodily fluids should be avoided, and washing with soap and water is recommended. WHO does not recommend

isolation of male or female convalescent patients whose blood has tested negative for Ebola virus (WHO, 2019).

Outbreak containment measures, including prompt and dignified safe burial of the dead, identifying people who may have had contact with someone infected with Ebola and monitoring their health for 21 days, the importance of separating the healthy from the sick, and the importance of good hygiene and maintaining a clean environment.

Controlling Infection in Health Care Settings

HCWs should always take standard precautions when caring for patients, regardless of their presumed diagnosis. These include basic hand hygiene, respiratory hygiene, use of PPE (to block splashes or other contact with infected materials), safe injection practices, and safe burial practices.

HCWs caring for patients with suspected or confirmed Ebola virus should apply extra infection control measures to prevent contact with the patient's blood and bodily fluids and contaminated surfaces or materials, such as clothing and bedding. When in close contact (within 1 metre) of patients with EBV, HCWs should wear a face shield or a medical mask and goggles; a clean, non-sterile long-sleeved gown; and gloves (sterile for some procedures).

Laboratory workers are also at risk. Testing samples taken from humans and animals for Ebola should be handled by trained staff and processed in suitably equipped laboratories.

WHO Response to Ebola and Marburg

WHO aims to prevent Ebola outbreaks by maintaining surveillance for EVD and supporting at-risk countries in developing preparedness plans, which should provide overall guidance for control of Ebola and Marburg virus outbreaks:

When an outbreak is detected, WHO responds by supporting surveillance, community engagement, case management, laboratory services, contact tracing, infection control, logistical support and training, and assistance with safe burial.

4.8.2 Use Standard Precautions with All Patients

Establish routine precautions for infection control. Use standard precautions consistently, especially hand washing before and after examining patients with fever. This section describes how to:

- Consider every person (patient or staff) regardless of their infection status, as potentially infectious and susceptible to infection
- Establish safe handling and disposal of used needles and syringes
- Be prepared to intensify standard precautions and include VHF isolation precautions
- Identify a VHF coordinator to oversee and coordinate activities associated with VHF isolation precautions
- Use appropriate hand hygiene techniques, including hand washing, hand antisepsis, and antiseptic hand rub
- Wear PPE, including gloves, masks, goggles, caps, gowns, boots, and aprons
- Handle sharps, patient care and resuscitation equipment, and linen and manage patient placement and patient environmental cleaning
- Safely dispose of infectious waste materials to protect those who handle them and prevent injury or spread to the community
- Process instruments by cleaning and then either sterilization or HLD using recommended procedures

4.8.3 Identify Suspected Cases of VHF

Common Signs and Symptoms and Immediate Precautions

- In a non-outbreak situation, suspect VHF in patients with fever, severe illness, and signs of unexplained bleeding.
- Alert relevant HF staff and begin VHF isolation precautions as soon as VHF is suspected.
- Report the suspected case to designated health authorities.
- If confirmed that a patient has VHF, decontaminate the patient's house and burn all clothing.
- Immediately begin tracing contact persons and isolate them for 21 days.

4.8.4 Isolate the Patient

- Gather recommended supplies to set up an isolation area.
- Make a substitute item from available materials if recommended items are not available.

Select a site for the VHF isolation area and set up:

- The patient's room
- A changing room for other HF staff to use near their work area
- A family entrance, if necessary
- Restricted access to the patient—only HF staff trained in VHF isolation precautions
- A barrier between the VHF patient and uninfected patients, other HF staff, and visitors
- A security barrier around the entire isolation area
- Counselling for family members about patient care

Make sure the selected site has:

- An isolated toilet
- If a toilet is not next to the patient's room, select and isolate a toilet nearby. Use it to receive the patient's disinfected waste and other liquid waste.
- If a toilet is not available, prepare a latrine for disposal of the patient's waste and other liquid waste.
- Adequate ventilation: The isolation room should have adequate ventilation because chlorine disinfectants will be used. To prevent airborne or droplet transmission of infectious agents, avoid rooms with air conditioning.
- Screened windows: If windows are left open for cooling, screen them to prevent transmission of mosquito- and other insect-borne diseases.

Wear protective clothing that should be worn when VHF is present in the HF; select appropriate items when recommended clothing is not available. **All who attend VHF cases as described below should wear protective clothing.**

- All doctors, nurses, and HCWs who provide direct patient care to suspected VHF patients
- All support staff who clean the isolation room, handle contaminated supplies and equipment, launder reusable supplies, and collect and dispose of infectious waste from VHF patients
- All laboratory staff who handle patient specimens and bodily fluids from suspected VHF cases
- Laboratory support staff who clean and disinfect laboratory equipment used to test VHF specimens

- Burial teams who remove bodies of deceased VHF patients and prepare them for burial
- Family members who care for VHF patients

When VHF is suspected in the HF, the following protective clothing should be worn in the isolation area:

- A scrub suit or inner layer of clothing (an old shirt and trousers brought from home); avoid wearing long skirts to prevent contact between clothing and spills of infectious waste on the floor.
- A pair of thin gloves to permit fine-motor function when examining or caring for patients. They can be latex, vinyl, or surgical gloves; they do not need to be sterile. The gloves must reach well above the wrist, preferably 10-15 cm long (4-6 inches), measuring from the wrist up along the arm.
- Rubber boots or overshoes (common rubber boots are recommended); the sides of the boots should be at least 30 cm (12 inches) high and have textured soles. If boots are not available, wear two layers of plastic bags.
- A gown or outer layer of clothing (surgical or disposable gown with long sleeves and cuffs)
- A plastic apron worn over both layers of clothes
- A second pair of thin or thick gloves; wearing a second pair of gloves provides an added measure of safety during patient care and when handling contaminated supplies.
- A HEPA filter respirator or other biosafety mask (or surgical mask if HEPA filter or other biosafety mask is not available)
- Head covering
- Clear eyeglasses or non-fogging goggles

4.8.5 Putting PPE On

- Make sure the changing room (and the changing area for cleaning and other staff) contains a supply of protective clothing
- Before entering the changing room, remove jewellery, wallets, and other valuables. Store them safely outside the changing room.
- Remove street clothes and hang them on a hook. Put on the scrub suit or set of old clothes.

Step 1. Put on the first pair of gloves.

- Look at your hands for cut or broken skin. If skin is cut or broken, refrain from direct patient contact.
- Put on one glove at a time. If the scrub suit or set of old clothes has long sleeves, place the edge of each glove under the cuff.
- When only one pair of gloves is worn, place the edge of the glove over the cuff or gown.

Step 2. Put on the outer gown. Pick up the gown from the inside, place arms through the armholes, and tie it in back, or ask another HCW to tie the gown.

Step 3. Put on the plastic or rubber apron.

Step 4. Put on the second pair of gloves.

- Place the edge of the second pair of gloves over the cuff of the gown.
- If using plastic bags, place the second layer of plastic bags over the first. Close ends of the bags with plastic tape or elastic bands.
- HF staff who do cleaning, laundering, disinfecting, waste disposal, or handling the body should wear thick utility gloves as the second pair of gloves.

Step 5. Put on the mask. Tie it at the back of the neck and toward the top of the head.

Step 6. Put on a head cover.

Step 7. Put on protective eyewear. Attach eyeglasses or goggles behind the head with string or cord to prevent them from falling off when working with patients in the isolation ward.

Remember: Make sure the mask, head cover, and eyewear fit comfortably. Once gloved hands have touched a patient, do not touch the mask, head cover, and eyewear.

4.8.6 How to Take Off PPE

The steps for removing protective clothing include disinfection with bleach solutions and washing hands with soap and water. Outer gloves and boots are likely to have the most contact with infectious bodily fluids during patient care or while conducting other duties in the isolation unit.

Before Leaving the Patient's Room

Step 1. Disinfect the outer pair of gloves.

- Wash gloved hands in soap and water.
- Dip gloved hands in 0.5% bleach solution for 1 minute.

Step 2. Disinfect the apron by spraying or wiping it with 0.5% bleach solution.

Step 3. Disinfect the boots carefully and make sure to reach all surfaces of the textured soles (which can be difficult to clean).

- Use a sprayer containing 0.5% bleach/chlorine solution to spray boots OR
- Hold the foot over a pan or basin and ask another health worker to pour 1:100 bleach solution over the boots OR
- Step into a shallow pan containing 0.5% bleach solution and wipe boots on a bleach-drenched cloth.

Outside the Patient's Room

Step 4. Remove the outer pair of gloves.

- If two pairs of gloves are worn, pull the edge of the glove back over the gloved hand so that the glove turns inside out as it is being pulled back.

Step 5. Remove the apron and outer gown.

- Put the apron in a laundry container or hang it for reuse (if it will be reused).
- Remove the outer gown. Hang it on a hook for reuse. Make sure it is hung inside out.
- If the gown needs laundering, place it in the laundry container.

Step 6. Disinfect gloved hands.

- After contact with apron and outer gown, rinse gloved hands in 1:100 bleach solutions, then wash them in soap and water.
- Dry gloved hands with a one-use towel.

Step 7. Remove eyewear, head cover, and mask.

- If eyewear is heavily soiled, wash the eyeglasses in soapy water and wipe clean. Store in a drawer or shelf with the clean supply of eyeglasses.
- Remove head cover; if unsoiled, store it with the cleaned eyewear. If it is soiled, discard it in the bucket for disposal of contaminated waste.
- Remove the mask and hang it on a hook or store it for reuse.
- A HEPA filter respirator or other biosafety mask can be reused by the same HCW as long as it is not soiled.

Step 8. Remove the boots.

- Place a towel that has been soaked in 0.5% bleach solution on the floor for HF staff to stand on when removing boots.
- Use a boot remover to take off rubber boots. Avoid touching the boots with bare or gloved hands.
- Store boots safely until next use. For example, store them in a plastic sack or on

a covered shelf.

Step 9. Remove the inner pair of gloves.

- Remove the first glove with the other gloved hand. Pull the edge of the first glove back over the gloved hand so that the glove turns inside out as it is being pulled back
- Place the inside-out glove in the palm of the gloved hand.
- Reach inside the glove to a clean area. Pull the glove back over the hand so that only the inside of the glove is exposed and covers the glove held in the palm.
- Discard the gloves in a bucket for disposal of contaminated waste.
- Wash ungloved hands with soap and water.

Step 10. Remove inner layer of clothes and dress in street clothes.

- If the inner layer is not soiled, store the clothing for reuse.
- If soiled, place the clothing in the laundry container.
- If personal shower facilities are available, shower before dressing in street clothes.
- If skin has contacted soiled material, follow guidelines for accidental exposure.
- Put on street clothes.
- Wash hands with soap and clean water before leaving the changing room.

4.8.7 Ambulance Transport of a Suspected VHF Case

Preliminary Considerations

- A suspected case can potentially be a source of VHF transmission.
- Sick patients can be irritable and difficult to manage.
- Sick patients must be treated with dignity and respect.
- Full IPC precautions and PPE must be used while transporting a suspected case.
- Depending on the country, the transport of a patient can be directly managed by the rapid response team (RRT) or by a partner.
- The coordinator of the RRT remains the guarantor for good practices and the application of SOPs during the transport of a patient.

Specific Requirements for an Ambulance to Transport a Suspected Case

- Physical separation between the cockpit and the rear of the vehicle
- Rear of the vehicle long enough to transport a lying patient (do not use a double cabin pick-up)
- Rear of the vehicle has the minimum equipment to clean and disinfect

Standard Ambulance Escort

- If the ambulance escort is part of the RRT
  - o A driver
  - o A nurse
  - o 2 bearers
- If the ambulance escort is NOT part of the RRT:
  - o Same as above plus an IPC expert

Transporting a Suspected EVD Case in an Ambulance

- Mobilize the RRT and ambulance escort once an EVD suspected case alert is received.
- Prepare vehicles and equipment before dispatch.
- Arrive at the suspected EVD location and load patient into the ambulance.
- Disinfection and doffing of PPE by the ambulance team accept the nurse accompanying the patient.
- Depart location and arrive at the Ebola treatment center.
- Remove waste and disinfect the ambulance.

Disinfection of Reusable Supplies and Equipment at VHF Isolation

Observe VHF isolation precautions during patient care and when disinfecting and cleaning contaminated surfaces, supplies, and equipment. When VHF is suspected in the HF, all medical, nursing, laboratory, and cleaning staff should disinfect:

- Hands and skin after contact with a VHF patient or infectious bodily fluids
- Gloved hands after contact with each VHF patient or after contact with infectious bodily fluids (when gloves cannot be changed)
- Thermometers, stethoscopes, and other medical instruments after use with each VHF patient
- Spills of infectious bodily fluids on the walls and floors
- Patient excreta and containers contaminated by patient excreta
- Reusable supplies, such as protective clothing and patient bedding
- Used needles and syringes

Prepare Bleach Solutions

In a central place in the HF, prepare solutions:

- A 2% bleach solution is used to disinfect excreta and bodies.
- It is also used to prepare a 0.5% solution for decontaminating table tops surfaces,

medical equipment and mattresses.
- A 0.05% bleach solution is used for hand washing and birthing and to disinfect, patient bedding, and reusable clothing before it is laundered.

It is also recommended for:
- Rinsing gloves between contacts with each patient
- Rinsing gloves, apron, and boots before leaving a patient's room
- Disinfecting contaminated waste for disposal

Bleach solutions must be prepared daily. They lose their strength after 24 hours. Anytime the odour of chlorine is not present, discard the solution.

Note: *A 0.5% bleach solution is caustic. Avoid direct contact with skin and eyes. Prepare the bleach solutions in a well-ventilated area.*

Disinfect Reusable Medical Instruments

In the isolation room, each time HCWs wash their hands between patients, they should also disinfect the thermometers and stethoscopes they used to examine the patient.

Disinfecting Thermometers and Stethoscopes with 70% Isopropyl Alcohol
- Place the alcohol in a covered container and put it in the patient's room. Change the alcohol at least once a week.
- Dip a clean cloth or paper towel in the alcohol solution.
- Carefully wipe the thermometer with the alcohol solution and hold the cloth around it for 30 seconds. Discard the cloth into the laundry container or paper towel into the correct bucket. Let the thermometer air dry.
- Dip another clean cloth or new paper towel in the alcohol solution.
- Carefully wipe the metal part of the stethoscope and hold the cloth against the surface for 30 seconds. Discard the cloth into the laundry container or paper towel into the correct bucket. Let it air dry.

Disinfecting Thermometers and Stethoscopes with Bleach Solution
- Place a covered container of 0.5% bleach solution in the isolation room. Change the bleach solution each day.
- Dip a clean cloth or paper towel in the bleach solution. Never dip a soiled cloth

back into the bleach solution. Use a cup or dipper to pour bleach solution on a soiled cloth.

- Wipe the thermometer with the cloth or soak the thermometer for 10 minutes in the bleach solution. Discard the cloth into the laundry container or paper towel into the appropriate waste bucket. Let the thermometer air dry.
- Dip another clean cloth or new paper towel into the bleach solution.
- Wipe the metal part of the stethoscope with 0.5% bleach solution. Let it air dry.
- Discard the cloth in the laundry container or paper towels into the bucket for waste to be burned.

Disinfecting Bed Pans or Waste Buckets

- Cover the contents with 2% bleach. Empty the bed pan contents directly into the isolated toilet or latrine.
- Clean the bed pan with soap and water to remove solid waste. Pour into toilet or latrine. Rinse the bed pan with 0.05% bleach solution and return it to the patient's room.
- If a family member is responsible for carrying out this task, make sure the family member wears protective clothing.

Disinfecting Patient's Utensils

If the family is assisting with patient care, provide 0.05% bleach solution, soap, and water so the family member can wash the patient's eating utensils. After washing the utensils, rinse them with 0.05% bleach solution, and let them air dry.

Disinfect Spills of Infectious Bodily Fluids

Place a bucket containing 0.05%, 0.5% and 2% bleach solution in the isolation area.

- Use absorbent materials to cover the spill.
- Remove the blood or spilled material with a cloth soaked with 0.05% bleach solution and put the collected spill in 2% of chlorine bucket. Then cover the area completely with 0.5% bleach solution for 10 minutes. Take care to prevent drops or splashes of the contaminated body fluid from reaching anyone when pouring bleach solution on the area contaminated with the spill. .
- Discard waste in the container for disposable infectious waste or in the isolated latrine or toilet.
- Wash area as usual with soap and clean water.

Disinfect the Walls and Other Surfaces

Surfaces, such as table tops, sinks, walls, and floors are not generally involved in disease transmission. However, in a VHF patient's room, if walls are visibly soiled with blood or other bodily fluids, clean them as follows:

- Use a sprayer or mop to wash the walls with 0.05% bleach solution.
- Rinse the mop in a fresh supply of 0.05% bleach solution. (If using a sprayer, apply the spray close to the surface to minimize splashing and aerosols.)
- Wash the wall as usual with soap and clean water to remove visible soil.
- Discard waste in the container for infectious waste or in the isolated latrine or toilet.

Disinfect Infectious Waste and Non-Reusable Supplies for Burning

Place a bucket or other container containing 0.05% bleach solution in the patient's room to collect infectious waste, contaminated items, and non-reusable supplies that will be burned.

Clean and Disinfect Protective Clothing

Set aside a special part of the laundry or cleaning area for laundry from suspected VHF patients. Make sure HF staff who handle contaminated laundry wear protective clothing, including thick gloves as the second pair of gloves.

- Transfer laundry as soon as possible to area set aside for VHF laundry.
- Carefully move the laundry to a bucket with fresh 0.05% bleach solution.
- Soak laundry in 0.05% bleach solution for 20 minutes. Be sure that all items are completely soaked.
- Remove items from the bleach solution and place in soapy water; soak overnight.
- Scrub thoroughly to remove stains. Rinse and line dry.
- Use a needle and thread to repair any holes or torn areas.
- The clean clothing is now ready to use. It can be ironed although this is not necessary. (It is not necessary to wear protective clothing when ironing cleaned clothing).
- Items that are very worn out should be discarded or used as cleaning rags.

Clean and Disinfect Boots

Place a sprayer or pan with 0.5% bleach solution at the exit to the patient's room. Change the pan often.

Step into a shallow pan containing 0.5% chlorine solution and wipe boots on chlorine -soaked cloth.

Note: The soles of gumboots are difficult to clean because they are textured. Disinfect them carefully and make sure to reach all surfaces of the textured soles. Gumboots must be sent to laundry for further cleaning and disinfection before reuse

Clean and Disinfect Patient's Bedding

Plastic Sheeting

- If plastic sheeting becomes soiled during use with the same patient, remove liquid or solid waste with absorbent towels.
- Discard the waste in the container for collecting infectious waste for burning. Then wash the plastic sheeting with 0.5% bleach solution.
- Change the plastic sheeting between patients.
- If plastic sheeting cannot be changed between patients, wash it with 1:100 bleach solution after each patient.

Patient's Sheets

- Remove sheets from the bed. Put them in a container (plastic bag or bucket) in the patient's room.
- Take the container directly to the laundry area.
- Soak in 0.05% bleach solution for 20 minutes. Be sure all items are completely soaked.
- Remove items from the bleach solution and place them in soapy water; soak overnight.
- Scrub thoroughly to remove stains. Rinse and line dry.

Mattresses

If a mattress is heavily soiled, remove it from the isolation area to the outdoors and burn it. Make sure HF staff wear protective clothing and gloves when touching and carrying the soiled mattress.

If mattresses are reused:

- Pour 0.5% bleach solution directly on the mattress, and let it soak through

completely to the other side.
- Flood the soiled area with soapy water and rinse with clean water.
- Let the mattress dry in the sun for several days.
- Turn the mattress often so it dries on both sides.

Mobilize the Community and Conduct Community Education

When VHF is suspected:
- Make sure that the community knows about the VHF outbreak and how the disease is transmitted.
- Involve the community in identifying the source of and controlling the epidemic.
- Reduce fear and rumours in the population.

To develop community education in an urgent situation:
- Describe the extent of the current health problem.
- Identify and mobilize key community members who will plan and lead education efforts.
- Describe the target population and develop health messages.
- Plan and conduct activities to communicate messages.
- Conduct ongoing evaluation of activities and make improvements as needed.

Make Advance Preparations to Use VHF Isolation Precautions

Being prepared for an emergency can ultimately save lives. HCWs should know how to use VHF isolation precautions, and adequate supplies should be readily available.
- Prepare in advance before a VHF occurs by gathering supplies.
- When advance preparations are not possible, VHF isolation precautions must be implemented in an emergency situation.
- When a VHF case is suspected, VHF isolation precautions must begin immediately. All efforts must be focused on meeting patients' needs. There is no time to provide training in VHF isolation precautions.

Identify a VHF Coordinator to Oversee Preparations

Someone in the HF may already be serving as a coordinator for emergency situations. This person can also serve as the VHF coordinator. If the emergency coordinator cannot assume VHF activities, select a staff person with authority who can serve as the VHF coordinator. The coordinator:

- Oversees all preparations for VHF isolation precautions
- Serves as the focal point for information and leadership when a VHF case is suspected
- Informs all HF staff about VHFs and the risks associated with them
- Organizes training in VHF isolation precautions for medical, nursing, and laboratory staff who will work directly with VHF patients or infectious bodily fluids
- Assigns responsibility to medical, laboratory, and cleaning staff for ensuring that all necessary precautions, treatment protocols, and clean-up procedures are carried out within their areas
- Hires or reassigns and trains additional cleaning staff to work with disinfection of waste, clothing, and equipment
- Makes sure that teams are trained to prepare and transport bodies for burial
- Reinforces consistent hand washing practices, regularly monitors and improves them needed. For example:
  - Has hand washing been identified as a routine practice in the HF?
  - Do all staff wash their hands after contact with each patient, especially new patients with fever?
  - Are there reliable supplies of liquid soap and running water or buckets with clean water available in areas where health workers should use them?
  - Are posters reminding health workers to wash their hands placed in areas where health workers can see them?

When a VHF case is suspected, the HF will immediately take steps to limit disease transmission by:

- Creating an isolation room for VHF patients
- Limiting contact with VHF patients to a small number of specially trained staff and, in some areas, a family member who has received information and training in VHF isolation precautions
- Limiting the use of invasive procedures as much as possible in treatment of VHF patients
- Having all staff who have contact with VHF patients or their bodily fluids use protective clothing
- Using safe disinfection and waste disposal methods

4.8.8 Procedures for Accidental Exposures

Information on how to respond to accidental exposures can be found in the *National Guidelines on Post-Exposure Prophylaxis Following Occupational and Non-Occupational Exposures to Blood and Other Body Fluids (2014)* (MoHSW, 2014)

Standard precautions aim to reduce the risk of disease transmission in the health care setting, even when the source of infection is not known. Standard precautions are designed for use with all patients who present in the health care setting and apply to:

- Blood and most bodily fluids whether or not they contain blood
- Broken skin
- Mucous membranes

To reduce the risk of disease transmission in the health care setting, use the following standard precautions:

- Wash hands immediately with soap and water before and after examining patients and after any contact with blood, bodily fluids, and contaminated items, whether or not gloves were worn. Soaps containing an antimicrobial agent are recommended.
- Wear clean, ordinary, thin gloves anytime there is contact with blood, bodily fluids, mucous membrane, and broken skin. Change gloves between tasks or procedures on the same patient.
- Before going to another patient, remove gloves promptly and wash hands immediately, and then put on new gloves.
- Wear a mask, protective eyewear, and gown during any patient care activity where splashes or sprays of bodily fluids are likely. Remove the soiled gown as soon as possible and wash hands.
- Handle needles and other sharp instruments safely. Do not recap needles.
- Make sure contaminated equipment is not reused with another patient until it has been cleaned, disinfected, and sterilized properly.
- Dispose of non-reusable needles, syringes, and other sharp patient care instruments in puncture-resistant containers.
- Routinely clean and disinfect frequently touched surfaces, including beds, bed rails, patient examination tables, and bedside tables.
- Clean and disinfect soiled linens and launder them safely. Avoid direct contact with items soiled with blood and bodily fluids.

- Place a patient whose blood or bodily fluids are likely to contaminate surfaces or other patients in an isolation room or area.
- Minimize the use of invasive procedures to avoid the potential for injury and accidental exposure. Use oral rather than injectable medications whenever possible.
- Once a specific diagnosis is made, find out how the disease is transmitted. Use precautions according to transmission risk.

Give First Aid for Accidental Exposures

Accidental needle stick injury: Assume any needle stick injury is a suspected contact for VHF whether or not a break in the skin can be seen. If an accidental needle stick injury occurs, treat the exposure site:

- Immerse the exposed site in 70% alcohol for 20 to 30 seconds and wash with soap and clean water.
- Flush the site in running water for 20 to 30 seconds.
- If needed, cover with a dressing.
- Report the incident to a supervisor or the physician-in-charge.
- The purpose of notifying the physician-in-charge is to:
  - o Identify what caused the problem
  - o Take corrective action to solve the problem and prevent accidental transmission
  - o Provide appropriate care for the possible case of VHF

Remind the HF staff that accidents do happen even when every precaution to prevent them has been taken. Reassure HF staff that reporting accidental exposure will have no negative consequences. Explain that reporting accidental exposure is essential for protecting themselves, their families, other health workers, and patients.

Accidental contact with infectious bodily fluids: An accidental contact can occur if there is unprotected contact between infectious bodily fluids and broken skin or the mouth, nose, or eye.

For example, vomit may run under a glove, a patient might cough blood which runs into the HCW's eye, or coughed blood may run underneath a HCW's mask and

get into the mouth. Treat any accidental contact as a suspected contact with VHF. As soon as the contact occurs:

- Flush the area in the most appropriate manner with soap and clean water. If a splash occurs in the eye, flush it with clean water.
- Leave the isolation area and remove the protective clothing as recommended.
- Take a shower and put on street clothes.
- Report the exposure to a supervisor or physician-in-charge. Complete the necessary forms.

Follow Up Accidental Exposures

- Monitor the condition of the HF staff. Take a measured temperature two times per day
- If a fever occurs (temperature is 38.5 °C [101 °F] or higher), the staff member should not engage in patient care activities.
- Treat as a suspected case of VHF if the staff member's signs and symptoms meet the case definition.

Isolate the Patient

- Restrict patient access to HF staff trained to use VHF isolation precautions.
- Establish a barrier between the VHF patient and uninfected patients, other HF staff, and visitors.

Select Site for the Isolation Area

Ideally, an isolation area should already be available to admit patients requiring isolation.

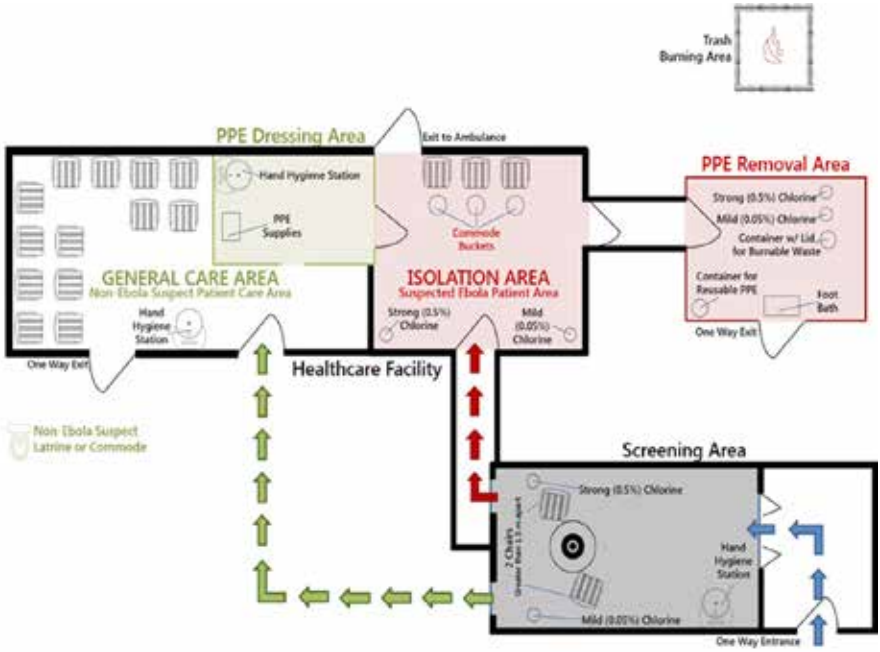
If an isolation area is not available, or if advance preparations have not been done, and VHF is suspected, immediately identify and set aside:

- A room with an adjoining toilet or latrine
- A separate building or ward that can be used for VHF patients only (especially if Ebola haemorrhagic fever is suspected, or if there is a large number of patients)
- An area in a larger ward that is separate and far away from other patients in the ward
- An uncrowded corner of a large room or hall
- Any area that can be separated from the rest of the HF (TB rooms, isolation ward for infectious diseases, private or semiprivate rooms)

Make sure the selected site has:

- **An isolated toilet:** If a toilet is not next to the patient's room, select and isolate a toilet near the isolation area. Use it to receive the patient's disinfected waste and other liquid waste. If a toilet is not available, prepare a latrine for disposal of the patient's and other liquid waste.
- **Adequate ventilation:** The isolation room should have adequate ventilation because chlorine disinfectants will be used. To prevent airborne or droplet transmission of infectious agents, avoid rooms with air conditioning.
- **Screened windows:** If windows are left open for cooling, screen them to prevent transmission of mosquito- and other insect-borne diseases.
- **Restrict access:** Tie a rope or line around the area outside the window to restrict the area and prevent entry through the window
- Make use of the available space and design of the HF to arrange the isolation area. The diagram below shows an example of an arrangement for an isolation area.

Figure 4.1: Arrangement of isolation area



Source: (MoHCDGEC, 2018)

Safe Disposal of Waste

Direct, unprotected contact during disposal of infectious waste can result in accidental transmission of VHF. For this reason, all contaminated waste produced during the care of a VHF patient must be disposed of safely. All non-reusable items must be destroyed in the isolation area so they cannot be used again. Burning should be carried out at least daily.

When VHF is suspected, disinfect and dispose of:

- Infectious blood and other bodily fluids, such as urine, faeces, and vomitus
- Disposable needles and syringes and disposable or non-reusable protective clothing
- Treatment materials and dressings
- Non-reusable gloves
- Laboratory supplies and biological samples
- Used disinfectants

Recommended Disposal Methods

Liquid waste, including patient excreta, can be disposed of in an isolated latrine or toilet set aside for VHF cases. Burning is the recommended method for disposal of other VHF-contaminated waste. A safe and inexpensive disposal system can be made by using an incinerator or a pit for burning.

- A latrine or toilet that joins the patient's isolation room can be used to receive the disinfected bed pan contents from the VHF patient. The latrine or toilet should be isolated. Access should be restricted to HF staff trained to work in the VHF isolation area.
- Incinerators are containers with holes for ventilation to allow air to enter and exit the container. This allows the fire to reach temperatures high enough to completely destroy all biological materials. Use flammable fuel, such as diesel, to speed the burning process and keep temperatures high.
- Incineration is recommended for disposal of:
  - Needles and syringes
  - Used treatment materials and dressings
  - Non-reusable protective clothing
  - Laboratory supplies
- When an incinerator is not available, burn waste in a pit.
- Use fuel to accelerate the burning and ensure that all waste is completely

destroyed.

- Use a pit to dispose of:
  1. Disinfected bodily fluids, such as urine, faeces, and vomitus when no designated latrine or toilet is available
  2. Used disinfectants; if it is not possible to dispose of used disinfectants in a latrine or toilet, burn it together with flammable items (disposable gowns or masks, for example). Burning with flammable items will help keep the temperature hot enough to boil off the liquids.

Note: *All staff who are likely to handle infectious material should know and use VHF isolation precautions. Reinforce the importance of handling infectious waste safely with all HF staff.*

Select a person with authority who will:

1. Oversee all disposal procedures, including preparing the incinerator and pit
2. Train and supervise the staff who will carry out waste disposal
3. Make a schedule for collecting and burning disposable waste
4. Supervise the collection and burning to make sure it is carried out safely

Dignified, Safe Burial Practices

There is risk of transmission in the HF when a VHF patient dies because the bodies and bodily fluids of deceased VHF patients remain contagious for several days after death. Family and community members are also at risk if burial practices involve touching and washing the body.

Prepare the Body Safely

Burial should take place as soon as possible after the body has been prepared in the HF. HF staff should:

- Be aware of the family's cultural practices and religious beliefs. Help the family understand why some practices cannot be done because they place the family or others at risk for exposure.
- Counsel the family about why special steps need to be taken to protect the family and community from illness. If the body is prepared without providing information and support to the family and the community, they may not want to bring other family members to the HF in the future. They may think that if the patient dies, the body will not be returned to them.

- Identify a family member who has influence with the rest of the family and who can make sure family members avoid dangerous practices, such as washing or touching the body**.**

Preparing the Body in the HF

- Wear protective clothing as recommended for staff in the patient isolation area. Use thick rubber gloves as the second pair (or outer layer) of gloves.
- Spray the body and the area around it with 0.5% bleach solution.
- Place the body in a body bag (mortuary sack) and close it securely. Spray the body bag with 0.5% bleach solution.
- If body bags are not available, wrap the body in two thicknesses of cotton cloth and soak with 0.5% bleach solution. Then wrap the body in plastic sheeting.
- Seal the wrapping with plastic tape.
- Spray the body bag.
- Place the body in a coffin if one is available.
- Transport the body to the burial site as soon as possible.
- Assign a health officer or HF staff person to accompany the body to ensure that safety precautions remain in place during the journey.

Transport the Body Safely

VHF isolation precautions should remain in force when the body is being transported to the burial site:

- Plan to take the shortest route possible for security purposes and to limit any possibility of disease transmission through accidental contact.
- Any HF staff who must touch or carry the body during transport should wear the same protective clothing as is worn in the isolation area. The driver does not need to wear protective clothing if there is no contact with the body.
- Take a closed container or sprayer with 1:10 bleach solution in the event of any accidental contact with the body or infectious bodily fluids. Also use it to clean up spills in the transport vehicle.

Prepare Burial Site

- The grave should be at least 2 meters deep.
- Explain to the family that viewing the body is not possible.
- Help them understand the reason for limiting the burial ceremony to family only.

Disinfect the Vehicle after Transporting the Body

- The staff person who disinfects the vehicle must wear protective clothing.
- Rinse the interior of the vehicle where the body was carried with 0.5% bleach solution.
- Let it soak for 10 minutes.
- Rinse well with clean water and let the vehicle air dry. Be sure to rinse well because the solution is corrosive to the vehicle.

4.9 PREVENTING NOSOCOMIAL DIARRHEA

Controlling the spread of nosocomial diarrhoea from contaminated food is an on-going concern in hospitals and nursing homes. Frequently, this is due to poorly trained food-handling staff using unsafe practices involving the storage, preparation, and handling of raw meat, chicken, fish, fresh eggs, and vegetables.

4.9.1 Definitions of Terms

Diarrhoea: Having at least three loose or watery stools per day

Nosocomial diarrhoea: On at least two consecutive days, having at least three loose or watery stools with the onset more than 72 hours after admission to the hospital (or more days than the incubation period if the agent is known)

4.9.2 Causes of Diarrheal

Outbreaks of diarrhoea in hospitals, nursing homes, and NICUs have been associated with a wide variety of organisms including:

E. coli
Clostridium spp
Rotavirus and other enteroviruses
Salmonella
Shigella
C. difficile
Vibrio cholerae
Candida albicans
Staph. aureus
Cryptosporidium, etc

4.9.3 Common Agents

Salmonella: Salmonellosis is a common cause of diarrhoea, second to food poisoning. The incubation period is less than 72 hours (3 days) when large doses of organisms are eaten in contaminated food or drinks.

Rotavirus: The causative agent of sudden onset of vomiting and diarrhoea within two to three days after exposure; it is the most common cause of diarrhoea in children under five years.

The virus may be present in sputum or other secretions and survives well on inanimate surfaces. It may become endemic in hospitals.

4.9.4 Risk Factors

Risk factors for nosocomial diarrhoea include:

- Old age
- Patients with burns
- Trauma
- Decreased immunity
- Decreased gastric acidity
- Altered flora in the stomach and gut caused by antibiotic treatment
- Lack of hand hygiene, especially by food handlers
- Non-compliance with glove use

Important Considerations

For staff in diarrhoea wards:

- Clean and wipe bed pans and bathroom equipment that are regularly handled by patients and staff with a disinfectant (0.5% chlorine solution) daily and whenever they have been used.
- Immediately disinfect and clean all soiled articles if soilage occurs.
- Staff who sort linen should wear utility or heavy-duty gloves. Also, soiled linen should be bundled so that leakage does not occur, and all linen should be handled as if faecal contamination were present.
- Wear gloves when handling linen soiled with moist body substances, used diapers, or toilet paper and place in a plastic bag or leak-proof, covered waster container.

Food Service Personnel

Food handlers with diarrhoea should be immediately removed from handling foods. They should not return to food handling or work with immunocompromised patients, intensive care patients, or patients undergoing transplant until all symptoms are over for 24-48 hours.

Patients with Diarrhoea

- Patients with diarrhoea from any cause should be managed according to standard precautions with transmission-based precautions.
- Other precautions include moving roommates to another room in the hospital if faecal contamination is likely.
- Infants born to mothers with diarrhoea should not enter the regular nursery. In addition, rooming-in should be provided for mother and infant. The mother and other caretakers should be taught good hygiene.

4.10 PREVENTION AND CONTROL OF CHOLERA OUTBREAKS

4.10.1 Diagnosis

Cholera is an infectious and often fatal bacterial disease of the small intestine, typically contracted from infected water supplies that cause severe vomiting and diarrhoea. The causative agent is *V. cholerae*.

The presence of *V. cholerae* in stools is confirmed through laboratory procedures. However, a rapid diagnostic test (RDT) allows quick testing at the patient's bedside. WHO is currently in the process of validating this RDT, to be able to include it on the list of its pre-qualified products.

WHO suggests that all samples that test positive with a RDT be retested using classic laboratory procedures for confirmation. Not all cases fitting the WHO clinical case definition need to be tested. Once an outbreak is confirmed, a clinical diagnosis using WHO standard case definition is sufficient, accompanied by sporadic testing at regular intervals.

4.10.2 Signs and Symptoms

Approximately one in ten (5-10%) infected persons will have severe cholera, which in the early stages includes:

- Profuse watery diarrhoea, sometimes described as "rice-water stools"
- Vomiting
- Rapid heart rate
- Loss of skin elasticity
- Dry mucous membranes
- Low blood pressure
- Thirst
- Muscle cramps
- Restlessness or irritability

4.10.3 Prevention

Measures for prevention of cholera mostly consist of providing clean water and proper sanitation to populations who do not yet have access to basic services. Health education and good food hygiene are equally important. Communities should be reminded of basic hygiene behaviour, including the need to wash hands with soap after defecation and before handling food or eating, as well as safe preparation and conservation of food. Appropriate media, such as radio, television, or newspapers, should be involved in disseminating health education messages. Community and religious leaders should also be associated with social mobilization campaigns.

In addition, strengthening surveillance and early warning greatly helps in detecting the first cases and putting control measures in place. Conversely, routine treatment of a community with antibiotics, or mass chemoprophylaxis, has no effect on the spread of cholera, can have adverse effects by increasing AMR, and provides a false sense of security.

4.10.4 Control

Among people developing symptoms, 80% of episodes are of mild or moderate severity. The remaining 10-20% of cases develop severe watery diarrhoea with signs of dehydration. Once an outbreak is detected, the usual intervention strategy aims to reduce mortality, ideally below 1%, by ensuring access to treatment and controlling the spread of disease. To achieve this, all partners involved should be

properly coordinated and those in charge of water and sanitation must be included in the response strategy. Recommended control methods, including standardized case management, have proven effective in reducing the case fatality rate.

The main tools for cholera control are:

- Proper and timely case management in CTCs
- Specific training for proper case management, including avoiding nosocomial infections
- Sufficient prepositioned medical supplies for case management (e.g., diarrhoeal disease kits)
- Improved access to water, effective sanitation, proper waste management, and vector control
- Enhanced hygiene and food safety practices
- Improved communication and public information

4.10.5 Case management

Efficient treatment resides in prompt rehydration by administering oral rehydration salts (ORS) or IV fluids, depending on severity of the case. Up to 80% of patients can be treated adequately by administering ORS (WHO/UNICEF ORS standard sachet). Very severely dehydrated patients are treated by administering IV fluids, preferably Ringers lactate. Appropriate antibiotics can be given to severe cases to diminish the duration of diarrhoea, reduce the volume of rehydration fluids needed, and shorten the duration of *V. cholerae* excretion. For children up to five years, supplementary administration of zinc as proven effective in reducing the duration of diarrhoea as well as reducing successive diarrhoea episodes. To ensure timely access to treatment, CTCs should be set up among the affected populations whenever feasible.

4.10.5.1 Use of Antibiotics for Cholera

Children under 12 years of age should be given a 3-day course of erythromycin (12.5 mg/kg 4 times a day). Children under 5 years of age should also be given zinc for 10 days (10 mg per day under 6 months, 20 mg per day over 6 months). For older children and adults, a three-day course of tetracycline (12.5 mg/kg 4 times a day) or a single dose of doxycycline (300 mg) is recommended.

Careful and regular laboratory monitoring of the antibiotic sensitivity of circulating

strains is recommended in all settings, including during an outbreak, to guide treatment. O1 and O139 *V. cholerae* strains that are resistant to antibiotics, such as cyclines and quinolones, have been isolated from all regions.

4.10.5.2 Antibiotic Prophylaxis to Prevent Cholera

The wide-scale use of antibiotics encourages selection and spread of antibiotic-resistant pathogenic bacteria. Two aspects should therefore be considered: (1) the risk that antibiotic resistant strains of *V. cholerae* may emerge and (2) the risk that other organisms may develop resistance, compromising the use of that antibiotic in the management of other infectious diseases. Antibiotic resistance in *V. cholerae* O1/O139 is well documented, together with conclusions that the use of antibiotics for cholera has contributed to the spread of such resistance.

Rapid development of resistance to tetracycline and doxycycline was observed when these antibiotics were used on a large scale for prophylaxis during cholera outbreaks in Africa in the 1970s and 1980s and in South America in the 1990s. WHO has previously stated that "mass antibiotics prophylaxis is not recommended because it has not been shown to be effective and because it contributes to the emergence of resistance" (WHO, 2018).

Selective prophylaxis for household contacts of cholera cases (i.e., considered at high risk of being infected with *V. cholerae*) has been implemented in the past with difficulties related to the identification of contacts, timely delivery of drugs, non-compliance, and side effects. A recent literature review concluded that this strategy may have a protective effect among household contacts of people with cholera but impact on cholera transmission could not be demonstrated. Overall, there is no evidence that the providing antibiotics to staff or travellers coming from cholera-endemic transmission areas (i.e., considered at risk of being infected with/carriers of *V. cholerae*) before travel would decrease or prevent the risk of cholera introduction into non-endemic countries. Moreover, this strategy would contribute to the emergence of resistance and provide a false sense of security.

Antibiotic prophylaxis specifically targeting carriers of *V. cholerae* would require the systematic screening of people. However, no effective (sensitive and specific) screening methods for carriers are currently available, and such measures would likely be costly, difficult to implement, and ineffective in detecting carriers of *V.*

cholerae. WHO does not advise requiring prophylactic administration of antibiotics or proof of such administration for travellers coming from or going to a country affected by cholera.

4.10.5.3 Cholera Vaccines

There are two WHO prequalified oral cholera vaccines (OCVs) currently available on the market. These vaccines were proven safe, effective, and well accepted and are available for individuals aged one year and above. They are administered in two doses given at least seven days apart. Overall, more than 1.6 million doses of WHO prequalified OCVs have been deployed in mass vaccination campaigns since 1997. WHO official recommendations for the use of OCV have been issued and state that (WHO, 2019):

- The OCV should always be used as an additional public health tool and should not replace usually recommended control measures, such as improved water supplies, adequate sanitation, and health education. It needs also to be linked to strengthened surveillance and early warning.
- Pre-emptive vaccination campaigns with OCV should be used in areas where the disease is endemic, including during humanitarian crises, as an additional means for cholera prevention and control, but should not replace usually recommended control measures, such as improved water supply, adequate sanitation, food safety, and health education. In such settings, vaccination should be targeted at high-risk areas and high-risk population groups, such as displaced populations in camps with precarious living conditions, underserved populations in resource poor settings, etc.
- Mass vaccination campaigns may be organized on a reactive basis, as part of the response to a cholera outbreak, which has already commenced, to reduce mortality and limit the spread of the disease. However, vaccination should not disrupt provision of other high-priority health interventions to control or prevent cholera. Considering the lack of experience with implementing reactive vaccination against cholera, the feasibility and impact of vaccination in halting on-going outbreaks should be documented and results widely disseminated.

The use of the parenteral cholera vaccine has never been recommended by WHO because of its low protective efficacy and the high occurrence of severe adverse reactions (WHO, 2019).

4.10.5.4 WHO Recommendations to Unaffected Neighbouring Countries

Countries neighbouring an area affected by cholera should improve:

- Preparedness to rapidly respond to an outbreak, should cholera spread across borders, and limit its consequences
- Surveillance to obtain better data for risk assessment and early detection of outbreaks, including establishing an active surveillance system

However, the following measures should be avoided, as they have been proven ineffective, costly, and counterproductive:

- Routine treatment of a community with antibiotics, or mass chemoprophylaxis; it has no effect on the spread of cholera, can increase AMR, and provides a false sense of security
- Restrictions in travel and trade between countries or between different regions of a country
- Setting up a cordon sanitaire at borders; it diverts resources and hampers the spirit of good cooperation between institutions and countries instead of uniting efforts

Health care providers should take precautions to prevent the spread of cholera in clinical settings:

- Wash hands with soap and clean water before and after each patient contact.
- If water and soap are not available, use an ABHR (with at least 70% alcohol).
- Use chlorine solutions for disinfection (solution calculations are based on using unscented household bleach with 5–6% active chlorine):
- Do not provide antibiotics (chemoprophylaxis) to health care providers.

4096.2% Chlorine: Made by mixing 3 parts water and 2 parts bleach; used for disinfecting vomit, faeces, and corpses

4097.0.5% Chlorine: Made by mixing 9 parts water and 1 part bleach; used for foot baths, cleaning floors, bedding, latrines

4098.0.05% Chlorine: Made by mixing 9 parts water and 1 part 0.5% chlorine solution; used for bathing soiled patients, hand washing, rinsing dishes, laundry

4.10.6 Design of a CTC

Site Selection Criteria

When establishing CTCs, the following should be considered when selecting a site:

- Proximity to the affected area
- Easy accessibility for patients and delivery of supplies
- Protected from wind (there should be wind breaks)
- Adequate space
- Compatibility with adjacent existing structures and activities
- Availability of adequate potable/safe water supply within a minimum distance to avoid contamination
- Good drainage from the site
- Provision of waste management facilities (clinical and general waste)
- Availability of sanitary facilities (temporary)
- Provision for extension of CTC (basing on estimation given by epidemiologist).

Setting Up a Camp

Urban Settings and Refugee Camps

- Ideally, the CTC should be located inside the existing hospital premises but clearly separated and isolated from other departments to avoid spread of infection to non-cholera patients.
- If the hospital premises are not suitable, another site must be found.
- It is preferable to have one single CTC and several oral rehydration points (ORPs) rather than setting up multiple CTCs, thereby increasing potential sources of infection.
- Ambulances can be provided for referral, or a cholera treatment unit (CTU) may be established as an intermediate structure.
- Using taxis/buses should be discouraged given the high contamination risk during the journey.

Rural Settings

- The CTU should be located inside the HF or close to it. If this is not possible, other existing structures may be used. CTUs may paralyse routine health services as adequate case management is labour intensive and other health services may suffer from staff shortages. In areas that are far from any treatment facility, it may

be possible to decentralize the CTU to the level of the affected villages.

- ORPs have two objectives: to treat patients and to screen off and refer severely dehydrated patients to CTC/CTU(s). They reduce pressure on overburdened CTCs and CTUs. They can be decentralized to the community level. The community health worker should receive quick training and regular supplies to be able to achieve given objectives.

Setting Up a Temporary Cholera Treatment Camp

- An existing building can be used or tents can be set up.
- Consider safety of patients and ventilation as high temperatures contribute to dehydration of patients.
- The camp should operate 24 hours a day independently of other HFs, therefore, the necessary staff has to be recruited.
- It should be supplied with necessary medical material specifically for the centre.
- An enclosure or other form of acceptable screen should be set up around the cholera camp.
- The various workstations should be clearly labelled and directions provided.
- The CTC must be a "closed system" where contamination is introduced through patients and must be destroyed inside the structure. Under no circumstances should any contamination come out (through patients, water, material, solid and liquid waste, etc.).

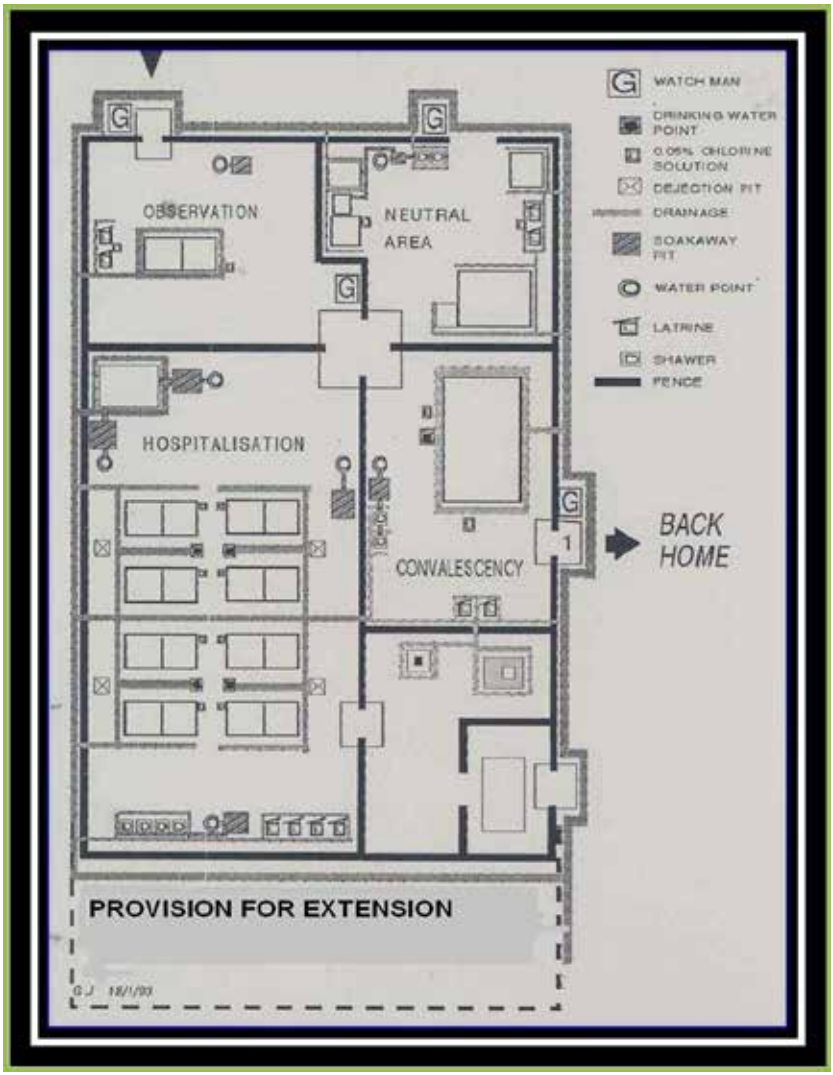
General Rules for A Good Design

- Restrict unnecessary movement for staff and patient
- Each zone is a "closed box"

Systematic disinfection between zones:

- Discipline and mutual control for the patient, attendant and staff on hygiene

Figure 4.2: Standard design of a cholera treatment centre.



4.11 HEALTH LABORATORY

Health laboratory personnel, especially the staff of microbiology, work with infectious organisms and materials that do or may contain microorganisms. Some of these organisms are pathogenic and potentially dangerous.

Avoidance of infection is thus an essential element of the professional expertise of workers. They must protect not only themselves but also their materials from possible cross-contamination that may invalidate their work by giving false results. Health laboratory workers are also at risk of chemical, fire, and radiation hazards.

WHO has provided guidance regarding hazards of infective microorganisms by risk group, and laboratories are designated by level according to their design features, construction, and containment facilities (safety precautions and equipment) as:

1. Basic biosafety level (BSL) 1
2. Basic BSL 2
3. BSL 3: Containment
4. BSL 4: Maximum containment

Depending on the laboratory level, the health worker is referred to the WHO safety guidelines (Biosafety Level guidelines) (WHO, 2004).

4.11.1 Definitions of Terms

Biological safety cabinets (BSCs) provide protection for personnel, the agent being processed, and the environment. They range in complexity from level I (general research cabinets for use with low- to moderate-risk microorganisms) to level 3 (totally enclosed cabinets with gas-tight construction that provide maximum protection to workers and the environment).

Laboratory-acquired infections are HCAIs resulting from the performance of laboratory activities by staff, regardless of how they occurred.

4.11.2 Types of Exposure Resulting in Laboratory Acquired Infections

Inhalation: Mixing, grinding, or blending an infectious agent or flaming a transfer loop can generate aerosols that can be inhaled by unprotected workers.

Ingestion: HCWs may be exposed by:

- Unconscious hand-to-mouth actions
- Placing contaminated articles (pencils) or fingers (when biting fingernails) in the mouth

- Eating, drinking, or smoking in the laboratory or failing to use proper hand hygiene (neglecting to wash hands or to use a waterless, ABHR before and after eating)
- Pipetting (13% of accidental laboratory-acquired infections are associated with mouth pipetting)

Puncture wounds: Accidental injury with sharps (suture needles, scalpel blades, and contaminated broken glassware) is the leading cause of laboratory-acquired infections.

Contamination of skin and mucous membranes: Splashes and sprays of contaminated fluids onto mucous membranes of the mouth, nasal cavity, and conjunctivae of the eyes and hand-to-face actions can lead to the transmission of pathogenic organisms.

4.11.3 BSL Guidelines

A combination of primary and secondary containment and safety guidelines are designed for use in microbiology laboratories and bacteriology research units functioning at four levels (BSL-1 to BSL-4) of increasing risk.

BSL-1 is the lowest level of containment and microbiologic safety guidelines and is entirely based on standard laboratory practices. These guidelines are recommended for those working with microorganisms, such as *Bacillus subtilis*, that are not known to cause infections in healthy adults.

BSL-2 is generally applied in bacteriology laboratories working with agents (e.g., Salmonella species*)* associated with human diseases of varying severity. When standard microbiologic practices are applied, the agents may be handled on open benches, especially if PPE, such as facemasks, gowns and examination gloves are used when appropriate. The use of BSCs and safety centrifuges may be necessary.

BSL-3 is aimed at containing hazardous microorganisms primarily transmitted by the airborne route (aerosols and droplets), such as TB or varicella (chicken pox). Laboratory staff who work in these situations must be trained in the use of appropriate equipment, including suitable ventilation systems and the use of BSCs.

BSL-4 is designed for use where agents causing life-threatening or untreatable diseases that can affect the laboratory worker via the airborne route are present, such as VHFs. Trained workers using level 3 BSCs or wearing full-body, air-supported, positive-pressure suits must perform all procedures in these laboratories. In addition, the facility itself must be totally isolated from other laboratories and have specialized ventilation and waste management systems.

4.11.4 General Biosafety and Infection Prevention Guidelines

- Wear new examination gloves when handling blood, bodily fluids, and/or specimens containing pathogenic microorganisms; do not touch telephones, pens, lockers, etc., with gloves on.
- Eating, drinking, or smoking is prohibited in the laboratory.
- Food should not be stored in refrigerators used for clinical or research specimens.
- Mouth pipetting is prohibited; use proper mechanical devices (e.g., suction bulbs).
- Do not open centrifuges while still in motion.
- Always cover the end of blood collection tubes with a cloth or paper towel, or point them away from anyone's face when opening.
- Decontaminate work surfaces daily or when contaminated, such as after spills are collected, with 0.5% chlorine solution.
- Wear protective face shields or masks and goggles if splashes of blood, bodily fluids, or fluids containing infectious agents are possible.
- Wear heavy-duty or utility gloves when cleaning laboratory glassware.
- Use puncture-resistant, leak-proof containers for sharps.
- Place infectious waste materials in appropriate plastic bags or containers.
- Wear a laboratory coat while in the laboratory and remove it when leaving the laboratory (coats should not be worn in non-laboratory areas, such as offices, libraries, canteens, etc.).
- Secure the lid of the specimen container tightly.
- Label the specimen clearly with name, date, time of collection, and type of specimen at the site of collection.
- The laboratory should be kept neat, clean, and free of materials that are not pertinent to the work.

4.11.5 Blood Drawing (Phlebotomy)

Blood drawing (phlebotomy) is considered to be one of the highest-risk sharps procedures because the most frequently used needles are large bore (18-22 gauge), and a considerable amount of blood is left in the needle after use.

When collecting a blood specimen be sure to:

- Wear single-use examination gloves
- Have assistance when patients might be uncooperative (children, mentally impaired, etc.)
- Have assistance for holding children when doing heel sticks

4.12 BLOOD BANKS AND TRANSFUSION SERVICES

In this section, the guidelines for the safe provision of blood bank and transfusion services are summarized from the perspective of:

- Screening the blood donor
- Ensuring the safety of the donor
- Testing to make sure the blood or blood product is safe for use
- Protecting the patient receiving the transfusion
- Ensuring the safety of laboratory and clinical staff

4.12.1 Definitions of Terms

Blood bank: Facility or hospital unit that performs the collection, processing, storage, and distribution of human blood or blood products

Clinically significant antibody: An antibody capable of producing an adverse reaction to transfused blood or blood product obtained from a donor (allogenic antibody) or recipient (autologous antibody)

Closed system for obtaining blood: System in which the blood is not exposed to air or outside elements during collection and processing, including separation of components (e.g., platelets) if required prior to transfusion; it is the safest way to collect, process, and store blood.

Donor-patient: Person whose blood is collected for possible transfusion to another person (allogenic transfusion)

Donor-recipient: Person whose own blood is collected for possible transfusion to herself/himself (autologous transfusion)

Look-back system: Process of identifying persons who have received a blood transfusion from donors who are subsequently found to have infections with HCV or HIV (and often HBV) and notifying them if appropriate

Recipient transfusion reaction: Adverse reaction to infusing blood or blood products into a patient (recipient); it may occur at any time during the transfusion but often happens shortly after starting it. The reaction may be mild or severe but is rarely fatal.

Transfusion service: Facility or hospital unit that provides storage, pre-transfusion testing and cross matching, and infusion of blood or blood products to intended patients (recipients)

Unit of blood: Sterile plastic bag in which a fixed volume of blood is collected in a suitable amount of anticoagulant; the collection system should be a closed system, usually consisting of a sterile hypodermic needle connected by tubing to a collection bag that has one or two sterile ports for inserting a sterile blood administration set.

Urticarial reaction: Allergic reaction consisting of itching (pruritis), hives, skin rash, and/or similar allergic condition occurring during or following a transfusion of blood products

4.12.2 Indications for Blood Transfusion

- Acute severe anaemia
- Massive blood loss
- Blood disorders

4.12.3 Provision of Blood Transfusion Services

Blood bank and transfusion services involve selecting donors; ensuring that they are informed; collecting blood from screened donors; testing for blood components, antibodies, and infectious diseases; storing and transporting blood; pre-transfusion testing of patient (recipient) blood; and transfusing patients.

4.12.3.1 Donor Selection

The donor selection process is one of the most important steps in protecting the

safety of the blood supply. It is intended to identify medical problems, behaviours, (e.g., IV drug use) or events that put a person at risk of being infected and transmitting a serious disease to the person receiving the transfusion.

4.12.3.2 Informed Consent

Prior to collection of blood, the elements of the donation process should be explained in simple, easily understandable terms in the patient's primary language, if possible. The explanation should include information about the risks of venipuncture (phlebitis or local infection and rarely bacteremia or septicemia) and potential adverse responses to having 400–500 mL of blood removed.

A donor who wants to know his/her HIV status should be informed with appropriate pre- and post-test counselling.

4.12.3.3 Blood Storage and Transportation

Blood units must be stored in a refrigerator that can be maintained at temperatures of 1-6 °C (34-46 °F). There must be a system to monitor temperatures continuously and record them at least every four hours. In addition, the refrigerator should have an alarm system that signals by sound before the blood reaches unacceptable storage temperatures. Blood units exposed to a temperature above the accepted level for an unknown period should be discarded. To do this:

- Wear examination or utility gloves and protective eyewear
- Pour contents down a utility sink drain or into a flushable toilet or latrine
- Place empty blood bags and tubing in a plastic bag or leak-proof, covered waste container
- Dispose of plastic bags or contents of the container according to hospital or facility waste management guidelines

Blood units transported a short distance (e.g., from the blood bank or transfusion service to the ward or OR) require no special handling. Blood should not, however, be allowed to reach temperatures outside the acceptable range.

4.12.3.4 Blood Components and Infectious Disease Testing

ABO blood group is determined by testing the donor's red cells with anti-A and anti-B reagents and by testing the donor's serum or plasma A and B red cells.

Rh type is determined by testing with anti-D reagent. If the initial test with anti-D is negative, the blood also should be tested using a method designed to detect weak D.

Blood from donors with a history of transfusions or pregnancy should be tested for unexpected antibodies to red cell antibodies using methods to demonstrate clinically significant antibodies.

***Note**: In addition, blood should be tested for several infectious diseases. Blood should not be released for transfusion unless the results are negative for all tests, with the exception of the test for syphilis, which has been shown to be a biologic false positive.*

The recommended tests include:

- Syphilis by screening with a standard antibody test, such as the rapid plasma regain test
- HBV by testing for the hepatitis B surface antigen (HbsAg) and HBV core antigen (anti-HBc)
- HCV by testing for anti-HCV
- HIV by testing for type 1 (HIV-1) antigen and antibodies to HIV-1 and HIV-2 antigens
- Malaria parasites

4.13 INFECTION CONTROL IN ICU

Hospital acquired infections (HAIs) are common in intensive care unit (ICU) patient and are associated with increased morbidity and mortality. The main reason being severity of illness, interruption of normal defense mechanism (e.g. mechanical ventilation), malnutrition & inability to ambulate make it more susceptible to multi drug resistant organism (MDRO). The last several years, numerous developments have been made in infection preventive strategies. Including planning & execution of infection control practices, training, monitoring & data collection, interpretation of data as well as modification in practices.

The main focus in ICU settings is on monitoring hand hygiene, update on isolation precaution, new methods on environmental cleaning, prevention of device related in infections, MDRO, Clostridum difficile infection.

The three main clinical end points for controlling infection in ICU include cant. Control high infection rate, Maintain low infection rate, Prevention of antibiotics resistance.

Source of microorganism for HAI's: Source of microorganism may be exogenous (such as bacteria, fungi, virus etc)

From other patient, health care worker or visitors. Other reservoir may be endogebous flora (flora from skin, mucous membrane, GI tract or respiratory tract) or inanimate object which has become contaminated (e.g. patient bed surface, equipment or other devices or objects used in ICU) Intrinsic risk factorsinclude immunocompromised state, severity of illness, extremes of age, inadequate nutrition, and immobilization make ICU patient more susceptible.

Extrinsic risk factors include invasive procedure, catheters, mechanical ventilation & other therapeutic interventions in ICU.

Modes of transmission: The most frequent mode of transmission is Contact transmission, this may be direct or indirect other modes include droplet transmission, airborne transmission, common vehicle such as ventilator etc.

Contributing factors: Factors common to ICU patients that contribute to the risk of nosocomial infections include-

1. Acuity of illness
2. Response to physiological stressors
3. Age and associated comorbidity
4. Indiscriminate use of antibiotics promoting the development of antibiotics-resistant organisms.
5. Drug therapies for stress ulcer
6. sleep deprivation
7. protein-energy malnutrition, and understaffing.

1) Acuity of illness: The severity of an illness increases, energy stores needed to sustain normal body processes such as immune function become depleted, reducing the ability of the patient to resist colonization by exogenous organisms Critically ill patient are also more susceptible to overgrowth of resistant endogenous.

2) Physiological and psychological stressors: Physiological stressors resulting from injury and illness psychological stressors such as noise. Pain, anxiety, and isolation are a few of the many stressors encountered daily by ICU patient.

3) Age and comorbidity: Elderly patient are less resistant to infection than their younger counterparts. The mortality from bacterial nosocomial pneumonia is live times more likely in Patient more than 65 years old. One possible explanation is the progressive atrophy of the thymus that occurs with age; also, nature defenses in the elderly are compromised. The higher prevalence of chronic illnesses among the elderly also contributes to the risk for nosocomial infections.

4) Indiscriminate use of antibiotics and the developementof resistant organisms: Broad-spectrum Antibiotics are often prescribed for critically ill patient when signs and symptoms consistent with infection are present, white blood cell counts are elevated, or invasive procedures are required. Indiscriminate use of antibiotics leads to the elimination of a greater number of normal floras, thus enabling modified and more virulent organisms to produce infection. These modified organisms have new characteristics against which standard agents are no longer effective.

The National Nosocomial Infection Surveillance System reported that the percentage of nosocomial infection caused by vancomycin – resistant enterococci increased from 0.4% to 13.6% between 1989 and 1993.

5) Prophylaxis for stress ulcers: Routine administration of antacid and histamine antagonists for prevention of stress ulcers in critically ill patient may increase the risk of infection. The increase in gastric Ph produced by these agents may attenuate the bactericidal effect of an acidic pH, thus promoting gastric colonization not only by gram- negative and gram – positive bacteria but also by yeasts.

6) Slep deprivation: lack of the usual quantity and quality of sleep, including loss of normal progression through sleep cycles, adds to the stress critically ill patient experience and may alter immune function.

7) Malnutrition: Catabolism of protein, carbohydrate, and fat stores and changes in the use of defensive mechanism by reducing the production of immune cells.

Protein malnutrition has been linked with a breakdown of the intestinal mucosal lining allows bacteria to move through the disrupted barrier into the and bloodstream to produce infection. (Another mechanism is) bacterial movement from the bowels, bacterial translocation, the process of bacterial movement through an intact mucosal barrier.

Ventilator associated pneumonia

VAP is most common infection acquired in ICU. VAP as defined by CDC is a pneumonia which occurs in a patient who was intubated & mechanically ventilated at the time of onset of pneumonia or within 48 hours before onset of pneumonia. The criteria include:

New or progressive infiltrates, Consolidation, cavitation pr pleural effusion on chest X ray and at Least one of the following -

- New onset of purulent sputum or change of character of sputum.
- Fever
- Increased or Decreased WBC counts
- Organism cultured from blood Isolation of an etiological agent from biopsy or bronchial brushing specimen.

The prevention strategy of VAP includes pharmacological & non- pharmacological intervention. Develop VAP prevention protocol

- Awareness & Training
- Shorten the duration of intubation and invasive ventilation. Consider use of noninvasive ventilation.
- Avoid continues use of paralytics as far as possible. Ensure appropriate dosages of sedation or narcotics. Consider use of sedation scale to avoid over-sedation.
- Daily Interruption of sedation to assess readiness for extubation.Wean patient off invasive ventilation as soon as possible.
- Prevent unplanned extubation e.g. patient self extubation. Practice of standard precaution should be observed
- Perform tracheal suction properly with aseptic precaution & avoid routine saline instillation during suctioning.
- Ensure appropriate disinfection, sterilization, and maintenance of respiratory equipment Prevent condensate from ventilator circuits drain toward the patients.

- Prevent leakage of subglottic secretion into lower airway.
- Place the ventilated patient in semi- upright position around 45 degrees.
- Consider use of antiseptic oral rinse such as 0.12% Aq. Chlorhexidine at set interval for maintenance of oral hygiene.
- Stress ulcer prophylaxis.

Hand hygiene indications

- When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled
- with blood or other body fluids, wash hands with either a non- antimicrobial soap and water or an antimicrobial soap and water.
- Before having direct contact with patients.
- Decontaminate hands before inserting/ caring indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure.
- Decontaminate hands after non- intact skin, and wound dressing if hands are not visibly soiled.
- Decontaminate hands if moving from a contaminated body site to a clean- body site during patient care.
- Decontaminate hands after removing gloves. Before eating and after using a restroom, wash hands with a soap & water.

Hand-Hygiene technique

When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and finger, until hands are dry. Usually 2-3 ml of hand rub solution is required.

Other aspects of hand hygiene

- Do not wear artificial fingernails or extenders in ICU
- Do not wear artificial nails, Keep natural nail tips less than 1/4 – inch long
- Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and non- intake skin could occur.
- Remove gloves after caring for patient.
- Change gloves during patient care if moving from a contaminated body site to a clean body site.
- Healthcare worker educational and motivational programs.
- Monitor HCWs adherence with recommended hand hygiene practices.

Administrative measures: Make improved hands hygiene adherence an institutional priority and provide appropriate administrative support and financial resources.Implement a multidisciplinary program designed to improve adherence of health personnel to recommended hand hygiene practice.

As part of a multidisciplinary program to improve hand hygiene adherence, provide HCWs with a readily accessible alcohol- based hand- rub product. To improve hands- hygiene adherence among personnel in ICU make an alcohol-based hand rub available at the bed side as well as in other convenient locations.

Performance indicators: Periodically monitor and record adherence as the number of hands – hygiene episodes performed by personnel/ number of hand – hygiene opportunities. Monitor the volume of alcohol- based hand rub per 1,000 patient days.

Urinary trect infection: Urinary tract infections (UTIs) are the most common type of nosocomial infections, accounting for 40% of all infections in hospital per year. Almost 80% of these infections are due to instrumentation or catheterization.

- Organisms attacking any portion of the urinary system cause urinary tract infections. Kidneys (pyelonephritis)
- Bladder (cystitis)
- Prostate (prostatitis)
- Urethra (urethritis)
- Urine (bacteriuria)

Once bacteria infect any site, all other areas are at risk. The diagnosis of lower UTIs (cystitis and urethritis) is usually made on the basis of signs and symptoms and then confirmed by culture. Most episodes of short-term catheter- associated bacteriuria (greater than 10^5 organisms per mL of urine), however, are without symptoms.

Most nosocomial UTIs are caused by gram-negative coli form bacteria, particularly Escherichia coli, pseudomonas species, and organisms from the enterobacter group. Collectively they account for more than 80% of culture- positive UTIsthe most common organism is E.coli.

- Female gender
- Postpartum status.
- Older age

- Severe underlying illness an
- High blood creatinine level.
- The wrong reason for catheterization,
- Contamination during insertion,
- Errors in catheter care
- Use of antibiotics.

Organisms may reach the bladder in two ways:

a. Through the inside of a catheter (i.e. the backward flow of urine)
b. By travelling up the space between the outer surface of the catheter and the urethral mucosa.

Therefore, once the catheter is inserted, any back-and- forth movement of the catheter (e.g. raising the collection bag above the level of the bladder), o allowing urine to be collected in an open drainage system(bag or container) should be avoided because each of these activities potentially enables organism to enter the bladder. The first way (backward flow of urine in the catheter) is the more common infection is men. The second (Organisms migrating into the bladder along the outside of the catheter) is more common in women in part because of their shorter urethra.

Placement of an indwelling catheter should be performed only when other methods of emptying the bladder are not effective, and it is particularly important to limit the duration.

Preventing infections in catheterized patients

- Remove the catheter as soon as possible.
- The Catheter collection systems should remain closed unless absolutely necessary for diagnosis or therapeutic reasons.
- Caution the patient against pulling on the catheter.Urine flow through the catheter should be checked regularly to ensure that the catheter is not blocked.
- Avoid raising the collection bag above the level of the patient's 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 stand up, drain all urine from the tubing into the bag. The urine drainage (collection) bags should be emptied aseptically, touching the tip of the emptying tube to the side of the collection bag or permitting the tip to touch the urine in the vessel should be avoided.

- Replace bags with new or clean containers when needed.
- If the drainage tubing becomes disconnected, do not touch the ends of the catheter or tubing. Wipe the ends of the catheter and tubing with an antiseptic solution before re connecting them.
- Wash the head of the penis and urethral opening (men) or the tissue around the urethral opening (women) after a bowel movement or if the patient is incontinent.
- Avoid irrigation, if frequent irrigation is required, the catheter should be changed.

Intravascular catheter related infection

Intravascular catheters are integral part of modern ICU care. Infectious complications include local site infection, catheter related blood stream infection (CRBSI), septic thrombophlebitis, endocarditis & other common pathogens leading to CRBSI are coagulase nestive staphylococci, StaphylicoccusAureus, enterococci, candida etc. Recently there is increasing percentage of Enterobacteriaceae isolates from ICU's producing ESBL, particularly Klebsiellapneumonia. Suchorganisms are resistant to cephalosporins& other antibiotics.

1. The material of which device is made; (Teflon, silicon & polyurethane is superior)
2. Intrinsic virulence of an infective organism.

Preventive Strategy

Site: Subclavian vein is preferred site for central venous cannulation. The other sites in descending order of preference are jugular & Femoral.

Material: Catheter made up of Teflon or polyurethane has lesser infection incidence in comparison to PVC or polyethylene.

Strict aseptic precaution while cannulation
Transparent dressing: secures the dressing and allow quick inspection of catheter site & less frequent changes in comparison to standard gauze dressing.

Use of anticoagulant may have some role by preventing the deposition of fibrin & thrombi and thus preventing bacterial colonization.
Daily inspection & changing CVC if signs of local infections appear.

Surgical Site Infection (SSI)

Either an incisional or organ/space infection occurring within 30 days after

operation or within 1 year if an implant is present, incisional SSIs are further divided into

a. Superficial incisional(only involves skin and subcutaneous tissue)
b. Deep incisional (involves deeper soft tissue, including fascia and muscle layers.) most SSIs, the source of the pathogen(s) comes from the patient skin mucous membranes or bowel and rarely from another infected site in the body (endogenous sources) while exogenous sources. of SSI pathogens are occasionally responsible. e.g. Contaminated surface or instrument , or from member of surgical team. Antibiotics prophylaxis should be given to the patient undergoing surgery. The dose of the antibiotics must be administered within 60 minute prior to incision, to achieve adequate concentration at surgical site.

PART 5: IPC MANAGEMENT

5.1 PROGRAM MANAGEMENT ON IPC

Successful programs for preventing the spread of infectious diseases by any route (bodily fluids, air, droplet, or contact) in HFs are based on understanding the scope of the problem, prioritizing activities, and effectively using available resources. Careful planning, implementing, and monitoring of activities on a regular basis are all essential.

HCAIs and AMR are important public health concerns in Tanzania. There is conclusive evidence to show that the establishment of a surveillance system for HCAIs and AMR is associated with reductions in infection rates.

5.1.1 Scope of IPC Programme

- To prevent the occurrence of HCAIs in patients, HCWs, visitors, and other persons associated with HFs
- To prepare HFs for the early detection and management of epidemics and organize a prompt and effective response
- To contribute to a coordinated response to control community-acquired infectious diseases, endemic or epidemic, that may be "amplified" via health care
- To contribute to preventing the emergence of AMR and/or dissemination of resistant strains of microorganisms
- To minimize the environmental impact of these infections or their management.

An IPC programme, implemented within an HF, is critical not only to prevent HCAIs but also to prepare for and respond to communicable diseases crises. A set of essential core components has been defined to plan, organize, and implement an IPC programme.

5.1.2 Core Components for IPC

- Make sure technical guidelines are available and used
- Human resources, including training, programme staffing, and occupational health issues for HCWs
- Surveillance of disease and assessment of compliance with IPC practices
- Microbiology laboratory support
- Environment IPC

- Evaluation of IPC programmes
- Link with public health and other services/societal bodies
- Preventing infections in home-based care settings

5.1.3 Strategies for Successful IPC Programme

Promoting Early Detection of Infections Through Surveillance and Monitoring

The MOHCDGEC shall:

- Develop a national infection control surveillance system to produce quality data on targeted HCAIs and antibiotic-resistant organisms; President Office Regional Authority Local Government (PORALG) and QIT shall implement appropriate interventions according to the developed surveillance system
- Identify key infectious diseases for targeted surveillance
- Develop appropriate reporting mechanisms that provide clinical teams with comparative data on the levels of HCAI rates within their hospitals
- Coordinate and optimize linkages between laboratory services and HFs to ensure optimal use of laboratory data for the diagnosis of HCAIs

Addressing HCW Needs and Requirements; Education for All Level of HCWs

- The MOHCDGEC shall develop standardized courses for IPC to equip infection control officers to provide appropriate in-service training for HCWs in facilities.
- The PORALG, in collaboration with MOHCDGEC, shall implement an education and training programme for all level of HCWs.
- RHMT and CHMT shall strengthen HF based work improvement team (WIT) and QIT and provide them with appropriate training on infection control.
- WIT and QIT in the HFs shall increase awareness of the importance of prevention, surveillance, and control of infections among HCWs.

Reducing Risk through Implementation of Guidelines for IPC

All levels of health care shall promote the use of existing guidelines through awareness-raising activities that fully engage patients, service users, and health care professionals (e.g., conduct national and zonal workshops and distribute guidelines as widely as possible).

Reducing Reservoirs of Infection

- The MOHCDGEC shall develop infrastructure design and management for airborne isolation.
- HFs shall implement employee programmes on IPC in the work place to minimize the possibility of HCWs contracting preventable infectious diseases and transmitting such diseases to other HCWs.
- HFs shall adhere to standards for IPC, which includes:
  - Designing and implementing a coordinated programme to reduce the risk of nosocomial infections in patients and HCWs
  - Implementing targeted surveillance of devise-associated infections
  - Identifying the procedures and processes associated with the risk of infection, and implement strategies to reduce infection risk
  - Ensuring protective clothing, disinfectants, and other barrier techniques are available and are used correctly when required
  - Ensuring laboratory cultures are obtained from designated sites in the HF associated with significant infection risk when indicated
  - Ensuring the HFs' IPC plan has a quality management and improvement program (QIT and WIT)
  - Ensuring adherence to infection control and environmental cleaning standards (QIT and WIT)
  - Ensuring that cleaners receive in-service training on cleaning and use of chemicals and solutions for disinfection (QIT and WIT)

The MOHCDGEC shall:

- Develop a surveillance system for antimicrobial use and resistance to provide information for the optimal management of resistance
- Build capacity of HCWs on conducting epidemiological surveillance of AMR
- Provide continuous education for all groups of prescribers and dispensers on the importance of rational antimicrobial use
- Develop laboratory capacity in all HFs for culture and sensitivity testing to guide antimicrobial choice
- Provide public health education to promote appropriate antimicrobial use and use of preventive measures, such as immunization and vector control.
- Liaise with academic and research institutions to conduct studies to identify behaviours and environmental factors that predispose people to infectious diseases and to determine the status quo with regard to practices, skills,

knowledge, staffing, availability, use of guidelines and protocols, effectiveness of reporting lines, etc.; the outcome of these studies shall determine priorities to be addressed by the MOHCDGEC IPC structures

- Encourage academic and national research institutions to develop a research programme that addresses gaps
- Liaise with partners to support development of a national nosocomial research programme

In additions, the HF shall adhere to rational prescriptions of antimicrobial agents.

5.1.4 Program Development

Infection prevention must be made a priority; hence adequate IPC infrastructure and sufficient fiscal and human resources must be made available. The PORALG, in collaboration with MOHCDGEC, shall ensure availability of the required IPC infrastructure and sufficient appropriate equipment and supplies necessary for consistent IPC in all HFs.

5.1.4.1 Provision of IPC Infrastructure in HF Design

Outpatient and inpatient accommodations in HFs should be designed to address IPC, maximising patient comfort and dignity, ensuring ease of delivery of medical care, making appropriate provision for family members and other visitors, minimising the risk of infection, minimising the risk of other adverse events (falls, medication errors), sustainable design, and energy efficiency.

HFs shall be designed to accommodate the recommended IPC infrastructure:

- Hand hygiene infrastructure supplies
- Safe water supply
- Sanitary infrastructure (waste water)
- Ventilation and isolation
- Laundry, sluice, and other cleaning areas
- Health care waste disposal

5.1.4.2 Equipment and Supplies

Ensure availability of sufficient and appropriate supplies necessary for adherence to standard precautions (e.g., hand hygiene products, PPE, and injection equipment). Access to examination gloves, ABHR, and health care waste collection and removal

facilities (bins, liners, trolleys) is also important.

5.1.4.3 Cleaning and Sterilization

The QIT shall implement policies and procedures for environmental cleaning practices, cleaning frequency, and equipment sterilization. Each HF must ensure that:

- Standard environmental cleaning procedures with clearly defined responsibilities for all areas in the facility where decontamination is performed are available
- A written cleaning and disinfection schedule with clear cleaning areas, including stands, tables, countertops, sinks, floor, and equipment surfaces, is available
- Floors are cleaned at least twice a day
- Sinks are cleaned each shift at a minimum and more frequently as necessary
- Sinks used for cleaning endoscopes and respiratory equipment shall be cleaned between each use
- Endoscopes, laryngoscopes, dialysis, otoscopes, and dental and respiratory equipment is cleaned and sterilized after every single use
- The sequence of cleaning shall be from clean areas to soiled areas, from high areas to low areas (i.e., top of walls to floor), and from least contaminated to most contaminated
- Environmental cleaning staff shall not move back and forth between clean and soiled areas
- Environmental cleaning equipment used in the decontamination area shall not be used in any other area
- Training for health care staff on cleaning and sterilization is provided regularly
- Health workers wear proper PPE during cleaning and sterilization procedures

5.1.4.4 Behaviour Changes for Compliance with IPC

In order for HCWs to comply with IPC guideline and standards, QIT and WIT shall ensure the following activities:

- Providing regular in-service training on IPC
- Setting standards and monitoring staff performance
- Enhancing consistent support by all hospital administrators, managers, and staff
- Providing regular feedback and rewarding appropriate behaviour
- Encouraging senior staff and HF management to be role models for recommended IPC practices

5.1.5 Program Management

5.1.5.1 Organization Principles

Each HF must have an IPC focal person in the QIT to coordinate IPC activities. The WIT chairperson should be responsible for IPC activities in the unit. The purpose of IPC program management is to guide and support the use of recommended practices and to review and resolve problems that may arise. IPC program management should be conducted in a variety of patient care areas including surgery, CSSD, housekeeping, laboratory, purchasing, and administration.

5.1.5.2 Responsibilities of the IPC Focal Person in QIT

- Conducting initial and follow-up assessments of IPC infrastructure, isolation facilities, equipment and supplies, cleaning and sterilization, and behaviour changes
- Establishing the relative importance of the problem using Spaulding's categories of potential risk, including critical, semi-critical, and non-critical
- Coordinating IPC activities with WIT members in different units
- Identifying and analysing the reasons for poor or incorrect performance and estimating the costs and benefits
- Estimating cost of annual IPC supplies, including ABHR, PPE, and disinfectants
- Estimating cost of repair and maintenance for essential IPC equipment, such as the autoclave
- Participating in the preparation of an action plan with costing, budgeting, and financing
- Developing a strategy for HCWs on continuous IPC education in the work place
- Strengthening supportive supervision on IPC
- Conducting staff orientation before new guidelines, recommendations, or procedures are started and providing follow-up training when reinforcement is needed
- Ensuring continuous availability of IPC supplies and equipment
- Confirming value through monitoring, providing data, and measuring the impact of IPC interventions
- Ensuring effective and regular communication and feedback at all levels

5.1.6 Management Roles and Responsibilities in IPC

5.1.6.1 Roles and Responsibilities of the MOHCDGEC in Ensuring Proper IPC Practices (National Level)

- Providing IPC guideline and standards
- Building HCW capacity in IPC
- Coordinating monitoring and supervision of IPC at all levels
- Mobilizing resources (HR, financial, and materials) for IPC activities

Roles and Responsibilities of PORALG to Ensure Proper IPC Practice (Local Government Level)

- Coordinating implementation of IPC activities at regional and district levels corresponding to guidelines and standards from MOHCDGEC
- Mobilizing and allocating resources (HR, financial, and materials) for IPC activities
- Providing supportive supervision to local government authorities on IPC in collaboration with MOHCDGEC
- Reporting to MOHCDGEC on the result of supervision and all relevant activities

5.1.6.2 Roles and Responsibilities of RHMT to Ensure Proper IPC Practices (Regional Level)

- Providing training to HCWs in IPC
- Planning and implementing supportive supervision to all councils in the region
- Monitoring allocation of utilization of resources for IPC
- Reporting to PORALG on the result of supervision and all relevant activities
- Staffing and allocating staff for better practice of IPC

5.1.6.3 Roles and Responsibilities of CHMT to Ensure Proper IPC Practices (Council Level)

- Providing training to HCWs in IPC
- Planning and implementing supportive supervision to all HFs in the council
- Preparing a comprehensive council health plan incorporating IPC activities
- Reporting to RHMT on the result of supervision and all relevant activities

5.1.6.4 Roles and Responsibilities of the HF to Ensure Proper IPC Practices (HF Level)

- Planning IPC activities in the HF
- Budgeting and allocating resources that correspond to the HF's IPC activity plan
- Implementing IPC activities in the HF
- Reporting to CHMT on the result of monitoring and evaluation of IPC in the HF
- Conducting regular monitoring and evaluation on IPC activities in the HF
- Organizing QIT and WIT
- Appointing an IPC focal person in the QIT
- Designate leadership and authority for the IPC programme with dedicated, qualified staff, scope, functions, and adequate budget
- Establish preparedness and response procedures in the HF for communicable disease emergencies
- Adapt and implement guidelines at the local level
- Provide basic training for all HCWs
- Provide specialized training for IPC professionals
- Ensure adequate staffing levels (numbers, skills and training)
- Assess local context and define local objectives, priorities, and surveillance methods
- Conduct appropriate surveillance, in line with local needs and national objectives, and report to appropriate authorities
- Monitor compliance with IPC practices in a blame-free culture
- Ensure good quality microbiology laboratory services
- Establish liaison and communication between laboratory and IPC activities
- Implement biosafety standards
- Identify infectious risks in the environment and implement appropriate interventions
- Conduct regular monitoring
- Submit regular reports on processes, outcome, and status of the local IPC programme
- Promote evaluation of performance in a non-punitive culture
- Establish links with public health activities and represent IPC to other HF services

Note: *IPC should be a permanent agenda of QI meeting*

All levels of management should ensure following critical activities in IPC:

- Compliance with multimodal strategy for hand hygiene by WHO
- Appropriate selection of effective, affordable, locally available antiseptic agents or chemical disinfectants
- Consistent use of PPE, especially gloves and other items
- Design of safer surgical operations
- Compliance with cleaning and sterilization requirements
- Repair and maintenance of IPC infrastructure (built environment)
- Use of safety checklists for making the OR safer for patients and staff
- Proper waste management, particularly difficult problems

5.1.7 Administrative Priorities in All HFs

- Ensure that recommended infection prevention practices are adhered to, such as sterilization or, where appropriate, HLD, of all items that come in contact with normally sterile tissue
- Ensure that patient care practices are performed according to the standard precautions
- Monitor compliance with recommended practices for certain high-risk procedures, such as inserting central venous catheters
- Work to eliminate unnecessary and unsafe practices, e.g., unsafe injections
- Ensure that routine surveillance does not outweigh investigating outbreaks, or providing safe water, food, and sanitation within the hospital or HFs

5.1.7.1 Staff Training

The QIT shall ensure that all cadres of HCWs are trained on IPC, such as:

- Public health importance of HCAIs
- Disease transmission cycle, routes of infection, and how to break the cycle
- Using standard precautions when dealing with all patients
- Methods of minimizing disease transmission and hands-on demonstrations on standard precautions
- AMR

Support staff, including cleaners, security guards, and drivers, shall be trained on:

- Public health importance of HCAIs
- Disease transmission cycle, routes of infection (linen, clothing, and health care waste), and how to break the cycle

- Using standard precautions when dealing with all patients
- Methods of minimizing disease transmission and hands-on demonstrations on standard precautions

Newly recruited clinical personnel (i.e., nurses, doctors, laboratory technicians, pharmacists, radiologists, and medical attendants) should be trained within the first six months of employment, and regular employees should have refresher training every six months on national IPC guidelines and standards.

After training, QIT should conduct supportive supervision to assess its effectiveness.

General reminders regarding the importance of maintaining an infection-free environment for safer delivery of services should be repeatedly emphasized.

5.1.7.2 Guidelines for HPs on How to Prevent Infections in Home-Based Care Settings

For any procedures where the skin may be broken, there may be contact with an open wound or sore, or where there may be contact with blood or other bodily secretions, caregivers should use the following guidelines:

- Practice good hand hygiene.
- Use gloves and plastic aprons when contact with blood and bodily fluids is anticipated.
- If the patient has a skin condition with open lesions/sores (broken skin), keep them clean and dry, and clean the lesions/sores with mildly salty water and cover them with a clean, dry dressing.
- Dispose of all materials that have come in contact with blood, bodily fluids, secretions, or excretions carefully so that they do not pose a risk to members of the community.
- If they are to be reused, clean and HLD them in 0.5% chlorine solution prepared with boiled or sterile water.
- Dispose of any cloth or plastic sheets that come in contact with blood, bodily fluids, secretions, or excretions; if they are to be reused, wash with soap or detergent, and dry in full sunlight (and iron the cloth).
- Wipe surfaces (e.g., mattresses, tables) that may have been in contact with blood after cleaning bodily fluids, secretions, or excretions with a cloth that has been soaked in 0.5% chlorine solution.

- Burn and bury all materials that have come in contact with blood, bodily fluid, secretions, or excretions (cloth or plastic sheets, razor blades, gloves, etc.).
- Waste should be buried in a deep hole and completely covered with soil so that it is not accessible to community members or children; it can also be disposed of in a deep pit latrine.
- Wear utility gloves when handling and disposing of contaminated waste products.

5.1.8 Preventing Infection in Home Deliveries

For women who deliver at home, in addition to the above guidelines, there are some specific requirements for conducting a clean delivery. In preparation for delivery, the following delivery kit should be available:

- New razor blade
- New cord ties (string to tie the umbilical cord)
- Clean delivery surface (a plastic sheet is recommended; a cloth that has been well washed and fully dried in sunlight and ironed, if possible, is the next best alternative)
- Gloves
- Soap
- Clean and safe water
- Sanitary pads or pieces of cloth that have been washed and dried in full sunlight and ironed, if possible
- Clean warm wrappings for the baby, which have been washed and dried in full sunlight and ironed, if possible
- Running water for hand washing
- Clean protective clothing for the birth attendant

In conjunction with the supplies, the following are recommended:

- Avoid shaving hair.
- Clean and boil any reusable instruments, and properly dispose of any waste products.
- If there are large spills of blood, bodily fluids, secretions or excretions, contain the spill, clean with water and soap; when it is dry, wipe with chlorine.

5.2 INFECTION MONITORING AND SURVEILLANCE

5.2.1 Surveillance

Public health problems are diverse, including infectious and non-infectious disease. A surveillance system is a key tool to monitor the situation; identify the problem, the cause of the problem, and the best interventions; and to evaluate the effectiveness of the interventions. The goal of surveillance varies, however, its general goal is to provide information that can be used for health action by health care or public health personnel, government leaders, and the public to guide public health policy and programs.

5.2.2 Types of Surveillance

Active Surveillance

- For example, contacting health providers to obtain reports or trained personnel (mainly IPC focal person) vigorously looking for HCAIs
- Ensures more complete reporting of conditions
- Used in conjunction with specific epidemiologic investigation
- Trained personnel, mainly IPC focal person, vigorously look for HCAI
- Information accumulated by using a variety of data sources within and beyond the HF

Passive Surveillance

- Diseases reported by health care providers
- Simple and inexpensive
- Limited by incompleteness of reporting and variability of quality
- Persons who do not have a primary surveillance role, such as ward nurses or respiratory therapists, identify and report HCAIs

5.2.2.1 Patient- and Laboratory-Based

Patient-Based

- Count HCAIs, assess risk factors, and monitor patient care procedures and practices for adherence to infection control principles
- Antimicrobial use and susceptibility patterns
- Requires ward rounds and discussions with caregivers

Laboratory-Based

Detection is based solely on the findings of laboratory studies of clinical specimens.

5.2.2.2 Prospective and Retrospective

Prospective Surveillance

- Monitor patients during their hospitalization
- For SSIs, also monitor during the post-discharge period

Retrospective Surveillance

Identify infections via chart reviews after patient discharge.

5.2.2.3 Targeted and Comprehensive

Targeted

- Objectives for surveillance are defined
- Focus is on specific events, processes, organisms, and/or patient populations

Comprehensive

- Continuous monitoring of all patients for all events and/or processes
- Highly personnel-resource intensive, if done manually

5.2.3 Surveillance of HCAIs

5.2.3.1 Definition of Surveillance

"The on-going, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control" (WHO, 2019).

Surveillance is also useful in monitoring the effectiveness of IPC programs and is required for patient safety. Surveillance of HCAIs and feedback of the results to QIT is central to efforts to improve performance.

Output from the surveillance program can be used in the following ways:

- Identify patients and their contacts for treatment and intervention

- Detect epidemics, health problems, changes in health behaviours
- Estimate magnitude and scope of health problems
- Measure trends and characterize disease
- Monitor changes in infectious and environmental agents
- Assess effectiveness of programs and control measures
- Develop hypotheses and stimulate research

Therefore, having a surveillance system is essential to controlling infections in the HF and community settings. Also, keeping good quality records and data of targeted diseases and conditions is crucial for effective implementation practices.

5.2.3.2 Objectives of Surveillance

The overall aim of surveillance is to provide information that is required to inform public health actions. The specific objectives and the associated actions are:

- Assessing the quality of health care services to inform QIT for action with respect to control and prevention of HCAIs and AMR infections and the occurrence of disease in the health care setting
- Defining IPC priorities to inform policy and planning with respect to the current and likely future impact of HCAIs and AMR infections
- Evaluating IPC programmes to inform decisions regarding the status of existing IPC interventions
- Stimulating research to generate hypotheses and inform research methodologies
- Detecting outbreaks and exposure

5.2.3.3 How to Start Surveillance

- Assess the targeted health care population and identify the outcomes or processes of interest.
- Select the outcome or process for surveillance:
  - Examples of outcomes: HCAI, infection or colonization with a specific organism, pyrogenic reaction or vascular access infection in haemodialysis patients, sharp injuries, etc.
  - Examples of processes: Central-line insertion practices, surgical care processes (e.g., preoperative antimicrobial prophylaxis), medication errors, influenza vaccination rates, HBV immunity rates, personnel compliance with protocols, etc.

- Examples of other events: Occurrence of reportable diseases and conditions, communicable diseases in personnel, organisms, or syndromes indicative of bioterrorist events, etc.

- Determine observation time period.
- Choose the surveillance methodology.
- Monitor for the outcome or process using standardized definitions for all data collected.
- Collect appropriate denominator data, if rates are to be calculated.
- Analyse surveillance data.
- Report and use surveillance information in a timely manner.

Evidence-based implementation practice and health care programmes to prevent HCAIs have been shown to reduce the occurrence of HCAIs and AMR. Surveillance is an essential element for revealing the current prevalence of HCAIs and AMR to identify potential risk factors and implement various preventive strategies.

The IPC focal person should conduct routine HCAI surveillance in most inpatient HFs in an active, patient-based, prospective, targeted manner that yields risk-adjusted incidence rates.

5.2.4 How to Conduct Surveillance

5.2.4.1 Planning

Because it is not feasible to monitor all types of infections at all times, choosing which infections to survey is based on an initial assessment to establish priorities for the surveillance system. An initial assessment will include the:

- Types of patients/residents that are served by the health care setting
- Key medical interventions and procedures provided in the health care setting
- Frequency of particular types of infections within a particular health care setting
- Impact of the infection (including percentage of case fatalities and excess costs associated with the infection)
- Preventability of the infection required mandatory reporting elements (e.g., antibiotic-resistant organisms, ventilator-associated pneumonia).

5.2.4.2 Data Collection

Collection of infection data for surveillance purposes must be done using validated, published definitions for HCAIs. If the definitions are not standardized, a health care setting's infection rates cannot be accurately compared to either their own historical data or to external benchmarks. To generate valid HCAI rates, information must be collected on those who are at risk of getting an HCAI (denominator) and those who actually develop an HCAI (numerator). Electronic screening of patient records is an emerging tool for identification of potential HCAIs. These computerized systems of case finding will reduce the time spent by infection control professionals in case finding.

Long-term care homes will have a more limited range of information available for case finding, relying on on-going contact and feedback from those directly involved in resident care.

Post-discharge surveillance for SSIs is becoming an increasingly important component of surveillance system in acute care, due to shorter hospital stays following surgeries and an increasing proportion of outpatient surgeries. Innovative strategies that do not put an undue burden on program resources are encouraged in hospitals to detect SSIs.

5.2.4.3 Data Analysis

The recommendation is to calculate incidence density rates in hospitals and long-term care homes (i.e., the measurement of new cases of infection [incidence] during a defined period of risk in the patient/resident population, e.g., length of stay in a hospital or long-term care and control practices that can be implemented to lower the risk of HCAI). The facility's IPC committee or other body that advises the infection control team can analyse and interpret infection data.

HCAI rates may be compared to both the facility's own previous HCAI rates and benchmarks or to external standards or benchmarks set by other health care settings. When comparing HCAI rates to those of other health care settings, it is essential that the same case finding methods are used, the same case definitions are applied, and the same methods for risk stratification are used. Recommended practice is that a set of peer facilities that serve a similar case mix and use the same case definitions and similar case finding methods be identified to serve as a comparison group.

5.2.4.4 Communication of Results

Communication of surveillance data should on-going, systematic, and targeted to those with the ability to change IPC practice. Communication may be targeted to:

- A health care setting's IPC committee, which provides an aggregate picture of all infections of interest in the hospital
- A particular patient/resident care area or specialty care area, focused on the risk of specific types of infections that are of importance to these groups
- Patient/resident care staff following the identification of an emerging risk of infection, to remind or notify them of the required precautions in IPC
- Local public health unit when there is a reportable communicable disease event

Where medical devices are inserted and/or surgical procedures are performed, rates of device-associated infection or SSI should also be calculated on an on-going basis. It may be useful in hospitals to stratify rates of SSIs by standardized risk ratios/rates in order to compare the rates to other hospitals.

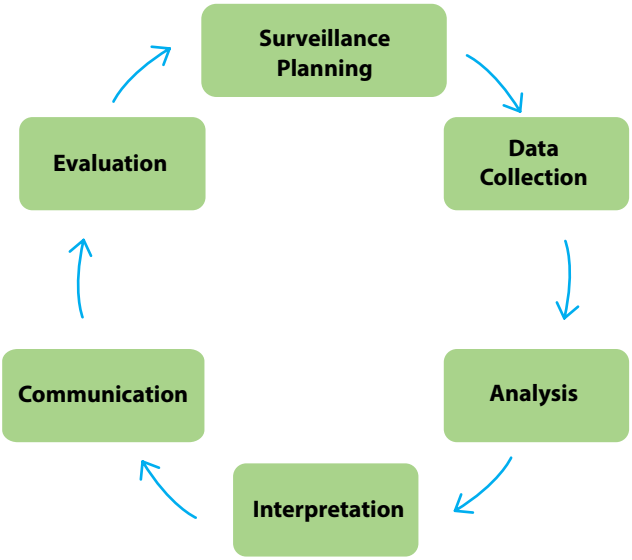
An electronic spread sheet/database and/or statistical analysis program should be used in hospitals and long-term care homes to store data and calculate HCAI rates, maximize IPC resources, and reduce the potential for errors associated with manual calculations.

5.2.4.5 Interpretation of Data

Surveillance data require interpretation to identify areas where improvements to infection prevention outcomes to which the surveillance system contributes. Evaluation should include how information produced by a surveillance system is used to reduce the risk of HCAI. Outcome evaluation should take place at least annually, and a realignment of surveillance objectives undertaken when indicated.

The steps provided in this best practices guide will assist IPC professionals in developing and implementing their surveillance programs in a manner that will permit comparisons with their peers and allow them to quickly detect early increases in HCAIs that may indicate the presence of an outbreak.

Figure 5.1: Steps in conducting surveillance



How to Collect Data for Surveillance

Surveillance data must be accurate and consistent for effective monitoring of trends and outbreaks.

Clinical review of medical records should include collecting basic demographic information (e.g., name, age, date of birth, admission diagnosis), checking for fever, new antibiotic use, and new cases of diarrhoea, clinical sepsis, or the presence of an inflamed surgical wound, drain, or IV site.

Discussions with patients (or parents of newborns) should focus on their health, the health of other young children at home, general hygiene, food handling, and sanitation.

Discussions with staff working in the affected area should deal with ensuring that recommended patient care activities are being performed correctly and at the appropriate times.

Laboratory information to be checked should include a review of positive cultures and other diagnostic findings, if available.

Pharmacy information on prescribed and dispensed antimicrobials should be checked.

Surveillance system attributes

Table 5.1: Attributes Surveillance system

Attribute	Question it answers
Usefulness	How useful is the system in accomplishing its objectives?
Data quality	How reliable are the available data? How complete and accurate are data fields in the reports received by the system?
Timeliness	How quickly are reports received?
Flexibility	How quickly can the system adapt to changes?
Simplicity and acceptability	How easy is the system's operation?
Stability	Does the surveillance system work well? Does it break down often?
Sensitivity	How well does it capture the intended cases?
Predictive value positive	How many of the reported cases meet the case definition?
Representativeness	How good is the system at representing the population under surveillance?

5.3 AMR SURVEILLANCE

5.3.1 Overview

"Antimicrobial resistance happens when microorganisms (such as bacteria, fungi, viruses, and parasites) change when they are exposed to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarial, and anthelmintic)" (WHO, 2017).

How Resistance Happens

Simply using antibiotics creates resistance. These drugs should only be used to manage infections.

Trends in Drug Resistance

Antibiotics are among the most commonly prescribed drugs used in human medicine and can be lifesaving drugs. However, up to 50% of antibiotics are not optimally prescribed, often not needed, and/or with incorrect dosing or duration.

The germs that contaminate food can become resistant because of the use of antibiotics in people and food animals. For some germs, like salmonella and campylobacter, it is primarily the use of antibiotics in food animals that increases resistance.

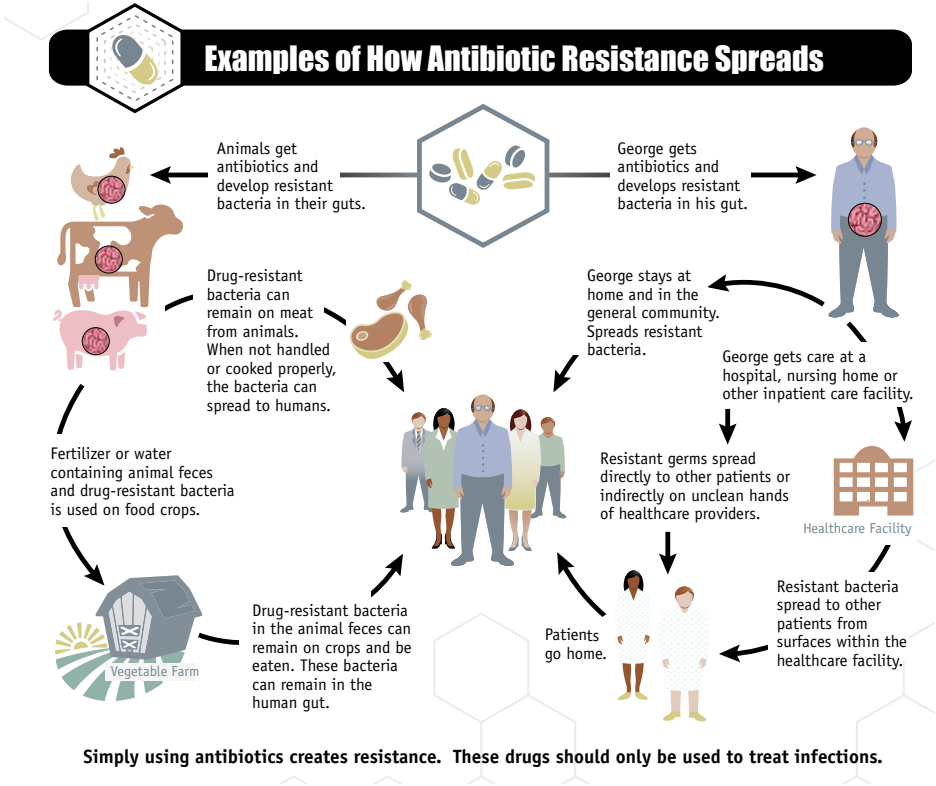
Because of the link between antibiotic use in food-producing animals and the occurrence of antibiotic-resistant infections in humans, antibiotics that are medically important to treating infections in humans should be used in food-producing animals only under veterinary oversight and only to manage and treat infectious disease, not to promote growth.

The other major factor in the growth of antibiotic resistance is the spread of resistant strains of bacteria from person to person or from non-human sources in the environment.

Figure 5.2: How antibiotic resistance happens

Source: (CDC, 2013)

Figure 5.3: Examples of how antibiotic resistance spreads



Source: (CDC, 2013)

5.3.2 5 D's of Antimicrobial Stewardship

Table 5.2: 5 D's of antimicrobial stewardship

Diagnosis	Ensuring a diagnosis or indication is established that directs antibiotic therapy; must be consistent among prescribers according to standards and guidelines
Drug selection	Provider reviews empirically prescribed antibiotics in a timely manner and adjusts or discontinues based on microbiology results
Dose optimization	STG specifies a dose according to age, weight, drug interaction, severity of disease, etc.
Duration	From commencement of dose to completion

De-escalation therapy and discharge	Suggests the need to reduce the spectrum or number of antibiotics formerly prescribed for critical patients, upon clinical improvement and/or microorganism recovery

5.3.3 Four Core Actions to Fight AMR

5.3.3.1 Preventing Infections and the Spread of Resistance

Avoiding infections in the first place reduces the amount of antibiotics that have to be used and reduces the likelihood that resistance will develop during therapy. There are many ways that drug-resistant infections can be prevented: immunization, safe food preparation, hand washing, and using antibiotics as directed and only when necessary. In addition, preventing infections also prevents the spread of resistant bacteria.

5.3.3.2 Tracking

Data on antibiotic-resistant infections causes of infections, and whether there are particular reasons (risk factors) that cause some people to get a resistant infection should be collected. With that information, experts can develop specific strategies to prevent those infections and prevent resistant bacteria from spreading.

5.3.3.3 Improving Antibiotic Prescribing/Stewardship

Perhaps the single most important action needed to greatly slow down the development and spread of antibiotic-resistant infections is to change the way antibiotics are used. Up to half of antibiotic use in humans and much of antibiotic use in animals is unnecessary and inappropriate and makes everyone less safe. Stopping even some of the inappropriate and unnecessary use would help greatly in slowing down the spread of resistant bacteria. This commitment to always use the right antibiotics appropriately and safely, only when needed, and administered correctly is known as antibiotic stewardship.

5.3.3.4 Developing New Drugs and Diagnostic Tests

Because antibiotic resistance occurs as part of a natural process in which bacteria evolve, it can be slowed, but not stopped. Therefore, new antibiotics will always be needed to keep up with resistant bacteria as well as new diagnostic tests to track the development of resistance.

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APPENDICES

Appendix 1. Core IPC Interventions for HFs at a Glance

Specific interventions	Target groups	Equipment and supply needs	Clinical process indicators for monitoring
Hand hygiene	2 All HCWs 3 Visitors 4 Patients	5 Clean running water 6 Soap (preferably mounted) 7 Towels 8 Alcohol-based solutions	Proportion of staff observed performing hand hygiene before attending patients
PPE	9 All health workers	10 Gloves 11 Gowns	Proportion of staff observed wearing gloves when exposure to blood or bodily fluids is anticipated
Isolation precautions	12 Nurses 13 Physicians 14 Nursing aides 15 Others	16 Gloves 17 Gowns 18 Masks 19 Eye protection	Average time between admission and isolation for TB patients
Aseptic techniques	20 Nurses 21 Physicians 22 Laboratory technicians 23 Dental surgeons	24 Antiseptics 25 Sterile gloves 26 Sterile devices and instruments 27 Sterile barrier devices	Proportion of IV lines inserted using aseptic technique
Cleaning and disinfection	28 Nurses 29 Nursing aides 30 Housekeeping 31 Laboratory staff	32 Cleaning fluids 33 Cleaning equipment 34 Disinfectant	Proportion of rooms appropriately disinfected after patient's discharge

Specific interventions	Target groups	Equipment and supply needs	Clinical process indicators for monitoring
Sterilization	35 Sterilization staff 36 Nurses 37 Laboratory technicians 38 Dental surgeons	39 Autoclaves and steam sterilizers 40 Test strips 41 Chemicals	Proportion of sterilized devices whose sterility is documented with test strips
Waste management	42 HCWs 43 Waste handlers 44 Logistics	45 Sharp boxes and other collection containers 46 Storage space and container for interim storage 47 Final disposal options 48 PPE for waste handlers	Presence of health care waste in the surroundings of the HF
Protocol for antibiotic use	49 Physicians	50 Essential list of antibiotics	Proportion of prescriptions that include an antibiotic
Immunization and exposure management	51 All HCWs	52 HBV vaccine and other appropriate vaccines	Three-dose HBV vaccine coverage among nurses, physicians, and laboratory technicians

Appendix 2. List of Participants for the Development of National IPC Guidelines for Health Care Services in Tanzania

SN	Name	Title
	Dr. Mohamed A. Mohamed	Director, Health Quality Assurance Division
	Dr. Eliudi S. Eliakimu	Assistant Director, Health Services Inspectorate and Quality Assurance Section, MOHCDGEC
	Dr. Joseph C. Hokororo	National IPC Coordinator, MOHCDGEC
	Ruth R. Ngowi	Directorate of Health Quality Assurance, MOHCDGEC
	Dr. Talhiya Yahya	National Star Rating Coordinator, MOHCDGEC
	Dr. Aloyce Lengesia	Directorate of Health Quality Assurance, MOHCDGEC
	Dr. Saum Nungu	
	Dr. Chrisogone J. German	
	Ms. Lucy Issarow	
	Dr. Radenta P. Bahegwa	
	Dr. Omary Nassoro	
	Dr. Mbwana Martin	
	Ms. Laura Marandu	
	Dr. Azma Simba	Epidemiology Section, Directorate of Preventive Services, MOHCDGEC
	Mr. Yohannes Msigwa	Directorate of Health Quality Assurance, MOHCDGEC
	Ms. Jackline Makupa	Head, Occupational Health, Directorate of Preventive Services, MOHCDGEC
	Mr. Honest Anicetus	Environmental Health Officer, Directorate of Preventive Services, MOHCDGEC

SN	Name	Title
	Ms. Sukyung Kim	Country Representative, Medipeace Tanzania
	Ms. Sehyeon Kim	Program Officer, Medipeace Tanzania
	Mr. Bakari Mahadhi	
	Dr. Nyambuli Jigabha	Public Health Specialist, Medipeace Tanzania
	Ms. Fatuma Salimu	
	Ms. Pauline Mtesigwa	Researcher, Medipeace Tanzania
	Dr. Elizabeth Lyimo,	District Dental Officer, Sinza Hospital
	Ms. Siana Mapunjo	Pharmaceutical Services Unit, MOHCDGEC
	Dr. Daniel Nkungu,	Medical Officer In-Charge Mwananyamala Regional Referral Hospital
	Dr. Mary Kitambi	Emergency Preparedness and Response Section, Directorate of Health Quality Assurance, MOHCDGEC
	Dr. Hamisi Malebo	National Institute for Medical Research
	Ms. Stella Stanslaus	Muhimbili National Hospital
	Ms. Grace Ngugo	Muhimbili Orthopaedic Institute
	Ms. Romana Sanga	Public and Private Health Facilities Section, Directorate of Curative Services, MOHCDGEC
	Dr. Akili Mawazo	Muhimbili University of Health and Allied Sciences
	Ms. Niyonezigiye A. Anicet	Muhimbili National Hospital
	Ms. Lucy D. Mbusi	Amana Regional Referral Hospital
	Mr. David F. Chiunga	Marie Stopes Tanzania
	Mr. Noel H. Mhadu	Pharmaceutical Services Unit, MOHCDGEC
	Mr. Francisco Chibunda	Bugando Medical Centre

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