NATIONAL GUIDELINES ON INFECTION PREVENTION AND CONTROL

Ministry of Health and Wellness

REPUBLIC OF MAURITIUS

MAY 2025

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Approval Form

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Updates

VERSION 2

- Grammatical mistakes were corrected.
- The following chapters were added and written by Dr. D. Nuckchady:
    - Biomedical waste management
    - Sterilization
    - IPC in the adult and pediatric intensive care units
    - IPC in oncology
    - Screening, triage and notification of contagious diseases
    - Food safety and clean water in healthcare facilities
    - IPC in other areas of the healthcare facilities
    - Management of corpses
    - IPC for specific diseases
    - Cholera
    - Marburg virus disease and Ebola virus disease
- The following annexes were added by Dr. D. Nuckchady:
    - Cleaning schedule
    - Terms of reference of antimicrobial stewardship teams
    - List of notifiable diseases in Mauritius
    - Posters on donning and doffing PPE
    - Checklist for donning and doffing of PPE when in coverall
    - Legislation in Mauritius relevant to IPC in healthcare facilities
    - Schemes of service relevant to IPC in the public sector
- The following guideline was merged with this one; brief clarifications were added to a few paragraphs by Dr. D. Nuckchady after discussion the nurses working in the neonatal ICUs:

- IPC in the Neonatal ICU

- The following chapters or sections were expanded and significantly revised by Dr. D. Nuckchady:
  - Section 1.2 i.e., the situational analysis
  - Section 4.7.3 i.e., contact precautions
  - IPC in the operation theater
  - IPC in maternal units
  - IPC in hemodialysis units
  - IPC in dentistry
  - Biosafety in the clinical laboratory
  - Section 16.3.4 i.e., gowning in the neonatal ICU
  - Surveillance of healthcare associated infections
  - Bundles of care for specific HAI
  - Antibiogram for the public hospitals of Mauritius in 2022
- Additional minor edits were made by Dr. A. Joorawon, Dr. L. Ramdani, Dr. U. Ballam and Dr. D. Capiron, who are all IPC team members.
- This document was also forwarded for comments to the heads of departments in the public health sector via their Regional Health Directors, to the laboratory and to private hospitals.
- For version 2, most additional material was taken directly from documents of the World Health Organization and Centers for Disease Control of the United States. However, it is highlighted that the section on the classification of notifiable diseases was based on Chinese and South African protocols whilst some parts of the chapter on management of corpses was obtained from Irish and Hong Kongese documents and the chapter on food safety and IPC in special areas was adapted partly from the UK.

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For version 1 a significant amount of material was adapted from the IPC guidelines written by the health authorities of South Africa, Australia, Canada, India and the United States of America.

VERSION HISTORY

Version	Date
Version 1.0: Created	15 November 2021
Version 1.0: Approved	27 December 2021

Version 2.0: Revised	17 March 2025
Version 2.0: Approved	7 May 2025

DISCLAIMER

This document is intended to provide general guidance and best practices for infection prevention and control within healthcare and related settings. The guideline serves as a reference document and should not be considered as a substitute for professional judgment, clinical expertise, or applicable national laws and regulations.

The recommendations outlined are based on the best available evidence at the time of publication and are subject to periodic review and updates as new evidence emerges. Healthcare professionals and institutions are encouraged to adapt the guidance according to their specific context, available resources, and local epidemiological conditions.

Every effort has been made to ensure the accuracy and relevance of the information at the time of publication. Healthcare workers should continue to refer to national policies and standard operating procedures approved by the ministry in conjunction with this guideline in their application of IPC.

List of Abbreviations

ACH – Air Changes Per Hour

AMR – Antimicrobial Resistance

AIIR – Airborne Infection Isolation Room

ASP – Antimicrobial Stewardship Programs

BAPU – Bacteremia Associated with Pressure Ulcers

BBV – Blood-Borne Virus

BSI – Bloodstream Infections

BSL – Biosafety level

CAUTI – Catheter-Associated Urinary Tract Infections

CDC – Centers for Disease Control and Prevention

CLABSI – Central Line-Associated Blood Stream Infections

CRAB – Carbapenem-Resistant *Acinetobacter Baumannii*

CRE – Carbapenem-Resistant Enterobacteriaceae

CRP – Carbapenem-Resistant *Pseudomonas Aeruginosa*

HAI – Healthcare Associated Infection

HAP – Hospital-Acquired Pneumonia

HBV – Hepatitis B Virus

HCW – Healthcare Workers

HEPA – High Efficiency Particulate Air

HD – Hemodialysis

HIV – Human Immunodeficiency Virus

ICC – Infection Prevention and Control Committee

ICP – Infection Control Professional

ICT – Infection Control Team

ICU – Intensive Care Unit

IPC – Infection Prevention and Control

LAF – Laminar Flow

MDRO – Multi-Drug Resistant Organisms

MOHW – Ministry of Health and Wellness

MRSA – Methicillin Resistant *Staphylococcus Aureus*

NIC – National Infection Prevention and Control Committee

OPD – Outpatient Department

OT – Operating Theater

PLABSI – Peripheral Line-Associated Blood Stream Infections

PEP – Post-Exposure Prophylaxis

PPE – Personal Protective Equipment

RIC – Regional Infection Prevention and Control Committee

RHD – Regional Health Director

RASS – Richmond Agitation Sedation Scale

RTI – Respiratory Tract Infections

SSI – Surgical Site Infections

VAP – Ventilator-Associated Pneumonia

VRE – Vancomycin-Resistant Enterococci

WASH – Water Sanitation and Hygiene

WHO – World Health Organization

Chapter 1: Basic Principles of Infection Prevention and Control

1.1 INTRODUCTION

Infection prevention and control (IPC) is a practical, evidence-based approach that prevents patients and healthcare workers (HCW) from being harmed by avoidable and preventable infections.

A good IPC programme reduces the risk of healthcare associated infections (HAI) for patients, visitors, and all staff by providing expert advice, specialist knowledge and support to the medical staff, nursing staff, healthcare professionals and other employees throughout the hospital.

The emergence of new infectious diseases has made all countries around the world realize the necessity for increased awareness and attention to IPC.

IPC addresses factors related to the spread of infections within the healthcare setting, whether among patients, from patients to staff, from staff to patients, or among staff. This includes preventive measures such as handwashing, cleaning, disinfecting, sterilizing, improved healthcare waste management and vaccination. Other aspects include the appropriate use and availability of personal protective equipment (PPE), surveillance, monitoring, and investigating and managing suspected outbreaks of infection.

A subsidiary aspect of infection control involves preventing the spread of antimicrobial resistant organisms such as methicillin resistant *Staphylococcus aureus*. This in turn connects to the discipline of antimicrobial stewardship i.e., limiting the use of antimicrobials to necessary cases, as increased usage inevitably results in the selection and dissemination of resistant organisms.

1.2 BACKGROUND AND SITUATION ANALYSIS

Healthcare Associated Infection (HAIs) refer to infections that occur in patients as a result of treatment at a healthcare facility; the infection must not have been present at the time of arrival at the facility. To identify HAIs, a timeframe for onset of an infection must be defined to differentiate an HAI from an infection acquired in the community. The US Centers for Disease Control and Prevention (CDC), defines some common HAIs as infections that begin on or after day 3 of hospitalization (the day of hospital admission is day 1), on the day of discharge, or on the day after discharge (CDC, 2018; WHO, 2011). Understanding the incubation period of infections is important – infections that have an incubation period of greater than 48 hours can be community-acquired and present more than 48 hours after admission.

HAIs are one of the most frequent adverse events in health care delivery systems worldwide. They are a major cause of preventable diseases, deaths, and higher healthcare costs. Many HAIs are caused by microorganisms that are present on the patient's body (resident flora) or from transient sources such as the HCWs' hands, contaminated equipment, or the environment. The spread of these organisms usually results from breaches in compliance with standard precautions, such as inadequate hand hygiene and environmental cleaning, lapses in disinfection and sterilization, and incorrect use of PPE, as well as inappropriately applied transmission-based precautions; namely contact, droplet, and airborne precautions. Such breaches result in the transmission of infections to and from patients (WHO, 2011).

In 2021, the Ministry of Health and Wellness (MOHW) established the National IPC Committee and the IPC Writing Committee with the objectives of ensuring that standard operating procedures, guidelines and protocols on IPC are written and implemented so as to reduce the rate of HAI in the

country. IPC teams were set up in the 5 regions of the country and training of HCW on IPC has been emphasized.

Since the institution of an IPC programme nationally, the following progress has been noted:

- The WHO IPC Assessment Framework (IPCAF) score improved from 28% in 2020 to 50% in 2023.
- The WHO IPC Assessment Tool 2 (IPCAT-2) score improved from 5% in 2020 to 61% in 2023.
- The WHO Minimum Requirements for IPC score (IPCAF-MR) improved from 7% in 2020 to 62% in 2023.
- The score on the WHO COVID-19 Scorecard improved from 25% in 2020 to 89% in 2023.

However, significant weaknesses remain in IPC as highlighted in red in table 1 below which lists some of the national indicators on IPC.

Serial No.	Indicators	Score (2022)	Score (2023)	Target (2023)
	IPC Programme			
2023-1	% score for each facility with respect to WHO's requirements on IPC (IPCAF)	63%	50%*	70%
2023-2	National support and guidance (IPCAT-2)	54%	61%	60%
2023-3	National IPC checklist	73%	63%*	80%
2023-4	% of activities implemented to bridge the 200 gaps in IPC	24%	36%	30%
2023-5	% implementation of the IPC NAP 2022-2023	35%	57%	80%
2023-6	Functionality of Regional IPC Committees	72%	54%*	80%
2023-7	Functionality of IPC teams	NA	58%	60%
	Water, Sanitation and Hygiene			
2023-8	Compliance to hand hygiene	NA	11%	30%
2023-9	% score for availability of equipment in wards for hand hygiene (WHO Ward Infrastructure Survey)	NA	54%	40%
2023-10	No. of alcohol dispensers per bed	0.33	0.13*	0.35
2023-11	% of handwashing stations with washing agents	63%	64%	75%
2023-12	No. of handwashing stations for every 10 beds	1.2	0.9*	1
2023-13	% of handwashing stations with paper towel	25%	14%*	35%
2023-14	% of handwashing stations with elbow taps	39%	26%*	50%
	Isolation / Ventilation / Triage			
2023-15	% of isolation rooms in use that display appropriate signs	7%	12%	20%
2023-16	% of patients that need isolation according to the national protocol that are actually isolated	0%	40%	20%
2023-17	% of isolation rooms with a doffing station	7%	12%	20%

2023-18	% of wards with ACH at recommended threshold	NA	79%	25%
Personal Protective Equipment				
2023-19	% of NICUs using crocks	20%	40%	30%
2023-20	% of patient bays with boxes of gloves	7%	43%	15%
Injection Safety				
2023-21	Proportion of locations where unhygienic pricking of saline pints have stopped	100%	72%*	100%
Occupational Health and Safety				
2023-22	Proportion of healthcare workers that are immunized against influenza	10%	9%*	20%
2023-23	Proportion of healthcare workers that are immunized against COVID-19	100%	100%	100%
Environmental Cleanliness / Waste Sorting / Waste Disposal / Disinfection and Sterilization				
2023-35	% of medication refrigerators without food	80%	47%*	90%
2023-36	% of terminally cleaned areas that appear clean to the naked eye	50%	49%*	60%
2023-37	% of bins where waste is correctly segregated	53%	62%	60%
2023-38	% of wards that are able to dilute Javel correctly	40%	46%	60%
2023-39	% of wards that follow the sterilization protocol for dry heat sterilizers (temperature + duration)	14%	64%	25%
2023-40	Thoroughness of disinfection cleaning score	NA	NA	25%

Table 1: Some of the national indicators on IPC.

Based on data from 2021, the incidence rate of ventilator-associated pneumonia was 23 per 1,000 ventilator-days, a value that is considerably higher than that in developed countries. Data collected in 2022 showed that a remarkable 26% of central lines inserted for more than 48 hours got infected and this was associated with approximately a two times higher risk of death. Once again, this is significantly higher compared to the developed world.

Readers who wish to have more details on the strengths and weaknesses of IPC in Mauritius are referred to the most recent National Action Plan on IPC in which a SWOT analysis was carried out.

1.3 PURPOSE AND SCOPE

The primary objective of these guidelines is to provide evidence and expert consensus-based recommendations on the core components of IPC programmes that are required to be in place at the national and facility level to prevent HAIs and to combat AMR through good IPC practices. They are intended to provide a feasible, effective and acceptable framework for the development and strengthening of IPC programmes. The recommendations will as far as possible be adapted to the local context based on information collected ahead of implementation and thus influenced by available resources and public health needs.

Specific IPC knowledge and skills are required for staff working in specialist areas or roles (e.g., sterile services, operating theatres, hygiene services, hemodialysis, oncology departments and laboratories).

Teamwork, support from management teams, dress code, personal hygiene and staff acting within the limits of their competence and authority are components of a safe and effective workforce.

The scope of the IPC programmes embraces all hospital departments and services dealing with the delivery and support of patient care. All employees in the hospitals are responsible to follow the infection control program to detect, prevent and control infections within the facility.

This manual is aligned with the World Health Organization Core Component IPC programme recommendations and highlights the essentials for developing and improving IPC at health facility level in a systematic, stepwise manner for Mauritius.

These guidelines are aimed at HCW at both public and private health facilities, non-governmental and other organizations rendering health care, including regional and national level IPC practitioners responsible for implementation and governance of IPC programme at health facilities. This manual will be used as a basis for the training of HCW.

Understanding the modes of transmission of infectious organisms and knowing how and when to apply the basic principles of IPC is critical to the success of an infection control program. This responsibility applies to everybody working in and visiting a healthcare facility, including administrators, staff, patients and carers. IPC is integral to clinical care and often requires a range of strategies to be successful.

It should not be considered as an additional set of practices but as part of standard of care. Involving patients and their carers is essential to succeed in preventing infections in clinical care. Patients need to be sufficiently informed to be able to participate in reducing the risk of transmission of infectious agents.

By assisting HCW to improve the quality of the care they deliver, these guidelines aim to promote and facilitate the overall goal of IPC: the creation of safe healthcare environments through the implementation of evidence-based practices that minimize the risk of transmission of infectious agents.

This national guideline is expected to help the healthcare facilities meet WHO's IPC minimum requirements. This includes setting up functional IPC committees, training staff, carrying out surveillance of hospital-acquired infections, auditing what has been implemented, ensuring appropriate staffing level, and making sure there is a sufficient quantity of IPC supplies – see Annex F for details.

However, one should note that adherence to guidelines does not guarantee a successful outcome. Ultimately, HCW must make their own decisions about care on a case-by-case basis, using their clinical judgement, knowledge and expertise.

1.4 METHODOLOGY

- Version 1 of the National IPC Guidelines expired in January 2023. In March 2024, the IPC Writing Committee (IWC) decided that an update had to be carried out.
- In May 2024, minor comments were received from members of the IWC for changes in the guidelines.
- By August 2024, additional information was gathered by the IWC with respect to notifiable diseases.
- From September till November 2024, the National IPC Focal Point (NIFP) updated, compiled and reorganized this guideline.
- In December 2024, approval was sought from MOHW to seek comments from heads of departments; administration requested additional clarification on the updates made.

- In January 2025, clarifications were made, and views of consultants-in-charge were sought.
- In February 2025, a reminder was forwarded to regional hospitals for views to be submitted.
- In March 2025, views of the private sector were requested; the document was updated based on the comments received. Administrative approval was sought.

1.5 GENERAL POLICY STATEMENTS

HAIs are a significant threat to patient and HCW's safety in Mauritius, and there is a need to improve health outcomes, prevent future outbreaks, and establish a culture of safety in healthcare facilities.

MOHW has prioritized a series of actions to address the deficits in IPC across the entire health system with the aim of improving the safety of patients and healthcare workers.

Patient and healthcare worker safety can be greatly enhanced through the implementation of simple measures such as improved hygiene conditions, appropriate management of potentially infectious patients including the use and availability of PPE, improved healthcare waste management and the safe use of injections, invasive devices, and blood transfusions.

This national IPC guideline, containing recommended instructions and practices for patient and healthcare worker safety, is an important component of a comprehensive national IPC strategy to enhance patient and HCW safety. This manual does not stand alone: in conjunction with adequate training, surveillance, monitoring, audit, feedback and the provision of appropriate resources; multimodal strategies will be implemented to ensure the safety of HCW and patients alike.

IPC features in a prominent manner in Mauritius' Health Sector and Strategic Plan (HSSP) 2020-2024.

The mission of the Ministry of Health and Wellness is "Caring for People's Health and Well-Being across the Lifespan". In view of this mission, several strategic goals have been planned:

- Improve service excellence for the provision of safe and compassionate care.
- Build a robust and effective surveillance system.

Chapter 2: Healthcare-Associated Infections

2.1 INTRODUCTION

Healthcare-associated infection (HAI), also referred to as "nosocomial" or "hospital-acquired" infection, is an infection occurring in a patient or staff during the process of care in a hospital or other healthcare facility which was not present or incubating at the time of admission. HAI can affect patients in any type of settings where they receive care and can also appear after discharge. Furthermore, they include occupational infections among staff.[1]

2.2 DEFINITION OF HAI

An infection is classified as an HAI if it is clinically evident after admission and was not incubating prior to admission. For most hospital-acquired definitions, for simplicity, this is taken to imply the presence of symptoms 48 hours or more after admission to the facility (on the third day or after admission to the health facility where the day of admission is day 1).

To establish the origin of HAIs, ensure that the following are recorded:

1. Adequate history of the patient's previous HAI if any.
2. Information regarding any transfer between facilities.
3. Availability of the patient's admission date.
4. Evidence that no infection was present or incubating at the time of admission to the acute care setting or during the first two days after admission.
5. Whether the infection is related to an intervention or procedure during admission.
6. Whether symptoms appear within 48 hours or more after discharge or within thirty to ninety days after surgery, depending on the type of surgical intervention.
    a. It is important to keep in mind that some diseases can have long incubation periods and can be acquired in a healthcare facility long before it is detected. 48 hours is taken to be the usual incubation time (time to symptoms) but is not always the cut point.
7. With respect to device-associated infections e.g., involving the use of a ventilator, central line or an indwelling urinary catheter, the following additional criteria must be considered:
    a. The device was in place for more than two calendar days prior to the infection.
    b. If an HAI occurs on the day of discontinuation of the device, it must have already been in place for more than two calendar days.
8. There should be enough evidence that the source of contamination (e.g., reservoir, contaminated fomite, other sick patients or staff with the same disease prior contamination) was present within the healthcare facility when the patient got infected.

2.3 THE CHAIN OF TRANSMISSION

It is important to understand the mode of transmission of disease in a healthcare facility so that appropriate measures can be taken to control the spread of infection. A variety of microorganisms – including bacteria, viruses, fungi, parasites and prions – can either colonize or cause infection, depending on the susceptibility of the host.

The ability of a microorganism to invade, establish and multiply in the cells and tissues of a host and produce signs and symptoms of disease depends on several factors like the host's immune system, the inoculum of the microbe and its ports of entry or exit. The following figure illustrates the chain of infection.

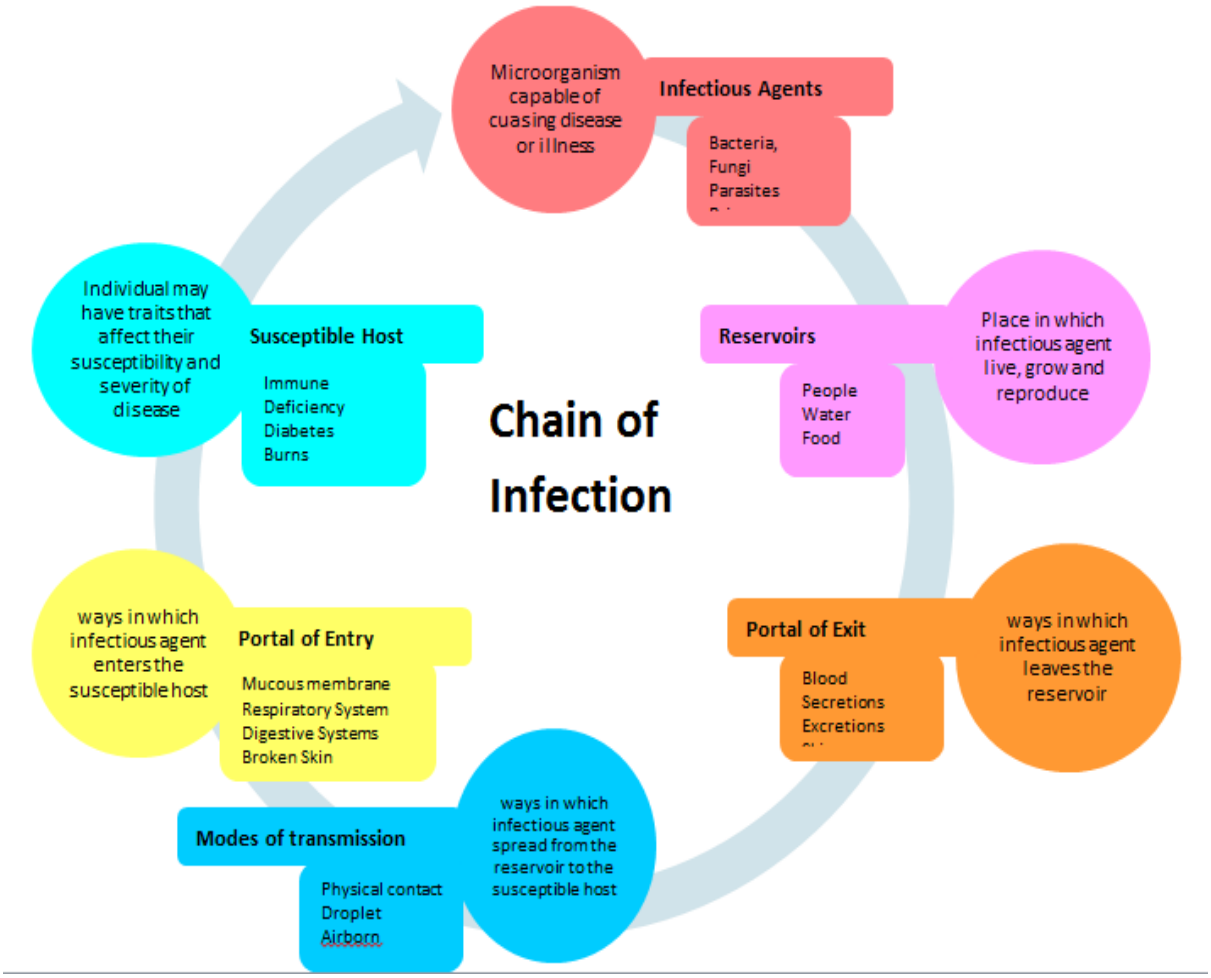


Figure 1: The chain of infection describes the various mechanisms by which microorganisms can lead to disease in a susceptible host. Source: www.physio-pedia.com

2.4 MAJOR TYPES OF HAI

The most common types of HAIs in hospitals and long-term care facilities are:

1. Primary bloodstream infections (BSI),
2. Catheter-associated urinary tract infections (CAUTI),
3. Central line-associated bloodstream infections (CLABSI),
4. Peripheral line-associated blood stream infections (PLABSI),
5. Surgical site infections (SSI),

6. Ventilator-associated pneumonias (VAP),
7. Hospital-acquired pneumonias (HAP), and
8. Bacteremia associated with pressure ulcers (BAPU).

However, any other infection acquired nosocomially can be considered an HAI e.g., gastroenteritis, cellulitis, meningitis, etc.

Of note, HAI among newborns are defined as those that occur beyond 48 hours after birth and are caused by pathogens that are not maternally derived.

2.5 THE CHAIN OF DISEASE TRANSMISSION

2.5.1 Contact transmission

Contact is the most common mode of transmission, and usually involves transmission by touch (e.g., contact with fomites) or via contact with blood, body fluids or secretions. Contact may be direct or indirect.

1. Direct transmission occurs when infectious agents are transferred from one person to another, e.g., a patient's blood entering a HCW's body through an unprotected cut in the skin.
2. Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object (fomite) or person, e.g., a HCW's hands transmitting infectious agents after touching an infected body site on one patient without performing hand hygiene before touching another patient, or a HCW coming into contact with fomites (e.g., bedding) or faeces and then with a patient.

Examples of infectious agents transmitted by indirect contact include multi-drug resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), carbapenem-resistant gram-negative bacteria, *Clostridioides difficile*, norovirus and Ebola virus. On the other hand, human immunodeficiency virus (HIV) and hepatitis B and C viruses are transmitted parenterally, sexually and / or vertically (i.e., from mother to child).

2.5.2 Droplet transmission / direct deposition

Direct deposition (which is now the preferred term instead of droplet transmission) represents cases when infectious respiratory particles are expelled into the air from an infectious person, and are then directly deposited on the exposed mouth, nose or eyes of another person nearby, then entering the human respiratory system and potentially causing infection.

Direct deposition occurs when an infected person coughs, sneezes or talks, or during certain procedures. The droplet distribution range is limited by the force of expulsion and gravity and is usually less than 1 meter. Droplets can also be transmitted indirectly to mucosal surfaces (e.g., via hands). Examples of infectious agents that are transmitted via droplets include the influenza virus, *Bordetella pertussis* and meningococcus.

Over the past few years, much evidence has accumulated to suggest that many respiratory pathogens like influenza and SARS-CoV-2 can be transmitted via the airborne route given the right environmental conditions. While some experts may advocate for the use of airborne precautions in all such circumstances, this is not considered cost-effective or practical, especially since the use of N95 / FFP2 respirators and negative pressure ventilation have not been shown to prevent infections in clinical studies.

The Healthcare Infection Control Practices Advisory Committee (HICPAC of the USA) proposed ending the use of the term 'droplets precautions' in 2023 and to use 'routine air precautions' instead

(whereby ‘airborne precautions’ would be called ‘special air precautions’). These terms have not yet caught on because of various controversies but they imply that all microbes that are transmitted by the droplets mechanism can also be airborne, and that the level of precautions to be taken by healthcare workers should depend on other factors like the lethality of the infection, whether the organism is a newly emerging one and the ventilation rate inside the building.

2.5.3 Airborne transmission

Airborne transmission or inhalation can occur at a short or long distance from the infectious person and distance depends on various factors (airflow, humidity, temperature, ventilation, etc).

Airborne dissemination occurs via particles containing infectious agents that remain suspended in air over time and distance. Small-particle aerosols are created during breathing, talking, coughing or sneezing and secondarily by evaporation of larger droplets in conditions of low humidity. Certain procedures, particularly those that induce coughing, can promote airborne transmission. Evidence regarding which procedures generate contagious aerosols is being constantly updated – readers are requested to review recent literature on this topic for the most updated information. Some authors include diagnostic sputum induction, bronchoscopy, airway suctioning, endotracheal intubation, positive pressure ventilation via facemask and high-frequency oscillatory ventilation, as aerosol-generating procedures.

Aerosols containing infectious agents can be dispersed over long distances by air currents (e.g., ventilation or air-conditioning systems) and inhaled by susceptible individuals who have not had any contact with the infectious person. Examples of infectious agents that are transmitted via the airborne route include measles virus, chickenpox (varicella) virus and *Mycobacterium tuberculosis*.

2.5.4 Vector-borne transmission

Vector-borne transmission refers to transmission of microorganisms by vectors such as mosquitoes and can be prevented by appropriate construction and maintenance of a healthcare facility, having closed or screened windows, and proper housekeeping. Examples of vector-borne diseases include malaria, dengue and chikungunya.

Other routes of transmission can include sexual, congenital (vertical) transmission, foodborne / fecal-oral and needlestick injuries (bloodborne).

2.6 STRATEGIES TO PREVENT INFECTIONS

Several strategies can be used to reduce infections – the following figure illustrates some of the approaches that are commonly used.

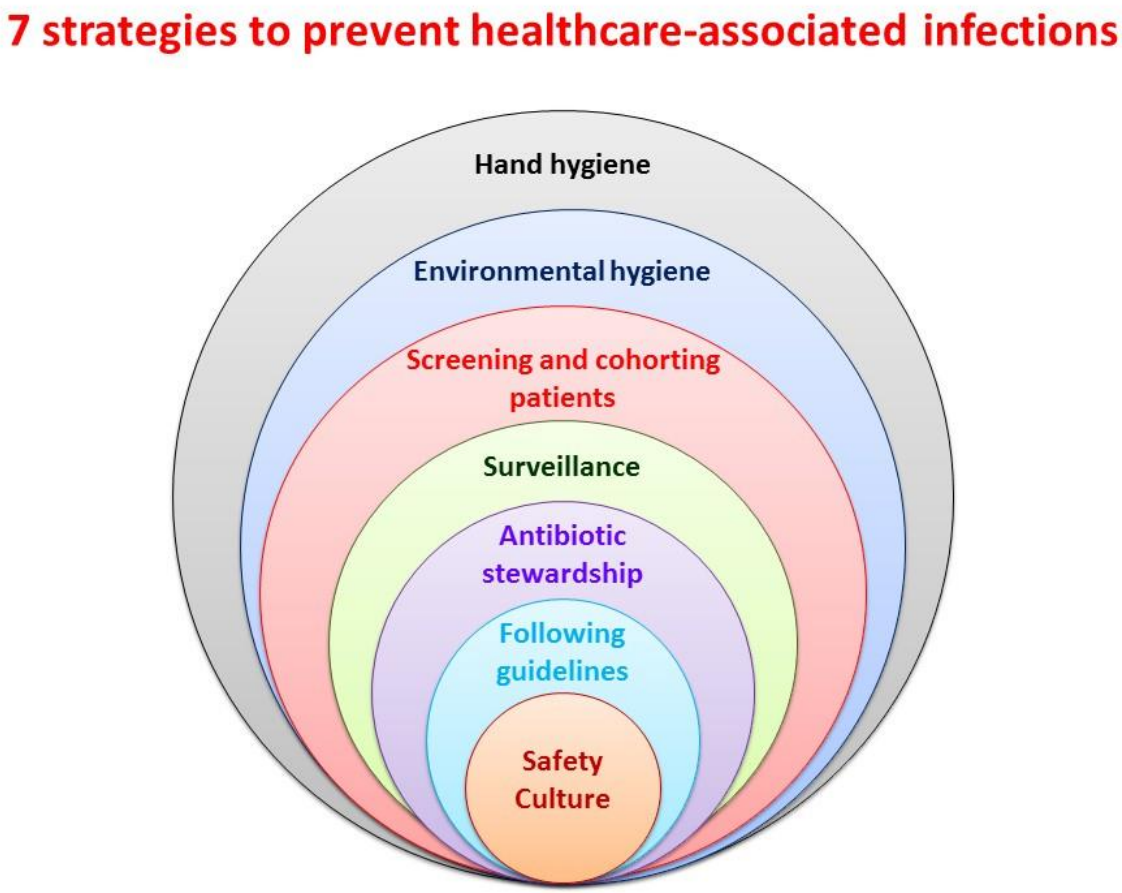


Figure 2: Taken from https://infectionsinsurgery.org: "7 strategies to prevent healthcare-associated infections. Global Alliance for Infections in Surgery."

2.6.1 Hand hygiene

Proper hand hygiene is the most important, simplest, and least expensive means of reducing the prevalence of HAIs and the spread of antimicrobial resistance (AMR).

Cleaning one's hands can prevent the spread of microorganisms, including those that are resistant to antibiotics and are becoming difficult, if not impossible, to treat.

Despite acknowledgement of the critically important role of hand hygiene in reducing the transmission of pathogenic microorganisms, overall compliance with hand hygiene is less than optimal in many healthcare settings worldwide. In most healthcare institutions, adherence to recommended hand-washing practices remains unacceptably low. Poor hand hygiene compliance reflects a lack of awareness, incorrect attitudes, and inadequate behaviors towards IPC.

2.6.2 Environmental hygiene

Environmental hygiene is a fundamental principle of infection prevention in healthcare settings. Contaminated hospital surfaces play an important role in the transmission of micro-organisms, including *Clostridioides difficile*, and multidrug-resistant organisms such as MRSA and vancomycin-resistant enterococci (VRE). Therefore, appropriate hygiene of surfaces and equipment which patients

and healthcare personnel touch is necessary to reduce exposure. Evidence supports the hypothesis that hospitals can act as an important reservoir of many nosocomial pathogens through contamination of surfaces, medical equipment and water system. The role of environmental hygiene is to reduce the number of infectious agents that may be present on surfaces and minimize the risk of transfer of micro-organisms from one person / object to another, thereby reducing the risk of cross-infection.

2.6.3 Screening and cohorting of patients

Early detection of multidrug-resistant organisms and other contagious pathogens is an important component of any infection control program. For instance, there is good evidence that active screening of preoperative patients for MRSA, with decolonization of carriers, results in reductions in postoperative infections caused by MRSA, at least for certain specific high-risk surgeries like cardiac surgeries. Furthermore, surveillance cultures via rectal swabs for carbapenem-resistant *Enterobacteriaceae* (CRE) have been advocated in a number of reports as part of an overall strategy to prevent its spread.

Isolation or cohorting of colonized/infected patients is a cornerstone of IPC. Its purpose is to prevent the transmission of microorganisms from such patients to other patients, hospital visitors, and healthcare workers, who may subsequently transmit them to other patients or become infected or colonized themselves. Isolating a patient with highly resistant bacteria is beneficial in stopping patient-to-patient spread. Isolation measures should be an integral part of any IPC program; however, they are often not applied consistently and rigorously, because they are expensive and time-consuming.

2.6.4 Surveillance

It is widely acknowledged that surveillance systems allow the evaluation of the local burden of HAIs and AMR and contribute to the early detection of HAIs including the identification of clusters and outbreaks. Surveillance systems for HAIs are an essential component of both national and facility IPC programs. National surveillance systems should be integral to a public health system.

The steps required for implementing HAI surveillance are illustrated in figure 3.

A standardized surveillance model for HAIs is essential to:

1. Establish the baseline of HAIs in the hospital through either prevalence point surveys (PPS), through laboratory reports from hospitals, or through national surveillance systems to identify the most prevalent AMR patterns;
2. Establish an early detection system for patterns of diseases among inpatients;
3. Establish a data collection system at health facility level;
4. Establish an early protocol of control at hospital level;
5. Choosing an appropriate intervention or bundle of care to avoid infections;
6. Implementing interventions through repeated quality improvement cycles of plan-do-study-act (PDSA); and
7. Monitoring the impact by measuring HAI rates and compliance to bundle interventions.

The following figure illustrates the steps that can be followed in order to reduce the prevalence of HAI in a healthcare facility.

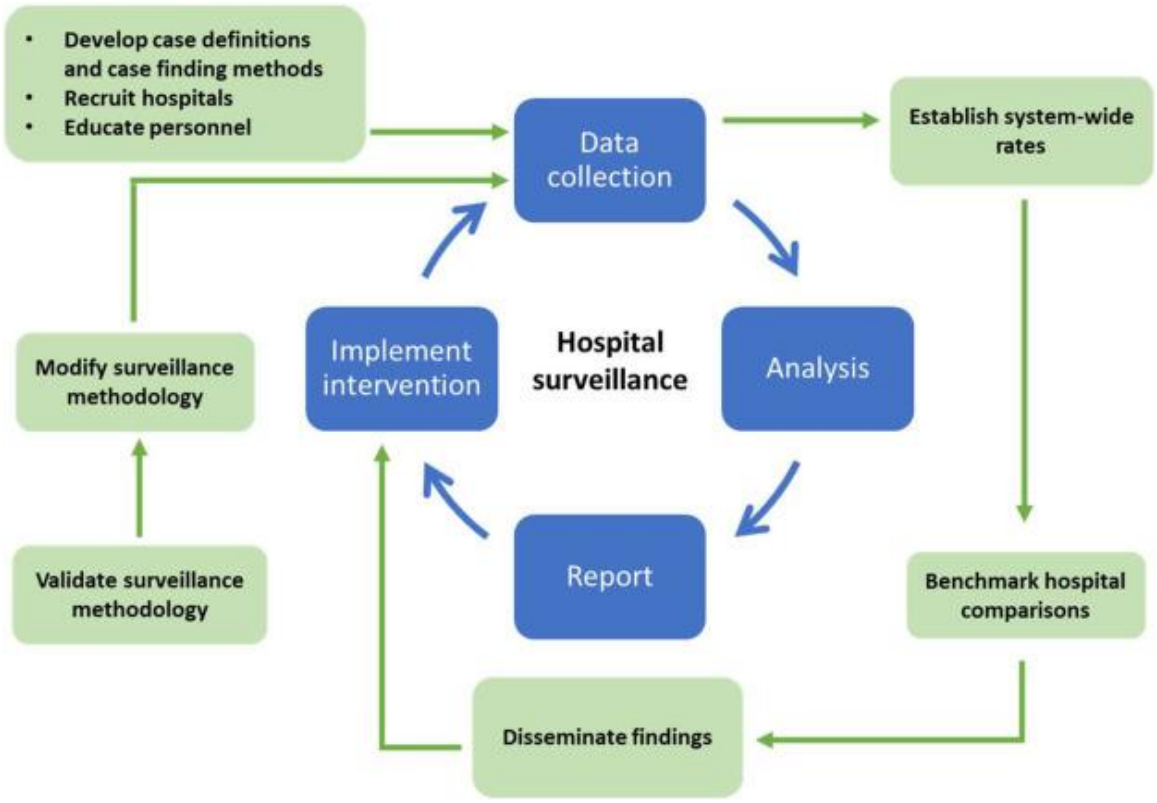


Figure 3: HAI surveillance, intervention and improvement cycle. From 'Russo PL, Saguil E, Chakravarthy M et al. Improving surgical site infection prevention in Asia-Pacific through appropriate surveillance programs: Challenges and recommendation. Infect Dis Health. 2021 Aug;26(3):198-207.'

2.6.5 Antimicrobial stewardship

Optimal infection control programs have been identified as important components of any comprehensive strategy for the control of AMR, primarily through limiting transmission of resistant organisms among patients. The successful containment of AMR in acute care facilities, however, also requires an appropriate antibiotic use. Antimicrobial stewardship programs (ASPs) can help reduce antibiotic exposure and minimize healthcare costs. Most antibiotic stewardship activities affect multiple organisms simultaneously and have as a primary goal the prevention of the emergence of antibiotic resistance. Additionally, ASPs can contribute to the prevention of surgical site infections via the optimized use of surgical antibiotic prophylaxis.

2.6.6 Following guidelines

Keeping abreast of the latest findings regarding the spread of infections and strategies for infection prevention is essential for a successful IPC program.

While many infection control interventions focus on reducing the transmission of organisms, it is as important to identify measures to reduce the risk of infection. Both the World Health Organization and the Centers for Disease Control and Prevention have published guidelines for the prevention of HAIs. However, knowledge, attitude, and awareness of IPC measures are often inadequate, and a great gap exists between the best evidence and clinical practice with regards to HAI prevention. Despite evidence supporting the effectiveness of best practices, many clinicians fail to implement them, and evidence-based processes and practices that are known to reduce the incidence of HAIs tend to be underused in routine practice.

2.6.7 Patient safety

Patient safety describes the lack of avoidable harm during the process of health care and the reduction of unnecessary harm associated with health care to an acceptable minimum. Improving patient safety in today's hospitals worldwide requires a systematic approach to combating HAIs and AMR. These infections developed during the course of health care treatment 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 to those already incurred by the patient's underlying disease. HAIs are considered an undesirable outcome, and as many are preventable, they are considered an indicator of the quality of patient care, an adverse event, and a patient safety issue.

Through the adoption of WHO's Global Patient Safety Action Plan 2021–2030, Mauritius has agreed to reduce patient harm through 7 strategic objectives: the implementation of relevant policies, setting up high-reliability systems, assessing the safety of clinical processes, engaging patients and their relatives, training, risk management and active partnership.[2]

References

1. National Guidelines for Infection Prevention and Control in Healthcare Facilities. Ministry of Health and Family Welfare, Government of India. January 2020.
2. Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care. Geneva: World Health Organization; 2021.

Chapter 3: Infection Prevention and Control Program

An appropriate, clear, and firm organizational structure is essential for the success of an IPC programme. Since each institution is unique, its specific needs must be considered when developing an IPC programme. Moreover, due to differing needs of each institution, the IPC programme may fall under the responsibility of different cadres.

3.1 NATIONAL AND REGIONAL STRUCTURE OF THE IPC PROGRAM

An IPC program includes activities, procedures and policies designed to reduce the spread of infections, usually within healthcare facilities. The primary goals of an IPC program are:

1. To prevent a staff or susceptible patients from acquiring infections; and
2. To limit the spread of antimicrobial resistant infections.

It is important to have an established program in healthcare facilities since this is the place where the spread of microorganisms is more common and more disastrous. Most of these infections are preventable and IPC programs can help prevent these.

An IPC program can include:

1. A doctor and a nurse with responsibilities for IPC;
2. A manual of dated critical IPC policies with valid citations of evidence for these policies;
3. An educational program for staff; and
4. A clear line of responsibility to senior management.

Annex G lists the tasks and responsibilities of IPC committees and team in Mauritius as approved by Ministry of Health and Wellness (MOHW).

3.1.1 National level

MOHW has developed a national program to support all healthcare facilities in reducing the risk of hospital-acquired infections. It has designated a group of officials to form an expert National IPC Committee (NIC) which is chaired by the Director of Health Services responsible for public health. The following diagram gives an overview of the existing governance structure of the IPC program at MOHW. In the schema, IWC is the IPC Writing Committee which helps in the creation of posters, brochures, standard operating procedures, protocols and guidelines. Of note, antimicrobial stewardship (AMS) teams report to their respective Regional IPC Committees – relevant items are taken up at the AMS technical working group and the One Health Committee on Antimicrobial Resistance.

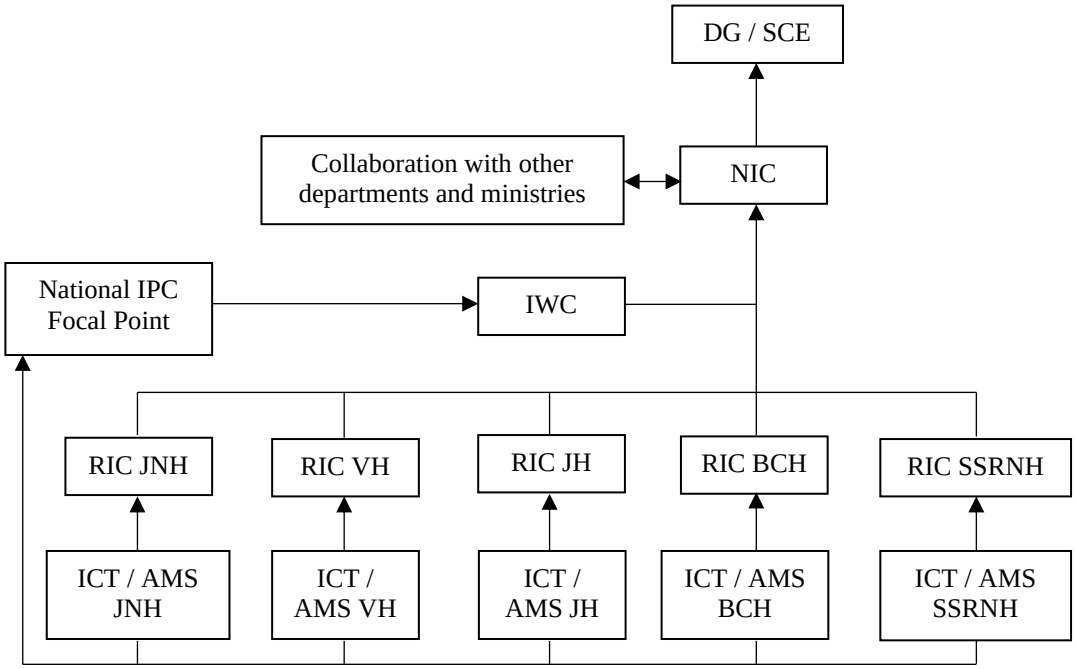


Figure 4

3.1.2 Regional level

At the regional level, the Regional Health Directors (RHD) of the five areas are responsible to ensure commitment of the respective regional hospitals and attached health institutions to the national IPC program and national IPC guidelines.

3.1.3 Regional IPC Committee (RIC)

The RIC provides a forum for multidisciplinary input, cooperation, and information sharing. The RIC members are usually selected by the RHD and may constitute of the:

1. RHD;
2. Medical Superintendent;
3. Regional Public Health Superintendent;
4. Regional Nursing Administrator;
5. Regional Health Service Administrator;
6. Specialist in infectious diseases, a microbiologist and/or an IPC expert;
7. Specialists in various departments like internal medicine, general surgery, orthopedic surgery, occupational health, critical care specialist, etc.;
8. IPC nursing officers; and
9. Representatives of other departments (e.g., pharmacy, procurement, etc.).

3.2 RESPONSIBILITIES AND AUTHORITIES

3.2.1 National IPC Committee (NIC)

The NIC has the following tasks:

1. To set a plan and relevant objectives in keeping with IPC;
2. To develop and regularly update IPC guidelines and to review and approve IPC policies;
3. To develop a system to monitor infection control and assess the effectiveness of measures applied;
4. To coordinate continuous training and education in IPC;
5. To ensure access to products essential to IPC;
6. To review epidemiological surveillance data and identify areas for intervention;
7. To coordinate outbreak investigations; and
8. To communicate and cooperate with other committees.

3.2.2 Regional IPC Committee (RIC)

The RHDs are to ensure that appropriate arrangements are in place for effective IPC practices and to ensure that its Infection Control Team (ICT) is functional.

The RIC is responsible for planning and implementation of all matters related to IPC. The RIC reports to the NIC. The RIC also acts as a liaison between different departments in order to provide effective care and services for IPC practices.

The RIC holds regular meetings and notes of meetings are recorded. The role of the RHD is to provide leadership by supporting the RIC.

Role of the RHD

1. Establish a multidisciplinary RIC;
2. Identify and direct resources to the IPC program to prevent and monitor infection rates;
3. Ensure education and training of all staff on IPC;
4. Periodically review the status of nosocomial infections and the effectiveness of the measures meant to prevent them;
5. Review and implement policies approved by the NIC;
6. Ensure the RIC has the authority to facilitate appropriate program function; and
7. Expedite outbreak investigations.

Role of the RIC

1. Make regular plan of work and ensure adherence to ad hoc and routine IPC protocols;
2. Support the ICT and direct resources to address problems identified;
3. Ensure adequate availability and distribution of supplies for IPC;
4. Promote monitoring and feedback regarding HAI;

5. Ensure staff training and education in IPC; and
6. Carry out outbreak investigations in the healthcare setting.

Role of doctors in the prevention of HAIs

1. Provide patient care while minimizing the spread of infections and multi-drug resistant organisms;
2. Follow appropriate hygiene and other preventive measures;
3. Support the ICT;
4. Isolate patients promptly whenever necessary;
5. Implement IPC measures in a timely manner to keep patients safe;
6. Rapidly detect HAIs; and
7. Notify the ICT about HAIs.

Role of the microbiologist

1. Help in carrying out cultures and antimicrobial sensitivities;
2. Help in the development of IPC guidelines;
3. Ensure laboratory practices meet appropriate standards;
4. Identify outbreaks and assist in their management; and
5. Keep track of the epidemiology of hospital microorganisms.

Role of the hospital pharmacist

1. Obtain, store and distribute medicines and pharmacological preparations to combat infections;
2. Maintain records of antibiotics distributed to different departments;
3. Assist in antimicrobial stewardship; and
4. Help in antimicrobial consumption surveillance.

Role of the nursing administrator

1. Participate in the RIC;
2. Promote the practice of IPC during patient care; and
3. Monitor adherence of nursing staff to IPC practices.

Role of the charge nurse and ward managers

1. Maintain hygiene and good nursing practice in the ward;
2. Monitor aseptic techniques, hand hygiene, etc.;
3. Initiate patient isolation whenever applicable; and
4. Maintain adequate supply of ward equipment and supplies.

Role of the infection control nurse

1. Participate in training of personnel;
2. Surveillance of HAI;
3. Participate in outbreak investigations;
4. Support the writing of IPC documents;
5. Liaise with the public health department and other departments whenever necessary; and
6. Support the RIC.

Refer to the national list of duties of IPC nurses for more information.

Role of IPC doctors

1. Interprets microbiological data to identify infection trends and outbreaks;
2. Supports outbreak investigation and response;
3. Collaborates with the microbiology lab to ensure timely identification of pathogens; and
4. Guides and supervises the IPC nurses.

Role of IPC Team Leader

1. Oversees the functioning of the IPC team;
2. Coordinates training and awareness campaigns; and
3. Interfaces with hospital administration and clinical leadership.

Role of the central sterilization service

1. Establish protocols and activity checklists;
2. Clean, decontaminate, and sterilize equipment and linen according to approved standard operating procedures;
3. Report any discrepancies to the RIC; and
4. Maintain appropriate records.

Role of the laundry service

1. Maintain appropriate supplies of clean linen; and
2. Ensure appropriate flow of linen.

Role of hospital attendants

1. Implement the correct techniques of cleaning and disinfection; and
2. Wear appropriate PPE whenever providing their services.

Role of Antimicrobial Stewardship Team (AMS) Leader

1. Oversees implementation of AMS policies and protocols by the AMS team;
2. Coordinates multidisciplinary AMS team meetings;
3. Reviews and advises on antimicrobial prescriptions, especially in complex or resistant cases;

4. Reports AMS performance indicators to leadership and stakeholders; and
5. Ensures alignment of AMS activities with national AMR action plans.

Role of AMS doctors

1. Participates in antimicrobial rounds and case discussions;
2. Collaborates with microbiologists and pharmacists to optimize therapy;
3. Educates staff on antimicrobial resistance and appropriate use; and
4. Monitors antibiotic prescribing patterns and resistance trends.

3.2.3 IPC Team (ICT)

The ICT reports directly to the RIC. The ICT should:

1. Be responsible for day-to-day running of the IPC program;
2. Be available for advice regarding IPC;
3. Meet regularly to discuss relevant issues;
4. Be involved in continuous education and training;
5. Monitor and evaluate daily IPC practices;
6. Identify problems in the implementation of IPC activities which need to be addressed to the RIC;
7. Organize epidemiological surveillance of HAIs;
8. Investigate outbreaks;
9. Participate in audit activities; and
10. Submit reports on IPC activities to the RIC.

It is highlighted that treating teams (including both doctors and nurses) implement IPC practices while IPC teams guide, supervise, support and train HCW.

3.3 IPC MANUAL

It is important that the NIC follows the national infection control manual that contains the relevant recommendations regarding IPC practices. This manual should be reviewed and updated periodically. It should also be made available for consultation by healthcare workers.

3.4 CAPACITY BUILDING PROGRAMMES

3.4.1 Introduction

Capacity building is defined as the process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world[1]. Capacity building in IPC necessitates the enhancement of knowledge, the development of skills, and the empowerment of HCW.

Healthcare-associated infections (HAIs) are responsible for a large number of infections often leading to death or legal suits worldwide[2]. Patients admitted in high-risks areas such as ICUs are more prone

to HAIs[4]. However, catheter associated urinary tract infections (CAUTI) as well as surgical site infections (SSI) are also leading infection risks in countries with limited resources[2].

In cases of public health outbreaks, healthcare workers are not only at risk but can also be involved in the chain of transmission. This is due to the lack of training as well as insufficient knowledge and practice of IPC. It is therefore critical to build the IPC capacity of HCWs during the COVID-19 pandemic nationwide. It is equally vital to expand awareness of IPC practices and guidelines within the community level including disease control and self-protecting practices[2].

3.4.2 Strategies to be adopted

The key strategies identified are to be implemented on four levels namely[3]:

- Country;
- District;
- Facility; and
- Community levels.

The four key strategies proposed are[3]:

- IPC capacity building training;
- Mentorship;
- Improved supply chain management; and
- Enhanced engagement between health facilities and community.

It is also primordial to establish an environment of trust by providing clear and true information to staff, patients and public.

Furthermore, an IPC focal person should be responsible for the health facilities' IPC at national level and selected clinicians to form part of the committee at various facility levels to ensure proper coordination and review meeting on a selected duration.

Training should revolve around the eight core components of IPC according to WHO[2]:

- Core component 1 involves IPC programmes to ensure a safe and high-quality health service delivery. IPC programme with the aim of preventing HAIs and inhibiting AMR by the application of good practices of IPC on the healthcare facility level, whereas on national level, active IPC programmes with clearly defined goals are implemented for prevention of HAIs and inhibition of AMR through IPC good practices.
- Core component 2 refers to IPC guidelines which recommend using evidence-based guidelines in the reduction of HAI and AMR through the education and training of HCWs and monitoring of adherence to guidelines.
- Core component 3 refers to IPC education and training to be put in place for all healthcare workers by using team and task-based strategies to decrease the incidence of HAI and AMR while on the national level, support should be given for the education and training of HCWs.
- Core component 4 is surveillance on facility level to monitor HAI in order to provide guidance on IPC interventions and detect outbreaks with timely feedback to stakeholders and HCWs through national networks.
- Core component 5 is multimodal strategies implementation for application of IPC

activities to improve practices and minimize HAI and AMR and national IPC programmes should coordinate and facilitate the implementation of IPC activities on a national level.

- Core component 6 is monitoring/audit of IPC practices and feedback which includes regular monitoring/audit and timely feedback of healthcare practices according to IPC to control and prevent HAIs and AMR within the health facility level and on national level, performance indicators should be used as key elements to assess extent to which IPC standards are being met.
- Core component 7 concerns workload, staffing and bed occupancy related to healthcare facility level which should be appropriate to prevent preventing HAI and AMR.
- Finally, core component 8 refers to the built environment, materials, and equipment for IPC at the health facility level. The environment in which the patient care activities are done must be hygienic and clean to prevent and control HAI and AMR, WASH infrastructure and services should be available as well as appropriate materials and equipment to perform hand hygiene. IPC supply chain management is an important aspect of this component and pertains to the prevention of shortage of materials needed to follow IPC practices by proper planning and distribution to needy areas of the country.

The training programmes that are dispensed are often of three types:

1. Diploma:
    a. This is conducted by the Mauritius Institute of Health with the collaboration of MOHW. The duration is 1 year and it is an intensive and comprehensive course.
2. Short duration training programme (training of trainers):
    a. This is a training organized by MOHW and WHO and is of 1 week duration. It comprises of the most important components of IPC training. It aims to train personnel who will act as trainers.
3. Single day / half day training programme:
    a. It is usually conducted at regional level by personnel who have been trained at least in the short duration programme. It targets all staff working in the health care setups.
    b. The training materials have been prepared by the members of the NIC and RIC with the support of the WHO. The delivery of the material is conducted by the ICT of all the regional hospitals. All the staff who are in direct or indirect contact with the patients are targeted for training.

Refer to Annex E for details about the core components of IPC.

3.5 RISK ASSESSMENT AND MANAGEMENT

Whenever HCWs work within a healthcare facility or patients get admitted to a hospital, there is a risk that they get colonized or infected with a variety of microorganisms. Risk assessment is a process whereby medical hazards are identified, evaluated, and ways are established to eliminate or control it.

The following steps should be followed whenever the risk to HCWs or patients need to be evaluated (see the next figure):

1. Identify factors (policies, environment, practices, and processes) that may be harmful to staff, patients and visitors;

2. Evaluate how likely the risk is and the seriousness of hazards;
3. Decide the steps to take so as to prevent or control harm from happening;
4. Assess the probability of an infection to occur and its consequences;
5. Implement priority interventions to manage the risk; and
6. Monitor and evaluate the results.

Such an assessment is vital so that the risks of catching an infection can be eliminated, reduced, contained and managed appropriately.

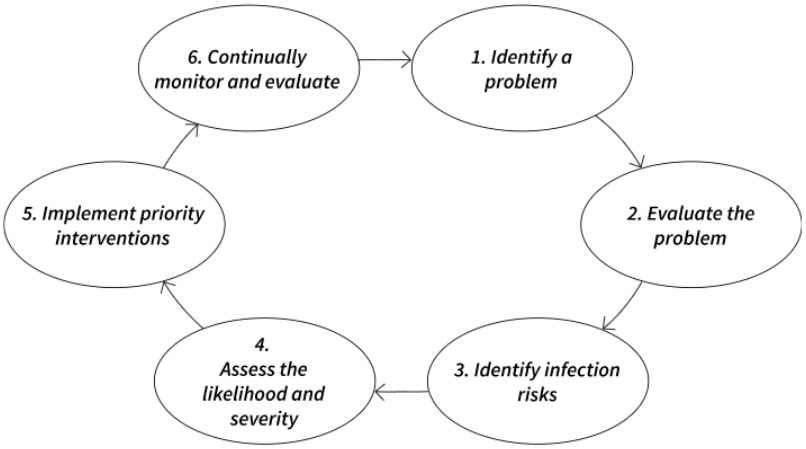


Figure 5: The steps that should be followed when doing a risk assessment.

3.6 INCIDENT REPORTING

A key component of strengthening IPC strategies is a robust incident reporting system that allows healthcare facilities to identify risks, analyze patterns, and implement corrective measures.

The role of incident reporting includes:

- Early Detection of Infection Risks: Incident reporting helps in identifying infection risks in real-time, allowing for prompt intervention. Reporting near misses and actual infections provides valuable data to track infection trends and detect potential outbreaks early.
- Improving Compliance with IPC Protocols: Regular reporting ensures adherence to IPC guidelines by holding staff accountable for following standard procedures, such as hand hygiene, sterilization, and isolation protocols. Continuous monitoring reinforces a culture of compliance and safety.
- Enhancing Root Cause Analysis: A structured reporting system enables hospitals to conduct thorough root cause analyses of infection-related incidents. By understanding the underlying factors contributing to infections—such as breaches in aseptic techniques or equipment contamination—hospitals can develop targeted corrective actions.
- Facilitating Continuous Training and Awareness: Data from incident reports serve as a valuable resource for training healthcare workers on IPC measures. Real-life case studies derived from reports enhance learning, ensuring staff remain informed about emerging risks and best practices.
- Strengthening Policy Development: Systematic reporting provides evidence-based insights that inform hospital policies and standard operating procedures. It supports decision-making

for resource allocation, infrastructure improvements, and the adoption of advanced infection control technologies.

- Enhancing Patient and Staff Safety: By addressing reported incidents proactively, hospitals can mitigate infection risks, safeguard patient health, and protect healthcare workers from occupational hazards, ultimately fostering a safer healthcare environment.

Most facilities face challenges with incident reporting as follows:

- Underreporting Issues: Fear of blame or punitive action may discourage reporting. Encouraging a non-punitive culture and ensuring anonymity can improve reporting rates.
- Data Utilization: Merely collecting reports is insufficient; hospitals must analyze and act on the data to drive meaningful IPC improvements.
- Integration with Surveillance Systems: Incident reporting should be aligned with national and global surveillance frameworks to contribute to broader infection control efforts.

3.7 PLANNING, MONITORING AUDITING AND FEEDBACK

To improve practices and reduce HAI and AMR at the healthcare facility, WHO recommends the use of multimodal strategies. Regular monitoring and auditing of healthcare practices should be done, and timely feedback should be provided to all audited persons and relevant staff.

Auditing practices and feedback are vital to achieve behavioral change, hence improving quality care and practices. Through monitoring, stakeholders are engaged, partnerships are created and working groups as well as networks are developed. Monitoring and feedback should be conducted in a blame-free and non-punitive manner. IPC programmes should be evaluated to assess the extent to which the national IPC objectives are met.

The following tools can be used for auditing and feedback (which is not exhaustive): national checklists as approved by the NIC, IPCAT, IPCAF, WASH-FIT and the WHO COVID-19 scorecard. More checklists are being developed and approved over the years. As an example, see annex I for the Surgical Safety Checklist.

Of note, one of the requirements for meeting the minimum IPC standard (see Annex F) is the appropriate monitoring of IPC benchmarks – this helps to give accountability to all stakeholders and allows the NIC and RIC to define and assign tasks to the IPC teams to ensure timely implementation of policies and activities related to IPC.

The PDSA (Plan, Do, Study and Act) cycle is a useful strategy in management as illustrated in the diagram below. It increases the chance of successfully changing the culture and favorably introducing transformations.

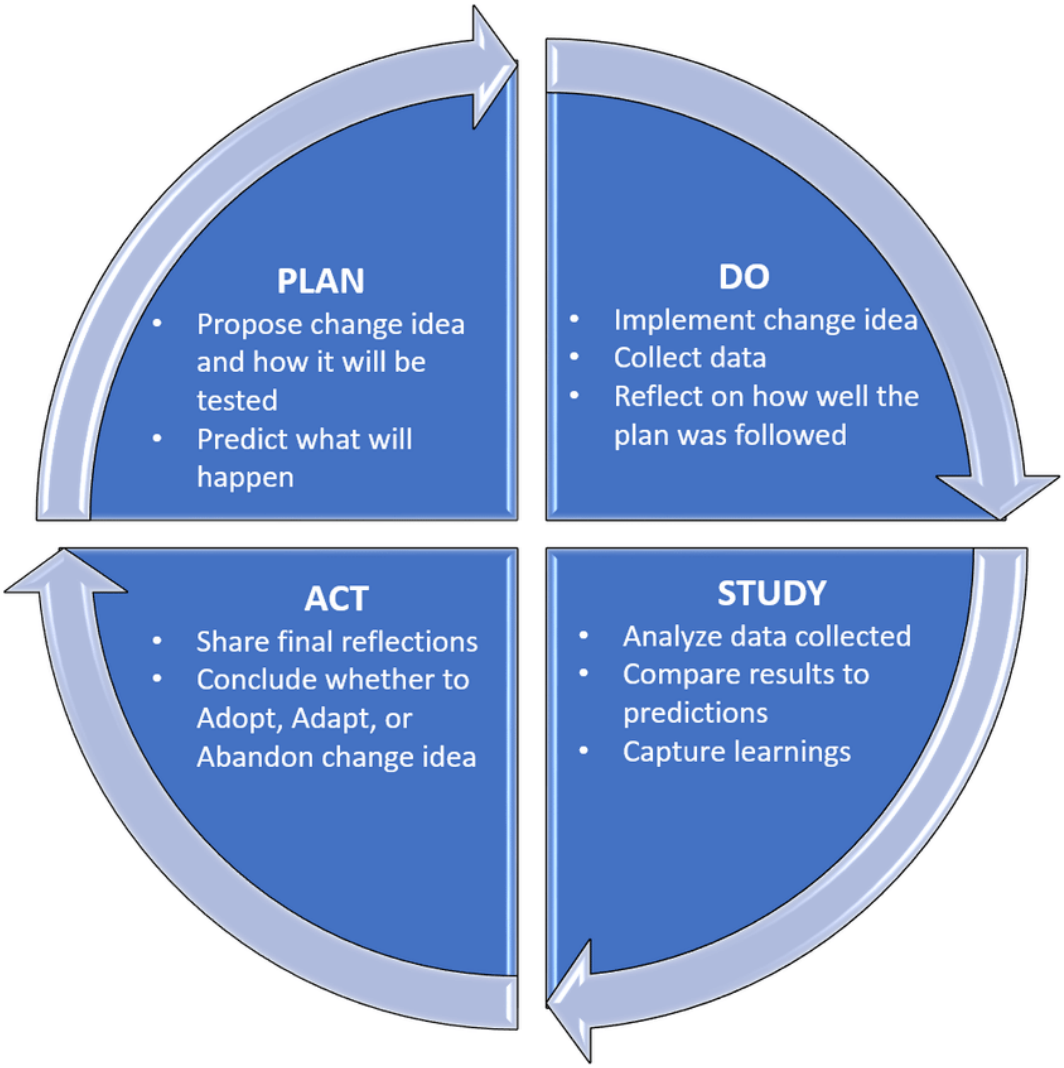


Figure 6: Source - https://artpictures.club/autumn-2023.html

3.7 IMPLEMENTATION AND RESEARCH STRATEGIES

For the success of the IPC programme, research helps in the identification of gaps and promotes the implementation of newer, more effective strategies to reduce HAIs.

Implementation strategies can be divided into four groups:[5]

1. Planning e.g., performing a situational analysis;
2. Educating e.g., training HCWs on IPC using demonstrations and group sessions;
3. Restructuring e.g., revising the roles and responsibilities of HCWs whenever necessary; and
4. Quality management e.g., using checklists, scorecards and other evaluation tools to assess the quality of care.

As an example, to improve hand hygiene, the following strategies can be implemented:[6]

- PLAN: Stakeholder buy-in of established intervention prior to roll-out with hospital leadership; ensuring procurement of alcohol hand rub both for HCWs and in the patient rooms in the health facility
- EDUCATE: Nurses and physicians to be trained on hand hygiene; posters and educational

materials to be placed in facility wards

- RESTRUCTURE: Provide HCWs with personal alcohol hand rub
- QUALITY MANAGEMENT: Pre-intervention hand hygiene quality assessment via observations; audit and feedback can be given to facility administrators on hand hygiene compliance among HCWs post-intervention.

The next two figures illustrate some of the multimodal strategies that can be used in IPC and the components that should be included in all strategic plans on IPC.

Organisation of IPC programmes	A structure responsible for policies, goals, strategies; legal, technical frameworks and monitoring. Existence of qualified dedicated technical staff with defined responsibilities, scope and functions. A budget adequate to meet programmed activities.
Technical guidelines	Development, dissemination and implementation of technical evidence-based guidelines for prevention of the relevant risks and/or infections, adapted to local conditions.
Human resources	Training for all health care personnel in IPC and specialised training for infection-control professionals. Adequate staff responsible for IPC activities. Address biological risks and implement preventive measures.
Surveillance of infections and assessment of compliance with IPC practices	Established priorities for surveillance of infections and pathogens, standardised case definitions and active methods of surveillance. Systematic assessment of compliance with IPC practices. Detection of outbreaks and prompt response. Documentation of the situation of HAI and IPC practices.
Microbiology laboratory	Standardisation of microbiology laboratory techniques. Promotion of the interaction between IPC activities and the microbiology laboratory. Use microbiology data for surveillance and IPC activities. Establish laboratory biosafety standards.
Environment	Minimum requirements for IPC: clean water, ventilation, handwashing facilities, patient placement and isolation facilities, storage of sterile supplies, conditions for building and/or renovation.
Monitor and evaluation of programmes	Regular monitoring, evaluation and reporting of IPC outcomes, processes and strategies at national level and in health care facilities. Promotion of evaluation in a non-punitive culture.
Links with public health or other services	Links between public health services and the facilities for events of mandatory reporting. Permanent coordination with activities related to waste management and sanitation, biosafety, antimicrobial pharmacy, occupational health, patients and consumers and quality of health care.

WHO: World Health Organization; IPC: infection prevention and control; HAI: health care-associated infection.

Figure 7: The implementation of multimodal strategies helps to ensure success of a national IPC programme. From WHO (course on IPC core components).

Figure 8: Certain components of a national IPC programme are vital to its success. From WHO.

The World Health Organization (WHO) has developed multimodal strategies for Infection Prevention and Control (IPC) as part of its efforts to combat HAIs and antimicrobial resistance (AMR). These strategies are grounded in evidence-based interventions aimed at preventing infections, particularly in healthcare settings, where transmission risks are high. WHO's multimodal approach has been widely adopted and endorsed, as it emphasizes a comprehensive and sustainable method for improving IPC practices, reducing infections, and promoting patient safety.

WHO's multimodal strategy comprises five key elements that work together to bring about sustainable improvements in infection prevention:

1. **System Change (Build it)**: This involves ensuring that the necessary infrastructure and supplies are available in healthcare settings to enable effective IPC practices. For example, healthcare facilities must have adequate access to clean water, hand hygiene facilities, personal protective equipment (PPE), and other necessary supplies. This component ensures that the basic conditions for infection prevention are met.
2. **Training and Education (Teach it)**: Healthcare workers and staff must be trained on appropriate IPC practices, such as proper hand hygiene, use of PPE, waste management, and safe injection practices. WHO emphasizes continuous education to maintain a culture of safety and ensure that healthcare workers remain up-to-date with the latest guidelines and recommendations. Training also extends to patients and their families, promoting awareness and involvement in IPC.

3. **Monitoring and Feedback (Check it)**: Regular monitoring of IPC practices is crucial to identify gaps and areas for improvement. WHO encourages the use of simple tools, like checklists, to track compliance with IPC protocols. Feedback is essential for reinforcing positive behaviors and correcting deviations. This component ensures accountability and provides healthcare workers with a sense of ownership over infection control measures.

4. **Communication (Sell it):** Communication and reminders are critical components of a multimodal strategy in Infection Prevention and Control (IPC). These elements help reinforce the principles of effective IPC practices, ensure adherence among healthcare workers, and foster a culture of safety and accountability within healthcare settings. In busy healthcare environments, where staff face competing priorities and high workloads, it's easy for even well-trained individuals to overlook critical IPC measures. Reminders help mitigate this risk by providing constant prompts that reinforce essential practices. For example, posters, signs, and digital prompts reminding staff to perform hand hygiene before and after patient contact can help maintain high compliance rates.

5. **Workplace Culture (Live it)**: The WHO multimodal strategy promotes a culture of safety within healthcare facilities. This involves fostering teamwork, communication, and leadership to create an environment where IPC practices are prioritized. Leadership engagement is critical in setting the tone for a strong IPC culture, as it ensures that infection control becomes an integral part of the organization's mission and everyday practices.

References

1. Academic impact. Capacity building. United nations. Accessed online at https://www.un.org/en/academic-impact/capacity-building
2. Storr et al. Core components for effective infection prevention and control programmes: new WHO evidence-based recommendations. Antimicrobial Resistance and Infection Control (2017) 6:6. doi: 10.1186/s13756-016-0149-9.
3. Michael O et al. Implementing infection prevention and control capacity building strategies within the context of Ebola outbreak in a "Hard-to-Reach" area of Liberia. Pan African Medical Journal. 2018;31:107. doi: 10.11604/pamj.2018.31.107.15517.
4. Licker M, et al., Infection control capacity building in European countries with limited resources: issues and priorities, Journal of Hospital Infection (2017), doi: 10.1016/j.jhin.2016.12.024.
5. G. Birgand, A. Johansson, E. Szilagyi, J. C. Lucet. Overcoming the obstacles of implementing infection prevention and control guidelines. Clinical Microbiology and Infection. Volume 21, Issue 12, December 2015, Pages 1067-1071.
6. Barrera-Cancedda, A. E., Riman, K. A., Shinnick, J. E. *et al.* Implementation strategies for infection prevention and control promotion for nurses in Sub-Saharan Africa: a systematic review. *Implementation Sci* 14, 111 (2019). doi: 10.1186/s13012-019-0958-3.

Chapter 4: Standard Precautions

4.1 INTRODUCTION

Standard precautions are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered. These practices are designed to prevent the spread of infection and protect both health care personnel and patients. Standard precautions consist of:

1. Hand hygiene;
2. Rational use of personal protective equipment (PPE);
3. Respiratory hygiene and cough etiquette;
4. Safe handling of patient care equipment;
5. Injection safety and sharp management;
6. Environmental cleaning and disinfection;
7. Safe handling of linen; and
8. Healthcare waste management.

4.2 HAND HYGIENE

4.2.1 Introduction

Hand hygiene is the primary measure proven to be effective in preventing HAI and the spread of antimicrobial resistance.

Failure to perform appropriate hand hygiene is considered the leading cause of HAI and the spread of multi-resistant organisms and has been recognized as a significant contributor to outbreaks.

Hand hygiene comprises of the following:

1. Routine handwashing following the correct steps for the right duration;
2. Using alcohol hand rub or chlorinated water (at 0.05% concentration); and
3. Performing a surgical scrub.

4.2.2 Routine handwashing

This is the conventional method of hand hygiene whereby washing of the hands is performed using soap and running water. It physically removes microorganisms that get transferred to the hands while handling blood, body fluids, excretions and other contaminated items during daily work. Thorough hand washing with adequate quantities of water and soap removes more than 90% of the transient, i.e., superficial flora including most contaminants. It is most appropriate when the hands are soiled. Chlorinated water at a concentration of 0.05% may be used in case an antiseptic is required. The next 2 figures illustrate the times and steps for handwashing.

Figure 9: Times when handwashing is important. Source: US CDC.

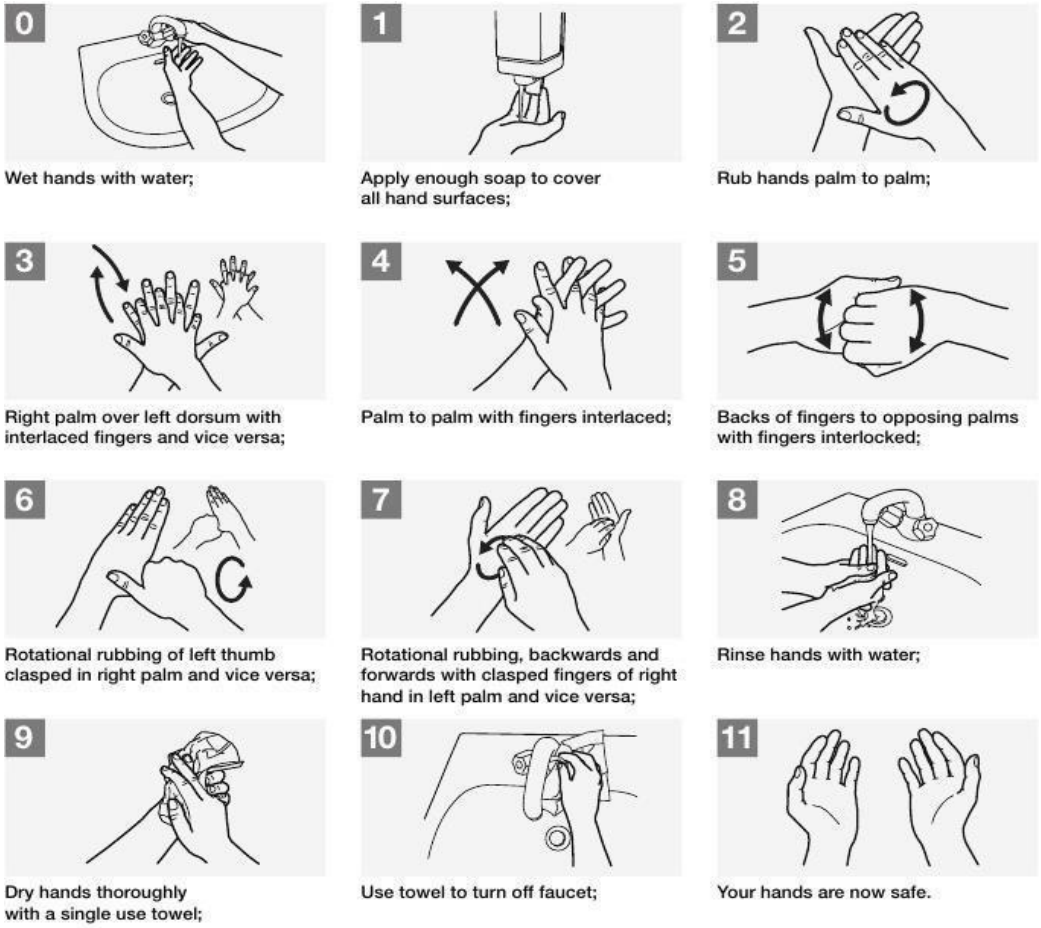


Figure 10: Steps in handwashing. Duration of the procedure is 40 to 60 seconds. Source: WHO.

4.2.3 Alcohol hand rub

This is a simple and fast procedure, requiring only 20 to 30 seconds, using 60% to 90% concentration of ethanol, isopropanol or n-propanol. It kills or inhibits the growth of most microorganisms but does not remove them. Therefore, hands which have been contaminated following exposure to soil, blood, and body fluids must be washed before application of an alcohol-based hand rub. See the poster for the steps to hand rub.

Figure 7: Steps for alcohol hand rub. The procedure should take 20 to 30 seconds. From WHO.

4.2.4 Surgical hand scrub

Use of a surgical hand scrub before the start of any surgical procedure helps to prevent the growth of microorganisms for some time. It also helps to reduce the risk of infection in cases when damage to gloves occurs. The figure below displays the steps that should be followed.

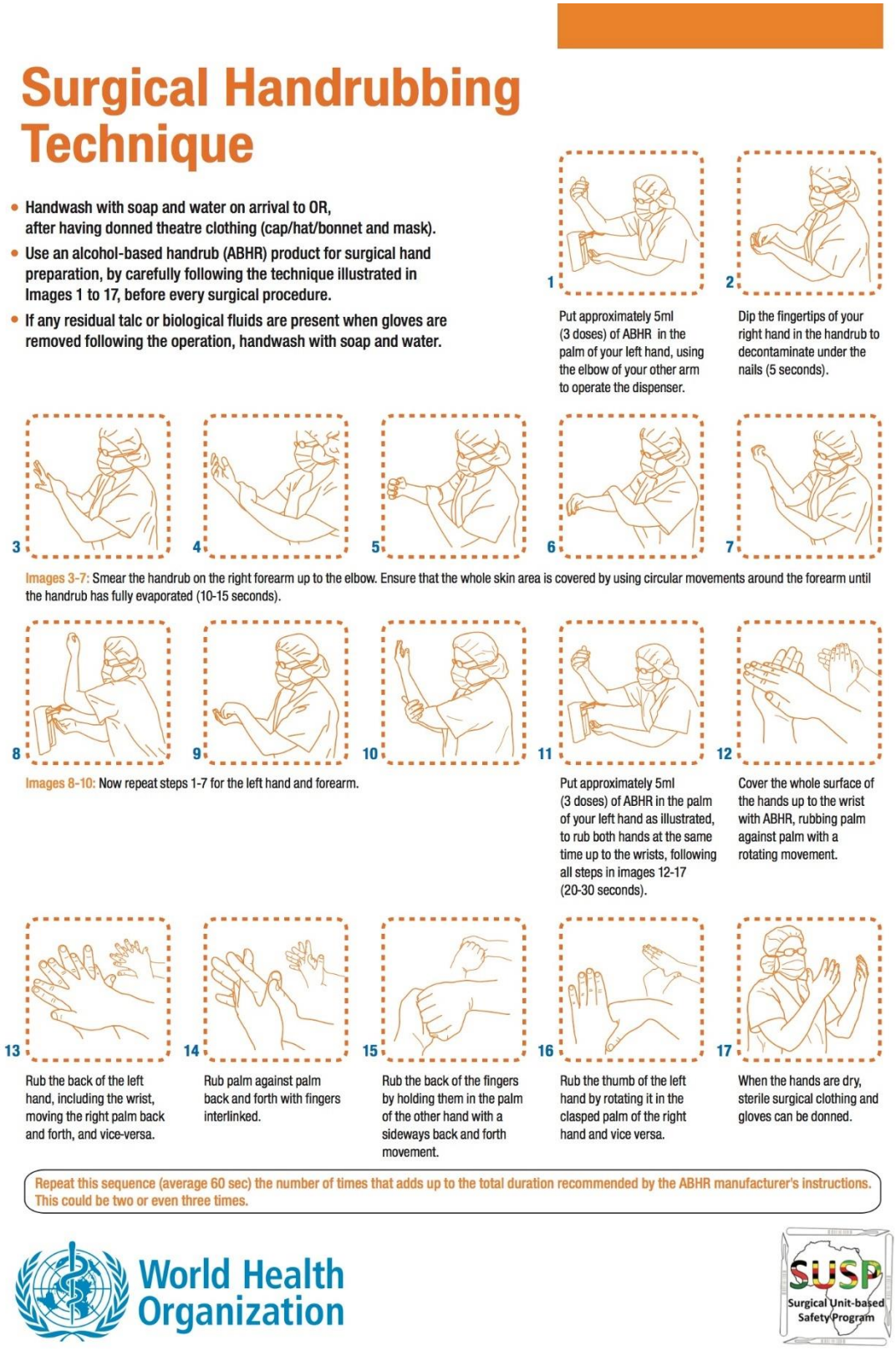


Figure 8: Source – from WHO.

4.2.5 Indications for hand hygiene

Hand hygiene is always indicated in the following scenarios:

1. Before and after touching the patient;
2. When the hands are visibly dirty or visibly soiled with blood or other body fluids;
3. After using the toilet;
4. Before preparing food for patients;
5. After handling waste;
6. Before putting on and after taking off PPE;
7. Before handling an invasive device for patient care (regardless of whether or not gloves are used);
8. Before handling medication for patients;
9. If moving from a contaminated body site to another body site during care of the same patient;
10. After contact with surfaces and objects in the immediate vicinity of the patient e.g., medical equipment, patient bed and patient charts; and
11. After removing sterile or non-sterile gloves.

The following figure illustrates the 5 moments of hand hygiene.

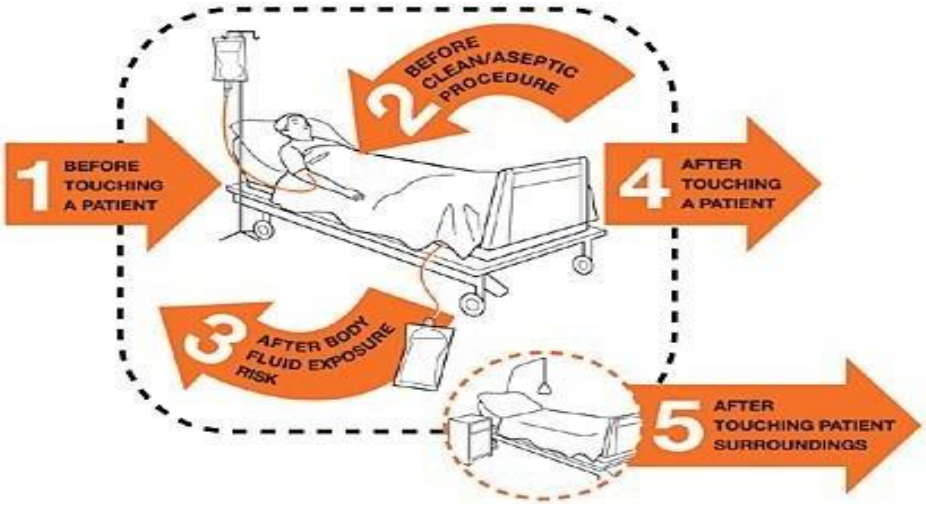


Figure 9: The 5 moments of hand hygiene. From WHO.

4.2.6 Important points to remember

1. If you do not have an elbow tap, close the tap with a piece of tissue paper. Liquid soap is better than bar / tablet soap. If you use tablet soap, make sure it is placed correctly so that water can flow freely.
2. Sharing of towel to dry the hands is strictly not recommended. Try to bring your own hand towel daily if disposable paper towel is not available in your health premises. Air drying is also not acceptable since studies suggest it can cause aerosolized microorganisms to spread in the

environment.

3. Provide HCWs with efficacious hand hygiene products that have low irritating potential. HCWs having dry skin should use emollients or moisturizers after the use of alcohol.
4. Ensure that liquid soap dispensers are accessible at points-of-care. Of note, a point-of-care is defined as the place where three elements come together - the patient, the HCW, and care or treatment involving contact with the patient or his / her surroundings (within the patient zone); point-of-care products should be accessible without having to leave the patient zone (ideally within arm's reach of the HCW or within 2 meters).
5. Ensure that the liquid soap dispensers function adequately and reliably and deliver an appropriate volume of the product.
6. Do not dilute the product in liquid soap dispensers.
7. The use of gloves does not replace the need for hand hygiene by either handrubbing or hand washing.
8. Do not wear artificial fingernails or extenders when having direct contact with patients.
9. Keep natural nails short (tips should be less than 0.5cm long or approximately ¼ inch).
10. Do not wear jewelry on fingers, hands and wrists.

4.3 RESPIRATORY HYGIENE

4.3.1 Introduction

Respiratory tract infections (RTI) are usually spread by inhaling droplets of the respiratory secretions released from an infected person's cough or sneeze, or from touching surfaces contaminated when they coughed or sneezed, e.g., used tissues, tables or door handles.

Respiratory and cough hygiene can help to reduce the risk of spreading respiratory infections, thus protecting those in contact with the infected person.

Staff should adopt good respiratory and cough hygiene practices themselves while promoting same to service users.

Moreover, physical distancing can significantly help in reducing the transmission of microbes via droplets: HCWs and patients who are coughing or sneezing should remain at least 1 to 2 meters away from other persons.

4.3.2 Respiratory and cough hygiene

To reduce the risk of spreading RTIs when coughing, sneezing, wiping or blowing the nose, staff and service users should:

1. Have access to and use disposable tissues;
2. Dispose of used tissues into a waste bin or bag immediately after use; and
3. Practice hand hygiene.

4.3.3 Important points to remember

1. Avoid the use of cloth handkerchiefs.

2. Do not touch the eyes, nose and mouth until hands have been cleaned after contact with respiratory secretions.
3. Do not contaminate surfaces and pockets with used tissues.
4. If no disposable tissue is available, cough or sneeze into your elbow or upper arm, not your hand/s or into the air.
5. Bins must be covered after you have thrown away used tissues.
6. Wear masks when suffering from a respiratory illness so as not to expose others e.g., in the workplace.
7. Request for sick leaves and stay at home when going through the highly contagious period of a respiratory illness.

4.4 PERSONAL PROTECTIVE EQUIPMEMT

4.4.1 Introduction

Personal Protective Equipment (PPE) acts as a barrier for protection from patients' blood and body fluids and protects the staff from microorganisms contaminating the patient. All PPE supplied to staff must undergo quality control and must fulfil the standard and specifications as guided by the WHO, the US CDC, Mauritius Standard Bureau or other well-recognized international / national organizations. For details on the use of PPE in the context of COVID-19, consult the document entitled "Standard operating procedure on the rational use of PPE in the context of the COVID-19 outbreak".

4.4.2 Types of PPE

See the figure below for the types of PPE that are commonly used in the hospital environment.

Figure 10: Examples of personal protective equipment.

Head cover / hood

Its purpose is to protect the hair and scalp from possible contamination.

It should be worn when anticipating sprays or aerial exposure to pathogens or when the hair can act as a source of infection e.g., during surgeries or sterilization of equipment.

Face protection

Its purpose is to prevent the transmission of germs to the eyes, nose and mouth. See the next figure for the examples of masks.

Use face protection during activities likely to generate splashes and sprays of body fluids (for example, during aspiration, surgery, labor and cleaning of some instruments) or when caring for a patient with a new or persistent cough.

Figure 11: Examples of PPE that protects the face.

An N95 mask is different from a surgical / medical mask: the former is used to protect oneself against airborne germs while the latter protects against droplets. A fit test must be used to ensure that the N95 mask is correctly adjusted to one's face.

General principles

1. The mask must not be too big or too small. Mask of different sizes must be made available for staff.
2. Do not keep adjusting the mask.
3. Your nose must not be exposed.
4. Do not remove the mask to talk.
5. Do not keep switching sides.
6. Mask must be changed if it gets dirty, wet or damaged, or if healthcare staff touches the inside of it.
7. In periods of shortage, face masks may be used for an extended period of time.

How to put on a face mask

1. Clean the hands with soap and water or hand sanitizer before touching the mask.
2. Make sure there are no obvious tears or holes on either side of the mask.
3. Determine which side of the mask is the top.
4. Determine which side of the mask is the front.
5. Put the mask over your nose and mouth and secure it under your chin.
6. Fit the mask snugly against the sides of your face, slipping the loops over your ears or tying the strings behind your head.
7. If you have to continually adjust your mask, it obviously doesn't fit properly and is thus not protecting you adequately. Then you might need to find a different mask type/size.
8. Make sure you can breathe easily.

How to put on a respirator

1. Position the respirator in your hands with the nose piece at your fingertips.
2. Cup the respirator in your hand allowing the headbands to hang below your hand. Hold the respirator under your chin with the nosepiece up.
3. The top strap (on single or double strap respirators) goes over and rests at the top back of your head. The bottom strap is positioned around the neck and below the ears. Do not crisscross straps.
4. Place your fingertips from both hands at the top of the metal nose clip (if present). Slide fingertips down both sides of the metal strip to mold the nose area to the shape of your nose.
5. Check the seal: Place both hands over the respirator, take a quick breath in to check whether the respirator seals tightly to the face. If you feel leakage, there is not a proper seal.

Reuse and extended use of N95 mask / respirators

1. Supplies of N95 respirators can become depleted during an influenza pandemic or widespread outbreaks of other infectious respiratory illnesses. Extended use or limited reuse has been recommended as an option for conserving respirators during previous respiratory pathogen outbreaks and pandemics.
2. Reuse refers to the practice of using the same N95 respirator for multiple encounters with patients but removing it ('doffing') after each encounter. The respirator is stored in between encounters to be put on again ('donned') prior to the next encounter with a patient.
3. Extended use refers to the practice of wearing the same N95 respirator for repeated close contact encounters with several patients, without removing the respirator between patient encounters.

Measures to reduce contact transmission after donning in case of extended use of mask

1. Discard N95 respirators following use during aerosol-generating procedures.
2. Discard N95 respirators contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.
3. Discard N95 respirators following close contact with, or exit from, the care area of any patient co-infected with an infectious disease requiring contact precautions.
4. Consider use of a cleanable face shield to reduce surface contamination.

5. Perform hand hygiene with soap and water or an alcohol-based hand sanitizer before and after touching or adjusting the respirator (if necessary for comfort or to maintain fit).
6. Discard any respirator that is obviously damaged or becomes hard to breathe through.
7. To minimize potential cross-contamination, store respirators so that they do not touch each other and the person using the respirator is clearly identified. Storage containers should be disposed of or cleaned regularly.
8. Avoid touching the inside of the respirator. If inadvertent contact is made with the inside of the respirator, discard the respirator and perform hand hygiene as described above.

Aprons

Aprons should be worn over gowns when they are likely to be exposed to a large amount of body fluids.

Gowns

Gowns are put on to protect the skin and to avoid getting one's clothes dirty. They are used when exposure to splashes or body fluids are likely or when the patient is on contact precautions.

Gloves

The correct indications for the use of gloves are:

1. Before a sterile procedure;
2. When contact with blood or other body fluids is anticipated, including contact with a damaged mucous membrane or skin, regardless of the need to create or maintain sterile conditions; and
3. In case of contact with the patient (and his immediate environment) when applying contact precautions.

Gloves should be removed:

1. As soon as the gloves are damaged or defective (or if their non-integrity is suspected);
2. As soon as contact with blood, body fluid, damaged skin or mucous membrane ends;
3. As soon as contact with a patient, or their immediate environment, or a contaminated body site ends; and
4. When there is an indication for hand hygiene.

Of note, the use of gloves does not replace hand hygiene. Avoid adjusting one's PPE and picking up items like cellphones, etc. when wearing gloves. Gloves should be disposable; do not reuse them.

Employers must provide healthcare workers having latex allergy with vinyl, nitrile, or polymer gloves.

Indications of when to use sterile gloves and when to use non-sterile gloves are different – see the figure below for details.

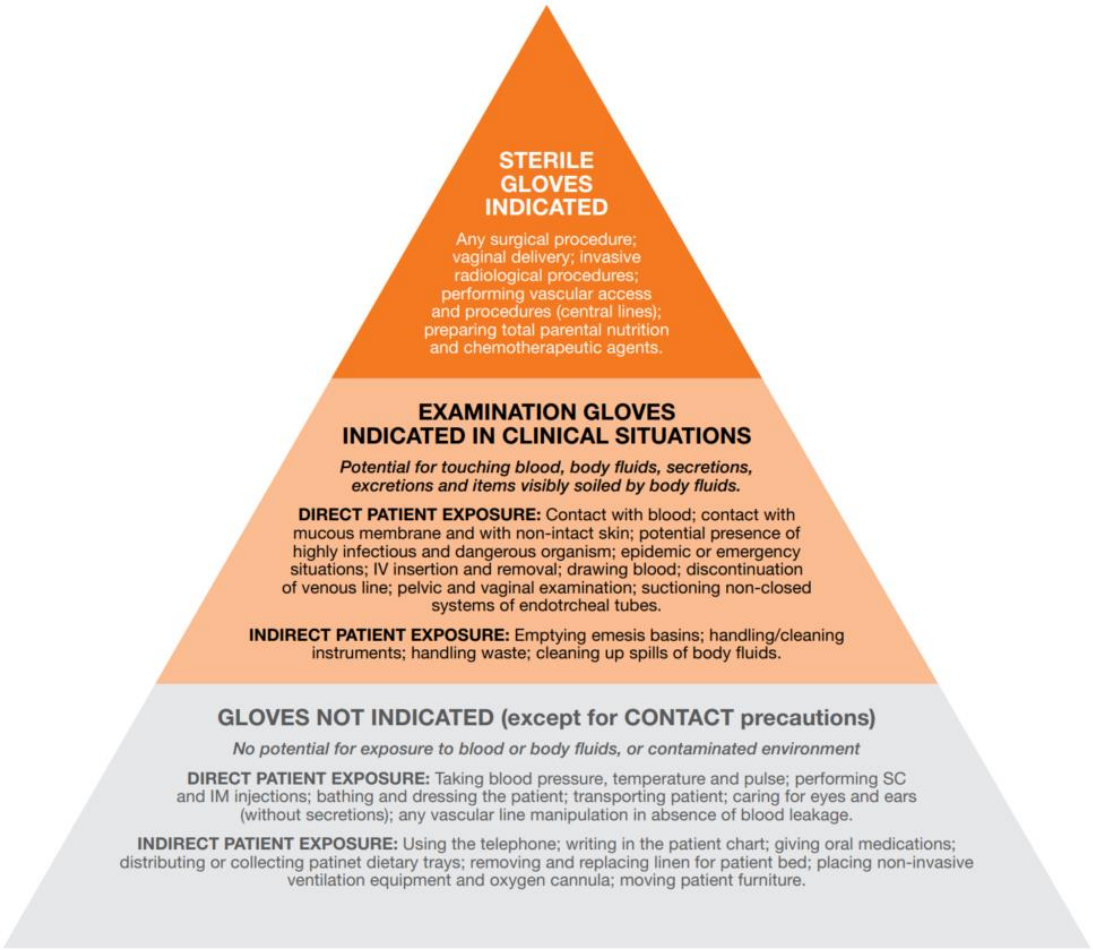


Figure 12: The glove pyramid explains the indications for using disposable and sterile gloves. From WHO.

Boots / shoe covers

Wear boots or shoe covers when there is a risk that the patient's blood, body fluids or secretions will splash, spill or leak on your feet / shoes.

Studies do not support the use of shoe covers before entering intensive care unit (ICU) or the operating theater – they do not reduce the risk of acquiring HAI.

The figure below illustrates the difference between overshoes and boots.

Figure 13: Examples of shoe covers (left) and boots (right).

4.4.3 Posters for donning and doffing PPE

Figure 14: Steps in donning PPE. Source: US CDC.

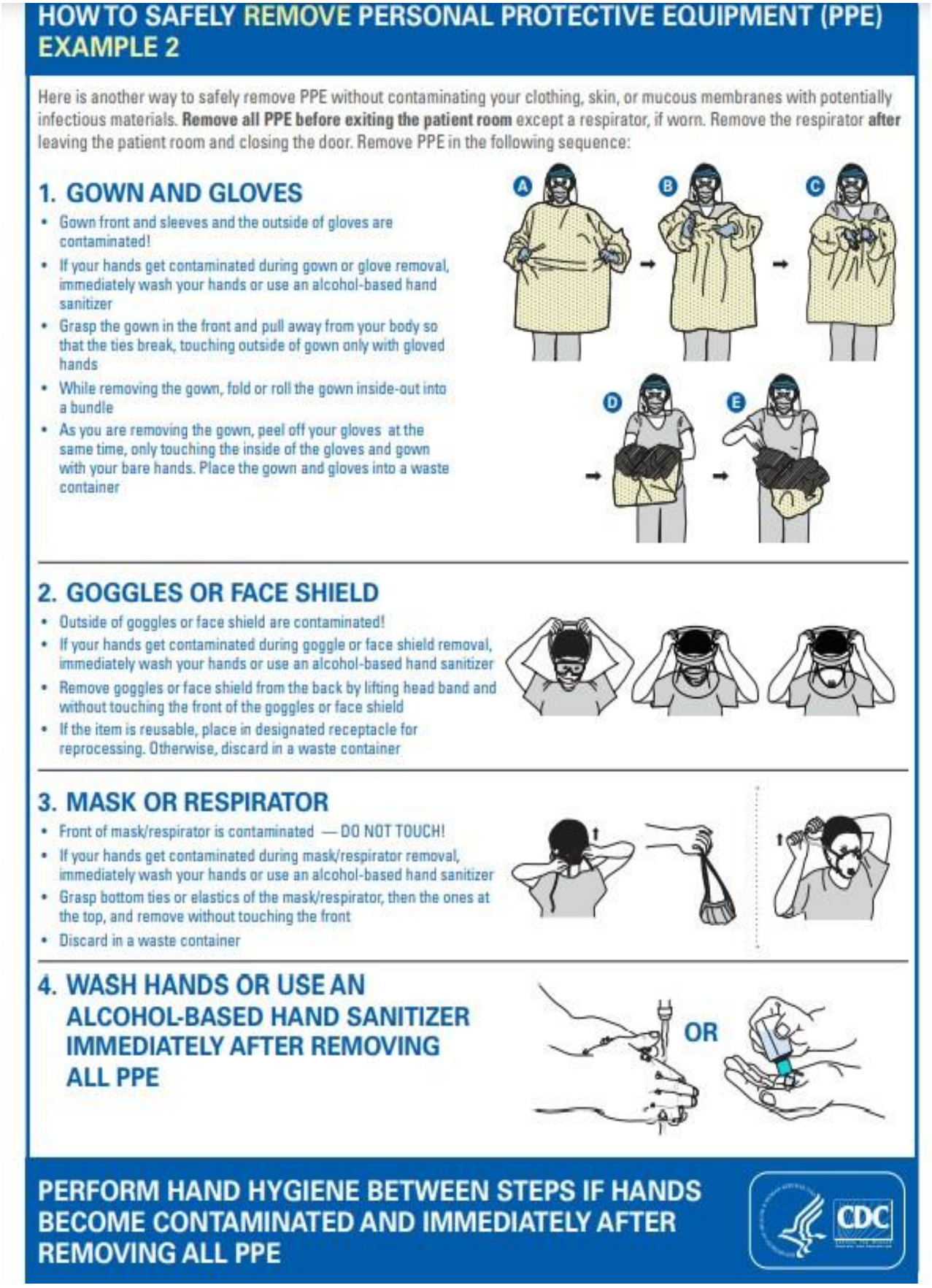


Figure 15: Steps in doffing PPE. Source: US CDC.

4.5 INJECTION SAFETY AND SHARP MANAGEMENT

4.5.1 What are sharp objects?

Any instrument that has edges that can cut through or wound the human skin during handling is considered a sharp object (see figure below for examples).

Figure 16: Examples of sharp objects.

4.5.2 What is injection safety?

This is a set of practices that aim to prevent the transmission of pathogens like hepatitis B virus and hepatitis C virus, HIV and Ebola virus during sharps-related accidents.

4.5.3 Steps to injection safety

- A clean and organized workspace is necessary to prevent contamination and ensure the safe preparation of the injection.
- Always practice hand hygiene before preparing an injection.
- Always use a sterile, new and well-sealed packaged syringe and needle.
- Use a single-dose sterile vial of medication and diluent whenever possible. If you use a multidose vial, take more precautions to avoid contamination.
- Disinfect the skin before injection.
- Collect sharp objects and place them in an appropriate sharp-resistant box.
- Ensure the appropriate management of wastes.
- Do not aspirate fluid from saline pints multiple times since this increases the risk of introducing microbes into the bag of fluid.

4.5.4 Good basic practices for sharp safety

- Wear gloves when carrying out intravenous injections.
- Use instruments rather than your hands to pick up needles and scalpels.
- Avoid passing sharp instruments from hand to hand: use a recipient or tray.

- Once used on a patient, needles and syringes are contaminated and should not be reused.
- Never administer an injectable medication using a drip or syringe already used for another patient, even if you change the needle.
- Never pierce an ampule or vial with an already used syringe or needle.
- Never use the same single-use ampoule of medication for more than one patient.

4.5.5 How to use a multidose vial?

- Never use a single-dose vial for multiple purposes.
- Use a multidose vial only when so labelled by the manufacturer.
- If possible, conserve a patient's multidose vial by storing it with his / her name on the vial.
- Mark on the vial the date of first use after opening.
- Clean the vial septum with an antiseptic, at each use.
- Use a new syringe and new needle each time the septum is pierced.

4.5.6 When to dispose a multidose vial?

Dispose of the vial if the sterility or content thereof is compromised, if the expiry date has passed and if it was not properly stored after opening.

4.5.7 How to handle sharps

The following figure illustrates the practices that should be discouraged when dealing with sharps.

Figure 17: Practices that should be discouraged whenever handling sharp objects.

4.5.8 How to dispose of sharps

A sharps container must never be filled to more than three quarters of its capacity. This type of waste can be disposed of in an incinerator or via other ways like an autoclave-shredder . See the next 2 figures for details.

Figure 22: Always dispose of sharp objects in the correct manner.

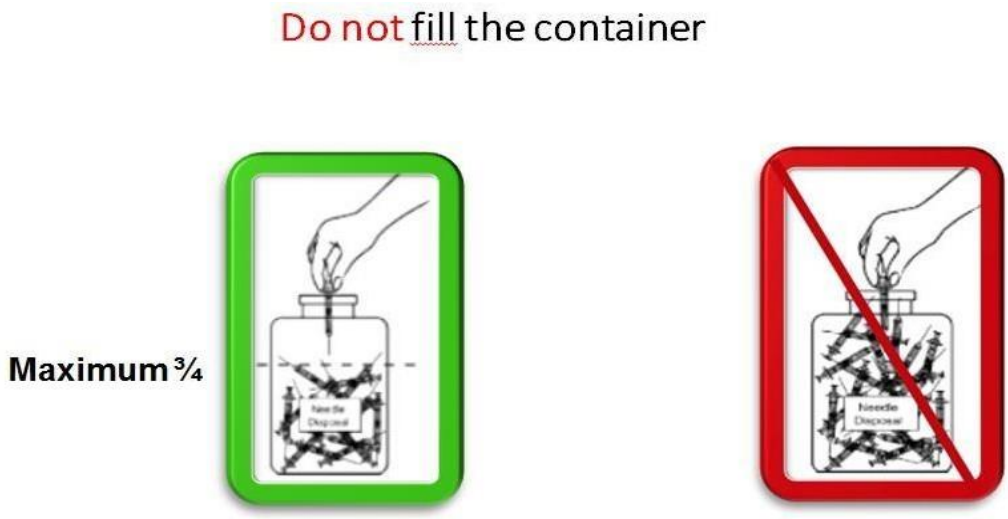


Figure 23: Do not overfill any sharps container.

Sharps disposal containers should be:

- made of a heavy-duty plastic (other material may be accepted if it can be shown that sharps will not penetrate the material during routine use);
- able to close with a tight-fitting, puncture-resistant lid, without sharps being able to come out;
- upright and stable during use;
- leak-resistant; and
- properly labeled to warn of hazardous waste inside the container.

4.5.9 Needlestick injuries

Injuries from needles used in medical procedures are sometimes called needlestick or sharps injuries. If you pierce or puncture your skin with a used needle, follow the following advice immediately:

1. Encourage the wound to bleed, ideally by holding it under running water.
2. Wash the wound using running water and plenty of soap.
3. Do not scrub the wound while you're washing it.
4. Do not suck the wound.
5. Dry the wound and cover it with a waterproof plaster or dressing.
6. Contact your superior so that arrangement can be made for you to be seen at the earliest possible by a doctor at the accident and emergency department of your regional hospital. You may need to contact the AIDS Unit for post-exposure prophylaxis for HIV.
7. Both you and the patient may need to be tested for HIV, hepatitis B and / or hepatitis C virus.
8. Post- exposure prophylaxis (PEP) will be initiated by the treating doctor if necessary.
9. PEP must always be started as soon as possible after the injury.

4.6 SAFE HANDLING OF PATIENTS CARE EQUIPMENT

4.6.1 Types of instruments

1. Critical;
2. Semi critical; and
3. Non-critical.

4.6.2 Spaulding classification

The Spaulding classification of an item determines the type of decontamination method that should be used for disinfection purposes.

CATEGORY	DEFINITION	DECONTAMINATION METHOD	EXAMPLES OF COMMON ITEMS / EQUIPMENT
High Risk **(Critical)**	**Medical devices that penetrate sterile tissue or the vascular system**	**Sterilization** **Moist (Autoclave) or dry heat, if stable to heat** **Chemical, if sensitive to heat.** **Heat sensitive items can also be treated with low temperature steam.**	**Surgical instruments, implants, prostheses and devices, urinary catheters, cardiac catheters, implants, needles and syringes, dressings, sutures, delivery kits, dental instruments, rigid bronchoscopes, cystoscopy**

Rigid endoscopes

CATEGORY	DEFINITION	DECONTAMINATION METHOD	EXAMPLES OF COMMON ITEMS / EQUIPMENT
Intermediate Risk **(Semi-critical)**	**Medical devices in contact with mucous membranes or non-intact skin**	**High-level disinfection by heat or chemicals (under controlled conditions with minimal toxicity to humans)**	**Respiratory therapy and anaesthesia equipment, flexible endoscopes, vaginal speculums, reusable bedpans and urinals. Equipment, etc. Bedpans, urine bottles, patient bowls.**

Flexible endoscopes

Low Risk **(Non-critical)**	**Items in contact with intact skin**	**Low-level disinfection, i.e must be cleaned and disinfected using towels or cloths soaked in disinfectant**	**Blood pressure cuffs, stethoscopes, ECG electrodes, etc.**

Figure 24: The Spaulding classification of instruments describes the decontamination method that should be used for each category of medical equipment.

4.6.3 Examples of disinfectants that may be utilized

MANUFACTURERS' RECOMMENDATIONS FOR PRODUCT, CONCENTRATION AND EXPOSURE TIME MUST BE FOLLOWED			
Level of Processing / Reprocessing	**Classification of Equipment Device**	**Examples of Equipment / Devices**	**Products****
<u>Cleaning</u> Physical removal of soil, dust or foreign material. Chemical, thermal or mechanical aids may be used. Cleaning usually involves soap and water, detergents or enzymatic cleaners. Thorough cleaning is required before disinfection or sterilization may take place.	All reusable equipment / devices	• All reusable equipment / devices • Oxygen tanks and cylinders	**concentration and contact time are dependent on manufacturer's instructions • Quatemary ammonium compounds (QUATs) • Enzymatic cleaners • Soap and water • Detergents • 0.5% Accelerated hydrogen peroxide
<u>Low-level Disinfection</u> Level of disinfection required when processing noncritical equipment / devices or some environmental surfaces. Low-level disinfectants kill most vegetative bacteria and some fungi as well as enveloped (lipid) viruses. Low-level disinfectants do not kill mycobacteria or bacterial spores.	Non-critical equipment / devices	Environmental surfaces touched by staff during procedures involving parenteral or mucous membrane contact (e.g. dental lamps, dialysis machines) • Bedpans, urinals, commodes • Stethoscopes • Blood pressure cuffs • Oximeters • Glucose meters • Electronic thermometers • Hydrotherapy tanks • Client / patient / resident lift slings • ECG machines / leads / cups etc. • Sonography / ultrasound equipment / probes that only contact intact skin • Bladder scanners • Baby scales • Cardiopulmonary training mannequins • Environmental surfaces (e.g. IV poles, wheelchairs, beds, call bells) • Fingernail care equipment that is single-client /patient/ resident use	**concentration and contact time are dependent on manufacturer's instructions • 3% Hydrogen peroxide (10 minutes) • 60-95% Alcohol (10 minutes) • Hypochlorite (1000 ppm) • 0.5% Accelerated Hydrogen peroxide • Quatemary ammonium compounds (QUATs) (10 minutes) • Lodophors • Phenolics ** (should not be used in nurseries)

MANUFACTURERS' RECOMMENDATIONS FOR PRODUCT, CONCENTRATION AND EXPOSURE TIME MUST BE FOLLOWED			
Level of Processing / Reprocessing	**Classification of Equipment Device**	**Examples of Equipment / Devices**	**Products****
<u>High-Level Disinfection</u> The level of disinfection required when processing semi-critical equipment/devices High-level disinfection processes destroy vegetative bacteria, mycobacteria, fungi and enveloped (lipid) and non-enveloped (non-lipid) viruses, but not necessarily bacterial spores.	Semicritical equipment / devices	• Flexible endoscopes that do not enter sterile cavities or tissues. • Laryngoscopes • Bronchoscopes, cystoscopes (sterilization is preferred) • Respiratory therapy equipment • Nebulizer cups • Anaesthesia equipment • Endotrachial tubes • Specula (nasal, anal, vaginal – disposable equipment is strongly recommended) • Tonometer foot plate • Ear syringe nozzles • Sonography (ultrasound) equipment / probes that come into contact with mucous membranes or non-intact skin (e.g transrectal probes) • Pessary and diaphragm fitting rings • Cervical caps • Breast pump accessories • Glass thermometers • CPR face masks • Alligator forceps • Cryosurgery tips • Ear cleaning equipment, ear curettes, otoscope tips • Fingernail care equipment used on multiple clients / patients / resident	**concentration and contact time are dependent on manufacturer's instructions • 2% Glutareldehyde (20 minutes at 20°C) • 6% Hydrogen peroxide (30 Minutes) • 0.55% Orthophthalaldehyde (OPA) (10 minutes at 20°C) • Pasteurization (30 minutes at 71°C) • 7% Accelerated Hydrogen Peroxide (20 Minutes) • 0.2% Peracetic acid (30 – 45 minutes)

MANUFACTURERS' RECOMMENDATIONS FOR PRODUCT, CONCENTRATION AND EXPOSURE TIME MUST BE FOLLOWED			
Level of Processing / Reprocessing	**Classification of Equipment Device**	**Examples of Equipment / Devices**	**Products****
Sterilization The level of reprocessing required when processing critical equipment / devices. Sterilization results in the destruction of all forms of microbacterial life including bacteria, viruses, spores and fungi.	Critical equipment / devices	• Surgical instruments • Foot care equipment • Implantable equipment / devices • Endoscopes that enter sterile cavities and spaces (e.g. arthroscopes, laparoscopes) • Bronchoscopes, cystoscopes (sterilization preferred) • Biopsy forceps, brushes and biopsy equipment associated with endoscopy (disposable equipment is strongly recommended) • Colposcopy equipment • Electrocautery tips • Endocervical curettes • Fish hook cutters • Transfer forceps • Eye equipment, including soft contact lenses • Dental equipment including high speed dental hand pieces	**concentration and contact time are dependent on manufacturer's instructions • Steam autoclave • 100% Ethylene oxide • Dry heat • Hydrogen peroxide gas plasma (75 Minutes at 50°C) • 2.5 – 3.5% Glutaraldehyde (10 hours at 20°C) • 0.2% Peracetic Acid (12 Minutes at 50 - 56°C) • 6-25% Hydrogen peroxide liquid (6 hours) • 7% Accelerated hydrogen peroxide (6 hours at 20°C)

Table 2: This table describes the concentration and type of products that can be used to clean items within each Spaulding category. From "Simcoe Muskoka District Health Unit. Quick and Dirty of Cleaning and Disinfection Designated Officer Training. 17 January 2013."

4.7 TRANSMISSION-BASED PRECAUTIONS

Transmission-based precautions are the second tier of basic infection control and are to be used in addition to standard precautions for patients who may be infected or colonized with certain infectious agents for which additional precautions are needed to prevent infection transmission.

Transmission-based precautions are required in patients known or suspected to be infected with highly transmissible or epidemiologically important pathogens, in which standard precautions may be insufficient to prevent transmission.

The three main categories of transmission-based precautions in the hospital setting are contact precautions, droplet precautions (or direct deposition) and airborne precautions. Annex B describes in more detail the types of precautions that should be taken when patients are infected with different types of organisms.

While it is preferable to separate patients with contagious illnesses in different rooms, when isolation

rooms are lacking, it is possible to cohort patients infected with the same disease in a single ward. Signages illustrating the type of transmission-based precaution that should be taken before entering an isolation ward or an isolation room, must always be clearly visible for all to see.

Visiting patients who are on transmission-based precautions should be restricted. If visitors are allowed to be within 2 meters of these patients, they should perform hand hygiene and wear PPE like HCW.

Components of transmission-based precautions are:

1. Special accommodations or isolation (i.e. single room, space between beds, separate toilet, cohorted bays, specialized ventilation, etc. – the correct amenities should be present i.e., hand sanitizer, a handwashing station with paper towel, liquid soap and non-touch taps for soiled hands, yellow pedal-operated bins, and donning and doffing stations);
2. Signage (i.e., posters on types of precautions to take before entering the room, on donning, on doffing and on hand hygiene);
3. Types of PPE to wear;
4. Dedicated equipment (if available or else careful cleaning of equipment in between patients) and additional cleaning;
5. Limit transport if possible or make patient wear necessary PPE if he / she will be transported;
6. Communication (i.e., to the patient, to the patient's relatives or visitors and to the destination when patients are being transported so that appropriate precautions can be taken).

4.7.1 Airborne transmission precautions

These apply to situations in which pathogens can be transmitted by the airborne route, that is, by staying in the air for prolonged periods of time (e.g., tuberculosis, measles, smallpox and chickenpox).

What are airborne precautions?

Restrict susceptible healthcare personnel from entering the room of patients who are under airborne precautions. HCW should wear a fit tested and approved N95 / FFP2 or higher-level respirator.

If available, patients can be placed in an airborne infection isolation room (AIIR) with a negative pressure ventilation and a minimum of 12 air changes per hour.

Limit transport and movement of patients. However, patients can be moved outside of the room for medically necessary purposes. If transport or movement outside an AIIR is necessary, instruct patients to wear a surgical mask, if possible, and observe respiratory hygiene with cough etiquette.

Immunize susceptible persons as soon as possible following unprotected contact with vaccine-preventable infections like measles.

Some international organizations require that light splash precautions be followed for all airborne precautions. In line with many other international institutions, this is not needed in Mauritius i.e., splash precautions should be followed only in accordance with standard precautions. For example, aerosol precautions (which are followed during aerosol generating procedures) include both airborne precautions as well as splash precautions.

4.7.2 Droplet transmission / direct deposition precautions

These apply to situations in which pathogens can be transmitted by large particles that don't stay in

the air for too long (e.g., mumps, rubella and influenza).

What are droplet precautions?

Isolate the patient and instruct him / her to follow respiratory hygiene with cough etiquette. Don mask upon entry into the patient room or patient space.

Limit transport and movement of patients. However, patients can be moved outside of the room for medically necessary purposes. If transport or movement outside of the room is necessary, instruct the patient to wear a mask.

Some international organizations require that light splash precautions be followed for all droplet precautions. In line with many other international institutions, this is not needed in Mauritius i.e., splash precautions should be followed only in accordance with standard precautions, in other words, based on the risk assessment.

4.7.3 Contact transmission precautions

These apply to situations in which pathogens can be transmitted by direct or indirect contact (e.g., methicillin-resistant *Staphylococcus aureus* and certain carbapenem resistant organisms).

What are contact precautions?

Isolate the patient. Wear a gown and gloves for all interactions that may involve contact with the patient or the patient's environment. Donning PPE upon room entry and properly discarding before exiting the patient room is done to contain pathogens.

Limit transport and movement of patients. However, patients can be moved outside of the room for medically necessary purposes. When transport or movement is necessary, cover or contain the infected or colonized areas of the patient's body. Remove and dispose of contaminated PPE and perform hand hygiene prior to transporting patients on contact precautions. Don clean PPE to handle the patient at the transport location.

Use disposable or dedicated patient-care equipment (e.g., blood pressure cuffs). If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient.

Prioritize cleaning and disinfection of the rooms of patients. Ensure that rooms are frequently cleaned and disinfected as per set guidelines and protocols focusing on frequently touched surfaces and equipment in the immediate vicinity of the patient.

Contact precautions can be divided into several types:

1. Simple, elementary or basic contact precautions: one pair of gloves + gowns +/- apron (+ use of alcohol sanitizers as needed). This is used for most of the infections that are transmitted by contact.
2. Contact Plus precautions: one pair of gloves + gowns +/- apron (+ use of soap and water as needed). This is used for spore-producing organisms which are not destroyed with alcohol e.g., *Clostridium difficile* infections.
3. Enteric precautions: one pair of gloves + gowns + dedicated toilets +/- apron (+ use of alcohol sanitizers as needed). If dedicated toilets are not available, dedicated commodes can be used. These types of precautions are used for organisms transmitted via the fecal-oral route e.g., cholera.
4. Enhanced or maximum contact precautions: two pairs of gloves + bonnet / cap / hood + coverall / Hazmat suit + boots / overshoes + impermeable apron (+ use of alcohol sanitizer as needed). This is used for HCIDs e.g., Ebola. No part of the skin should be left exposed.

5. Light splash precautions: one pair of gloves + impermeable gown or apron + face shield or goggles + covered shoes or crocs. This is used when minor exposure to bodily fluids is expected.
6. Heavy splash precautions: one pair of heavy-duty gloves (elbow-length is preferred) + gown + impermeable apron + face shield or goggles + caps + boots. This is used when extensive exposure to bodily fluids is anticipated.
7. Hair protection: Cap / bonnet. This is used to prevent hair from contaminating certain areas e.g., during surgery, preparing food in the kitchen or when preparing specific medications. It can also be used when in close contact with patients infected with lice.

Given the discomfort and excessive heat, staff should not use maximum contact precautions for more than one or two hours at a time while basic contact precautions can be used for a maximum of 4 hours at a time. A minimum of 30 minutes' break should be allowed before reusing contact precautions.

A few international organizations do not consider the wearing of gowns and gloves to be a minimum requirement for contact precautions, i.e., gowns should be worn only if the staff's clothes or skin will be in touch with either the patient's surroundings or with the patient while gloves should be worn only when contact with bodily fluids is expected.

However, in Mauritius, as per recommendations of multiple other international institutions, if a patient is under contact precautions, then at the very least, gowns and gloves should always be worn as soon as the healthcare worker steps into the patient's surroundings which is traditionally defined as being one meter around the patient.

4.7.4 Isolation facilities

Isolation is defined as the separation of a person suspected or confirmed of having a contagious illness from other people.

Source isolation is the physical separation of one patient from another in order to prevent the spread of infection. Protective isolation, sometimes referred to as reverse barrier nursing, is the physical separation of a patient at high risk from common microorganisms carried by others. The aim of protective isolation is to prevent the transmission of infection to an immunocompromised patient.

Isolation areas should preferably be single rooms with attached bathrooms and toilets. A PPE station should be present outside of the isolation rooms to facilitate the donning and doffing of PPE. Donning and doffing areas should be well separated from each other and should be equipped with a sanitizer or a handwashing basin and a bin.

Whenever possible, zoning with clearly demarcated areas and unidirectional flow of traffic should be practiced. A proper signage at the door of the isolation room should be displayed – this poster must accurately guide the people entering the room as to which PPE they should wear and what precautions must be taken when seeing the patient. The sign must be removed when the room is unoccupied.

Patients' charts and notes must be kept outside of the isolation room/area.

See the national SOP and guidelines on isolation for more details. It is noted that patients who are under droplet precautions do not have to be in a separate room – they can be placed 2m away from other patients and be asked to wear a mask. Patients under contact precautions can also be placed 2m from other patients. Patients under mosquito precautions are placed under bed nets and don't need a separate room either. However, separate rooms can be used if available. On the other hand, a separate room is necessary for patients under airborne precautions (which include HCIDs).

It is emphasized that contagious patients including patients colonized or infected with multi-drug resistant organisms should be isolated as soon as possible, typically within one hour after the treating team or the ward has been informed and definitely within 24 hours. Contingency plans should be in

place and implemented whenever space is not available.

To facilitate the isolation process, it is the treating team's duty to inform the destination of the contagiousness of the patient whenever he / she is being transferred. This is particularly important when the patient is being transferred from a private healthcare facility to a public one (or vice versa) or when the patient is being moved from one regional hospital to another.

4.7.5 Optimization of workflow

Having dedicated nurses for isolated patients is often not possible due to constraints in human resources. Hence, proper management of staff resource is important to minimize the risk of cross-infections without compromising workflow.

- Clearly demarcate "clean" and "contaminated" areas to reduce cross-contamination. Staff who are on the contaminated side can request for help from others who are on the clean side without the need to move from one side to the other.
- Minimize entry by using remote monitoring (e.g., cameras or intercoms) when possible.
- Group tasks (e.g., medication administration, wound care) to minimize the frequency of entering and exiting isolation rooms.
- Work closely with infection control teams, cleaning staff, and other healthcare providers.
- Hold daily or shift-based meetings to update the team on patient status and address concerns.
- Use structured communication tools (e.g., SBAR: Situation, Background, Assessment, Recommendation) during shift changes.
- Rotate nurses to avoid fatigue and ensure adequate rest periods.

4.7.6. Choosing the right PPE

A risk assessment should always be carried out to decide which PPE to wear – this is based on the activity as well as the infection risk present. This is displayed in the following table.

Procedure / area	**Precautions**	**PPE**
Contact with uninfected patients, triage with social distancing, transporting patients in a vehicle but without contact with the patient	Standard precautions	As per risk assessment
Infected patients: close interview, physical examination, routine care, transporting patient while in contact with the patient	Transmission-based precautions	Based on the mode of transmission of the disease
Infected patients: manipulation of lab samples	Transmission-based precautions and light-splash precautions	Can include gowns and goggles / face shields
Cleaning	Transmission-based precautions and light or heavy splash precautions depending on the level of cleaning	Can include boots and heavy duty gloves
Aerosol generating procedures	Airborne precautions and light splash precautions	Respirator (N95, FFP2, FFP3), fluid-resistant gowns, goggles / face shields, gloves

Table 3

4.8 HANDLING OF LINEN

All used linen should be handled with care to avoid dispersal of microorganisms into the environment and to avoid contact with staff clothing. The following principles apply for linen used for all patients (i.e., whether or not transmission-based precautions are required):

1. Appropriate personal protective equipment must be worn during handling of soiled linen to prevent exposure of skin and mucous membrane to blood and body substances.
2. Used linen should be 'bagged' at the location of use into an appropriate laundry receptacle.
3. Used linen must not be rinsed in patient-care areas or washed in domestic washing machines. However, solid debris on soiled linen should be removed at the point-of-care through scraping into the sluice / commode / toilet prior to sending to the laundry department or else stains will be left on the linen.
4. Linen soiled with body substances should be placed into leak-proof laundry bags for safe transport.
5. Hand hygiene must be performed following the handling of used linen.
6. Clean linen must be stored in a clean and dry place that prevents contamination by aerosols, dust, moisture and vermin, and is separate from used linen.
7. Never move or carry soiled linen against the body. Always place it in the designated container to prevent spread onto the staff's clothing or gowns.
8. Carefully roll up soiled linen to prevent contamination of the air, surfaces, staff, and/or residents. Do not shake linen! Moving or shaking linens can aerosolize pathogens causing spread to others or contamination of the environment.
9. Separate carts must be used for transporting clean from contaminated linen. If this is not possible, the contaminated linen cart should be thoroughly cleaned and disinfected per facility protocol before being used to move clean linens. Regardless, clean linens and contaminated linens should never be transported or stored at the same time on a single cart.
10. Clean patient's laundry should not be stored in the laundry room with dirty or soiled linens and when transporting resident's clean laundry, it should be done to prevent contamination such as use of covers or in a container (e.g. bag, box, or drawer).

References

1. NHS, 2020. Respiratory and Cough Hygiene, UK, Harrogate and District NHS Foundation Trust. Available from:DC-09-Respiratory-and-cough-hygiene-2020-Version-1.00.pdf
2. NHS FOUNDATION TRUST, 2021, COVID 19 staffs FAQS: wearing face masks in our hospitals. Available from: https://www.ouh.nhs.uk/working-for-us/staff/covid-staff-faqs-masks.aspx
3. CDC NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, 2020. Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings. Available from: https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
4. SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH,2021. How to put on and remove a face mask. Available from: https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
5. WHO, 2009. WHO Guidelines on hand hygiene in healthcare: a summary, Switzerland,

WHO Press. Available from: https://www.who.int/gpsc/5may/tools/who_guidelines-handhygiene_summary.pdf
6. CDC, 2016. Infection Control: Transmission-Based Precautions. Available from: https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html
7. WHO, 2020. Coronavirus disease(covid-19)advice for the public: When and how to use mask. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks
8. CDC, 2018. Standard Precautions. Available from: https://www.cdc.gov/oralhealth/infectioncontrol/summary-infection-prevention-practices/standard-precautions.html
9. Siegel D Jane, 2012. Principle and Practice of Paediatric infectious diseases. Available from: https://www.sciencedirect.com/topics/nursing-and-health-professions/transmission-based-precautions
10. George Freedman, Samaranayake Lakshman P., 2012. Contemporary Esthetic Dentistry. Available from: https://www.sciencedirect.com/topics/nursing-and-health-professions/transmission-based-precautions
11. WHO, 2021. Handbook on Infection Prevention and Control for Primary Health Care Workers.
12. Guidelines for Infection Prevention and control. Jeetoo Hospital-Ministry of Health and Wellness Mauritius.
13. Isolation Guidelines, 2020. Regional Infection Prevention and Control Committee of Region 1 Mauritius.
14. NHS, 2018. What should I do if I injure myself with a used needle? Available from: https://www.nhs.uk/common-health-questions/accidents-first-aid-and-treatments/what-should-i-do-if-i-injure-myself-with-a-used-needle/
15. CDC, 2012. NIOSH Fast Facts: How to prevent latex allergies. Available from: https://www.cdc.gov/niosh/docs/2012-119/pdfs/2012-119.pdf
16. MOHW, 2018. Protocole national de prise en charge des personnes vivant avec le VIH à Maurice.
17. Infection Prevention and Control of Epidemic- and Pandemic-Prone Acute Respiratory Infections in Health Care. Geneva: World Health Organization; 2014. Annex E, Isolation rooms or areas.
18. NHS, Sherwood Forest Hospitals. Isolation Precautions for Patients with Confirmed or Suspected Infectious Illness Policy. Jan 2023.
19. https://www.ahcancal.org/Quality/Clinical-Practice/Documents/Tips%20for%20Meeting%20the%20Linen%20Requirements%20in%20SNF%20LTC.pdf

Chapter 5: Environmental Cleaning and Control

5.1 INTRODUCTION

The correct implementation and control of environmental cleaning procedures in healthcare settings is crucial in mitigating the transmission of HAIs. Of every 100 hospitalized patients at any given time, 7 in developed and 10 in developing countries will acquire at least one health care-associated infection (Danasekaran et al., 2014). Environmental cleaning is important among all cadres working in health care settings and being conversant with protocols pertaining to environmental cleaning should be one of the key components of medical and paramedical education and training.

Several factors help in the determination of environmental cleaning procedures in terms of frequency, method, and process: the probability of contamination, the susceptibility of patients to infections and the potential for exposure to pathogens.

The following table describes the hospital-acquired infections rate in different countries.

	High-Income Countries	**Low- And Middle-Income Countries**
Leading cause of infection	Urinary tract infection	Surgical site infection: • Affects up to one-third of operated patients • 9 times higher than in developed countries.
ICU-acquired infection	30% of patients in intensive care units (ICU) are affected by at least one health care-associated infection (Vincent, 2003)	At least 2─3 fold higher than in high-income countries
Health care-associated infection in newborns	In USA, 1.7 million annually, causing approximately 99,000 deaths and severe morbidity (Thomas A.Hooven, 2014)	Infection rates three to 20 times higher than in high-income countries.

Table 4

5.2 ENVIRONMENTAL TRANSMISSION OF HAI

One major way that infections can spread is via contact with fomites, especially high-touch surfaces (i.e., areas that are frequently touched like doorknobs, taps, table surfaces, etc.). Transmission may also occur via medical devices such as blood pressure cuffs as well as items that have prolonged patient contact (e.g., mattress / pillow covers or curtains). It has also been documented that some healthcare-associated pathogens can survive on environmental surfaces for months.

An effective environmental cleaning program should include:

- Organization/administration;
- Staffing and training;

- Infrastructure and supplies;
- Policies and procedures; and
- Monitoring, feedback and audit.

The following figure illustrates the role of environmental surfaces, role of environmental cleaning, and hand hygiene in breaking the chain of transmission of HAIs.

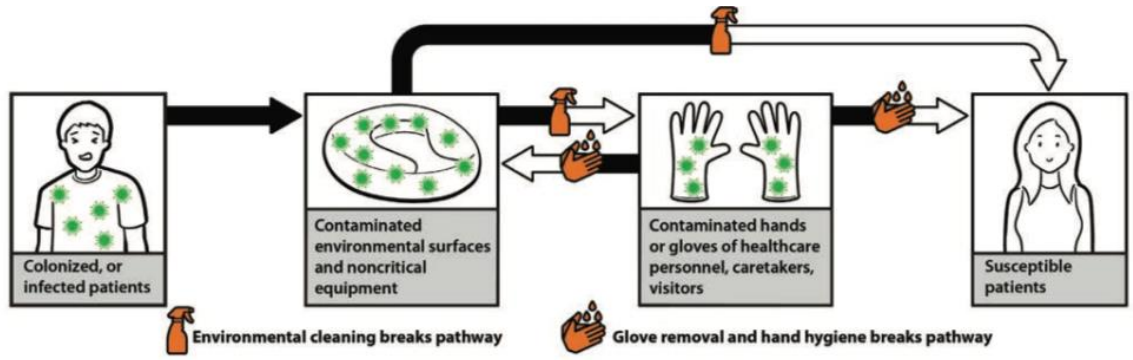


Figure 25: Contact transmission pathway. From US CDC.

Of note, normal viable counts in the hospital environment can vary depending on the international standard used and may not correlate with ongoing outbreaks or nosocomial infections. Routine environmental sampling is not recommended except under special circumstances. Expected ranges are provided in the table below.

Environment	Sampling Technique (Microbiological Parameter)	Benchmark Guidance Value*	Microbiological Indicator**
Hospitals	Dipslide (ACC 30°C/48h)	≤ 2.5 CFU/cm^2	*Staphylococcus aureus*, MRSA; MSSA
	Contact plates (ACC 37°C/48h)	≤ 2.5 CFU/cm^2	*Staphylococcus aureus*, MRSA; *Clostridium difficile*, Salmonella, Aspergillus, VRE
	ACC	< 5 CFU/cm^2	
	ATP-bioluminescence	< 100 RLU	*Staphylococcus aureus*, MRSA
	ATP-bioluminescence	< 250 RLU	
	Contact plates (TBC)	From ≤ 5 CFU/plate (operating room and other critical areas) to ≤ 50 CFU/plate (ICU and neonatology)	*Staphylococcus aureus, Aspergillus spp., Pseudomonas spp.,* Enterobacteria
	Contact plates (TBC 37°C)	- Low risk (office): ≤ 5 CFU/cm^2 - Medium risk (waiting room, lifts, counselling area): ≤ 2 CFU/cm^2 - High risk and very high risk (ICU, OT, neonatology, emergency unit): ≤ 0.2 CFU/cm^2	*Aspergillus fumigatus*
	Swabs (ACC 37°C/48h)	< 2.5 CFU/cm^2	MRSA
	Swabs (ACC 48h)	< 2.5 CFU/cm^2	*S. aureus, E. coli, P. aeruginosa, A. baumannii*

Ambulances	Swabs (TBC 37°C/48h)	≤ 5 CFU/cm^2	
Surgery Practices	Contact plates (TBC 37°C/72h; Total Fungal Count TFC 28°C/72h)	0 CFU/cm^2 (acceptable) 1-5 CFU/cm^2 (doubtful) > 5 CFU/cm^2 (not acceptable)	Enterobacteria, *P. aeruginosa*
Dental Practices	Contact plates (TBC 36°C/48h)	≤ 0.64 CFU/cm^2 (acceptable) 1.48 CFU/cm^2 (alert)	
	Swabs (TBC 36°C/48h)	≤ 1 CFU/cm^2	
Pharmaceutical Clean Rooms	RODAC plates (TBC 30–35°C/48h, then 20–25°C/72h)	Class A1: < 1 CFU/plate (walls and benches) Class B1 and B2: ≤ 5 CFU/plate (walls) and < 10 CFU/plate (benches)	*Staphylococcus spp., Micrococcus spp., Bacillus spp., Candida spp.*
		Class C: < 25 CFU/plate (walls) and < 50 CFU/plate (floor)	
		Class D1 and D2: < 50 CFU/plate (floor and walls)	
	Swabs	Class A2: < 1 CFU/swab	
	Contact plates	Surfaces: < 1 CFU/plate (sterility level A) to < 50 CFU/plate (level D)	
		Gloves: < 1 CFU/glove (zone A) to < 5 CFU/glove (zone B)	
Pharmaceuticals	Contact plates (TBC 37°C/24h, then RT/48h)	From < 0.2 CFU/cm^2 (clean rooms) to < 5 CFU/cm^2 (offices, stairs, etc.)	*Staphylococcus spp., Micrococcus spp., Bacillus spp., Candida spp.*
Food Preparation Areas (Surfaces and Tools)	Contact plates (25.8cm2 and 20–25°C/48h)	< 150 CFU/plate	*Pseudomonas fluorescens, E. coli, S. aureus*
	Contact plates (TBC)	≤ 10 CFU/cm^2 (after sanitization) TBC ≤ 10 CFU/cm^2	Total coliforms ≤ 1 CFU/cm2; absence of Salmonella and Listeria monocytogenes
	Contact plates (TBC 30°C/48h; TFC 25°C/120h)	0-2 CFU/plate (very good)	Coliforms, *S. aureus*
		3-9 CFU/plate (good)	
		10-29 CFU/plate (satisfactory)	
	Swabs (TBC)	0-8 CFU/100 cm^2 (very good)	Coliforms, *S. aureus*
		12-36 CFU/100 cm^2 (good)	
		37-116 CFU/100 cm^2 (satisfactory)	
Catering	Contact plates (TBC)	≤ 4 CFU/cm^2	Total microorganisms, coliforms, *S. aureus, E. coli, Salmonella spp., Listeria monocytogenes*
Restaurants	ATP-bioluminescence	50 RLU	*Escherichia coli*
	Swabs (TBC 30°C/24–48h)	80 CFU/cm^2	
Butcheries and Supermarkets	Contact plates (TBC)	≤ 4 CFU/cm^2	Total coliforms ≤ 1 CFU/cm^2; *E. coli*
Area Microbiologically Checked (Cooked Dishes)	Contact plates (TBC 37°C/24h and room temp./48h)	Area 1: < 5 CFU/cm^2 Area 2: < 2 CFU/cm^2 Area 3: < 0.2 CFU/cm^2 Area 4: < 0.2 CFU/cm^2	Coliforms and *E. coli*

*Table 5: TBC – total bacterial count; ACC – aerobic colony count; RLU – relative light units. Taken from: **Giovinazzo R** , Caradonna L, Giaquinta G, Mameli M, Mansi A, Marena G, Mastromartino T, Sarto D and Tomao P - Benchmark Guidance Values for Microbiological Monitoring on Surfaces: a Literature Overview - Biomedicine & Prevention issues (2017) - vol. 4 - CBRNe safety. Special issue (PART 2) - (135) - DOI:10.19252/000000087. * For total counts unless otherwise specified. ** These organisms should be absent or <1 CFU/cm^2 unless otherwise specified.*

5.3 ENVIRONMENTAL CLEANING SERVICE AREA

There should be a designated environmental cleaning service area within the facility for preparation, storage, and reprocessing of reusable cleaning equipment and supplies. This area should not be used for any other purposes. For multi-story facilities, it is best practice to have one of these areas on each floor.

The designated environmental cleaning area should:

- be well-ventilated and illuminated (lighting or window access);
- be labelled with a biohazard sign on the door;
- have an appropriate water supply (hot and cold water access, if feasible);
- have a utility sink/floor drain for safe disposal of used solutions;
- be designed so that, whenever possible, buckets can be emptied into the utility sink / floor drains without lifting them or creating splashes;
- have a dedicated handwashing sink, used only for handwashing;
- have appropriate PPE available;
- have enough space to keep reprocessing (dirty areas) separate from storage areas for cleaned equipment;
- be easily accessible in relation to the areas it serves (i.e., easily accessible throughout the facility);
- be appropriately sized to the amount of materials, equipment, and chemicals stored in the room/area;
- have posters serving as reminders for all environmental cleaning products, manufacturer's instructions, and job aids for preparation of cleaning and disinfectant solutions;
- never contain personal clothing or grooming supplies, food or beverages;
- there should be a separate area for cleaning staff to store these items;
- have safe chemical storage and access;
- have locks fitted to all doors to restrict access only to cleaning staff;
- be free from clutter; and
- have washable surfaces (floors, walls, shelves).

5.4 ENVIRONMENTAL CLEANING AND WASH INFRASTRUCTURE

All healthcare facilities must have adequate water supply and sanitation infrastructure (e.g., safe wastewater disposal) so that environmental cleaning can occur according to best practices. Access to basic water, sanitation, and hygiene (WASH) services in healthcare facilities is important to improve the ability of facilities to implement effective environmental cleaning programs.

5.5 AIR AND VENTILATION

The CDC has recommended a layered approach to mitigate transmission of airborne microorganisms like tuberculosis. One of the most emphasized components is proper ventilation. In under-resourced countries, this can be achieved by open windows and doors, when weather conditions allow, to increase outdoor air flow.

In developed countries, isolation rooms equipped with negative pressure ventilation are used to pull any potential contaminants out of the area and exhaust them to the outside air. This prevents cross-contamination from room to room. In addition, high efficiency particulate air (HEPA) filtration can be used to theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns.

Engineers should pay attention to air changes per hour (ACH) while designing healthcare facilities.

Area	Recommended ACH
Autopsy suite	12-20
Bronchoscopy room or sputum induction room	12-20
Operating theater	≥ 20 (used to be ≥ 15)
Airborne infection isolation rooms	≥ 12
General wards	≥ 12 (used to be ≥ 6)

Table 6: The recommended air changes per hour in healthcare facilities.

The use of air conditioners should be avoided in any area where airborne pathogens may be circulating; they are difficult to clean and will recirculate contaminated air in the room, thus increasing the chance of infecting anybody who is nearby.

The term ‘laminar flow’ (LAF) implies blowing HEPA-filtered air in a unidirectional pattern at 100–400 ACH. It is controversial whether laminar flow actually reduces surgical site infections. LAF is advised during the industrial preparation of medications. LAF in biosafety cabinets is important to reduce exposure to germs. LAF in hospital pharmacies can be useful to reduce contamination during compounding of intravenous medications or to reduce exposure to cytotoxic chemical fumes. However, it is preferred that medications are prepared under industrial high-standard conditions where appropriate engineering controls are maintained instead of being prepared in the hospital setting.

Occasionally, positive pressure ventilation is necessary in order to ensure airborne pathogens do not contaminate a vulnerable patient. It is used to protect highly immunosuppressed patients e.g., after bone marrow transplants.

General indoor air quality parameters for healthcare facilities are provided in the following table.

Parameter	Normal range
Air changes per hour	≥ 12

Ventilation rate	≥ 60 L/s/person
Temperature	22-26 ºC
Relative humidity	≤ 70%
Sulfur dioxide	≤ 0.5 ppm or 1.3 mg/m^3 over 8h
Nitrogen dioxide	≤ 100 ppb over 1h
Hydrogen chloride	≤ 1 ppm or 2 mg/m^3 over 8h
Hydrogen sulfide	≤ 5 ppm or 7 mg/m^3 over 8h
Carbon dioxide	≤ 1,000 ppm or 1,800 mg/m^3 over 8h
Carbon monoxide	≤ 9 ppm or 10 mg/m^3 over 8h
Ozone	≤ 0.2 ppm or 0.4 mg/m^3 over 15 min
Formaldehyde	≤ 2 ppm or 2.5 mg/m^3 over 15 min
Total volatile organic compounds	≤ 3 ppm
Particulate matter 2.5	≤ 35 µg/m^3 over 24h
Particulate matter 10	≤ 150 µg/m^3 over 24h
Particulate matter 0.3, 0.5, 1.0 or 5.0	≤ 10 mg/m^3 over 8h
Total particular matter or suspended particulate matter	≤ 150 µg/m^3
Air filtration	Not relevant in most locations except for special places (e.g., use MERV 16 in the OT)

Table 7: Taken from "Survey report for review the ventilation, HVAC systems and allied services at all haemodialysis units for the Ministry of Health and Wellness" by AXIS Engineers Ltd (K. Sungker et al.), Dec 2024. Data was generated from standards of ANSI, ASHRAE, NAAQS, UK Workplace protocols and Singapore guidelines. Parameter values can vary by organization, by survey method and by year of publication.

5.6 CLEANING AND DISINFECTION

Cleaning is the removal of foreign material (e.g., soil, and organic material) from objects and is normally accomplished using water with detergents or enzymatic products.

Disinfection is the reduction in the number of bacteria, viruses, or fungi to a low concentration. To ensure proper and effective disinfection, it is important to first clean the surface and remove visible dirt, food particles and debris, and then rinse to remove any residue. Application of a disinfectant done using the correct dilution and contact time, according to the manufacturer's instructions, and then rinsing with water completes the disinfection process.

Chlorine is an effective and cheap disinfectant. However, it can bleach and erode certain surfaces and equipment. The recommended concentration for disinfection is 0.5% chlorine for the cleaning of spills, 0.1% for healthcare facilities in general and 0.05% for hand hygiene. Instead of sodium hypochlorite, for some non-flammable surfaces and equipment, 70-90% alcohol can be used for disinfection.

The contact time for each disinfectant should be strictly respected. For instance, the wet contact time for chlorine is usually 10 to 20 minutes. Of note, chlorine solutions and certain other disinfectants are inactivated by the presence of organic matter (blood, other proteinaceous material and dirt), heavy

metal ions, low temperature, or ultraviolet irradiation – under these conditions, the contact time can increase significantly.

Sterilization which is the complete elimination of all microorganisms, may be required under certain circumstances – see the section on Spaulding classification in chapter 4 for more details.

For more details on the cleaning techniques that should be used, see the document entitled “Standard operating procedures for the cleaning of healthcare facilities in the public health sector”.

A minimum of one toilet should be available for every 20 patients. The patient bathroom and the staff bathroom should preferably be separate in order to reduce the risk of cross-contamination.

5.6.1 Steps to follow during cleaning

1. Conduct a visual preliminary site assessment.
2. Ensure that the patient status does not pose a challenge to safe cleaning.
3. Ascertain that you have sufficient supplies of PPE, water and disinfectants before proceeding.
4. Assess for any obstacles (e.g., clutter) or issues that could pose a challenge to safe cleaning.
5. Report any damaged or broken furniture or surfaces to the supervisor/management.

5.6.2 The 3-bucket cleaning system

A 3-bucket system can be used when cleaning with disinfection is required e.g., for the surroundings of patients carrying infectious pathogens, in isolation rooms or in the flu clinics. When cleaning only is needed e.g., in cases where patients are not carrying transmissible pathogens, in most corridors and waiting areas, a 2-bucket system is sufficient. The steps that should be followed in the 3-bucket system are as follows (also, see the next figure):

1. Wear appropriate PPE.
2. Fill bucket 1 with water and with all-purpose cleaning solution (soap).
3. Fill buckets 2 with clean water.
4. Fill bucket 3 with sodium hypochlorite or another disinfectant at the correct concentration.
5. Place the mop / cloth rag into bucket 1 and squeeze excess water off.
6. Clean part of the floor or surface.
7. Rinse the mop / cloth rag in bucket 2 and squeeze excess off.
8. Place the mop / cloth rag in bucket 3 and squeeze excess off.
9. Disinfect the floor or surface.
10. Once you have rinsed your mop / cloth rag in the clean water in bucket 2, repeat steps 2-9 until the room is completely cleaned.
11. Once the room is cleaned, empty all buckets down the toilet / sluice, rinse the buckets with warm water, empty down the toilet / sluice and repeat steps 1-9 for all other rooms.

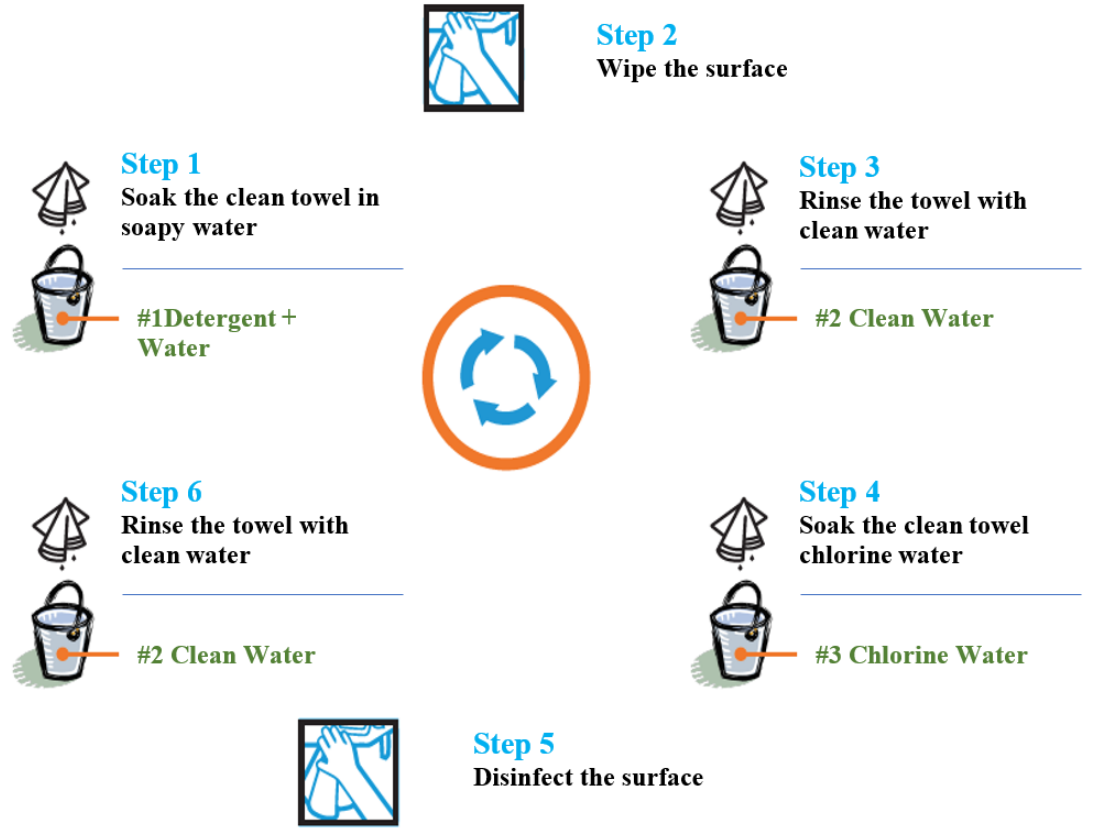


Figure 26: How to implement the 3-bucket system.

Rooms should be cleaned from the clean side to the dirty side – see the attached figure.

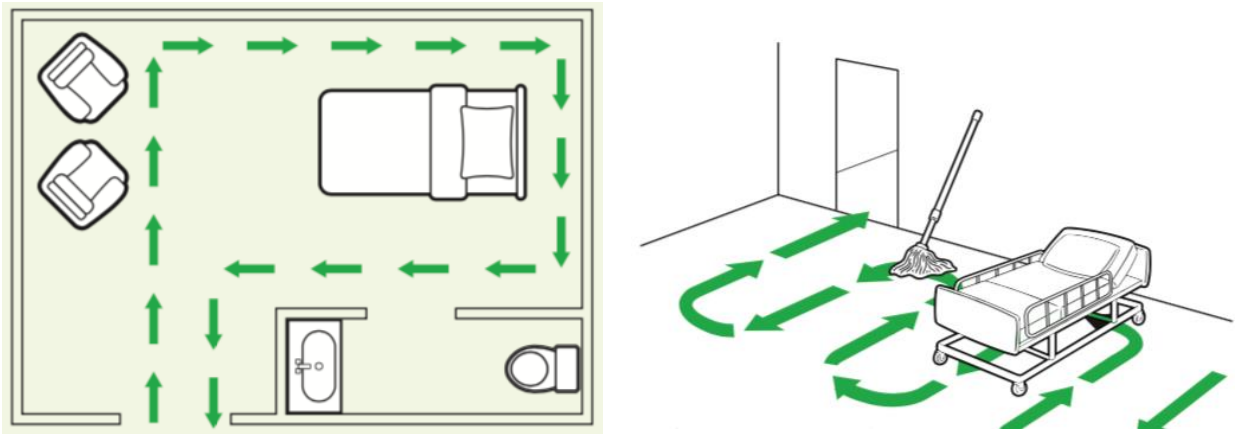


Figure 27: Example of a cleaning strategy for environmental surfaces, moving in a systemic manner around the patient care area. Source: WHO.

5.6.3 The limitations of fumigation

As per the CDC, WHO and the Healthcare Infection Control Practices Advisory Committee (USA, 2003), fumigation, misting, spraying and fogging, especially with formaldehyde or hypochlorite solution, are usually not indicated to control outbreaks nor to kill multi-drug resistant organisms. It is not an effective cleaning method, is time-consuming and the fumes are often toxic (i.e., irritating to mucous membranes of the nose and eyes). Similarly, data on fogging with quaternary ammonium compounds are limited and suggests it is ineffective.

However, fogging with hydrogen peroxide, misting with ozone or irradiation with ultraviolet light may be used in certain specific situations to control some outbreaks – seek expert advice before using these techniques. In all situations, proper cleaning is of paramount importance and efforts, especially in low- and middle-income countries should continue to focus on the right cleaning technique.

5.6.4 Types of cleaning procedures

Routine cleaning

During routine cleaning, concentrate on the following areas: high-touch surfaces (e.g., light switches, bed rails, bed frames, moveable lamps, tray table, bedside table, handles, IV poles and blood pressure cuff), non-critical medical equipment, bathrooms and floor. Annexes C and D describes the recommended cleaning protocol in more detail. The usual PPE that should be worn during cleaning is heavy-duty gloves, waterproof apron and boots. Additional PPE may be required (e.g., mask and face shield) depending on the transmission-based precautions in place in the area being cleaned.

Terminal or discharge cleaning

If a patient room or bed becomes vacant (e.g., the patient is discharged, is transferred or dies), terminal/discharge cleaning is indicated. Perform routine cleaning and furthermore, concentrate on cleaning difficult to reach areas of the room, low-frequency touch surfaces, the bed, its headboard, disinfect sideboards, change the bed sheet, remove waste and linen, clean corners of the room, decontaminate drawers and do a thorough cleaning of the bathroom. If the patient had a contagious illness, curtains should be removed for cleaning.

Deep cleaning

Deep cleaning is indicated during otherwise unmanageable outbreaks of infections or whenever recommended by the Infection Prevention and Control Team. This is a rigorous cleaning using a manual process: vacate the area of all patients, remove as many furniture as possible, curtains should be taken off and cleaned; all disposable supplies must be discarded; floors should be steam cleaned (or scrubbed and destained); vents, radiators, fans and air conditioners are disinfected thoroughly; and all surfaces are chemically cleansed while mattresses are decontaminated. All clinical and non-clinical equipment, fixtures and fittings must be disinfected.

Cleaning of spills

Always use appropriate PPE when cleaning spills like blood or vomitus. Wipe the spill with a towel. Dispose of the towel in a bin for infectious waste (do not soak the towel in water since it is highly infectious). Clean the spill with soap and water. Disinfect the area with 0.5% chlorine and wait for a contact time of 10 minutes. Always remember to perform hand hygiene before and after cleaning procedures.

Do not mop the area when organic material is still present since this will spread the microbes. Do not pour liquid disinfectant directly on organic material since this can lead to splash injury and to the spread of microbes when the liquid flows on the surface.

Controversies exist with regards to the application of 0.5% to 1% hypochlorite to the absorbent towel when it is used to absorb organic material. Some articles suggest that such concentrations of hypochlorite are easily deactivated by blood and therefore, routine cleaning without disinfectants should be performed first (Bloomfield et al., 1989). However, absorbent granules containing up to 60% chlorine (e.g., sodium dichloroisocyanurate) can be effective when available. Since the latter is not routinely utilized in the public facilities of Mauritius, when dealing with spills from patients infected with *high-consequence infectious diseases*, it is proposed that healthcare providers follow the steps below:

- Perform hand hygiene

- Wear full PPE
- The absorbent towel should be soaked in 1% hypochlorite
- Leave the towel on the spill for 15 minutes
- Dispose of the towel in a yellow bin
- Clean the area with soap and water
- Use another absorbent towel soaked in 1% hypochlorite to wipe the surface
- Leave for a contact time of 15 minutes
- Remove PPE – throw away all PPE including thick gloves
- Perform hand hygiene

The use of spill kits can facilitate the above process and reduce missteps.

5.6.5 Formula to make a diluted solution of chlorine

$$\left(\frac{\%\ chlorine\ in\ concentrated\ solution}{\%\ chlorine\ in\ desired\ solution}\right) - 1 = Total\ parts\ of\ water\ for\ each\ part\ of\ concentrate$$

Grams / liter = [% dilute/% concentrate] x 1000.

For example, to make a 0.5% dilute chlorine solution from a dry powder of 35% calcium hypochlorite = [0.5%/35%] x 1000 = 14.2 g. Hence, add 14.2 grams of dry powder to 1 liter of water or 142 grams to 10 liters of water.

To make 0.5 % chlorine from 4% sodium hypochlorite solution:

$$\left(\frac{4\%}{0.5\ \%}\right) - 1 = 7$$

Therefore, for every part of concentrate, add 7 parts of water. Ratio of concentrate to water is 1:7.

5.6.6 Cleaning frequency

The following table provides information on the frequency of cleaning. Not all areas need to be disinfected. Abuse of disinfectants is a waste of resources that is often seen among staff with poor knowledge in IPC. See annex D for the national cleaning schedule which contains more details.

Area	Frequency	Method	Process
Waiting/admission	At least twice a day	Clean floors and disinfect high-touch surfaces	High-touch surfaces and floors
Consultation	At least twice a day	Clean floors and disinfect high-touch	High-touch surfaces and floors

		surfaces	
Procedural (minor operative procedures e.g., draining abscesses, suturing wound)	Before and after each procedure	Clean and disinfect	High-touch surfaces and floors with emphasis on the patient zone, procedure table
All	Scheduled basis (weekly, monthly) and when visibly soiled	Clean	Weekly: High surfaces like walls, baseboard, corner, tops of cupboards, vents Monthly: windows, bed curtains, low-touch surfaces Annually: window curtains
In-patient wards	At least twice a day	Clean floors and disinfect high-touch surfaces	High-touch surfaces and floors
Spills	Immediately, as soon as possible	Clean and disinfect Do not use combined detergent-disinfectant product Use intermediate-level disinfectant	Spill area
Isolation wards / rooms	At least three times a day	Clean and disinfect	High-touch and low-touch surfaces Any surface (e.g., walls) that is visibly soiled with blood of body fluids Clean floors with neutral detergent and water

Table 8: The recommended cleaning frequencies for different areas in a healthcare facility.

The following table explains that disinfectants can be used during cleaning in areas where patients are placed under transmission-based precautions or whenever outbreaks are occurring in certain locations.

Type of cleaning		STANDARD CLEAN To be conducted on a ongoing basis whilst patients are occupying functional area.					DISCHARGE CLEAN To be conducted after a patient is discharged, transferred or deceased and BEFORE a new patient occupies the environment		SPOT & SPILL CLEAN To be conducted whenever elements appear visibly unclean or when there is a spillage of blood or body fluids
		Cleaning frequency			Cleaning method		Cleaning method		Cleaning method
		High risk functional area	Moderate risk functional area	Low risk functional area	Standard Precautions – use detergent	Transmission-based precautions – use Detergent AND disinfectant	Standard Precautions – use detergent	Transmission-based precautions – use Detergent AND disinfectant	The affected area where the "spot or spill" has occurred must be cleaned as soon as possible. Applying transmission-based precautions if the spot or spill is blood or body fluid (e.g. blood, urine, faeces etc.) Apply standard precautions for all other circumstances
Standard clean (No confirmed or suspected "cases")		✓ All elements	✓ All elements	✓ All elements	✓		✓ Applies to selected elements only		
Transmission-based clean (There are confirmed or suspected "cases")	**A Single case**	✓ As per "standard clean Above	✓ As per "standard clean Above	✓ As per "standard clean Above		✓ Apply to the LOCALISED area the isolated "case" is occupying only		✓Applies to selected elements in the LOCALISED area the isolated "case" was occupying	
	B Outbreak clean*	Cleaning frequency is upgraded to "very high risk" for all elements for the duration of the outbreak				✓ Apply to the WHOLE functional area		✓Applies to selected elements for the WHOLE functiional area	

NOTES

Case(s) = is a patient who has been confirmed/suspected to be colonised or infected with multidrug-resistant organism (MRSA, VRE, MRGN), infectious respiratory pathogen, infectious gastroenteritis, *Clostridioides difficile* or other pathogen of epidemiological significance.

Isolation = single, unrelated cases*.

Outbreak = An outbreak is defined as (1) occurrence of more cases* of disease than expected in a given area among a specific group of people over a particular period of time; OR (2) two or more linked cases of the same illness.

Table 9: When to clean vs clean and disinfect, in the hospital setting. Source: "Cleaning standard for South Australian Healthcare Facilities 2021. Government of South Australia. 2021."

5.6.7 Disinfectants

There are multiple different types of disinfectants that are available for use in Mauritius. Readers should refer to the national SOPs on this topic for further details.

The steps to follow when choosing an appropriate disinfectant are:

1. Use the national SOP on antimicrobial spectra to select which disinfectants have activity on the microbes likely to be present in the environment.
2. Follow the Spaulding classification to select which disinfectants from the above set will have the activity required to decrease the concentration of microbes to below the expected threshold for the item being disinfected. The concentration of the disinfectant can also be picked using the national SOPs. See the national SOP on environmental cleaning for details.
3. Select the most appropriate disinfectants from those in step 2 based on the type of surface being cleaned i.e., based on material compatibility. See the national SOP on environmental cleaning for additional details.

Remember that some disinfectants can be toxic and corrosive. Exercise caution when using them. Moreover, do not store disinfectants in dirty bottles, do not dip equipment for prolonged periods of time in disinfectants and do not expose disinfectants to the air for a long duration of time.

5.6.8 PPE required

The following table explains what PPE to wear during cleaning procedures.

Type of cleaning task	Required PPE for cleaning staff
Routine cleaning (standard precautions)	Face mask, disposable gloves
Terminal cleaning (standard precautions)	Face mask, reusable gloves
Blood and body fluid spills and high contamination risk areas (e.g., cleaning bed of incontinent patient, labor and delivery wards)	• Gown and/or plastic apron • Reusable rubber gloves • Face mask with face shield
Droplet precautions (routine and terminal cleaning)	• Gown and/or plastic apron • Reusable rubber gloves • Face mask with face shield
Contact precautions (routine and terminal cleaning)	• Gown and/or plastic apron • Reusable rubber gloves • Face mask with face shield
Airborne precautions (routine and terminal cleaning)	• Respirator (N95 / FFP2), fit tested • Reusable rubber gloves
Preparation of disinfectant product and solutions	• Chemical-resistant gloves • Gown and/or apron • Face mask with face shield

Table 10: Recommended personal protective equipment for environmental cleaning tasks.

5.6.9 Management of bed bugs

When a patient's bed is infested with bed bugs, the following steps should be followed:

1. Change the patient's clothes.
2. Linen, curtains and clothes should be laundered in hot water at > 60°C.
3. Vacuum clean the room.
4. Steam clean the beds, sofas and chairs.
5. Clean bedframes and furniture with 90% alcohol.
6. After 10 days, repeat the vacuum cleaning and steam cleaning exercises.
7. Inspect adjacent beds and rooms to ensure that other areas are not infested.

Refer to the national SOP on management of bed bugs for more details.

5.6.10 Important points to remember

With regards to cleaning procedures, best practices include:

1. Using fresh cleaning cloths at the start of each cleaning session (e.g., routine daily cleaning in a general inpatient ward). In the public hospitals, cleaning cloths are sent to laundry prior to reuse in healthcare facilities.
2. Change cleaning cloths when they are no longer saturated with solution, for a new, wetted cloth. Soiled cloths should be sent for reprocessing.
3. For higher-risk areas, change cleaning cloths between each patient zone (i.e., use a new cleaning cloth for each patient bed).
4. Ensure that there are enough cleaning cloths to complete the required cleaning session.
5. Never double-dip cleaning cloths into portable containers (e.g., bottles, small buckets) used for storing environmental cleaning products (or solutions).
6. Never shake mop heads and cleaning cloths—it disperses dust or droplets that could contain microorganisms.
7. Never leave soiled mop heads and cleaning cloths soaking in buckets.
8. Avoid using brooms to clean contaminated areas – this can aerosolize particles.
9. Use several buckets to clean a room as opposed to using a single bucket – this prevents the disinfectant from getting contaminated.
10. Chlorine solutions should be prepared fresh daily, as they are light sensitive.
11. Always clean from outside the patient zone (the cleaner areas) toward the patient zone (the dirtier areas).
12. Always proceed from the highest area to the lowest area.
13. Change the water and mop frequently to avoid contamination e.g., clean the buckets in between each patient room.
14. Cleaning material for isolation rooms must be stored and used only in isolation. The isolation area must always be cleaned/disinfected last.
15. Mop buckets must be rinsed, dried, and stored upside-down to drain.
16. Wall washing is not routinely recommended.
17. Do not spray disinfectants – this can aerosolize microbes.
18. Bed spacing should be adequate to reduce the chances of transmitting microbes. In general wards beds should be at least 1 to 2 meters apart.
19. Furniture in healthcare settings should be:
    a. Easy to clean,
    b. Easy to maintain and repair,
    c. Resistant to microbial growth,
    d. Nonporous, and
    e. Seamless.
20. Products for environmental cleaning should:
    a. Be nontoxic,

b. Be easy to use,

c. Have an acceptable odor,

d. Be easily soluble in water, and

e. Be economical/low cost.

21. Some flooring does not tolerate hypochlorite solution – use quaternary ammonium compounds or other disinfectants as recommended by the supplier.

References

1. Prevention, C. f. (n.d.). Environmental Cleaning Procedures. Retrieved from https://www.cdc.gov/hai/prevent/resource-limited/cleaning-procedures.html
2. Thomas A. and Hooven, R. A. (2014). Healthcare-associated infections in the hospitalized neonate: a review.
3. Vincent, P. J. (2003). Nosocomial infections in adult intensive-care units. The Lancet.
4. World Health Organisation. Health care-associated infections. Retrieved from https://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf
5. Yves Chartier, Jorge Emmanuel, Ute Pieper, et al. Safe management of wastes from health-care activities. World Health Organization. 2nd edition. 2014.
6. Bloomfield SF, Miller EA. A comparison of hypochlorite and phenolic disinfectants for disinfection of clean and soiled surfaces and blood spillages. J Hosp Infect. 1989 Apr;13(3):231-9. doi: 10.1016/0195-6701(89)90003-0.
7. Coates D, Wilson M. Use of sodium dichloroisocyanurate granules for spills of body fluids. J Hosp Infect. 1989 Apr;13(3):241-51. doi: 10.1016/0195-6701(89)90004-2.
8. https://www.ashrae.org/file%20library/technical%20resources/free%20resources/publications/whitepaper_sspc-170-hvac-design-of-compounding-pharmacies.pdf

Chapter 6: Biomedical Waste Management

6.1 INTRODUCTION

The containment, handling and disposal of medical waste is important because its microbial load, hence its infectivity potential, is higher than residential waste. The triaging and categorization of medical waste is yet another mandatory step in biomedical waste management. Infectious waste should be incinerated while general waste can be disposed of through burial or landfilling.

6.2 SEGREGATION OF WASTE

The following two tables describe the different disposal methods. Note that bins for infectious waste must always be covered to reduce the risk of contamination.

Type of biomedical waste	Example	Disposal method
Sharps	1. Needle – a very fine, slender, hollow piece of metal used blood withdrawal and administering drugs 2. Syringe – device which a needle is attached to inject medication into or withdraw fluid from the body. 3. Lancet also called a "fingerstick" – principally used for blood glucose checking and monitoring 4. Auto injector, including epinephrine pens – syringe pre-filled with fluid medication designed to be self-injected into the body. 5. Infusion set 6. Connection needle/set – needle that connects to a tube used to transfer fluids in and out of the body. This is generally used for patients on home hemodialysis.	Disposed of in sharps disposal container in the first instance. Further these sharp containers are discarded for incineration or treatment plant
Infectious Waste	Infectious waste is waste contaminated with blood and other bodily fluids (e.g., From discarded diagnostic samples), cultures and stocks of infectious agents from laboratory work (e.g., waste from	Infectious waste is usually discarded in Mauritian health care settings in yellow bag

	autopsies and infected animals from laboratories), or waste from patients with infections (e.g., swabs, bandages and disposable medical devices).	
OTHERS 1. Radioactive Waste: Items used in lab research or therapy that are contaminated, including liquids, products, tubing and glassware. 2. Chemical Waste: Lab reagents, contaminated items, film developer, cleaners and disinfectant 3. Pharmaceutical Waste: Medication that is expired or contaminated 4. Containers under pressure: Gas cartridges and cylinders	This category of wastes is most prominent in specialized units e.g., oncology unit and New Cancer Center, laboratory settings and radiological departments	These types are wastes are sorted and have specific disposal methods.
General wastes	General wastes remain the most generated of waste in health care facilities.	General wastes are usually discarded in black plastic bags

Table 11: Disposal methods for different types of healthcare waste.

Color	**Type of waste**
Black	Domestic refuse and kitchen waste
Yellow	Infectious / clinical waste
Red	Soiled linen
White	Used linen

Table 12: Example of color coding of bins for waste management.

6.3 WASTE QUANTIFICATION

Not all areas in a healthcare facility produce the same amount of waste. The following table mentions which parts of the hospital produce the most healthcare waste.

Facilities
University hospital General hospital District hospital
Emergency medical care services Health-care centres and dispensaries Obstetric and maternity clinics Outpatient clinics Dialysis centres Long-term health-care establishments and hospices Transfusion centres Military medical services Prison hospitals or clinics
Medical and biomedical laboratories Biotechnology laboratories and institutions Medical research centres
Mortuary and autopsy centres
Animal research and testing
Blood banks and blood collection services
Nursing homes for the elderly

Table 13: Major sources of healthcare waste as per WHO. This table is a guide only based on data in international hospitals – no such data has been compiled for Mauritius.

A paper trail is important during waste collection for the purpose of auditing and for data collection so that policy decisions can be data-driven. The following form is an example of a document used to collect useful information whenever waste is being removed from a facility.

Date _____
Name of data collector _____
Name of health facility _____
Number of occupied beds _____
Number of outpatients _____

Department	Type of waste[a]	Weight (kg)	Volume (litre)	Notes[b]

a The type of waste should be consistent with the classifications used in the country (e.g. sharps, infectious, pathological/anatomical, chemical, pharmaceutical, radioactive or general [non-hazardous] waste). General waste may be broken down further according to types of recyclable materials.
b Improper segregation practices, descriptions of containers in use, the level of fill of sharps containers or waste bags, and accidental spills should be noted.

Table 14: Example of a data collection form for healthcare waste. The form displayed is a guide only – hospitals can develop their own data collection forms based on their needs.

6.4 RISKS ASSOCIATED WITH POOR WASTE DISPOSAL

Improper waste disposal or not wearing the right PPE when transporting waste can be associated with the transmission of microbes. The following table explains the infections that can be transmitted by healthcare waste since the latter can act as a potent fomite.

Type of infection	Examples of causative organisms	Transmission vehicles
Gastroenteric infections	Enterobacteria, e.g. *Salmonella*, *Shigella* spp., *Vibrio cholerae*, *Clostridium difficile*, helminths	Faeces and/or vomit
Respiratory infections	*Mycobacterium tuberculosis*, measles virus, *Streptococcus pneumoniae*, severe acute respiratory syndrome (SARS)	Inhaled secretions, saliva
Ocular infection	Herpesvirus	Eye secretions
Genital infections	*Neisseria gonorrhoeae*, herpesvirus	Genital secretions
Skin infections	*Streptococcus* spp.	Pus
Anthrax	*Bacillus anthracis*	Skin secretions
Meningitis	*Neisseria meningitidis*	Cerebrospinal fluid
Acquired immunodeficiency syndrome (AIDS)	Human immunodeficiency virus (HIV)	Blood, sexual secretions, body fluids
Haemorrhagic fevers	Junin, Lassa, Ebola and Marburg viruses	All bloody products and secretions
Septicaemia	*Staphylococcus* spp.	Blood
Bacteraemia	Coagulase-negative *Staphylococcus* spp. (including methicillian-resistant *S. aureus*), *Enterobacter*, *Enterococcus*, *Klebsiella* and *Streptococcus* spp.	Nasal secretion, skin contact
Candidaemia	*Candida albicans*	Blood
Viral hepatitis A	Hepatitis A virus	Faeces
Viral hepatitis B and C	Hepatitis B and C viruses	Blood and body fluids
Avian influenza	H5N1 virus	Blood, faeces

Table 15: Potential infections caused by exposure to health-care wastes, causative organisms and transmission vehicles.

6.5 GUIDING PRINCIPLES

Five principles are widely recognized as underlying the effective and controlled management of wastes. These principles have been used by many countries when developing their policies, legislation and guidance:

1. The "polluter pays" principle implies that all producers of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce. This principle also attempts to assign liability to the party that causes damage.

2. The "precautionary" principle is a persuasive principle governing health and safety protection. It was defined and adopted under the Rio Declaration on Environment and Development (UNEP, 1972) as Principle 15: "Where there are threats of serious or irreversible damage to the environment, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation".

3. The "duty of care" principle stipulates that any person handling or managing hazardous substances or wastes or related equipment is ethically responsible for using the utmost care in that task. This principle is best achieved when all parties involved in the production, storage, transport, treatment and final disposal of hazardous wastes (including health-care waste) are appropriately registered or licensed to produce, receive and handle named categories of waste.

4. The “proximity” principle recommends that treatment and disposal of hazardous waste take place at the closest possible location to its source to minimize the risks involved in its transport. Similarly, every community should be encouraged to recycle or dispose of the waste it produces, inside its own territorial limits, unless it is unsafe to do so.
5. The “prior informed consent principle” as embodied in various international treaties is designed to protect public health and the environment from hazardous waste. It requires that affected communities and other stakeholders be apprised of the hazards and risks, and that their consent be obtained. In the context of healthcare waste, the principle could apply to the transport of waste and the siting and operation of waste-treatment and disposal facilities.

6.6 ASSIGNMENT OF RESPONSIBILITIES

Effective management of health-care waste is one aspect of the continuous need to control infections. Healthcare waste management should be viewed as part of infection control, and a local waste-management plan could be developed by infection-control staff where they are present. In the larger health-care facilities where large quantities of waste are generated, a separate waste-management group or committee may be formed instead. A typical waste-management committee in a large hospital may contain the following members:

1. head of hospital (as chairperson)
2. heads of hospital departments
3. infection-control officer
4. chief pharmacist
5. radiation officer
6. matron (or senior nursing officer)
7. hospital manager
8. hospital engineer
9. financial controller
10. waste-management officer (if one is designated)

6.7 WASTE MANAGEMENT HIERARCHY

Disposal of waste is the least effective and least environmentally friendly manner to reduce waste in our society. The best method is by preventing or reducing the production of waste. Recycling can be an important way that modern societies use to avoid the accumulation of solid waste.

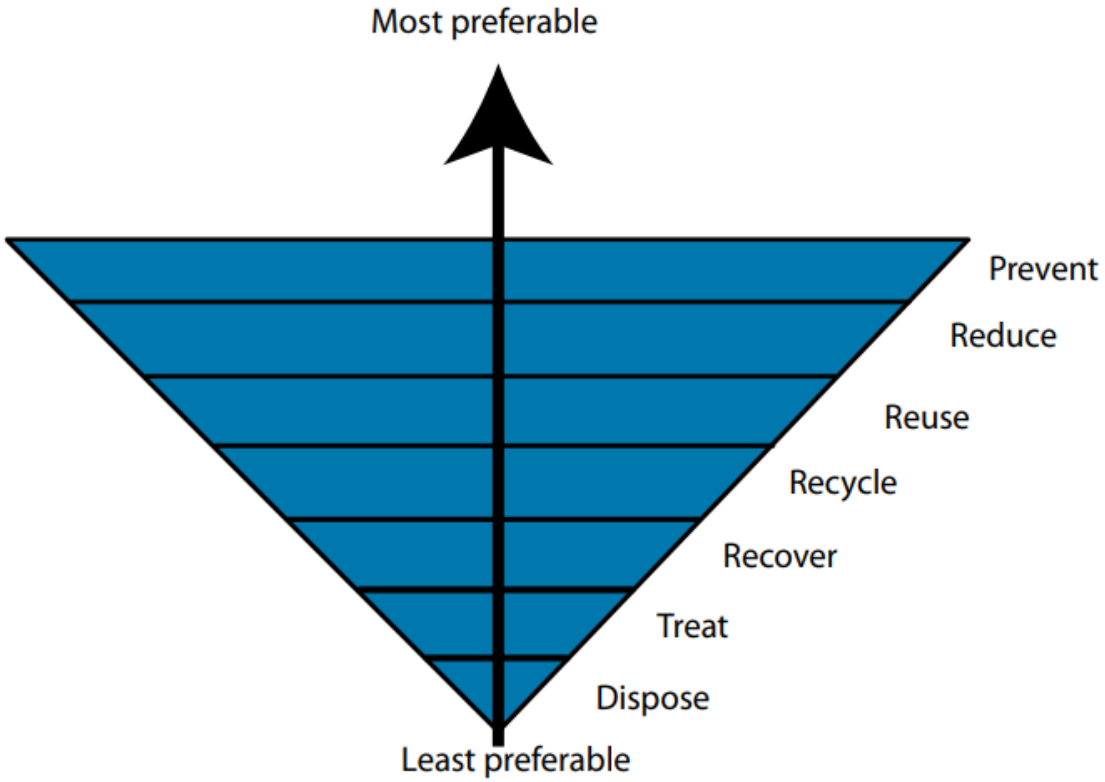


Figure 28: The waste management hierarchy.

6.8 WASTE REDUCTION

The following table gives examples of what strategies hospitals can use to reduce the production of waste in their facilities.

Category	Measures
Source Reduction	Purchasing reductions: selecting supplies that are less wasteful where smaller quantities can be used, or that produce a less hazardous waste product.
	Use of physical rather than chemical cleaning methods (e.g., steam disinfection instead of chemical disinfection).
	Prevention of wastage of products (e.g., in nursing and cleaning activities).
Management and Control Measures at Hospital Level	Centralized purchasing of hazardous chemicals.
	Monitoring of chemical use within the health centre from delivery to disposal as hazardous wastes.
Stock Management of Chemical and Pharmaceutical Products	More frequent ordering of relatively small quantities rather than large amounts at one time, to reduce the quantities used (applicable in particular to unstable products).
	Use of the oldest batch of a product first.
	Use of all the contents of each container.
	Checking the expiry date of all products at the time of delivery, and

	refusal to accept short-dated items from a supplier.

Table 16: Examples of practices that encourage waste minimization

6.9 WASTE PROCESS FLOW

The process flow of waste including sorting typically follows several stages to ensure efficient waste management, separation of infectious materials, and proper disposal of other hazardous waste like radioactive and pharmaceutical products. The process can be broken down into the steps displayed in the diagram below.

Figure 29

6.10 WASTE STORAGE

The waste shed is an important part of any healthcare facility that should be properly designed to prevent the spread of microbes and prevent contamination of healthcare workers.

6.10.1 Requirements for sheds

The following table mentions international requirements for waste storage areas.

The storage area should:

- have an impermeable, hard-standing floor with good drainage (away from watercourses); the floor should be easy to clean and disinfect;
- include the facility to keep general waste separated from infectious and other hazardous waste;
- have a water supply for cleaning purposes;
- have easy access for staff in charge of handling the waste;
- be lockable to prevent access by unauthorized persons;
- have easy access for waste-collection vehicles;
- have protection from the sun;
- be inaccessible to animals, insects and birds;
- have good lighting and at least passive ventilation;
- not be situated in the proximity of fresh food stores and food preparation areas;
- have a supply of cleaning equipment, protective clothing and waste bags or containers located conveniently close to the storage area;
- have a washing basin with running tap water and soap that is readily available for the staff;
- be cleaned regularly (at least once per week);
- have spillage containment equipment;
- be appropriate to the volumes of waste generated from each health-care facility.

Table 17: Recommendations for storage facilities for health-care waste

6.10.2 Infectious waste storage

Additional precautions should be taken when dealing with infectious waste.

- The shed for infectious waste should be locked, covered and have a biohazard sign indicating the presence of contagious material.
- Floors and walls should be sealed or tiled to allow easy disinfection.
- Untreated infectious waste or waste with a high content of blood or other body fluids cannot be disposed of offsite – all body fluids should be disposed of in the sluice first.
- While sharps can be stored without problems, other infectious waste should be kept cool or refrigerated at a temperature preferably no higher than 3 °C to 8 °C if stored for more than a week.
- Unless a refrigerated storage room is available, storage times for infectious waste (e.g. the time gap between generation and treatment) should not exceed the following periods:
    - Temperate climate:
        - 72 hours in winter
        - 48 hours in summer
    - Warm climate:
        - 48 hours during the cool season
        - 24 hours during the hot season.

6.11 MODERN WASTE DISPOSAL TECHNIQUES

Many health-care waste-treatment systems are commercially available today. The choice of technology depends on the characteristics of the waste of the health-care facility, the capabilities and requirements of the technology, environment and safety factors, and costs. Treatment technologies

employ thermal, chemical, irradiative, biological or mechanical processes. The common types of treatment technologies are:

- Autoclaves,
- integrated or hybrid steam-based treatment systems,
- microwave treatment technologies,
- dry-heat treatment technologies,
- chemical treatment technologies, and
- incinerators.

These technologies could be supplemented by post-treatment shredders, grinders and compactors. For most technologies, except incinerators, validation testing is needed to ensure that a minimum level of disinfection can be achieved.

Autoclaves come in a wide range of sizes and can be classified according to the method of air removal. Integrated steam-based treatment technologies incorporate various mechanical processes to improve treatment efficiency.

Incinerators can range from small batch units to large complex treatment plants. Incinerators should have flue gas cleaning systems to minimize pollutant releases and meet national or international emission limits. Small-scale incineration is a transitional means of disposal for health-care waste. When investing in new technologies, priority consideration should be given to technologies that do not produce dioxins or furans.

Regardless of the technology, the health-care facility should have an annual budget for periodic maintenance and repair.

Healthcare facilities can work with municipal authorities and other stakeholders to gradually improve the disposal of waste in landfills. Among the desirable features of a landfill are:

- restricted access to prevent scavenging,
- daily soil cover to prevent odors, and regular compaction,
- organized deposit of wastes in small work areas,
- isolation of waste to prevent contamination of groundwater and surrounding areas, and
- trained staff.

References

1. WHO. Safe management of wastes from health-care activities. 2nd edition. 2014.

Chapter 7: Sterilization

7.1 INTRODUCTION

Sterilization of medical devices is a cornerstone of patient safety and infection prevention in hospital settings. Medical devices used in patient care, such as surgical instruments, catheters, and endoscopes, can become vectors for harmful pathogens if not properly sterilized. Ensuring these devices are sterile reduces the risk of healthcare-associated infections (HAIs), protects patient health, and supports overall hospital hygiene standards.

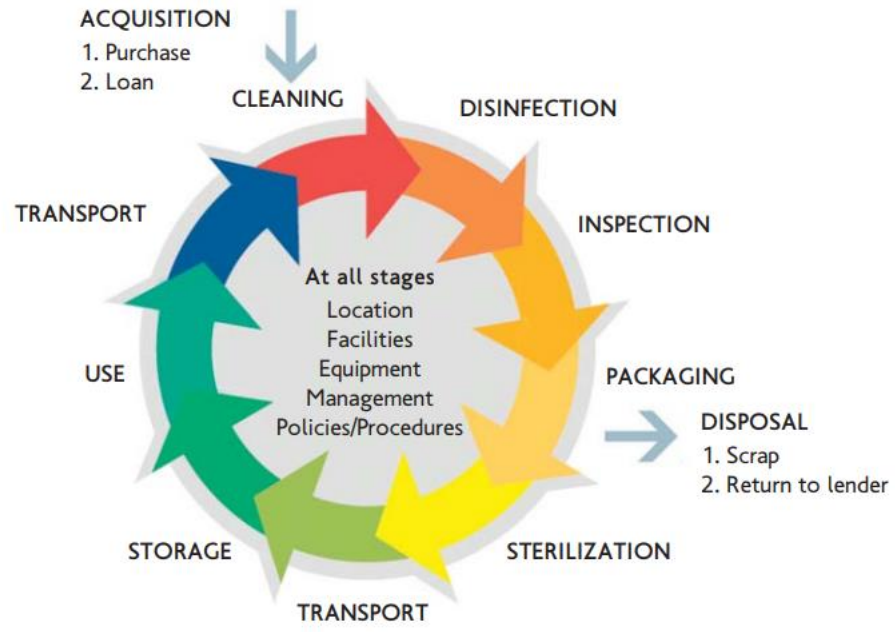
7.2 THE ROLE OF STERILIZATION IN IPC

1. **Prevention of Healthcare-Associated Infections (HAIs)**: HAIs are a significant concern in healthcare facilities, contributing to patient morbidity and mortality and increasing healthcare costs. Proper sterilization of medical devices removes bacteria, viruses, fungi, and spores that could otherwise enter a patient's body during procedures, thus minimizing the risk of HAIs and improving patient outcomes.
2. **Protection of Vulnerable Patients**: Patients undergoing invasive procedures or surgeries are particularly vulnerable to infections due to potential breaks in their body's natural defenses. Sterile medical devices are crucial for protecting these patients, especially those with compromised immune systems, newborns, the elderly, and individuals in critical care, where even minor infections can have serious health consequences.
3. **Cost Reduction and Resource Optimization**: HAIs can lead to prolonged hospital stays, increased use of antibiotics, and additional medical interventions, placing a substantial financial burden on healthcare facilities. By reducing infection rates through effective sterilization practices, hospitals can reduce costs associated with treating infections, free up resources, and improve efficiency in patient care delivery.
4. **Regulatory Compliance and Institutional Reputation**: Adhering to sterilization protocols is essential for hospitals to meet health regulations and accreditation standards. Compliance with sterilization guidelines demonstrates a commitment to patient safety, protecting the hospital's reputation and building trust among patients and healthcare providers.

7.3 LIFE CYCLE OF DECONTAMINATION

The life cycle of decontamination illustrates the salient features of decontamination, each step being as important as the next – see the next figure for details.

Figure 1. The decontamination life cycle



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

Figure 30

7.4 VALIDATION OF THE STERILIZATION PROCESS BY STEAM

It is vital that healthcare facilities ensure that sterilization has been properly carried out. This is done through the use of validation tests.

7.4.1 Pre-vacuum autoclave

- Calibrate the regulation and control elements
- Carry out a cycle with the vacuum test.
- Carry out a cycle with the Bowie-Dick test
- Implement three thermometric tests in an empty chamber in order to obtain the temperature profile at all points of the chamber

7.4.2 Displacement autoclave

- Calibrate the regulation and control elements
- Implement three thermometric tests in an empty chamber in order to obtain the temperature profile at all points of the chamber.

7.4.3 Controls/test procedures and checks

Tests are conducted to determine if the sterility levels have been obtained, once the device has been sterilized. The following table gives examples of control tests.

PROCESS	WHAT IS MEASURED AND WHEN?	
Cleaning	Daily Use of detergent and disinfectant	Per item Cleaning results by visual control or by using a cleaning test
Disinfection	Daily Use of disinfectant by concentration, temperature and pH of disinfectant	Per load Time of exposure
Chemical sterilizers		Per process Biological indicator Chemical indicators Physical indicator Per item External indicators
Moist heat (steam sterilizers)	Daily Bowie-Dick test for steam penetration in porous loads (pre- vacuum autoclave) (Helix test for hollow lumen instruments, if available.) Clean the chamber every week	Per process Biological indicator Chemical indicators Physical parameters met as per PQ Per item External indicators

Table 18: Summary of control tests. PQ – Performance Qualification protocols. Taken from the World Health Organization.

Maintenance should be carried out every 6 months for limited preventive technical control of all critical machines and annually for extensive technical control followed by validation.

It is not recommended that housekeeping staff be involved in cleaning medical devices unless they have been trained and certified and moved into the Sterilization and Supplies Department (SSD) staffing structure.

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

7.5 LAYOUT OF THE SSD

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

Basic criteria are:

- Entrance and corridors (public areas)
- Gowning points for staff to don PPE prior to entering work areas
- Dirty area receiving of used medical devices (dirty area)
- Inspection, assembly and packing [IAP] (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 SSD products)

A standard layout for the SSD is displayed below.

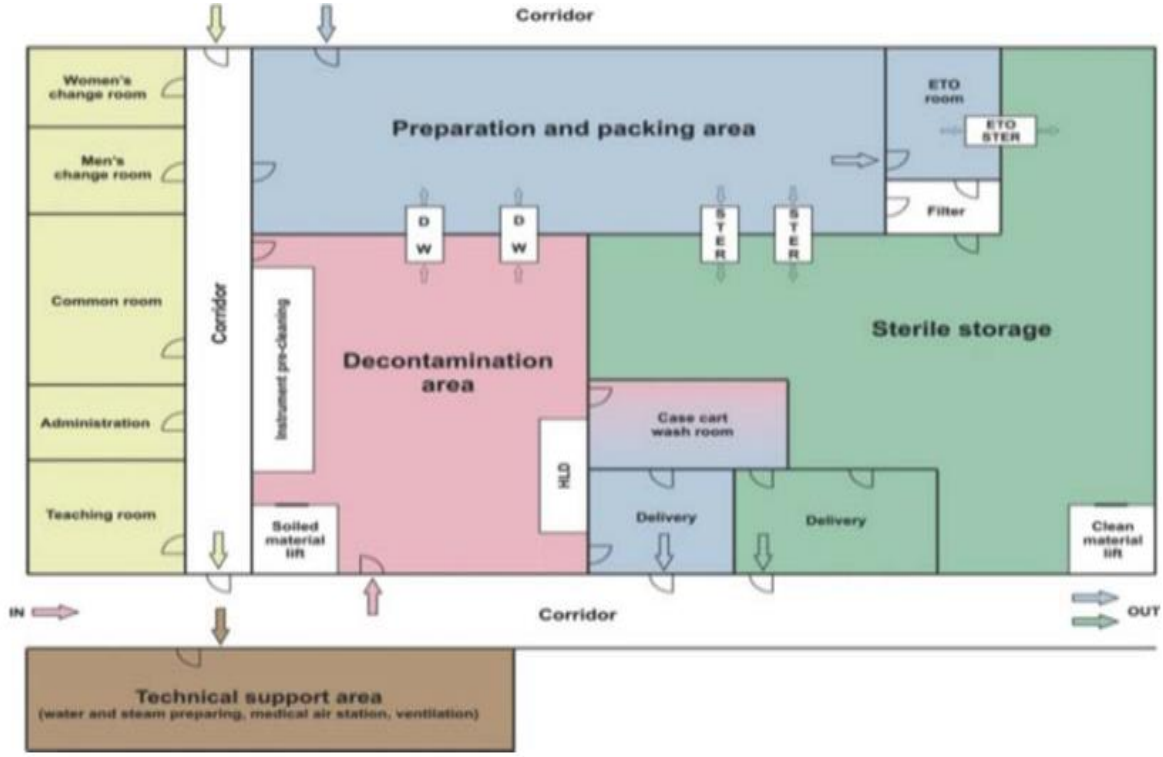
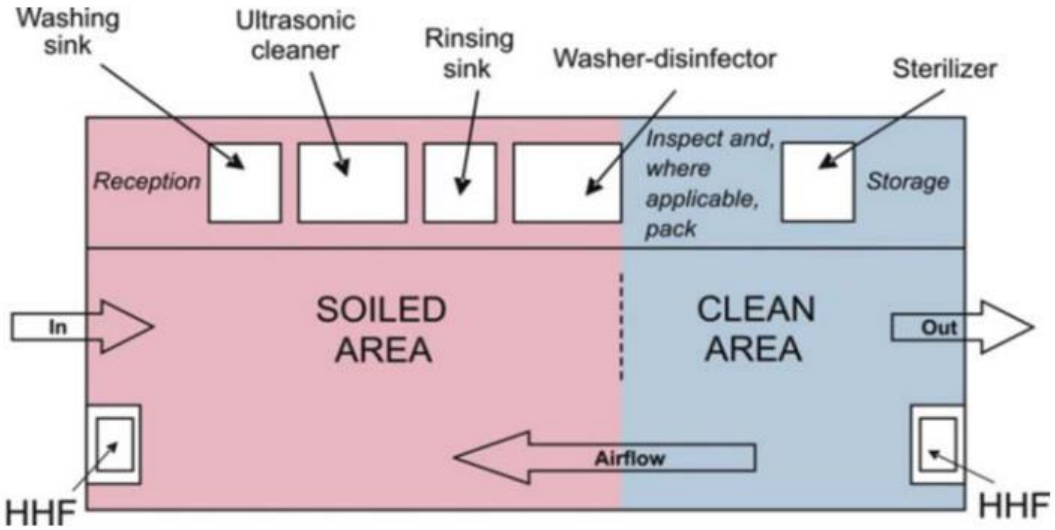


Figure 31: An example of an SSD layout. Taken from the World Health Organization.

In the dentistry area, due to constraints in physical space, the layout can be different as shown below.



HHF = hand hygiene facility

Figure 32: SSD layout inside the dentistry. Taken from World Health Organization.

7.6 VENTILATION IN THE SSD

Air supplied to the SSD should be of medical quality. This means that the air will be free of bacteria, chemicals and large particles of dirt.

The ISO 8573 air quality standards and ISO 12500 compressed air filter standards can help to select air treatment products. To achieve the recommended ISO 8573.1 Class 2 (classification for solid particulate removal), a 1.0 micron particulate filter is recommended.

Mechanical or controlled ventilation is recommended for SSD areas as they are demarcated into dirty and clean areas and have different ventilation requirements in each of these sections. Turbulent air flow and the use of portable fans are not allowed in any area of the SSD because rapid, uncontrolled air circulation can spread contamination. Ventilation systems must be cleaned, tested and maintained according to the manufacturer's instructions

In general, it is recommended that there should be no less than a total of 20 air changes per hour when using controlled ventilation in the SSD. In the absence of mechanical ventilation, direct access to the outdoor air is found in some SSDs. In this case, a minimum of 10 to 20 air changes per hour for the dirty area and 12 to 20 air changes per hour for the clean area has been recommended. What is important is that the pressure in the washroom is negative to the Inspection, Assembly and Packaging room.

The clean areas will be under positive pressure so that air flows away from clean surfaces towards the dirty area or the outside.

7.7 WATER QUALITY FOR STERILIZATION

Ideally, water used in the SSD should be soft, which means that the mineral and salt content is low and does not affect devices or processing equipment. Water can be softened by several methods:

- Filtration selectively removes minerals and salts
- Reverse osmosis (RO) is required to remove chlorides.

Since the processing of water can be expensive, it is recommended that soft water be used only for the final rinse if that is all that is affordable. When the water is purified, special control of its quality and eventual contamination should be undertaken. A microbiological control of this water must be performed. Reservoirs of water should be cleaned every 2 months.

Proper steam quality will prolong the life of reprocessed medical devices by reducing adverse effects that water impurities can have on device materials. Lime, rust, chlorine and salt can all be left as deposits on devices if demineralized water is not used. These compounds can lead to stress corrosion, pitting and discoloration of the device. Pitting, corrosion and precipitates must be avoided as their formation provides areas where organisms can readily accumulate and be protected from the killing effects of the steam process, i.e. increased risk of infection transmission due to inadequate sterilization.

The following table displays the characteristics of water used for sterilization.

Parameter	Value
Bacteria (cfu/mL)	< 200
Total organic carbon (mg/L)	< 1.0
Hardness (ppm $CaCO_3$)	< 1.0
Resistivity (MΩ·cm)	> 1.0

Total dissolved solids (mg/L $CaCO_3$)	< 0.4
Chloride (mg/L)	< 1.0
Iron (mg/L)	< 0.2
Copper (mg/L)	< 0.1
Manganese (mg/L)	< 0.1
Colour and Turbidity	Colorless, clear, no residues

Table 19: Expected concentration of minerals in water used for sterilization. Taken from the World Health Organization.

7.8 PHYSICAL PARAMETERS INSIDE THE SSD

The relative humidity is recommended to be 40-50%.

The expected temperature is as follows:

- Decontamination area: 18-20°C
- Clean areas: 18-23°C
- Sterile storage: 15-25°C

7.9 PERSONAL PROTECTIVE EQUIPMENT

Staff inside the SSD should wear personal protective equipment (PPE) to protect themselves from getting infected.

Examples of PPE to be worn are shown in the next table.

PPE indication	Gloves	Face cover/visors	Headgear	Aprons/ gowns	Closed shoes
Decontamination area • Handling used medical devices • Removal and disposal of sharps • Manual cleaning	Domestic gloves (heavy duty); long; disposable or tear-resistant if reused if available use nitrile gloves	Cover mucous membranes and eyes • Mask with integrated visor • Full visor • Face mask with goggles	Yes	Yes	Yes
IAP • Inspection after cleaning • Assembly • Packaging	Not indicated	Not indicated	Yes	Optional	Yes
Sterilization • Loading • Emptying sterilizer	Heavy duty heat-resistant gloves	Not indicated	Yes	No	Yes
Sterile stores • Loading shelves • Taking inventory • Documentation	Not indicated	Not indicated	Optional	No	Yes
Transportation • Delivering sterile pack	Not indicated	Not indicated	Optional	No	Yes
• Returning used medical devices	Yes – domestic gloves (heavy duty)	Only when handling open wet trays		Yes	Yes

Table 20: Indications for the use of PPE in the SSD

7.10 CLEANING

Cleaning is the first and most essential step before any process of disinfection or sterilization can be carried out. One can clean without sterilizing, but one cannot sterilize without cleaning!

Point-of-use preparation (i.e., rinsing or pre-washing) helps to prolong the life of surgical instruments as dried blood and saline can cause the decomposition of stainless steel and make surgical instruments much more difficult to clean.

Contaminated items should be contained in dedicated, fully enclosed, leak-proof and puncture-proof containers prior to transport. Soiled instruments should be opened and kept moist

- Spray with an enzymatic spray.
- Cover with a moist towel with water (not saline) or foam, spray, or gel specifically intended for this purpose.
- Do not transport in containers with water as water is a splash hazard.
- Do not soak items in saline or chlorine since these can be corrosive.

Only use appropriate detergents for instrument cleaning in the SSD. Detergents used for home cleaning or laundry use are not suitable for the cleaning of medical devices or instruments.

The immersion method and brushing should be used to clean hollow medical devices.

Chemical disinfection prior to cleaning is unnecessary, ineffective and of little value in the presence of organic matter.

Mechanical cleaning equipment may be available and do provide controlled and uniformly reliable results if the equipment is well maintained. Equipment used for the mechanical cleaning of medical devices includes:

- Ultrasonic cleaners
- Automated washers or washer-disinfectors
- Automated cart washers

Sinner’s cycle describes the components that are needed for proper cleaning.

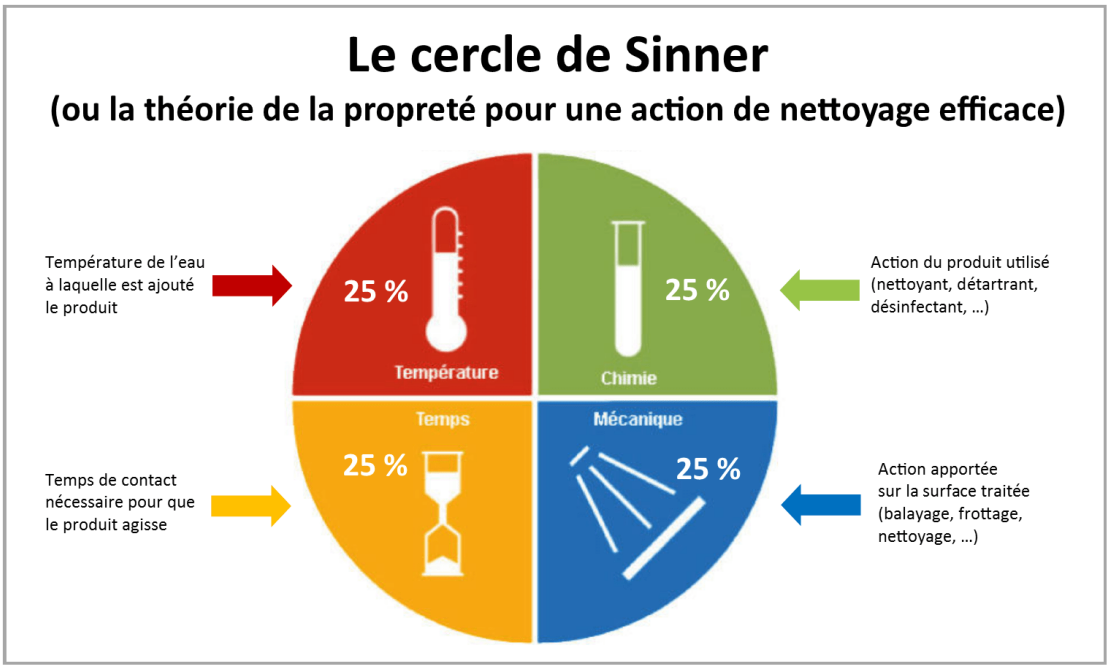


Figure 33: Sinner's circle for cleaning. From https://www.delcourt.fr/blog/qu-est-ce-que-le-bionettoyage-n15

7.11 INSPECTION, ASSEMBLY AND PACKAGING

The inspection, assembly and packaging (IAP) of reused medical devices (RMDs) in the SSD is where medical devices are visually inspected and function-tested by trained staff. All medical devices should be inspected in a place designated and controlled to optimize the effect of the sterilization process and minimize contamination. Use a bright light with a magnifying or a magnification light.

Devices may be packaged in any of the following sterile barrier systems (SBS): paper SBS, sterilization wrap or rigid reusable containers.

Packaging materials should be stored at room temperature 18°C to 22°C and at a relative humidity of 35% to 70%.

Packaging materials should not be stored adjacent to external walls or other surfaces, which may be at a lower temperature or a higher temperature than the ambient temperature of the storeroom.

Packaging materials should be stored on shelves 10 inch/28 cm above floor level.

Packaging material should be rotated to ensure that it does not exceed its shelf life ("first in, first out").

The use of double Paper-based sterile barrier systems (PSBS) is not recommended as a wrapping method as this increases the probability that the steam may not penetrate the packing material.

Containers should be properly loaded in terms of density to avoid problems of moisture retention and increased drying times. After use, containers should be disassembled and cleaned by washing with detergent and water and dried before sterilization.

The following is not recommended:

- Metal (sterilization) drum trays with holes that can be opened and closed manually. These do not guarantee sterility of its contents.

- Recycled material packaging because these have lost their integrity and the bacterial barrier and do not allow adequate air removal or steam penetration.

Adhesive tapes, such as sterilization indicator sealing tape, are commonly used to fasten wrappings and incorporate a chemical indicator. The chemical indicator is visible as diagonal stripes that darken or change in color during the sterilization process. Tape adhesive must be stable under the conditions occurring during sterilization and be permeable to the sterilizing agent.

7.12 HIGH-LEVEL DISINFECTION OR STERILIZATION OF ENDOSCOPES

Endoscopes require special techniques for disinfection before reuse since they are sensitive instruments. The following table explains the procedures that should be carried out.

Types of endoscopes	Rigid endoscope example	Flexible endoscope example	Level of decontamination
Invasive – passed into normally sterile body cavities or introduced into the body through a break in the skin or mucous membrane	Arthroscope Laparoscope Cystoscope	Nephroscope Angioscope Choledochoscope	Sterilization by steam or a low temperature method e.g. gas plasma
Non-invasive in contact with intact mucous membrane, but does not enter sterile cavities	Bronchoscope	Gastroscope Colonoscope Bronchoscope	High-level disinfection, e.g. immersion in glutaraldehyde, peracetic acid, chlorine dioxide

Table 21: Types of decontamination of endoscopes. Taken from World Health Organization.

The general steps to be followed are shown in the next table. Follow the manufacturer's instructions for specific details.

Stage	Why
Bedside procedure (pre-clean)	To remove readily detachable organic matter. This will help to reduce the possibility of drying and causing channel blockages, especially if there is a delay before manual cleaning takes place
Leak test	To ensure the integrity of the endoscope. Any damage to the outer surface could allow body fluids or chemicals into the internal workings of the endoscope
Manual clean	Brushing of accessible channels and flushing of all channels to remove organic matter. This stage will also allow the detection of channel blockages
Rinsing	To remove detergent residues that may affect the performance of the disinfectant
Drying	To expel excess fluid that may dilute the disinfectant
Disinfection	To eradicate potentially pathogenic microorganisms, i.e. bacteria, including mycobacteria and viruses
Rinsing	To remove disinfectant residues that could cause a harmful effect to the patient
Drying	To expel excess fluid before use on the patient or storage

Table 22: Stages of processing of flexible endoscopes

It is highlighted that long-term dipping of any medical equipment in disinfectants is not an appropriate form of sterilization or disinfection because it can corrode the equipment, partial dipping leaves certain areas contaminated, and some microbes can survive in disinfectants that are left open to the air for prolonged periods of time.

7.13 TYPES OF STEAM STERILIZERS

There are several types of steam sterilizers that utilize different methods to remove air from packages and the chamber, such as dynamic air removal (e.g. pre-vacuum) and steam-flush pressure-pulse sterilizers, or passive air removal (e.g. gravity).

7.13.1 Pre-vacuum sterilizers

Use a vacuum pump or water ejector to remove air from the chamber and packaged devices during the preconditioning phase and prior to sterilization. Such sterilizers operate at 132°C to 135°C.

7.13.2 Steam-flush pressure-pulse

Use a repeated sequence of a steam flush and pressure pulse to remove air from the chamber and packaged items. Such sterilizers operate at 121°C to 123°C, 132°C to 135°C, or 141°C to 144°C.

7.13.3 Gravity sterilizers

Gravity is used to displace the air from the sterilizer chamber and packaged devices. Such sterilizers operate at 121°C or higher.

7.14 LOGBOOK FOR STERILIZATION

For auditing and risk assessment purposes, it is important that a logbook is kept whenever a sterilization cycle is carried out. An example of a log is displayed below.

Date	Autoclave number	Load number	Start cycle	Start sterilization time	End of sterilization time	End cycle time	Signature

Table 23 :Manual control of physical parameters

7.15 CHEMICAL INDICATORS

Different types of indicators indicate which parts of the sterilization cycle have been completed. However, chemical indicators cannot definitely prove that sterility has been achieved. The next table explains the purposes of each type of chemical indicator.

Types	Purpose
Type 1 Process indicators	These indicators are intended for use with packs or containers to indicate that they have been directly exposed to the sterilization process and to distinguish between processed and unprocessed units
Type 2 Indicators for use in specific tests	These indicators are intended for use in specific test procedures, such as, the Bowie-Dick test for air removal
Type 3 Single variable indicators	These indicators are designed to react to one of the critical sterilization variables, e.g. time and temperature, and are intended to indicate exposure to a predetermined sterilization process variable, e.g. 134°C
Type 4 Multivariable indicators	These indicators are be designed to react to two or more of the critical sterilization variables, e.g. time and temperature, and are intended to indicate exposure to predetermined sterilization process variables, e.g. 134°C, 3 minute
Type 5 Integrating indicators	These indicators are designed to react to all critical variables of the sterilization process, e.g. time, temperature and presence of moisture, and are intended to be equivalent to or exceed the performance requirements given in the ISO 11138 series for biological indicators
Type 6 Emulating indicators	These indicators are designed to react to all critical variables of the sterilization process, e.g. time, temperature and presence of moisture, and are intended to match the critical variables of specified sterilization cycles

Table 24: Types of chemical indicators

7.16 OTHER TYPES OF STERILIZATION

Flash sterilization methods should be avoided as the material is sterilized without packaging and the cycle eliminates drying. As a result, the possibility of recontamination of the material increases.

Dry heat sterilization is inferior to steam sterilization and should be avoided if possible. The widespread use of tabletop sterilizers outside primary health or dental clinics is discouraged. Specific temperatures should be used for dry heat sterilizers. Consult the national SOPs on sterilization for details.

The following two tables describe low heat sterilization processes. Such sterilization methods can be used to sterilize rubber tubing, catheters, polyethylene tubing, lensed instruments and hinged instruments. Always consult the manufacturer's instructions before proceeding with chemical sterilization – exact parameters for sterilization can vary depending on the product and equipment.

Sterilant	Efficacy	Penetration and Organic material resistance	Action time	Material compatibility	Cannot process	Toxicity
Ethylene oxide (Eto)	All microbes and Spores	Excellent Penetrates even long lumens	12-24 Hours	Metal Plastic rubber	Flexible Scopes	Carcinogenic flammable Harms Environment
Gas plasma/ vaporized hydrogen peroxide	All microbes and Spores	Cannot penetrate long lumens	30 Mins for gas plasma 55 Mins for vapour H_2O_2	Metal plastic Flexible scopes cameras Videolaryngoscopes	Liquids Powder Paper Cellulose	Non toxic by-products: water vapour and oxygen
Ozone (O_3)	All microbes and Spores Even prions	2Mm lumen with <25 cm length; 3Mm lumen with <47 cm length	20000-30000 ppm 80% humidity 3-5 min; 15000 Ppm 90% humidity 7-10 mins	Stainless steel Plastic; pvc Nylon teflon Silicone Plexiglass Pyrexglass Aluminium	Rubber Latex Textile Copper Brass Zinc Nickel Flexible scopes Ampoules	Non toxic byproducts: water and oxygen Osha:<0.3 O_3ppm over 15 min safe; 0.003Ppm O_3 detected by nose
Low-temp steam and formaldehyde (2%) (LTSF)	All microbes and Spores	Excellent at 60-78°C	Pre-vacuum pre-pulses of steam formaldehyde sterilization washing pulses air pulses.	Endocopes Rigid laryngo scope blades	Vacuum and humidity sensitive equipment	Toxic Irritant to eyes and nose ?Carcinogenic 0.5Ppm=max safe limit
Nitrogen di oxide (Eniware)	All microbes and Spores	Excellent	20-40 Mins	Stainless steel; glass Pvc; aluminium Silicon	Nylon Paper Polyester Thermopla elastomer	Supplied as liquid; turns to vapour at room temp
Per acetic acid (35%)	All microbes and Spores	Does not require activation	25 Mins	Endoscopes Broncho scopes	Lead, brass, copper, zinc	Environmental friendly by-products (acetic acid, O_2, H_2O)
Ortho-phthalaldehyde (OPA)	All microbes and Spores	Does not require activation	5 Hours	Metals Plastic Elastomers	Stains skin and rubber grey	Avoid processing cystoscopes for bladder cancer patient
Cidex (2.4% Glutaraldehyde)	Some mycobacteria are resistant	Requires activation	10 Hrs	Stainless steel aluminium brass copper elastomer plastic		Irritant(eyes and nasal passage) Contact dermatitis

Table 25: Taken from "Shah SB, Bhargava AK. Recent advances in low temperature sterilization - Moving ahead from Cidex™/ETO to OPA/Ozone: An update. Indian J Anaesth. 2017 Oct;61(10):855-857. doi: 10.4103/ija.IJA_281_17."

Chemical	Usual parameters for sterilization
Ethylene oxide gas	1-6 hours processing time plus aeration time of 8-12 hours at 50-60°C
Hydrogen peroxide gas plasma	Processing time between 45-72 minutes

Glutaraldehyde-based formulations (> 2%) Glutaraldehyde (1.12%) with 1.93% phenol/phenate	10 h at 20–25°C
Hydrogen peroxide 7.5% (will corrode copper, zinc, and brass)	6 h
Peracetic acid (≥ 0.2%)	12 m at 50–56°C
Hydrogen peroxide (7.35%) with 0.23% peracetic acid Hydrogen peroxide 1% with peracetic acid 0.08% (Corrosive to metals)	3–8 h

Table 26: Taken from "https://www.cdc.gov/infection-control/hcp/disinfection-and-sterilization/methods.html"

7.17 STERILIZATION INSIDE THE DENTAL CLINIC

Dental procedures often involve contact with saliva, blood, and other bodily fluids, which can harbor harmful microorganisms, including bacteria, viruses, and fungi. Proper sterilization eliminates these pathogens, preventing cross-contamination.

It helps prevent the spread of infectious diseases, such as hepatitis B, hepatitis C, HIV, and other bloodborne infections, among patients and healthcare workers.

The following table provides general guidelines regarding procedures to be followed in the dental clinic setting with respect to disinfection and sterilization of equipment depending on the procedures being performed.

Risk categories	Procedures	Example of instruments	Comments
Critical item Entry into sterile tissue, cavities or bloodstream	Surgical dental procedures, such as the removal of a fully impacted tooth, extraction, and endodontic procedures on vital pulp tissue	• Needles and syringes • Dental forceps and elevators • Flap retractors and surgical burrs • Instruments for placement of implants, implantable items including mini-implants and surgical dental hand pieces	• Must be sterile at the time of use and either be "single-use disposable" or capable of being steam sterilized • Critical items must be used immediately after sterilization or stored in bags until use. • If the bags are damaged, the devices must be re-sterilized before use
Semi-critical item Contact with intact non-sterile mucosa or non-intact skin	General dental procedures	• Mouth mirrors • Restorative instruments • Dental tweezers and probes • Metal impression trays • Other non-critical items when used occasionally in the mouth, e.g. Lecron carver	• Instruments are sterilized between patients or are "single-use" (disposable) • After processing, devices should be bagged and kept in closed drawers or in dedicated containers, such as instrument cassettes, until required • Rarely, thermal disinfection for example, thermal disinfection of denture polishing buffs, may be acceptable as these are unlikely to be contaminated with blood
Non-critical item Where there is contact with intact skin		• Prosthetic gauges and measuring devices • Face bows • Protective eyewear • Bib chains • Dappen dishes • Willis gauges	• Cleaning with detergent and water is generally sufficient but in some cases thermal disinfection with heat and water may be indicated • After processing, these instruments should be stored in the same way as semi-critical instruments to prevent contamination prior to use

Table 27: Disinfection and sterilization in the dental clinic

7.18 PRIONS

7.18.1 Introduction

Transmissible spongiform encephalopathies (TSEs), also known as prion diseases, are fatal degenerative brain diseases that occur in humans and certain animal species. They are characterized by microscopic vacuoles and the deposition of amyloid (prion) protein in the grey matter of the brain. TSEs are invariably fatal and there is no proven treatment or prophylaxis.

Iatrogenic transmission of the CJD agent has been reported in more than 500 patients. Most have been linked to contaminated human growth hormone and dura mater grafts. A small number have been linked to corneal transplants, contaminated neurosurgical instruments and stereotactic EEG depth electrodes.

The most common form, sporadic Creutzfeldt-Jakob disease (CJD), has a worldwide death rate of about 1 case per million people each year, and typically affects people between 55 and 75 years of age.

7.18.2 Risk during routine procedures

Investigations like x-ray imaging procedures with TSE patients do not present a risk to healthcare workers, relatives, or the community. There is no reason to defer, deny, or in any way discourage the admission of a person with a TSE into any healthcare setting.

Based on current knowledge, isolation of patients is not necessary; they can be nursed in the open ward using standard precautions.

Contamination by body fluids (categorized as no detectable infectivity tissues) poses no greater hazard than for any other patient. No special precautions are required for feeding utensils, feeding tubes, suction tubes, bed linens, or items used in skin or bed sore care in the home environment. However, tissues from the brain, spinal cord and eye are highly infective.

7.18.3 Protective measures during invasive procedures

During surgery, minimize the number of personnel present, cover non-disposable equipment when not in use and incinerate all clothing used by staff. If lumbar punctures or bone marrow biopsies are to be done, wear protective clothing, minimize contact with body fluids and reduce to the maximum extent possible environmental contamination. Surgical instruments should be handled as per the table below.

1.	Instruments should be kept moist until cleaned and decontaminated.
2.	Instruments should be cleaned as soon as possible after use to minimize drying of tissues, blood and body fluids onto the item.
3.	Avoid mixing instruments used on no detectable infectivity tissues with those used on high and low infectivity tissues.
4.	Recycle durable items for re-use only after TSE decontamination by methods found in Section 6 and Annex III.
5.	Instruments to be cleaned in automated mechanical processors must be decontaminated by methods described in Section 6 and Annex III before processing through these machines, and the washers (or other equipment) should be run through an empty cycle before any further routine use.
6.	Cover work surfaces with disposable material, which can then be removed and incinerated; otherwise clean and decontaminate underlying surfaces thoroughly using recommended decontamination procedures in Section 6 and Annex III.
7.	Be familiar with and observe safety guidelines when working with hazardous chemicals such as sodium hydroxide (NaOH, 'soda lye') and sodium hypochlorite (NaOCl, 'bleach') (see Annex III for definitions).
8.	Observe manufacturers' recommendations regarding care and maintenance of equipment.

Table 28

Those instruments used for invasive procedures on TSE patients (i.e. used on high or low infectivity tissues) should be securely contained in a robust, leak-proof container labelled "Biohazard". They should be transferred to the sterilization department as soon as possible. If a facility can safely

quarantine instruments until a diagnosis is confirmed, quarantine can be used to avoid needless destruction of instruments when suspect cases are later found not to have a TSE.

7.18.4 Biosafety

General protective measures in the laboratory are mentioned in the next table.

1.	Eating, drinking, smoking, storing food and applying cosmetics must not be permitted in the laboratory work areas.
2.	Laboratory coveralls, gowns or uniforms must be worn for work and removed before entering non-laboratory areas; consider the use of disposable gowns; non-disposable gowns must be decontaminated by appropriate methods (see Section 7 Waste Disposal and Annex III).
3.	Safety glasses, face shields (visors) or other protective devices must be worn when it is necessary to protect the eyes and face from splashes and particles.
4.	Gloves appropriate for the work must be worn for all procedures that may involve unintentional direct contact with infectious materials. Armoured gloves should be considered in post mortem examinations or in the collection of high infectivity tissues.
5.	All gowns, gloves, face-shields and similar re-usable or non re-usable items must be either cleaned using methods set out in Annex III, or destroyed as per Section 7.
6.	Wherever possible, avoid or minimize the use of sharps (needles, knives, scissors and laboratory glassware), and use single-use disposable items.
7.	All technical procedures should be performed in a way that minimizes the formation of aerosols and droplets.
8.	Work surfaces must be decontaminated after any spill of potentially dangerous material and at the end of the working day, using methods described in Section 6 and Annex III.
9.	All contaminated materials, specimens and cultures must be either incinerated, or decontaminated using methods described in Section 6 and Annex III and Section 7 before disposal.
10.	All spills or accidents that are overt or potential exposures to infectious materials must be reported immediately to the laboratory supervisor, and a written record retained.
11.	The laboratory supervisor should ensure that adequate training in laboratory safety is provided and that practices and procedures are understood and followed.

Table 29

7.18.5 Management of corpses

After death, it is recommended that the deceased patient be placed in a sealed body bag prior to moving. Where the skull is open or there is CSF leakage, and where sutures do not completely control this leaking, the bag should be lined with materials to absorb any fluid, and the body should be moved in a sealed body bag.

Minimize the number of personnel present during post-mortems – use maximum protective clothing. Manual saws are recommended in order to avoid the creation of tissue particulates and aerosols and for ease of decontamination after use. If the body has undergone autopsy, care should be taken to limit contamination of the workplace by any leaking bodily fluids (especially from the cranium) when transferring the body from its transport bag to the mortuary table that has been covered with an impermeable sheet. The body should be placed on an impermeable sheet or body pouch so that suture site leakage can be contained, and perfusion drain sites should be similarly arranged to avoid surface contamination. All drainage fluids should be collected into a stainless steel container. Perfusion and autopsy incision sites should be closed with cyanoacrylates (super glue). The entire body should be

wiped down with bleach, and special care taken to ensure contact of bleach with perfusion sites and closed autopsy incisions.

Embalming an autopsied or traumatized body is not encouraged. During funeral, contact with the body is possible if autopsy has not been performed and there is no trauma to the body.

7.18.6 Decontamination of instruments and surfaces

Destruction of heat-resistant surgical instruments that come in contact with high-infectivity tissues is the safest method. However, it may not be practical or cost effective. In that case, healthcare providers should follow sterilization methods for tools used on suspected or confirmed CJD patients.

Instruments should not be allowed to air-dry during the surgical procedure. They should instead be kept moist by immersing them in water or disinfectant solution.

Most disinfectants in use in healthcare facilities are ineffective against prions. Close attention should be given to the procedures utilized in the decontamination of surfaces and equipment that have come into contact with prion-infected tissues.

Incineration

1. Use for all disposable instruments, materials, and wastes.
2. Preferred method for all instruments exposed to high infectivity tissues.

Autoclave/chemical methods for heat-resistant instruments

1. Immerse in sodium hydroxide (NaOH; 1N = 40g in 1L water; freshly prepared) and heat in a gravity displacement autoclave at 121°C for 30 min; clean; rinse in water and subject to routine sterilization.
2. Immerse in NaOH or sodium hypochlorite (20,000 ppm ≈ 5%) for 1 hr; transfer instruments to water; heat in a gravity displacement autoclave at 121°C for 1 hr; clean and subject to routine sterilization.
3. Immerse in NaOH or sodium hypochlorite for 1 hr.; remove and rinse in water, then transfer to open pan and heat in a gravity displacement (121°C) or porous load (134°C) autoclave for 1 hr.; clean and subject to routine sterilization.
4. Immerse in NaOH and boil for 10 min at atmospheric pressure; clean, rinse in water and subject to routine sterilization.
5. Immerse in sodium hypochlorite (preferred) or NaOH (alternative) at ambient temperature for 1 hr; clean; rinse in water and subject to routine sterilization.
6. Autoclave at 134°C for 18 minutes.

Chemical methods for surfaces and heat sensitive instruments

1. Flood with 2N NaOH or undiluted sodium hypochlorite; let stand for 1 hr.; mop up and rinse with water.

Caution: This method may not get rid of all prions.

References

1. Decontamination and reprocessing of medical devices for health-care facilities. World Health

Organization and Pan American Health Organization. 2016.
2. https://www.cdc.gov/creutzfeldt-jakob/hcp/infection-control/index.html
3. WHO Infection Control Guidelines for Transmissible Spongiform Encephalopathies. World Health Organization. March 1999.
4. Shah SB, Bhargava AK. Recent advances in low temperature sterilization - Moving ahead from Cidex™/ETO to OPA/Ozone: An update. Indian J Anaesth. 2017 Oct;61(10):855-857. doi: 10.4103/ija.IJA_281_17.
5. https://www.cdc.gov/infection-control/hcp/disinfection-and-sterilization/methods.html

Chapter 8: IPC in the Operation Theater

8.1 INTRODUCTION

Infection control in operating theaters is a critical component of surgical care. Surgical site infections (SSIs) are the most common hospital-acquired infections in under-developed countries and can result in significant patient morbidity and mortality. The majority of these infections occur during the surgical procedure when the wound is open, allowing microorganisms from both the patient's endogenous flora and the exogenous environment (operating staff, instruments, and air) to enter the sterile field.

8.2 OPERATING ROOM ENVIRONMENT AND DESIGN

The operating room environment plays a significant role in infection prevention:

- **Ventilation Systems:** Maintaining a positive pressure airflow in the operating theater prevents external contaminants from entering.
- **Room Layout and Hygiene:** The operating room should be free of clutter, and all surfaces in direct contact with the surgical team or patient must be cleaned and disinfected after each surgery. High-touch surfaces, such as door handles and anesthesia machines, require extra attention.
- **Sterilization of Instruments:** All surgical instruments and equipment must be sterilized and properly handled to prevent contamination. Instruments should be opened and exposed only at the time of use.

8.3 ASEPTIC PROTOCOLS

Hand hygiene for surgical team members is of crucial importance.

1. Nails should be kept short, and all jewelries, artificial nails or nail polish should be removed before surgical hand preparation.
2. Hands should be washed, and debris should be removed from underneath fingernails using a nail cleaner, preferably under running water.
3. Sinks should be designed to reduce the risk of splashes.
4. Surgical hand antisepsis should be performed using either a suitable antimicrobial soap or alcohol-based hand rub before donning sterile gloves.
5. A preoperative surgical hand scrub should be done for at least 5 minutes using an appropriate antiseptic scrub. Hands and forearms should be cleaned up to the elbows.
6. After performing the surgical hand scrub, hands should be kept up and away from the body (elbows in flexed position) so that water runs from the tips of the fingers toward the elbows and not vice versa.

8.4 SURGICAL ATTIRE

Microorganisms are constantly shed from the hair, skin and clothes of people. Microorganisms are also expelled through respiratory secretions while breathing, talking, and laughing.

“Scrubs” refers to the sanitary clothing worn by the operating theater (OT) staff, usually comprising a short-sleeve, V-neck shirt and loose-fitting, drawstring pants. The design of scrubs minimizes places where contaminants can hide, and they are easy to launder. They should be changed after a likely contamination and should always be cleaned in a healthcare laundering facility.

PPE to be worn during surgery include gloves, gowns, caps, mask and footwear. Eye protection, waterproof aprons may be utilized for some surgeries. They protect the patient from risk of infection from the hair, skin, clothes and respiratory secretions of the surgical team. The surgical attire also protects the surgical team from the risk of exposure to blood and tissues of the patient during operation.

Healthcare workers (HCW) who have donned OT attire should not walk outside the OT with these clothes. They should doff properly before exiting the OT or else wear a gown or a lab coat on their scrubs.

The following table summarizes the attire to be worn in the OT.

Zone	PPE
Protective / transitional / zones 4 or 5	Scrub, cap and crocks For staff visiting the OT for short periods of time, they can wear a sterile gown or coverall over their clothes
Clean / semi-restricted / zone 3	Scrub, cap and crocks
Aseptic / ‘sterile zone’ / restricted / zone 2	Scrub, cap, crocks and surgical mask Staff who will move within 1 meter of the ‘sterile core’ have to wear sterile gowns also
Ultra-clean / ‘sterile core’ / zone 1	Scrub, cap, crocks, surgical mask, sterile gloves and sterile gowns Face shields, goggles and beard covers can be worn based on risk assessment
Dirty / disposal	Scrub, cap and crocks

Table 30

8.5 THE STERILE FIELD

It is important to maintain a sterile field to prevent contamination of surgical incision. A sterile field is the area prepared around the surgical procedure site and where the sterile instruments and other items needed during the operation are placed.

It is created by placing sterile towels or sterile drapes on the prepared procedure site on the patient and includes a stand nearby.

Only sterile objects and persons in surgical attire (scrubbed team) are allowed within this field. Areas above the chest and below the waist of the scrubbed team are considered non-sterile. Items outside and below the draped area are considered non-sterile. The field is considered non-sterile if a non-sterile object or non-scrubbed person comes within the sterile field.

Maintenance of the sterile field:

1. Place only sterile items within the sterile field.

2. Open, transfer and dispense items without contaminating them.
3. The outer cover of sterile items is considered unsterile and should not be placed within the sterile field.
4. The scrubbed team should not touch non-sterile objects.
5. Non-sterile items or personnel should not enter the sterile field.
6. Never touch a sterile item with bare hands.
7. If a sterile barrier has been made wet, is cut or torn, it is considered non-sterile.
8. If there is a doubt whether the sterile field has been breached, consider it non-sterile.

Unnecessary movement of personnel should be minimized to reduce the risk of airborne contamination.

8.6 CLEANING AND DISINFECTION

A clean operating environment is essential to prevent surgical site infections. The OT is cleaned and disinfected to prevent microbial contamination. Exogenous sources of infection in the OT are people, anesthesia equipment, surfaces such as furniture, dust and some instruments.

There should be no dust in the OT; dust settling on the sterile field can carry microorganisms particularly in operations of long duration. Dust may be acquired from the outside environment due to defective filtration of air. Lint-containing textiles can be a source of dust as also floor mops. Dust particles can be reduced by good laundry practices to reduce the formation of lint and using wet vacuum on the floor.

Cleaning should be carried out in between procedures, at the end and start of the day and whenever there are spills or soiling.

See chapter 5 for details on cleaning procedures.

8.7 INFRASTRUCTURE OF OTS

8.7.1 Location

To ensure a clean and uncontaminated environment, the OT should be located away from patient care areas and patient traffic.

8.7.2 Components of the OT

The OT is a multifunctional area. For instance, there are areas for administrative functions, sluicing and waste disposal. The OT areas are distributed into zones depending upon the level of sterility and cleanliness required.

8.7.3 Zones

The features of the different zones in order of their cleanliness are:

1. The normal, unrestricted or outer zone has a similar level of cleanliness as other patient care areas in the hospital. It is the zone where patients are received, and administrative functions

are carried out. Toilets are located in this zone.

2. The protective or transitional zone is the restricted zone where entry is regulated. It is the transitional area between the outer zone and the clean area. Persons entering this zone have to change to protective clothing and footwear to prevent contamination of the surroundings.
    a. PPE to be worn are scrubs, caps and OT shoes.
    b. Overshoes are discouraged due to the risk of contaminating the hands while wearing them, because they are easily torn and because they easily fall off while walking.
    c. Visiting staff who are not wearing scrubs should wear coveralls or gowns.
    d. Some international guidelines (but not all) make masking mandatory in this area; however, it has been noticed that compliance with the wearing of masks is poor in this area of the OT in Mauritius.
    e. OT scrubs should not be worn outside the hospital.
    f. Staff who move out of the OT with their scrubs should wear a lab coat or a clean gown on their scrubs.
    g. OT shoes should be dedicated only to the OT and cleaned daily and when soiled.
3. The clean area is where the pre-op, post-op and anesthesia rooms are located. PPE to be worn is as in the transitional zone.
4. The aseptic zone includes the areas where the operation team and patients are doing surgery. The areas for packaging and sterilizing surgical instruments are also included in this zone. The different areas in this zone are physically separated from each other.
    a. PPE that needs to be worn are scrubs, caps, masks and OT shoes.
5. The ultra-clean zone is the area where the patient's tissues are exposed during surgery.
    a. PPE worn in this zone are caps, masks, OT shoes, sterile gowns and sterile gloves.
    b. Some international organizations make the wearing of beard covers and face shields / goggles mandatory in this zone.
6. The disposal or dirty zone is an area where dirty equipment is rinsed or kept prior to sending to the sterilization department. There should be no movement of staff or equipment from this zone to cleaner zones of the OT. This zone is connected by a separate corridor (also called "dirty corridor") leading out of the OT. Modern OTs no longer have a dirty zone since all dirty equipment is sent directly to the sterilization department right after rinsing.

8.8 INTERNATIONAL PROTOCOLS FOR OT OPERATION

European guidelines propose following certain protocols in the OT to reduce the risk of surgical site infections:

1. All patient, staff and visitor hand and body contact surfaces must be cleaned between each patient.
2. Clean and disinfect any areas contaminated by blood and body fluids.
3. Clean and disinfect clinical care equipment, including anesthetic machines, after each patient, and before the next patient arrives in the operating room.
4. Keep the operating room tidy and devoid of clutter in accordance with local housekeeping practice.

5. Allow clean beds with fresh, clean linen to be brought into operating theatre complex directly from clinical areas.
6. Place contagious patients to recover in a designated section of the recovery area.
7. Encourage patients to shower/bathe before surgery for personal hygiene reasons.
8. Instruct patients not to shave their surgical area in the days before surgery. Include this in any written patient information that is supplied to patients/carers in advance of surgery.
9. Disinfect the skin area with either chlorhexidine-alcohol or povidone iodine – wait for the appropriate contact time and for the solution to dry before incising. The contact time can vary depending on whether the skin is moist or dry and depending on the amount of hair present.
10. For all surgical/operative procedures, lay up the instruments and prosthetic materials as close as possible to when they are needed.
11. Minimize non-essential staff movement and hence door openings during surgical procedures to minimize bacterial air counts.
12. Do not allow scrubbed staff to wear jewellery below the elbow.
13. Do not allow scrubbed and unscrubbed staff to wear artificial or polished nails in the operating theatre.
14. Ensure that all staff working in the operating room wear a head covering and a face mask in accordance with local policies.
15. Change or cover operating theatre attire (e.g. with a single-use disposable gown) and change footwear if leaving the operating theatre complex with the intention of returning.

8.9 OT PARAMETERS

Expected parameters that should be maintained in an operating theater are displayed in the table below.

Positive pressure	+15±5 Pa
Air changes per hour	≥ 20 (up to 30) of which > 20% from outside air (old criteria was ≥ 15)
Humidity	40-60%
Noise	< 35 dB
Temperature	18-26 °C
HEPA filtration	Minimum Efficiency Reporting Value (MERV) 16 (used to be MERV 14)

Table 31: Values are as per ASHRAE, ISO and / or European standards.

OTs have a maximum allowable concentration of particles in the air – this is illustrated in the table below. Routine microbiological swabbing of OT surfaces is no longer internationally recommended in several countries for many years (except during specific circumstances e.g., whenever outbreaks occur). Monitoring of particle count at regular intervals has replaced this practice – see the table below for details.

	Maximum concentration of particles / m^3 allowable in air					
ISO classification	≥ 0.1 µm	≥ 0.2 µm	≥ 0.3 µm	≥ 0.5 µm	≥ 1.0 µm	≥ 5.0 µm
Class ISO 5	100,000	23,700	10,200	3,520	832	29
Class ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
Class ISO 7	Not specified	Not specified	Not specified	352,000	83,200	2,930
Class ISO 8	Not specified	Not specified	Not specified	3,520,000	832,000	29,300

Table 32: Particle concentration allowed in the OT as per ISO standards. Most OTs should meet ISO class 7. Transplant surgeries, orthopedic implants, and surgeries on burns patients should be done in OTs meeting ISO class 5.

Whenever viable counts are done, the following standard may be consulted.

ISO standard	SI standard	US standard	Expected CFU/m3 of air	Expected CFU/plate for surfaces
5	M3.5	100	< 3 (USA) or < 10* (Japan and UK)	< 3 (include floor and gloves); < 5 for clothing
7	M5.5	10,000	< 20 (USA) or < 100 (Japan)	< 5 for environment; < 10 for gloves; < 20 for clothing
8	M6.5	100,000	< 100 (USA) or < 200 (Japan)	

*Table 33: CFU: Colony forming unit. * < 35 CFU/m3 if the theater is occupied and there is laminar flow or else < 180 CFU/m3 if the theater is occupied without laminar flow. See: "IPC Team, NHS, Lothian. Microbiological Air Sampling in Conventional Operating Theatres Standard Operating Procedure. 2017", "Vijitha Alva, K. and Thomas S. Kuruvilla. 2020. Evaluation of Microbial Contamination using various Air Sampling Techniques in Operation Theatres. Int.J.Curr.Microbiol.App.Sci. 9(01): 37-45. doi: https://doi.org/10.20546/ijcmas.2020.901.005" and http://ftp.uspbpep.com/v29240/usp29nf24s0_c1116.html.*

References

1. Humphreys H., Bak A., Ridgway E. et al. Rituals and behaviours in the operating theatre – joint guidelines of the Healthcare Infection Society and the European Society of Clinical Microbiology and Infectious Diseases. Journal of Hospital Infection, Volume 140, 165.e1 - 165.e28
2. Weaving P, Cox F, Milton S. Infection prevention and control in the operating theatre: reducing the risk of surgical site infections (SSIs). J Perioper Pract. 2008 May;18(5):199-204.
3. Bali RK. Operating Room Protocols and Infection Control. Oral and Maxillofacial Surgery for the Clinician. 2020 Jun 24:173–94.

Chapter 9: IPC in the Adult and Pediatric Intensive Care Units

9.1 INTRODUCTION

Patients in critical care settings are more susceptible to nosocomial infections. Overall, compared with the general hospital population, patients in ICUs have more chronic comorbid illnesses and more severe acute physiologic derangements. The widespread use of indwelling catheters and devices among ICU patients provides a portal of entry of organisms into vital body organs and sites. The use and maintenance of these catheters necessitate frequent contact with health care personnel, predisposing patients to colonization and infection with nosocomial pathogens. In addition, equipment associated with the proper maintenance of these devices might serve as reservoirs for pathogens and be related to horizontal patient-to-patient transmission of pathogens.

The increasing prevalence of MDROs continues to pose a significant challenge. Comprehensive infection control measures, including antimicrobial stewardship and screening, are necessary but can be difficult to implement consistently.

Intensive care units (ICUs) house patients that are particularly vulnerable and at five to ten times higher risk of acquiring HAI. With the patients' immune system compromised due to the use of various invasive devices such as peripheral and central lines, urinary catheters and mechanical ventilators, they are particularly prone to device-related infections. Intrinsic factors such as immunosuppression and comorbidities compound their vulnerabilities. Patients in the ICU are also exposed to broad-spectrum antibiotics and are susceptible to multidrug-resistant organisms such as *Acinetobacter spp*. and *Pseudomonas spp.*

9.2 GENERAL PRINCIPLES

The goal of IPC in the ICU is to prevent patients from acquiring infections and thus reduce morbidity and mortality.

The space in between beds should be adequate for easy access and should be preferably more than 2 meters in order to reduce cross-contamination. Isolation cubicles should be readily available for patients that meet specific criteria for transmission-based precautions e.g., those infected or colonized with MDRO.

Studies have not been able to demonstrate a significant reduction in the incidence of HAI with the use of specific ICU footwear. Hence, their use is generally discouraged.

Due to the high prevalence of MDRO in the ICUs of Mauritius, special attention must be given to antimicrobial stewardship, to the proper isolation of patients colonized or infected with these organisms, to the cleaning techniques in use (especially of devices like ventilators) and to the correct use of transmission-based precautions. Whenever additional precautions are used, signages must be in place to communicate to in-coming staff the type of PPE that should be worn.

It is preferable not to place patient charts close to patients in ICUs since these can be contaminated with multi-drug resistant organisms and can act as fomites.

9.3 SPECIFIC IPC STRATEGIES

9.3.1 Hand hygiene

The most cost-effective measure to prevent infections is hand hygiene. Alcohol-based hand rubs are more efficient than soap and water, except for visibly soiled hands or *C. difficile* infections where soap and water are recommended.

Improving compliance with hand hygiene remains a challenge, with methods including direct observation, product usage monitoring, and electronic systems for real-time feedback.

9.3.2 Isolation precautions

Contact precautions are essential for managing MDROs, with strategies including wearing gowns and gloves. Controversies exist over universal screening for MDROs – some international centers screen all patients admitted to their ICUs for certain organisms like MRSA or VRE. While no such recommendations currently exist in Mauritius, screening will start to be implemented in the country gradually – follow national SOPs for further guidance.

9.3.3 Environmental cleaning

Regular cleaning of high-touch surfaces in patient environments is crucial. Monitoring and feedback systems for housekeepers have been shown to improve cleaning performance. Technologies like UV light and hydrogen peroxide vapor are emerging to enhance environmental disinfection but their utility is limited in the absence of proper cleaning.

9.3.4 Antimicrobial bathing

Chlorhexidine-based bathing has been adopted to reduce the colonization of MDROs and prevent bloodstream infections.

9.3.5 New materials

Advances like the use of antimicrobial surfaces (e.g., copper or silver-coated materials) in ICU rooms have been shown to reduce pathogen load.

9.3.6 Tracking systems

Video monitoring and sophisticated electronic systems for tracking compliance with hand hygiene and isolation protocols are being explored but raise concerns about privacy and cost.

9.3.7 Checklists

The use of checklists in the presence of team leadership and multidisciplinary rounds have been found to improve adherence to infection control measures.

9.3.8 Glycemic and nutritional control

Proper glycemic control has been shown to reduce the risk of infection in critically ill patients, particularly in those with diabetes. Early enteral feeding is preferred over parenteral nutrition as it reduces the risk of hospital-acquired infections. Patients with a low albumin or pre-albumin are known to have an increased risk of acquiring infections – early referral to dieticians can help with disease prevention.

9.3.9 Bundles of care

A bundle of care in IPC refers to a structured set of evidence-based practices aimed at improving patient outcomes by preventing HAIs. These bundles consist of 3 to 5 interventions that, when applied together consistently, have been proven to reduce the incidence of infections and improve the overall quality of care in settings like ICUs. The key principle behind a care bundle is that all the elements must be performed together to achieve the best results.

9.3.10 Surveillance

Regular surveillance of ICU patients, especially those at risk of MDRO colonization, plays a pivotal role in early detection and containment of infections.

9.3.11 Attire

While there is some data to show that lab coats and street clothes can be contaminated with microbes, there is no data to suggest that these microbes can be transmitted to patients and can cause infections. Therefore, any of the differing local policies can be followed with respect to the wearing of attire in the adult and pediatric ICUs.

In the public healthcare facilities of Mauritius, staff are expected to wear lab coats or hospital scrubs.

Of note, the routine wearing of overshoes is discouraged due to increasing data regarding its inefficacy and its detrimental effects; the Ministry of Health and Wellness of Mauritius has reviewed the literature on this topic and a report has been disseminated regarding the futility of overshoes in most instances. In addition, crocs are not mandatory inside adult or pediatric ICUs. However, it is noted that overshoes and closed shoes are still needed to protect oneself from splashes – a risk assessment has to be undertaken by healthcare personnel.

Emphasis should be placed on using alcohol handrub prior to entering the ICU and after leaving the ICU. The “Bare Below Elbow” principle can be followed as in the NICU. While this principle is controversial regarding its efficacy above and beyond the usual hand washing or hand rub, it can still help to remind all staff to take all necessary precautions to disinfect their hands before engaging in clinical activities.

References

1. Osman MF, Askari R. Infection control in the intensive care unit. Surg Clin North Am. 2014 Dec;94(6):1175-94. doi: 10.1016/j.suc.2014.08.011.
2. Gandra S, Ellison RT 3rd. Modern trends in infection control practices in intensive care units. J Intensive Care Med. 2014 Nov-Dec;29(6):311-26. doi: 10.1177/0885066613485215.
3. Yi J, Kim KH. Identification and infection control of carbapenem-resistant Enterobacterales in intensive care units. Acute Crit Care. 2021 Aug;36(3):175-184. doi: 10.4266/acc.2021.00409.
4. Chiranjay Mukhopadhyay. Infection Control in Intensive Care Units. Indian Journal of Respiratory Care 7(1):14. December 2017.

Chapter 10: IPC in Maternal Units

10.1 INTRODUCTION

Bacterial infections around the time of childbirth are among the leading causes of maternal mortality worldwide and account for about one-tenth of the global burden of maternal death. Apart from death, women who experience peripartum infections are prone to severe morbidity and long-term disabilities such as chronic pelvic pain, fallopian tube blockage, and secondary infertility. Maternal infections before or during childbirth are associated with an estimated 1 million newborn deaths annually.

Several factors have been associated with increased risk of maternal peripartum infections, including pre-existing maternal conditions (e.g., malnutrition, diabetes, obesity, severe anaemia, bacterial vaginosis) and spontaneous or provider-initiated conditions during labour and childbirth (e.g., prolonged rupture of membranes, multiple vaginal examinations, manual removal of the placenta, caesarean section). Strategies to reduce maternal peripartum infections and their complications have been largely directed at preventive measures where such risk factors exist.

10.2 WHO RECOMMENDATIONS

WHO recommendations prioritize evidence-based interventions for prevention and treatment of genital tract infections during labour, childbirth, and the puerperium. Globally, the most common intervention for preventing morbidity and mortality related to maternal peripartum infection is the use of antibiotics for prophylaxis and treatment. However, antibiotic misuse for obstetric conditions or procedures that are thought to carry risk of infection is common in clinical practice. Such inappropriate use of antibiotics among women giving birth has implications for global efforts to contain the emergence of antibiotic-resistant bacteria.

The following diagram summarizes WHO recommendations to reduce maternal infections.

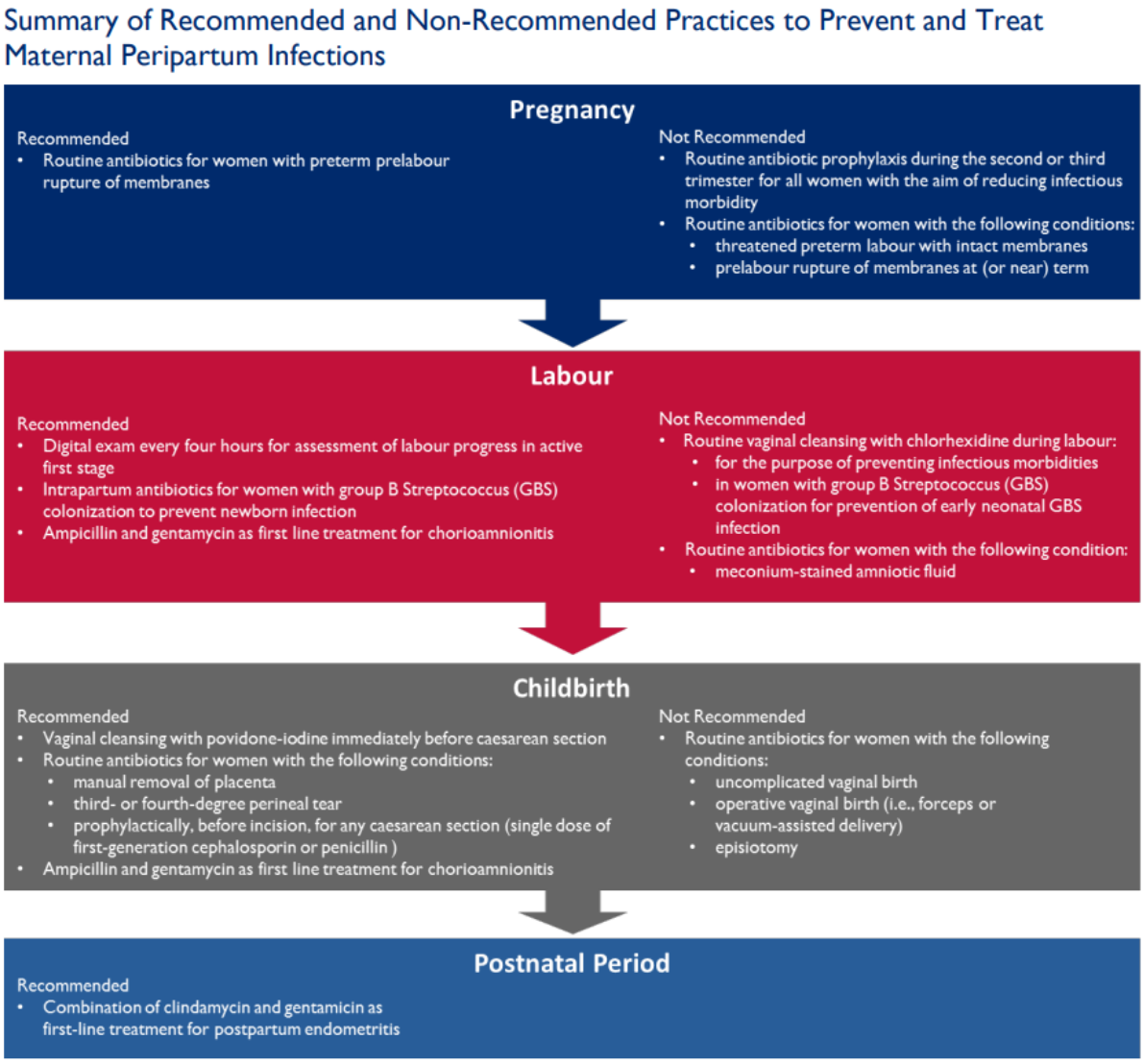


Figure 34: Taken from "WHO Recommendations for Prevention and Treatment of Maternal Peripartum Infections. Sep 2015". Follow the national antibiotic guidelines regarding treatment of endometritis – first line treatment is amoxicillin/clavulanate in Mauritius while clindamycin with gentamicin can be used as 2nd line or in patients allergic to penicillin.

10.3 PREVENTION OF MATERNAL AND NEONATAL INFECTIONS DURING VAGINAL DELIVERY

Vaginal deliveries do not require sterile conditions in the OT but cleanliness is of utmost importance. Particular attention should be given to having clean hands, clean perineal area and clean umbilicus.

Factors that increase the risk of infection during vaginal delivery include:

1. Prolonged rupture of membranes (>24 hours);
2. Trauma to the birth canal: lacerations of the vagina or perineum or urethral tear;
3. Retained placenta, necessitating manual removal of placenta or placental fragments;
4. Episiotomy;
5. Mid-forceps delivery; and
6. Multiple vaginal examinations.

Following these rules can reduce the risk of infection:

1. Sterile gloves should be used for digital vaginal examination.
2. Wash the perineal area with soap and clean water.
3. Use downward and backward motion while cleaning so that fecal organisms are not introduced into the vagina.
4. The anal area should be cleaned last and the wash towel discarded.
5. Perineal / pubic hair should not be shaved; hair clipper should be used if required. Routine shaving is not recommended by WHO as shaving has been shown to increase the risk of infection after delivery.
6. Always practice hand hygiene before and after delivery. Wash with antiseptic soap and water up to the elbows, adhering to the seven steps of hand hygiene.
7. Use appropriate PPE during delivery:
    a. Sterile gloves should provide protection up to the elbow; normal length gloves can be augmented by sterile surgical sleeves that come up to the elbow.
    b. Sterile water-resistant gown or rubber / plastic apron can be used.
    c. The use of a mask (with eye shield if splashing is likely to occur) should be promoted.
8. Instruments used during delivery should be sterile or high-level disinfected.
9. The baby should be received in a clean towel.

10.4 PREVENTION OF INFECTION DURING CAESAREAN SECTION

Caesarean section should be performed using all the precautions and procedures as for surgical procedures.

Procedures to prevent infection in patients undergoing caesarean section include:

1. The abdomen should not be shaved prior to surgery. If required, hair clippers should be used instead.
2. The surgeon and assistant should wear a face shield or mask and goggles, a plastic or rubber apron over the scrub-suit since splashing with blood and blood-tinged amniotic fluid is expected.
3. If there has been prolonged rupture of membranes or the caesarean section is non-elective, then a single shot of an appropriate antibiotic is given as prophylaxis.
4. The HCW receiving the infant should do hand hygiene and wear gloves.
5. The baby should be placed in a clean towel.

10.5 POSTPARTUM CARE OF THE MOTHER

Gloves should be worn when handling perineal pads, touching vaginal discharge or touching the episiotomy.

If the mother is breastfeeding, she should be taught how to care for her breasts and nipples.

If an indwelling urinary catheter is inserted, precautions to prevent urinary infection should be followed. Remove the catheter as soon as possible.

10.6 RATIONALE FOR EVIDENCE-BASED RECOMMENDATIONS

Heads of departments and IPC teams should ensure that evidence-based recommendations are followed rigorously to avoid cross-contamination.

The following table gives the rationale for WHO's IPC recommendations.

Prevention of Maternal Peripartum Infections	
WHO Recommendation 2015	**Rationale and Implementation Guidance**
I. Prevention of Peripartum Infections	
Recommendation 1: Routine perineal/pubic shaving prior to giving vaginal birth is not recommended.	• No evidence to support a clinical benefit of routine perineal or pubic shaving before childbirth. The decision regarding perineal/pubic shaving should be left to the woman and not to her health care provider.
Recommendation 2: Digital vaginal examination at intervals of four hours is recommended for routine assessment of active first stage of labour in low-risk women.	• Multiple vaginal examinations are recognized contributors to infectious morbidities, especially in the presence of other risk factors for infection (e.g., prolonged rupture of membranes and long duration of labour).
Recommendation 3: Routine vaginal cleansing with chlorhexidine during labour for the purpose of preventing infectious morbidities is not recommended.	• No evidence supports a clinical benefit to routine vaginal cleansing with chlorhexidine during labour. • Women are likely to prefer minimal interference with the labour process, and some women may find the procedure invasive and discomforting. Health care providers and policymakers are likely to place a high value on saving health care costs.
Recommendation 4: Routine vaginal cleansing with chlorhexidine during labour in women with group B Streptococcus (GBS) colonization is not recommended for prevention of early neonatal GBS infection.	• No evidence supports routine vaginal cleansing with chlorhexidine during labour for preventing early onset GBS-related disease in preterm and term neonates. Routine vaginal cleansing with chlorhexidine appears to increase vaginal irritation.
Recommendation 5: Intrapartum antibiotic administration to women with group B Streptococcus (GBS) colonization is recommended for prevention of early neonatal GBS infection.	• This recommendation is based on clinical benefits for neonates (in reducing risk of early neonatal onset GBS infection) as there is insufficient evidence for the effect on maternal infectious morbidities. • Intrapartum antibiotic (ampicillin or penicillin G) should be administered to all women with documented GBS colonization. • In light of the challenges of implementing GBS screening for all pregnant women, particularly in low-resource settings, policymakers should develop local policy and guidance on screening for GBS colonization based on local prevalence of GBS colonization and burden of early neonatal GBS infection.
Recommendation 6: Routine antibiotic prophylaxis during the second or third trimester for all women with the aim of reducing infectious morbidity is not recommended.	• In light of the available evidence, potential benefits related to use of antibiotics during pregnancy to prevent infectious morbidities do not appear to outweigh potential harm, particularly for women without a high-risk pregnancy.

Recommendation 7: Routine antibiotic administration is not recommended for women in preterm labour with intact amniotic membranes.	• Potential harm, including neonatal deaths and cerebral palsy, in association with the use of routine antibiotic prophylaxis outweigh the clinical benefits of antibiotics in terms of reducing maternal infectious morbidity.
Recommendation 8: Antibiotic administration is recommended for women with preterm prelabour rupture of membranes.	• To avoid inadvertent antibiotic administration to women with intact amniotic membranes, antibiotics should only be administered when a definite diagnosis of preterm premature rupture of membranes (PPROM) has been made.
Recommendation 9: Routine antibiotic administration is not recommended for women with prelabour rupture of membranes at (or near) term.	• "Routine" use implies administration of antibiotics in the absence of clinical signs of infection or any additional risk factors for infection. "Near term" in this context refers to 36 weeks gestation and above.
Recommendation 10: Routine antibiotic administration is not recommended for women with meconium-stained amniotic fluid.	• Evidence is insufficient to support prophylactic antibiotics for women with meconium- stained amniotic fluid during labour in the absence of other indications. • Antibiotics should be administered when characteristics of the liquor suggest infection. • Personnel experienced in neonatal resuscitation should attend delivery of infants in whom thick meconium liquor is noted, as risk of meconium aspiration is higher.
Recommendation 11: Routine antibiotic prophylaxis is recommended for women undergoing manual removal of the placenta.	• Materials should be updated to promote good hygiene and aseptic technique to help reduce maternal peripartum infection associated with manual removal of the placenta.
Recommendation 12: Routine antibiotic prophylaxis is not recommended for women undergoing operative vaginal birth.	• Evidence suggests that antibiotic prophylaxis does not reduce the risk of maternal infections after operative vaginal birth.
Recommendation 13: Routine antibiotic prophylaxis is recommended for women with a third- or fourth-degree perineal tear.	• Available evidence is insufficient to determine clinical benefits of routine administration of prophylactic antibiotics in women with third- or fourth-degree perineal tear postpartum. However, indirect evidence of a benefit exists for prophylactic antibiotics from potentially contaminated wounds (considering the bacterial flora in the rectum) in surgical practice, and it would be reasonable to use antibiotics to reduce the risk of infection.
Recommendation 14: Routine antibiotic prophylaxis is not recommended for women with episiotomy.	• There is a lack of evidence to determine the benefit or harm of routine administration of antibiotics to women who receive an episiotomy for vaginal birth. • Carefully performed episiotomies generally have a low rate of infection in settings where infection control measures are well-observed.
Recommendation 15: Routine antibiotic prophylaxis is not recommended for women with uncomplicated vaginal birth.	• "Uncomplicated vaginal birth" in this context connotes vaginal birth in the absence of any specific risk factor for or clinical signs of maternal peripartum infection.
Recommendation 16: Vaginal cleansing with povidone-iodine immediately before caesarean section is recommended.	• Vaginal preparation with povidone-iodine solution immediately prior to caesarean birth may reduce postoperative endometritis, particularly in women with ruptured membranes or those already in labour.
Recommendation 17: The choice of an antiseptic agent and its method of application for skin preparation prior to caesarean section should be based primarily on the clinician's experience with that particular antiseptic agent and method of application, its cost, and local	• Skin preparation is a vital part of the overall care that must be given to women undergoing surgery to prevent surgical site infections before caesarean section. However, there is no strong evidence to recommend the use of one specific antiseptic agent over another. • Key steps include the exclusion of maternal allergy to the skin preparation agent prior to surgery, as well as standard preoperative skin preparation

availability.	technique that is appropriate for the intended skin incision.
Recommendation 18: Routine antibiotic prophylaxis is recommended for women undergoing elective or emergency caesarean section.	• High-quality evidence demonstrates the clinical benefits of prophylactic antibiotics administered prior to/or during caesarean section, with the greatest benefit incurred when antibiotics are administered prior to incision.
Recommendation 18.1: For caesarean section, prophylactic antibiotics should be given prior to skin incision, rather than intraoperatively after umbilical cord clamping.	• Maximal benefit can be expected when prophylactic antibiotics are administered between 30–60 minutes before skin incision. • Evidence also supports the effectiveness of prophylactic antibiotics after umbilical cord clamping for the prevention of post-caesarean infectious morbidities. Therefore, antibiotics are still beneficial when used outside the suggested timeframe (i.e., 15–60 minutes before incision) and should be applied when the available time to administer a prophylactic antibiotic might be limited (e.g., emergency caesarean section).
Recommendation 18.2: For antibiotic prophylaxis for caesarean section, a single dose of first-generation cephalosporin or penicillin should be used in preference to other classes of antibiotics.	• No evidence demonstrates that any class of antibiotic is better than the other for prophylaxis in women undergoing caesarean section. However, first-generation cephalosporins and penicillin have an advantage over other classes of antibiotics in terms of cost and wide availability in all settings. • Due to the high risk of necrotizing enterocolitis among preterm babies, the use of "co-amoxiclav" for antibiotic prophylaxis should be avoided not only for caesarean delivery of preterm infants, but it might also be safer to avoid its use for caesarean delivery of term babies.

Table 34: Interventions for Prevention and Treatment of Maternal Peripartum Infections: Rationale and Implementation Guidance

10.7 MONITORING AND EVALUATION

The monitoring team should use indicators to assess adherence. Examples of indicators that are proposed for use by WHO are given in the next table.

	Suggested Indicators
Measures and indicators that can be adapted at regional and country levels to assess adherence to the guideline recommendations	• Proportion of women undergoing caesarean section who receive antibiotic prophylaxis, calculated as the number of women who receive antibiotic prophylaxis for caesarean section divided by the total number of women undergoing caesarean section.
	• Proportion of women with PPROM who receive antibiotic prophylaxis, calculated as the number of women with PPROM who receive antibiotic prophylaxis divided by the total number of women with PPROM.
	• Incidence of surgical wound infection among women undergoing caesarean section, calculated as the number of women with surgical wound infection after caesarean section divided by the total number of women undergoing caesarean section.

Table 35: Measures to Monitor Adherence with Guidelines to Reduce Infection-related Morbidity

References

1. USAID and WHO. WHO Recommendations for Prevention and Treatment of Maternal Peripartum Infections: Highlights and Key Messages from the World Health Organization's 2015 Global Recommendations. September 2015.

Chapter 11: IPC in Hemodialysis Units

11.1 INTRODUCTION

Infection is the most common cause of hospitalization and the second most common cause of mortality among hemodialysis (HD) patients, after cardiovascular disease. HD patients are exposed to different types of infection, which include bloodstream infections and localized infections at the vascular access sites, blood-borne infections (e.g., HBV, HCV and HIV) and airborne infections such as tuberculosis. Patients with chronic kidney disease are at increased risk of dying if they catch infections like SARS-CoV-2 and dialysis units must ensure that all precautions are taken to ensure that the transmission of microbes is minimized.

11.2 BASIC MEASURES TO REDUCE RISK OF INFECTION IN HEMODIALYSIS PATIENTS

In the hemodialysis setting, contact transmission plays a major role in the transmission of blood-borne pathogens. Transmission occurs via hands of HCWs, contaminated with infected blood directly or indirectly from contaminated surfaces and equipment.

Standard precautions are to be used routinely on all patients and include the use of gloves, disposable plastic aprons or gowns and masks (whenever needed) to prevent contact of HCWs with blood, secretions, excretions or contaminated items.

Respiratory etiquette should be observed routinely. Patients identified with an airborne illness should be masked immediately and separated from other patients in a single room which is preferably under negative pressure.

Details of standard and transmission-based precautions are given in Chapter 4. Patients and staff should be vaccinated against preventable illnesses.

The patient and nurse must wear a mask when a catheter is connected or disconnected from the blood lines during dialysis. To avoid exposure to splashes, nurses are advised to wear goggles or face shields when conducting certain procedures. Refer to the national SOP on Central Venous Catheters for more details.

11.3 IPC FOR PATIENTS WITH BLOOD-BORNE INFECTIONS

Besides standard precautions, the following points should be kept in mind.

1. HBsAg positive patients should undergo dialysis in a separate room using separate machines, equipment, instruments and supplies.
2. Staff caring for Hepatitis B Virus (HBV) positive patients should be HBV immune.
3. Care of patients with Hepatitis C Virus and HIV requires strict adherence to environmental IPC practices including equipment disinfection.

11.4 DIALYSIS WATER

The HD patient is exposed to more than 100 liters of water during each session of dialysis. Therefore, water must be purified and filtered. Contaminants must be removed by deionization and reverse osmosis.

Bacterial culture and endotoxin assay on dialysate and reverse osmosis water should be performed at least monthly and during outbreaks using standard quantitative methods.

11.5 DETAILED IPC MEASURES FROM INTERNATIONAL ORGANIZATIONS

Australian guidelines recommend that:

1. All patients be screened for hepatitis B virus and hepatitis C virus prior to commencement of dialysis or when transferring from another dialysis facility. The serological screening panel should include serology for hepatitis B (HBsAg, anti-HBc, anti-HBs), and hepatitis C (anti-HCV) together with baseline liver function tests.
2. Patients who are hepatitis B vaccinated with anti-HBs ≥10 mIU/mL can have anti-HBs titres rechecked annually. If their titre fall below this level, they can get a booster dose of the HBV vaccine – check national protocols on immunization for details.
3. Patients with anti-HBs titres <10 mIU/mL (e.g., who are vaccine non-responders) need to have their HBsAg checked every 6 months to see if they become infected.
4. Patients who are seronegative for hepatitis C should have anti-HCV rechecked every 6 months.
5. All patients negative for hepatitis B receiving in-centre haemodialysis are rescreened for hepatitis B (HBsAg, anti-HBc and anti-HBs) if there has been a notification of a seroconversion of hepatitis B (HBsAg negative to positive) within the dialysis population. All patients who are non-immune should have repeated screening every 2 weeks for 3 months.
6. All patients associated with a dialysis centre undergo rescreening for hepatitis C (anti-HCV, HCV RNA) if there has been a seroconversion of hepatitis C (anti-HCV negative to positive) within the dialysis population, thence repeat screening every 2 weeks for 3 months.
7. Hepatitis B non-immune haemodialysis patients should receive a course of hepatitis B vaccination.
8. HBsAg positive patients should be dialyzed in isolation or in an area separate to where patients who are HBsAg negative receive dialysis.
9. HBsAg positive patients should use a dedicated dialysis machine, and single-use dialysers. When dialysers are to be reused, they should be decontaminated and disinfected.
10. Reusable items should be disinfected between patient use.
11. Medications and supplies should not be moved between patients. Multi-dose medications should be prepared in a central designated area, and then dispensed to individual patients. No drugs or materials from the dialysis station should be returned to the preparation area.
12. If fluid is evident on the machine side of the filter then the machine should be taken out of service, the internal filter changed and the internal housing disinfected.
13. After cannulation the table and dialysis screen are cleaned immediately, and the dialysis bay is cleaned after each haemodialysis session.
14. Sterile gloves, apron/gown, face masks and goggles or face shield should be worn when inserting or manipulating central venous dialysis catheters using aseptic technique. See the

national SOP on Central Venous Catheters for details.

15. Patients with occult HBV* (most commonly recognized by serologically undetectable HBsAg but positive for anti-HBc) should be routinely monitored for evidence of HBV reactivation using six monthly assessments of aminotransferases (ALT/AST), and six monthly assessments of anti-HBs titres and HBsAg.
16. As an additional precaution, patients who do not consent to blood-borne virus surveillance should be dialysed in a separate area.
17. Hepatitis A vaccination is recommended in non-immune patients with chronic hepatitis B and hepatitis C.
18. Decolonization of MRSA should be considered for colonized chronic haemodialysis patients who have had MRSA related infections or who have central venous haemodialysis catheters as dialysis access.
19. Staff working with dialysis patients should have HBV vaccination.
20. Staff who are non-immune to hepatitis B, including vaccine non-responders, should not be assigned to the care of patients who are HBsAg positive.

11.6 LOCAL PRACTICES TO REDUCE INFECTIONS ACQUIRED DURING DIALYSIS

Mauritian guidelines also recommend that:

1. All dialysis patients should be screened for HIV prior to starting dialysis.
2. Dialysis patients who are HCV and / or HIV positive should preferably be dialyzed on a dedicated dialysis machine in an isolation area.
3. Patients with chronic hepatitis C who have undergone hepatitis C treatment and achieved a test of cure (sustained virological response) should be managed the same as non-HCV infected patients in the dialysis setting. However, if their risk factors to acquire HCV persist, they can be retested via HCV PCR every 6 months.
4. All patients who have active infections with an MDRO should be isolated during their dialysis sessions in order to protect other patients.
    a. Following infections with MRSA, decolonization should be undertaken followed by taking swabs of the nose and axilla / wound / groin to test for persistent colonization.
    b. Following infections with VRE or carbapenem resistant *Enterobacteriaceae*, rectal swabs should be taken after treatment.
    c. Patients should remain isolated as long as their screening tests remain positive.
    d. If positive, screening tests should be repeated every 4 weeks till negative.

References

1. Jardine M, Commons RJ, de Zoysa JR, Wong MG, Gilroy N, Green J, Henderson B, Stuart RL, Tunnicliffe DJ, van Eps C, Athan E. Kidney Health Australia - Caring for Australasians with Renal Impairment guideline recommendations for infection control for haemodialysis units. Nephrology (Carlton). 2019 Sep;24(9):951-957.

Chapter 12: IPC in Dentistry

12.1 INTRODUCTION

Infection prevention and control (IPC) in dentistry is crucial for several reasons:

1. High risk of exposure: Dental procedures involve close contact with patients' oral cavities, which contain blood, saliva, and other bodily fluids. These can harbor pathogens such as bacteria, viruses, and fungi. Without proper IPC measures, dental professionals and patients are at risk of transmitting infections.
2. Cross-contamination prevention: Tools and instruments used in dental procedures can become contaminated if not properly sterilized. Reusing contaminated equipment without adequate cleaning and sterilization can lead to the spread of infections, including serious diseases like hepatitis B, hepatitis C, HIV, and other bloodborne pathogens.
3. Airborne transmission: Dental procedures often involve the use of ultrasonic scalers, high-speed handpieces, and air-water syringes, which can create aerosols. These aerosols may contain infectious agents that can be inhaled by both the patient and dental staff, leading to respiratory infections or other airborne diseases, such as tuberculosis or COVID-19.
4. Antimicrobial resistance (AMR): Infections caused by antibiotic-resistant bacteria are a growing concern. Poor IPC practices in dental clinics could contribute to the spread of resistant bacteria, both in healthcare settings and the community. By following stringent infection control measures, dental professionals help prevent the spread of AMR.
5. Patient safety and confidence: Adherence to IPC protocols reassures patients that they are receiving care in a safe environment, reducing their anxiety about contracting infections during treatment. It also helps to build trust between dental professionals and their patients.
6. Regulatory and ethical responsibilities: Dental professionals are bound by ethical obligations and regulatory requirements to protect patients from harm, including preventing infections. Following proper IPC measures ensures compliance with health and safety standards and helps avoid legal and professional repercussions.

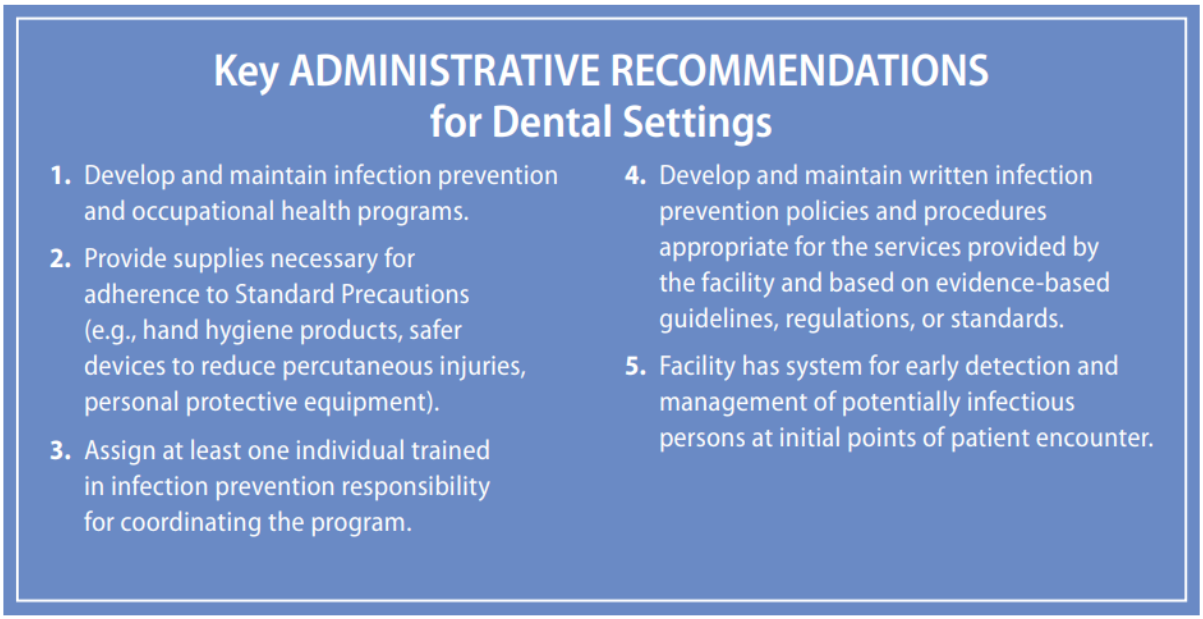
12.2 STANDARD PRECAUTIONS

Dentists are the most exposed professionals to respiratory diseases, e.g. COVID-19. As usual, standard precautions continue to apply. Special attention should be given to the following aspects:

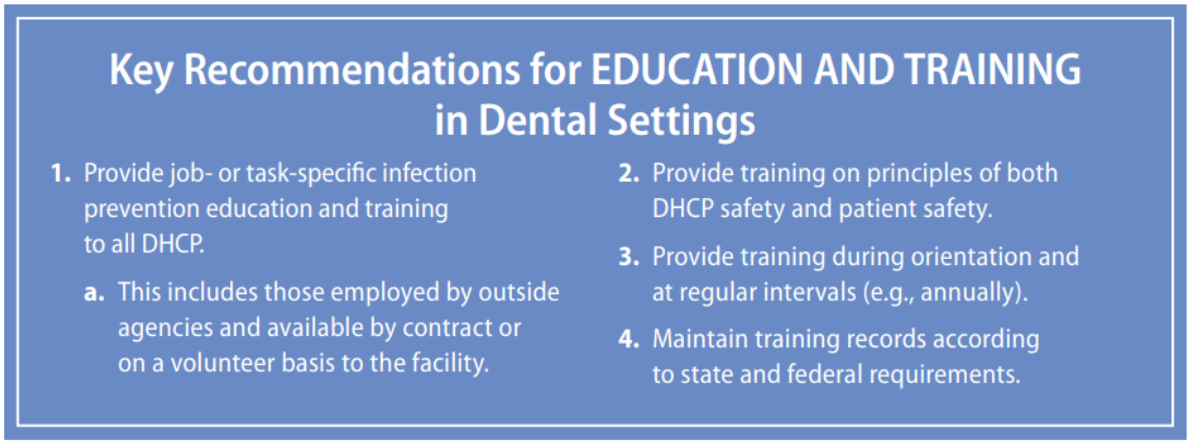
- Gloves should be worn when exposed to patient fluids.
- Masks must be worn in the patient treatment area and when the dentist is manipulating the prostheses in the laboratory.
- The use of disposable plastic face shields should be used when splashes are expected.
- Sharps disposal protocol should be followed, with particular emphasis on the use of a haemostat when handling blades.
- Outer barrier garments for aerosol protection, e.g. apron or gown, are worn at all times when treating a patient and always changed between patients.
- Needlestick injuries can be particularly prominent – all precautions must be taken to avoid these and the dentists should be appropriately vaccinated e.g., against HBV.

12.3 RECOMMENDATIONS OF US CDC

The following list of posters display key recommendations from the CDC for dental healthcare practitioners (DHCP).



Poster 1



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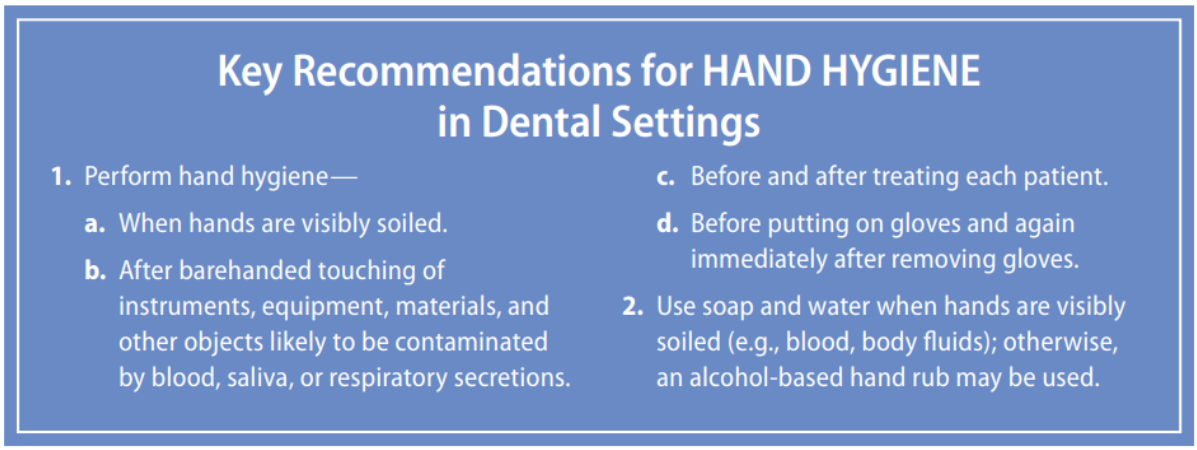

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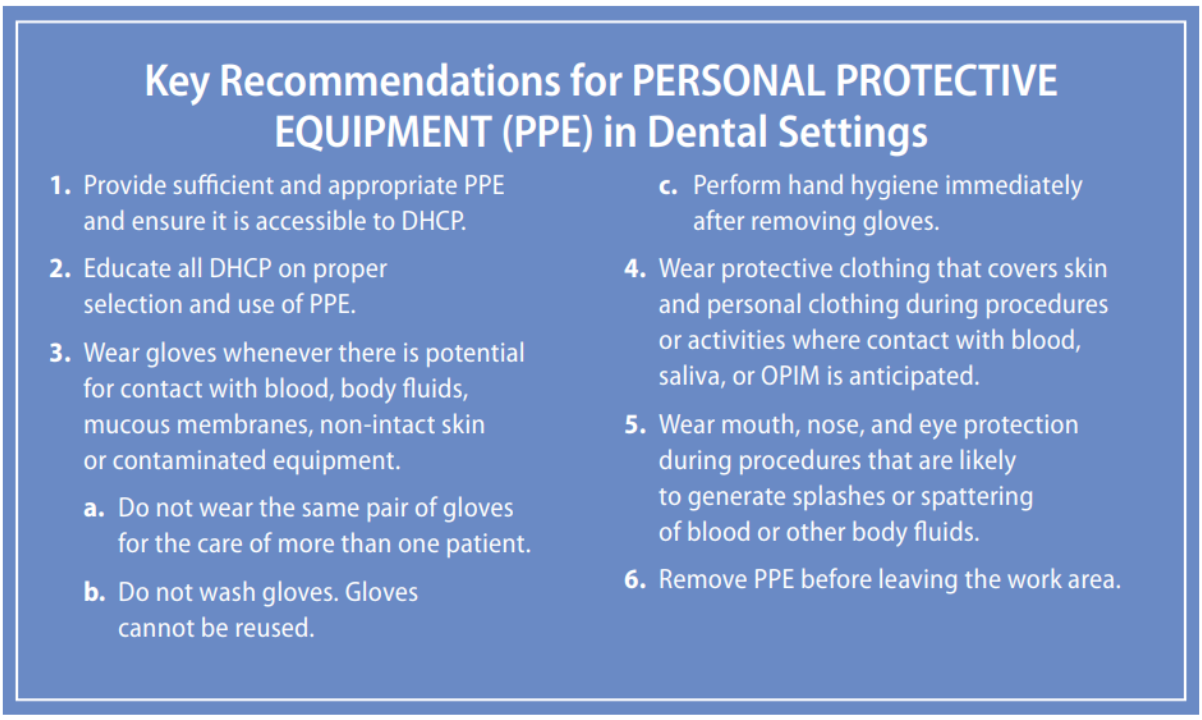


Poster 5

Key Recommendations for RESPIRATORY HYGIENE/COUGH ETIQUETTE in Dental Settings

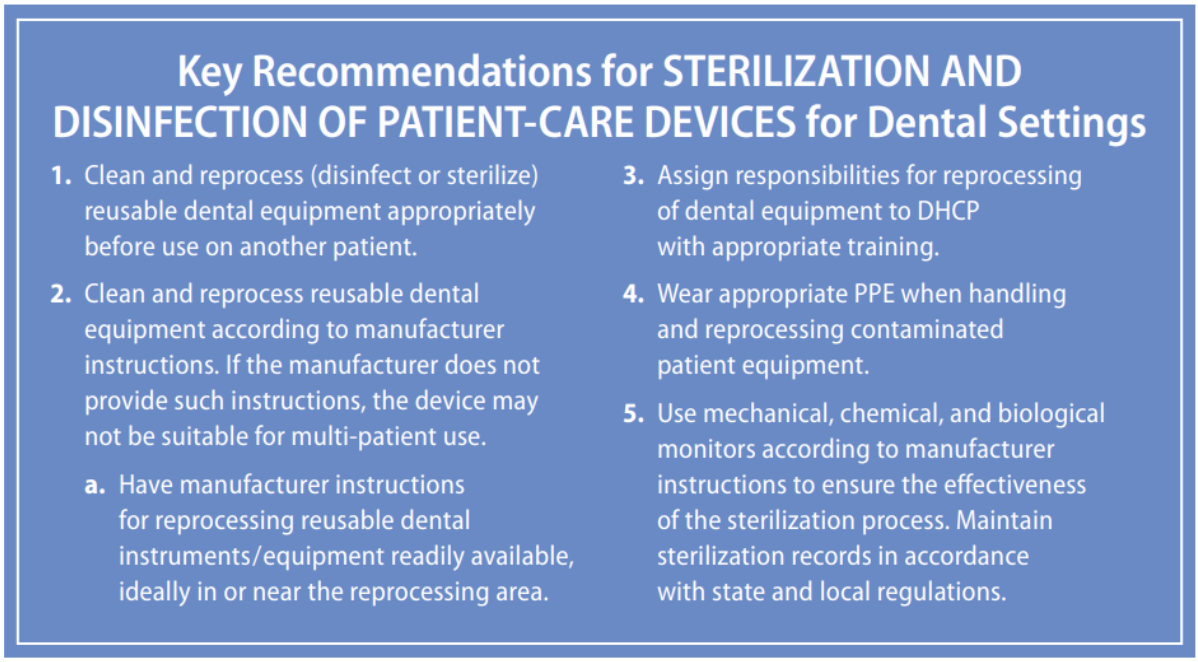
1. Implement measures to contain respiratory secretions in patients and accompanying individuals who have signs and symptoms of a respiratory infection, beginning at point of entry to the facility and continuing throughout the visit.
   - **a.** Post signs at entrances with instructions to patients with symptoms of respiratory infection to—
     - **i.** Cover their mouths/noses when coughing or sneezing.
     - **ii.** Use and dispose of tissues.
     - **iii.** Perform hand hygiene after hands have been in contact with respiratory secretions.
   - **b.** Provide tissues and no-touch receptacles for disposal of tissues.
   - **c.** Provide resources for performing hand hygiene in or near waiting areas.
   - **d.** Offer masks to coughing patients and other symptomatic persons when they enter the dental setting.
   - **e.** Provide space and encourage persons with symptoms of respiratory infections to sit as far away from others as possible. If available, facilities may wish to place these patients in a separate area while waiting for care.
2. Educate DHCP on the importance of infection prevention measures to contain respiratory secretions to prevent the spread of respiratory pathogens when examining and caring for patients with signs and symptoms of a respiratory infection.

Poster 6

Key Recommendations for SAFE INJECTION PRACTICES in Dental Settings

1. Prepare injections using aseptic technique[2] in a clean area.
2. Disinfect the rubber septum on a medication vial with alcohol before piercing.
3. Do not use needles or syringes* for more than one patient (this includes manufactured prefilled syringes and other devices such as insulin pens).
4. Medication containers (single and multidose vials, ampules, and bags) are entered with a new needle and new syringe, even when obtaining additional doses for the same patient.
5. Use single-dose vials for parenteral medications when possible.
6. Do not use single-dose (single-use) medication vials, ampules, and bags or bottles of intravenous solution for more than one patient.
7. Do not combine the leftover contents of single-use vials for later use.
8. The following apply if multidose vials are used—
   - **a.** Dedicate multidose vials to a single patient whenever possible.
   - **b.** If multidose vials will be used for more than one patient, they should be restricted to a centralized medication area and should not enter the immediate patient treatment area (e.g., dental operatory) to prevent inadvertent contamination.
   - **c.** If a multidose vial enters the immediate patient treatment area, it should be dedicated for single-patient use and discarded immediately after use.
   - **d.** Date multidose vials when first opened and discard within 28 days, unless the manufacturer specifies a shorter or longer date for that opened vial.
9. Do not use fluid infusion or administration sets (e.g., IV bags, tubings, connections) for more than one patient.

Poster 7



Poster 8

12.4 ADDITIONAL INTERNATIONAL RECOMMENDATIONS TO PROTECT STAFF AND PATIENTS

- Recommended immunizations for DHCP are hepatitis B, MMR (measles, mumps, and rubella), Tdap (tetanus, diphtheria, pertussis), influenza and COVID-19.
- Use surface barriers to protect clinical contact surfaces, particularly those that are difficult to clean (e.g., switches on dental chairs, computer equipment) and change surface barriers between patients.
- Use disinfectants at the correct concentration and for the correct contact time.
- Use water that meets national regulatory standards for drinking water for routine dental treatment output water.
- Use sterile saline or sterile water as a coolant/irrigant when performing surgical procedures.
- In April 2018, the CDC released a Statement on Reprocessing Dental Handpieces stressing that handpieces (both low-speed and high-speed) and other intraoral instruments that can be removed from the airlines and waterlines need to be heat sterilized between patients. The following points were emphasized:
    - Clean and heat sterilize handpieces and other intraoral instruments that can be removed from the airlines and waterlines of dental units.
    - For handpieces that do not attach to air lines and waterlines, follow the validated manufacturer's instructions for reprocessing these devices.
    - Per NICE guidelines, chlorhexidine mouthwash should not be offered as prophylaxis against infective endocarditis to people at risk of infective endocarditis undergoing dental procedures. However, chlorhexidine may still be used to prevent mucositis, gingivitis and / or dental abscesses.

12.5 STERILIZATION DURING DENTISTRY

12.5.1 Indicators

Sterilization is best monitored using a combination of mechanical, chemical, and biological indicators. The CDC has provided the following recommendations:

- Mechanical Indicators: Record cycle time, temperature, and pressure as displayed on the sterilizer gauges for each instrument load.
- Chemical Indicators: Use chemical indicators, such as indicator tapes, with each instrument load. These indicators change color after exposure to the proper sterilization environment.

Failure of the indicator to change color indicates that it was not exposed to the proper sterilization environment (e.g., proper pressure or temperature). In such cases, the instrument load should be re-sterilized.

Indicator tapes are sterilizer-specific (i.e., tapes for steam sterilizers cannot be used to test chemical vapor sterilizers).

Chemical indicators should not replace biological indicators, as only a biological indicator consisting of bacterial endospores can measure the microbial killing power of the sterilization process.

The CDC recommends monitoring sterilizers at least weekly with biological indicators. For biological monitoring, use an in-office incubator and spore monitoring strips. This method usually gives results in 24-48 hours. A positive spore test result indicates that sterilization failed.

12.5.2 Failure of sterilization

Always maintain a log of spore test results – this will help in the auditing process. Internationally, the records are usually kept for 5 to 7 years.

In cases where biological indicators suggest that sterilization has failed, follow the steps below:

- Take the sterilizer out of service.
- Review the sterilization process being followed in the office to rule out operator error as the cause of failure.
- Correct any identified procedural problems, and retest the sterilizer using biological, mechanical, and chemical indicators.
- If the repeat biological indicator test is negative and the other test results fall within normal limits, the sterilizer can be returned to service.
- If the biological indicator test is positive, or the mechanical or chemical test results indicate failure, the sterilizer should not be used until the reason for failure has been identified and corrected.
    - If no procedural errors are identified or failures persist after procedural errors are corrected, the sterilizer should not be used until the reason for failure has been identified and corrected.
    - Before the sterilizer can be returned to service, the biological indicator should return negative results for tests conducted during three consecutive empty-chamber sterilization cycles to ensure that the problem has been corrected.
    - To the extent possible, reprocess all instruments that were sterilized since the last

negative spore test.

- Record the positive test results and all actions taken to help ensure proper functioning of the sterilizer in the monitoring log.

Refer to the chapter on sterilization in this guideline for more details on sterilization of dental equipment.

References

1. Centers for Disease Control and Prevention. Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; October 2016.
2. https://www.ada.org/resources/ada-library/oral-health-topics/infection-control-and-sterilization. Accessed on 8 Oct 2024.
3. National Institute for Health and Care Excellence (NICE), UK. Prophylaxis against infective endocarditis: antimicrobial prophylaxis against infective endocarditis in adults and children undergoing interventional procedures. 8 July 2016.

Chapter 13: IPC in Oncology

13.1 INTRODUCTION

Patients receiving chemotherapy are at risk of developing infections because of their immunocompromised status. This may lead to hospitalization, disruptions in chemotherapy schedules and, in some cases, death. It is therefore imperative that great care is taken in order to prevent HAIs. Every staff member has an important role in preventing infections in cancer patients by following standard precautions, which are the minimum infection prevention measures that apply to all patient care.

13.2 STANDARD PRECAUTIONS

- Hand Hygiene

  It is very important that the WHO Moments of Hand Hygiene be followed. See the chapter on standard precautions for details.

- PPE

  PPE should be worn if there is risk for exposure to blood, body fluids (e.g., respiratory secretions, wound drainage), mucous membranes, nonintact skin or contaminated equipment. PPE choice should be based on the anticipated nature of the patient interaction and/or the likely mode(s) of transmission. Perform hand hygiene before and after removing PPE. PPE should be removed before exiting the patient environment

- Respiratory Hygiene

  All staff, patients and visitors should wear a face mask if they have any symptoms of respiratory tract illness.

- Injection Safety/Medication Handling

  Whenever preparing and administering chemotherapy or other parenteral medications strict asepsis should be maintained. Parenteral medications should be prepared as close as possible to the time of administration. A facemask should be worn when placing a catheter or injecting material into the epidural or subdural space.

- Central Venous Catheter

  Oncology patients often have central venous catheters for long term administration of chemotherapy. These may include peripherally inserted central catheters (PICCs), tunneled catheters and implanted ports. Strict aseptic technique should be used when accessing these lines. This includes performing hand hygiene and ensuring an appropriate antiseptic agent is properly applied prior to accessing the catheter. *(See SOP on care of CVC)*

- Environmental Cleaning

  Just as in other patient areas, regular environmental cleaning should be performed, focusing on high-touch surfaces, such as patient chairs and IV poles in chemotherapy areas and couches in patient exam rooms. Special care to be given to routine, terminal and deep cleaning when indicated.

13.3 INTERNATIONAL RECOMMENDATIONS

- Skin inspection should be done routinely with attention to sites at high risk for infection (eg, intravascular catheters, perineum); this is performed daily during nursing care with physician follow-up as needed.
- Expert recommendations include avoiding tampon use for menstruating hematopoietic stem cell transplant (HSCT) recipients as well as avoiding digital rectal examinations, rectal thermometers, enemas, and suppositories during periods of neutropenia to prevent mucosal breakdown.
- Use daily chlorhexidine bathing, particularly in critically ill patients, to reduce transmission of multidrug-resistant organisms (MDROs) and prevent infections.
- Complete periodontal examination followed by necessary treatment is recommended before management of head and neck cancers, high-dose chemotherapy, HSCT and any cancer regimen that is expected to lead to significant immunosuppression.
- Routine oral hygiene is important to minimize infections (eg, pneumonia) and may improve healing of mucositis. Oral rinses with sterile water or normal saline are recommended 4–6 times per day and neutropenic patients should routinely brush their teeth, taking care to minimize gingival trauma.
- The Centers for Disease Control and Prevention (CDC) recommends a low microbial diet for HSCT recipients. Reducing exposure to microbes in foods such as unpasteurized cheeses or beverages, raw fruits and vegetables, and undercooked meats during periods of neutropenia may decrease the incidence of infection. Drinking of bottled water instead of tap water is preferred for hematopoietic stem cell transplantation during the neutropenic episode.
- Cancer patients should receive all the routine vaccines including influenza vaccines. Live vaccines are relatively contraindicated during the immunosuppressed episode.
- Vaccine-strain polio virus in oral polio vaccine has the potential for person-to-person transmission and is absolutely contraindicated in healthcare personnel, family members, and other caregivers of immunocompromised patients. In general, HCW in contact with severely immunosuppressed patients should avoid taking live vaccines and if they are administered such vaccines, they should not be in contact with cancer patients on chemotherapy for a few weeks.
- All visitors should be instructed on basic infection prevention including hand hygiene techniques and isolation procedures.
- The CDC recommends that any visitor with an upper respiratory tract infection, a flu-like illness, a herpes zoster rash (whether covered or not), or recent known exposure to any transmittable disease should not be allowed access to the unit or should at least be restricted from visiting severely immunosuppressed patients.
- Likewise, visitors should be asked about recent vaccinations, and any with a recent history of oral polio vaccination or those who develop a rash within 6 weeks of live-attenuated varicella-zoster virus vaccination should also be restricted.

Some basic recommendations are summarized in the following table.

Prevention Category	Recommendations
General	Scrupulous hand hygiene
Respiratory viruses	Avoid contact with persons with respiratory viral symptoms (eg, rhinorrhea, nasal congestion, pharyngitis, cough, fever)
	Avoid crowded places (or wear surgical mask)
Foodborne/waterborne and fecal-oral pathogens	Maintain cleanliness of food preparation areas and utensils
	Handle raw meats separately and avoid cross-contamination
	Avoid high risk foods (see text) and cook meats properly
	Avoid drinking from private well-water sources and be aware of local boil-water advisories; confirm bottled water is appropriately processed to remove *Cryptosporidium*
	Avoid sexual practices resulting in oral exposure to feces
Environmental pathogens	Avoid gardening or direct contact with soil or plants
	Avoid marijuana use
Zoonotic pathogens	Limit contact with domestic pets and maintain pet health
	Avoid contact with animal saliva, urine, and feces
	Avoid contact with exotic pets and wild animals
International pathogens	Consult physician before travel to developing countries

Table 36: Recommendations to Immunosuppressed Patients and Caregivers for Infection Prevention in the Home. Taken from "Thom KA, Kleinberg M, Roghmann MC. Infection prevention in the cancer center. Clin Infect Dis. 2013 Aug;57(4):579-85."

13.4 ATTIRE DURING CHEMOTHERAPY ADMINISTRATION

While PPE should be worn to protect oneself from infections, there are also separate recommendations internationally on the use of PPE when preparing and handling anti-neoplastic and hazardous drugs.

Two pairs of chemotherapy-tested gloves should be worn for all hazardous drug-handling activities. Change gloves every 30 minutes or immediately if damaged or knowingly contaminated. Gloves must be disposable and powder-free; made from nitrile, neoprene, or latex; and have a cuff long enough to cover the sleeves of the gown. Thickness will vary according to glove material. With chemotherapy preparation, use sterile gloves as the outer glove.

Sources of exposure of health care providers to cytotoxic drugs are varied. Routes of exposure are typically inhalation, dermal, or oral.

One route of exposure is inhalation via droplets, particulates, and vapours. Many procedures can generate aerosols, including but not limited to the following:

1. piercing a vial and adding or removing material from a vial; manipulation of ampoules,
2. drug injection into an IV line,
3. removal of air from a syringe or infusion line,
4. leakage at the tubing, syringe, or stopcock connection,
5. clipping used needles,
6. drying of contaminated areas resulting in airborne drug particles.

Vapourisation of antineoplastic drugs has been recorded with drugs such as carmustine, ifosfamide, thiotepa, and cyclophosphamide. Use of biosafety cabinets to manipulate cytotoxic and hazardous drugs are therefore recommended.

Apart from malignancies that may occur due to exposure to cytotoxic medicines, the most common reproductive effects found are increased fetal loss, congenital malformations, low birth weight, congenital abnormalities, and infertility.

Figure 35: From the Oncology Nursing Society (USA).

Gowns should be impermeable. Chemotherapy gowns must be worn during the following:

- Compounding (no longer than 3 hours)
- Administration
- Disconnection
- Disposal of hazardous drugs (HD)
- Spill clean-up
- Handling excreta

The following two tables display what PPE should be worn when exposed to hazardous drugs.

Activity	Type of Protection
Airborne particles • *Intravesical administration* • *Spills that can be contained within a spill kit*	Fit-tested, NIOSH-certified N95 or more protective respirator
Gasses and vapors • *Unpacking HDs that are not contained in plastic* • *HD spills larger than what can be contained in a spill kit* • *Deactivating, decontaminating, and cleaning C-PEC*	Elastometric half-mask with a multi-gas cartridge and P100-filter. Replace filters when damaged, soiled or causing increased breathing resistance (NIOSH, 2005).

Table 37: Types of protection based on activity. From the Oncology Nursing Society (USA). C-PEC: Containment Primary Engineering Control. HD – Hazardous Drugs.

Eye Protection	
Use: Potential for splashing, such as administration in the operating room, intravesicularadministration, working above eye level, or when cleaning spills	**Section:** Goggles are needed to provide protection against splashing to the eyes. Eyeglasses or safety glasses with side shields are not sufficient protection (NIOSH, 2008).
Face Protection	
Use: Face shields used to protect against splashing	**Section:** Use face shield in combination with goggles to provide full protection against splashing to the eyes and face.
Head and Hair Cover	
Use: Used for protection from HD particulate or microbial contamination in clean rooms and other sensitive areas (NIOSH, 2008)	**Section:** Constructed of coated materials
Shoe Covers	
Use: Wear shoe covers when compounding HDs. Remove shoe covers when exiting the compounding room (NIOSH, 2008). Wear a second pair of shoe covers when entering the compounding area (USP, 2016).	
Sleeve Covers	
Use: Provide protection from HD residue on arms that come in contact with surfaces of the BSC (NIOSH, 2008	**Section:** Select disposable sleeve covers made of polyethylene-coated polypropylene or other laminate materials.

Table 38: Types of PPE to wear. From the Oncology Nursing Society (USA).

References

1. https://www.ons.org/sites/default/files/PPE%20Use%20With%20Hazardous%20Drugs.pdf. Accessed on 8 Oct 2024.
2. Thom KA, Kleinberg M, Roghmann MC. Infection prevention in the cancer center. Clin Infect Dis. 2013 Aug;57(4):579-85. doi: 10.1093/cid/cit290. Epub 2013 May 7.
3. https://journals.sagepub.com/doi/full/10.1177/10781552211070933

Chapter 14: Biosafety in the Clinical Laboratory

14.1 INTRODUCTION

The clinical laboratory is a workplace where many potential pathogens are encountered on a daily basis. However, the laboratory can be a safe place to work if possible risks are identified and safety and infection control protocols are followed. Laboratory workers can minimize the risks associated with work involving these infectious agents through the application of appropriate biosafety and containment principles and practices.

14.2 BASIC PRECAUTIONS

Certain steps, if followed diligently, can help to protect lab staff:

1. There should be a designated area for collecting blood and other clinical samples, physically separated from the patient waiting room and specimen processing area.
2. Ample space must be provided for the safe conduct of laboratory work and for cleaning and maintenance.
3. Facilities for eating and drinking and for rest should be provided outside the laboratory working area.
4. Laboratory coats should be fully buttoned and must be worn by all laboratory staff at all times in the laboratory. These coats should be left in the laboratory when going out for lunch or breaks and when leaving the laboratory.
5. Laboratory coats should be decontaminated and laundered regularly (never taken home for laundering).
6. Mouth pipetting is prohibited; instead, use pipetting bulbs.
7. Wear gloves when working with biological specimens. Change gloves when contaminated.
8. In preparing specimens, prevent aerosols and the resultant possible spread of infectious agents by:
    a. capping all tubes to be centrifuged prior to centrifugation;
    b. never opening the lids of centrifuges until the centrifuge has come to a complete stop; and
    c. only opening specimen tubes by gently twisting the stoppers and lifting them (sometimes holding a lint-free tissue over the stopper may prevent aerosolization).
9. Decontaminate equipment and work benches upon entering the laboratory and before leaving the work area with a freshly made solution of hypochlorite.
10. The international biohazard warning symbol and sign must be displayed on the doors of the rooms where microorganisms of risk group 2 or higher risk groups are handled.
11. All specimens are to be received in a closed container (without any spills) labelled with appropriate patient information along with a duly filled specimen referral form.
12. Steam autoclaving is the preferred method for all decontamination processes.

13. All biomedical waste must be properly managed.

14.3 BIOSAFETY LEVELS

Biosafety level 1 (BSL-1) is the basic level of protection and is appropriate for agents that are not known to cause disease in normal, healthy humans. Examples of such organisms are *Lactobacillus* spp. and *Staphylococcus epidermidis*.

Biosafety level 2 (BSL-2) is appropriate for handling moderate-risk agents that cause human disease of varying severity by ingestion or through percutaneous or mucous membrane exposure. Examples of such organisms are *Escherichia coli* and *Candida albicans*.

Biosafety level 3 (BSL-3) is appropriate for agents with a known potential for aerosol transmission, for agents that may cause serious and potentially lethal infections and that are indigenous or exotic in origin. Examples of BSL-3 organisms are tuberculosis and *Yersinia pestis*.

Exotic agents that pose a high individual risk of life-threatening disease by infectious aerosols, and for which no treatment is available, are restricted to high containment laboratories that meet biosafety level 4 (BSL-4) standards. An example of a BSL-4 organism is Ebola virus.

Biosafety cabinets are to be used when performing procedures with a high potential for producing infectious aerosols. These include:

1. Open-fronted Class I and Class II biosafety cabinets are primary barriers that offer significant levels of protection to laboratory personnel and to the environment when used with good microbiological techniques.
2. The Class II biological safety cabinet also provides protection from external contamination of the materials (e.g., cell cultures, microbiological stocks) being manipulated inside the cabinet.
3. The gas-tight Class III biological safety cabinet provides the highest attainable level of protection to personnel and the environment.

Table 9 shows the IPC practices that should be implemented in the laboratory.

BSL	Agents	Practices	Primary barriers	Facilities (secondary barriers)
1.	Not known to consistently cause diseases in healthy adults	Standard microbiological practices	• No primary barriers required. • PPE: laboratory coats and gloves, eyes, face protection as needed	Laboratory bench and sink required
2.	• Agents associated with human disease • Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure	BSL-1 practice plus: • Limited access • Biohazard warning signs • 'Sharps' precautions • Biosafety manual defining any needed waste decontamination or medical surveillance policies	Primary barriers: Biosafety cabinets or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials PPE: Laboratory coats, gloves, face and eye protection, as needed.	BSL-1 plus: Autoclave available
3.	Indigenous or exotic agents that may cause serious or potentially lethal disease through the	BSL-2 practice plus: • Controlled access • Decontamination of all waste	Primary barriers: • Biosafety cabinets or other physical containment devices	BSL-2 plus: • Physical separation from access corridors

	inhalation route of exposure	• Decontamination of laboratory clothing before laundering	used for all open manipulations of agents • PPE: Protective laboratory clothing, gloves, face, eye and respiratory protection, as needed.	• Self-closing, double-door access • Exhaust air not recirculated • Negative airflow into laboratory • Entry through airlock or anteroom • Handwashing sink near laboratory exit
4.	• Dangerous / exotic agents which pose high individual risk of aerosol-transmitted laboratory infections that are frequently fatal, for which there are no vaccines or treatments • Agents with a close or identical antigenic relationship to an agent requiring BSL-4 until data are available to redesignate the level • Related agents with unknown risk of transmission	BSL-3 practice plus: • Clothing change before entering • Shower on exit • All material decontaminated on exit from facility	Primary barriers: • All procedures conducted in Class III biosafety cabinets or Class I or II biosafety cabinets in combination with full-body, air- supplied, positive-pressure suit	BSL-3 plus: • Separate building or isolated zone • Dedicated supply and exhaust, vacuum and decontamination systems • Other requirements outlined in the text

Table 39: The barriers that should be implemented depending on the BSL level.

14.4 WHO RECOMMENDATIONS

Guidelines from WHO identify activities in the laboratory that can increase the risk of exposure to microorganisms. The next table illustrates this.

FACTORS ASSOCIATED WITH HIGH LIKELIHOOD OF INCIDENTS OCCURRING	RATIONALE
Laboratory activities associated with aerosolization (for example, sonication, homogenization, centrifugation)	When aerosols are generated by these methods, the likelihood of exposure through inhalation is increased, as is the likelihood of release of these aerosols into the surrounding environment where they might contaminate laboratory surfaces and also spread into the community.
Laboratory activities associated with sharps materials	When activities involve work with sharps, the likelihood of percutaneous exposure to a biological agent through a puncture wound is increased.
Low competency of personnel carrying out the work	Low proficiency of personnel in laboratory processes and procedures, through lack of experience, understanding or failure to comply with SOPs and GMPP, can lead to errors in performing the work which are more likely to result in exposure to and/or release of a biological agent. Cleaning and maintenance personnel must be trained before working close to a biological agent.
Highly environmentally stable biological agents	Biological agents that have settled on laboratory surfaces (for example, contamination caused by poor technique that allowed settling of aerosol or droplets after release) can be a source of inadvertent exposure as long as they remain stable in the environment, even if the contamination cannot be seen.
Inadequate or poor availability of electrical power, dilapidated laboratory facilities and building systems, malfunctioning equipment, damage from frequent severe weather and access of insects and rodents to the laboratory.	All these factors may result in partial breaches in, or complete failure of, biocontainment systems designed to reduce the likelihood of exposure to and/or release of biological agents.

Table 40: GMPP = good microbiological practice and procedure; SOPs = standard operating procedures. Factors that affect the likelihood of an incident occurring. From "Laboratory biosafety manual, fourth edition. Geneva: World Health Organization; 2020 (Laboratory biosafety manual, fourth edition and associated monographs)".

14.5 RISK ASSESSMENT

Exposure to certain pathogens is riskier than exposure to others. Factors that should be taken into account whenever carrying out a risk assessment are provided in the next table.

FACTORS ASSOCIATED WITH GREATER CONSEQUENCES IF AN INCIDENT WERE TO OCCUR	RATIONALE
Low infectious dose	For infection to occur in an exposed individual, a certain quantity (volume, concentration) of biological agent must be present. Even a small amount of an agent could result in severe consequences, such as a laboratory-associated infection. Furthermore, exposure to larger quantities of that agent (greater than the infectious dose) may result in a more severe presentation of the infection.
High communicability	Even one single exposure (causing carriage or a laboratory-associated infection) could rapidly spread from laboratory personnel or fomites to many individuals.
High severity and mortality	A laboratory-associated infection following exposure is more likely to cause personnel to become debilitated, lose their quality of life or die.
Limited availability of effective prophylaxis or therapeutic interventions	The symptoms or outcomes of a laboratory-associated infection cannot be effectively prevented, reduced or eliminated by a medical intervention. This may also include situations where medical intervention is not available, or emergency response capacity is limited.
Large susceptible population (including laboratory personnel at increased risk)	The larger the susceptible population, the more likely a laboratory-associated infection could rapidly spread and infect larger numbers of people.
Lack of endemicity (such as exotic disease)	When an agent is not endemic in the surrounding population, the population is more likely to be susceptible to the agent, leading to an increased likelihood of a laboratory-associated infection spreading to the community.

Table 41: Factors that affect the consequences of an incident if it were to occur. From "Laboratory biosafety manual, fourth edition. Geneva: World Health Organization; 2020 (Laboratory biosafety manual, fourth edition and associated monographs)".

14.6 RISK REDUCTION STRATEGIES

Simple procedures can help to reduce the risks to staff. The next table explains basic precautions that should be taken.

STRATEGY	EXAMPLE
Elimination	Eliminate the hazard: ▪ use an inactivated biological agent, ▪ use a harmless surrogate.
Reduction and substitution	Reduce the risk: ▪ substitute with an attenuated or less infectious biological agent, ▪ reduce the volume/titre being used, ▪ change the procedure for one that is less hazardous, such as polymerase chain reaction rather than culture.
Isolation	Isolate the hazard: ▪ elimination and reduction might not be possible, particularly in a clinical setting, therefore isolate the biological agent(s) (for example, in a primary containment device).
Protection	Protect personnel/the environment: ▪ use engineering controls (for example, BSC), ▪ use PPE, ▪ vaccinate personnel.
Compliance	Have administrative controls and effective biosafety programme management in place such as: ▪ GMPP observed by personnel, ▪ good communication of hazards, risks and risk control measures, ▪ appropriate training, ▪ clear SOPs, ▪ an established safety culture.

Table 42: Strategies for risk reduction. From "Laboratory biosafety manual, fourth edition. Geneva: World Health Organization; 2020 (Laboratory biosafety manual, fourth edition and associated monographs)".

Examples of laboratory best practices that can help to reduce risk are outlined below.

1. Never store food or drink, or personal items such as coats and bags in the laboratory. Activities such as eating, drinking, smoking, and applying cosmetics are only to be performed outside the laboratory.

2. Never put materials, such as pens, pencils or gum, in the mouth while inside the laboratory, regardless of whether gloves are worn or not.

3. Wash hands thoroughly, preferably with warm running water and soap, after handling biological material and/or animals, before leaving the laboratory or when hands are known or believed to be contaminated.

4. Ensure open flames or heat sources are never placed near flammable supplies and are never left unattended.

5. Ensure that cuts or broken skin are covered before entering the laboratory.

6. Before entering the laboratory, ensure that there are adequate supplies of laboratory equipment and consumables, including reagents, PPE and disinfectants, and that these items are suitable for the activities envisaged.

7. Ensure that supplies are stored safely and according to storage instructions to reduce accidents and incidents such as spills, trips and falls.

8. Ensure proper labelling of all biological agents and chemical and radioactive material.

9. Protect written documents from contamination using barriers (such as plastic coverings), particularly those that may need to be removed from the laboratory.

10. Ensure that the work is performed with care and without hurrying. Avoid working when fatigued.

11. Keep the work area tidy, clean and free of non-essential objects and materials.

12. Prohibit the use of earphones, which can distract personnel and prevent equipment or facility alarms from being heard.

13. Cover or remove any jewellery that could tear gloves, easily become contaminated or become fomites. Cleaning and decontamination of jewellery or spectacles should be considered, if such items are worn regularly.

14. Refrain from using portable electronic devices (for example, mobile telephones, tablets, laptops, flash drives, memory sticks, cameras, or other portable devices, including those used for DNA/RNA sequencing) when not specifically required for the laboratory procedures being performed.

15. Keep portable electronic devices in areas where they cannot easily become contaminated or act as fomites that transmit infection. Where close proximity of such devices to biological agents is unavoidable, ensure the devices are either protected by a physical barrier or decontaminated before leaving the laboratory.

14.7 SAFETY DURING TECHNICAL PROCEDURES

Technical procedures are a special subset of good microbiological practice and procedure (GMPP) which relate directly to controlling risks through safe conduct of laboratory techniques. These technical procedures, when executed correctly, allow work to be performed in a manner that minimizes the likelihood of cross contamination (that is contamination of other specimens, or previously sterile substances or objects as well as surface contamination) and also help prevent exposure of the laboratory personnel to biological agents. The following procedures help avoid certain biosafety incidents occurring e.g., by preventing the inhalation of biological agents.

- Use good techniques to minimize the formation of aerosols and droplets when manipulating specimens. This includes refraining from forcibly expelling substances from pipette tips into liquids, over-vigorous mixing, and carelessly flipping open tubes. Where pipette tips are used for mixing, this must be done slowly and with care. Brief centrifuging of mixed tubes before opening can help move any liquid away from the cap.
- Avoid introducing loops or similar instruments directly into an open heat source (flame) as this can cause spatter of infectious material. Where possible, use disposable transfer loops, which do not need to be resterilized. Alternatively, an enclosed electric microincinerator to sterilize metal transfer loops can also be effective.
- Avoiding ingestion of biological agents and contact with skin and eyes.
- Wear disposable gloves at all times when handling specimens known or reasonably expected to contain biological agents. Disposable gloves must not be reused.
- Avoid contact of gloved hands with the face.
- Remove gloves aseptically after use and wash hands as outlined in Monograph: personal protective equipment.
- Shield or otherwise protect the mouth, eyes and face during any operation where splashes may occur, such as during the mixing of disinfectant solutions.
- Secure hair to prevent contamination.
- Cover any broken skin with a suitable dressing.

- Prohibit pipetting by mouth.
- Avoiding injection of biological agents
- Wherever possible, replace any glassware with plastic-ware.
- If required, use scissors with blunt or rounded ends rather than pointed ends.
- If glassware must be used, check it on a regular basis for integrity and discard it if anything is broken, cracked or chipped.
- Use ampoule openers for safe handling of ampoules.

14.8 FACILITY DESIGN

- Designated hand-washing basins operated by a hands-free mechanism must be provided in each laboratory room, preferably close to the exit door.
- The laboratory must be a restricted-access area. Laboratory entrance doors should have vision panels (to avoid accidents during opening), appropriate fire ratings and preferably be self-closing.
- Doors must be appropriately labelled with the international biohazard warning symbols wherever biohazardous materials are handled and stored.
- Laboratory walls, floors and furniture must be smooth, easy to clean, impermeable to liquids and resistant to the chemicals and disinfectants normally used in the laboratory.
- Laboratory bench tops must be impervious to water and resistant to disinfectants, acids, alkalis, organic solvents and moderate heat.
- Laboratory furniture must be fit for purpose. Open spaces between and under benches, cabinets and equipment must be accessible for cleaning.
- Laboratory lighting (illumination) must be adequate for all activities. Daylight should be utilized effectively to save energy. Undesirable reflections and glare should be avoided. Emergency lighting must be sufficient to permit safe stopping of work as well as safe exit from the laboratory.
- Laboratory ventilation where provided (including heating/cooling systems, especially fans/local cooling split-system air conditioning units – specifically when retrofitted) should ensure airflows do not compromise safe working. Consideration must be given to resultant airflow speeds and directions, and turbulent airflows should be avoided; this applies also to natural ventilation.
- Laboratory storage space must be adequate to hold supplies for immediate use to prevent clutter on bench tops and in aisles. Additional long-term storage space, conveniently located outside of the laboratory room/space, should be considered.
- Space and facilities must be provided for the safe handling and storage of chemicals and solvents, radioactive materials, and compressed and liquefied gases if used.
- Facilities for storing food and drink, personal items, jackets and outerwear must be provided outside the laboratory.
- Facilities for eating and drinking must be provided outside the laboratory.
- First-aid facilities must be readily accessible and suitably equipped/stocked.

- Appropriate methods for decontamination of waste, for example, disinfectants and autoclaves, must be available in proximity to the laboratory.
- The management of waste must be considered in the design. Safety systems must cover fire, electrical emergencies and emergency/incident response facilities based on risk assessment.
- There must be a reliable and adequate electricity supply and lighting to permit safe exit.
- Emergency situations must be considered in the design as indicated in the local risk assessment and should include the geographical/meteorological context.
- Fire security and flood risk must be considered.

14.9 SPECIMEN RECEIPT AND STORAGE

14.9.1 Packaging specimens

Specimens must be observed on receipt to make sure they have been packaged correctly according to shipping requirements and that they are intact. Where breaches of packaging are observed, the package should be placed in an appropriate sealable container. This surface of the container should then be decontaminated and transferred to an appropriate location such as a biosafety cabinet before opening. The breach in packaging should be reported to the sender and couriers.

Specimen request or specification forms must be placed separately, preferably in waterproof envelopes, away from potential damage or contamination.

Specimens must be stored in containers that are:

- made of adequate strength, integrity and volume to contain the specimen,
- leak-proof when the cap or stopper is correctly applied,
- made of plastic (whenever possible),
- free of any biological material on the outside of the packaging,
- correctly labelled, marked and recorded to facilitate identification, and
- made of an appropriate material for the type of storage required.

Inactivation methods must be appropriately validated whenever an inactivation step is used upon receipt of specimens or before transferring the specimens to other areas for further manipulation, such as PCR analysis.

Levels of packaging include the following:

1 Primary package is the sample container which is often placed within a sealable bag or a plastic container, with enough absorbent material to contain a spill.

2 Primary container must be correctly marked with a minimum of three identifiers: sample name or unique ID, date of collection, time of collection.

3 Secondary package is a sturdy waterproof sealable container used to protect the samples during transport and can contain multiple primary packages.

4 Tertiary package can contain multiple secondary packages. It functions to regulate sample temperature, hold required documentation and protect the environment. Tertiary package

must be correctly marked and labelled.

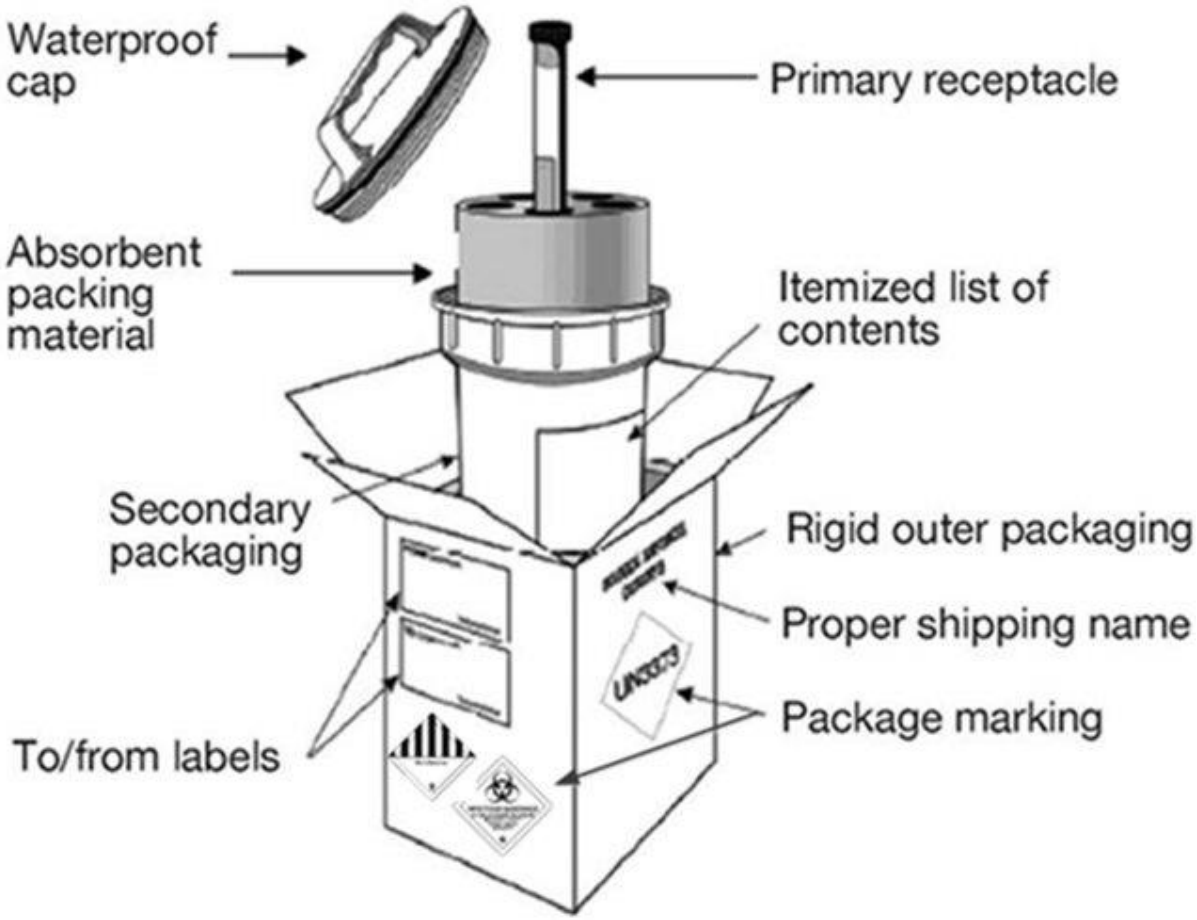


Figure 36: Taken from "Pastorino B, de Lamballerie X, Charrel R. Biosafety and Biosecurity in European Containment Level 3 Laboratories: Focus on French Recent Progress and Essential Requirements. Front Public Health. 2017 May 31;5:121. doi: 10.3389/fpubh.2017.00121."

14.9.2 Transport from clinical site

Using redundant layers of packaging is a common method for controlling any leakage or breach of containment of an infectious substance to reduce the likelihood of exposure and/or release during transport. A triple packaging system is commonly recommended and required by regulations in many countries for all three classifications of infectious substances.

A triple package consists of three layers – often the test tube, the biohazard bag and an outer box. The primary receptacle, containing the infectious substance must be watertight, leak-proof and appropriately labelled as to its contents. The primary receptacle must be wrapped in enough absorbent material to absorb its contents in the event spillage occurs. If multiple primary receptacles are packed together, cushioning material must be used to prevent contact between them. See the previous section for additional information.

14.9.3 Storage

Specimens for virus isolation and nucleic acid detection purposes should be tested as soon as possible. Specimens to be tested within 24 hours can be stored at 4 °C.

Specimens that cannot be tested within 24 hours should be stored at -70 °C or below (specimens may be temporarily stored in -20 °C refrigerators in the absence of -70 °C storage condition).

Serum can be stored at 4 °C for 3 days and below -20 °C for a longer period.

A special depot or cabinet is required to store specimens separately. Repeated freeze-thaw cycles during specimen transportation should be avoided.

Since different specimen types may require different storage conditions, contact the lab to obtain additional details.

14.9.4 Rules for transport over long distances

Category A samples

A sample that is classified in Category A is an infectious substance which is transported in a form that, when exposure occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.

An example is tuberculosis (TB) culture or virus culture.

A Category A infectious substance must be identified in transport as:

1 UN2814 – INFECTIOUS SUBSTANCE AFFECTING HUMANS (and animals);

2 UN2900 – INFECTIOUS SUBSTANCE AFFECTING ANIMALS only.

Category B samples

Category B is for an infectious substance that does not fit the criteria for inclusion in category A.

An example is TB sputum or nasal swab from suspected COVID-19 patient.

A Category B infectious substance must be identified in transport as “UN3373 BIOLOGICAL SUBSTANCE CATEGORY B”.

All shipments by air must be accompanied by a properly filled in Air Way Bill – Category A substances also require a Dangerous Goods Declaration.

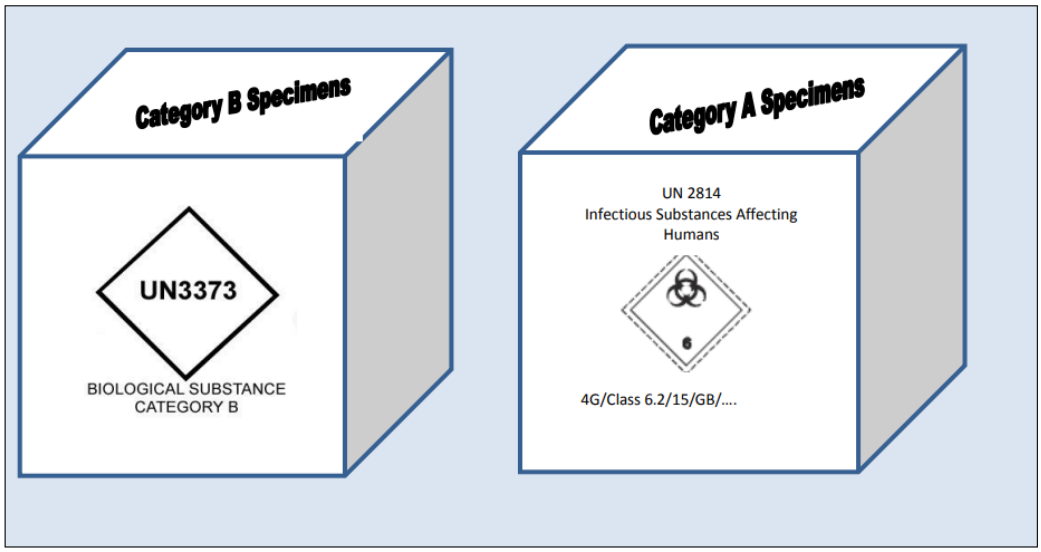


Figure 37

14.10 SPECIFIC LABORATORY ITEMS

14.10.1 Laboratory coats

Laboratory coats must be used in laboratories to prevent personal clothing from getting splashed or contaminated by biological agents. Laboratory coats must have long sleeves, preferably with fitted cuffs, and must be worn closed. Sleeves should never be rolled up. Coats must be long enough to cover the knees but not trail on the floor.

Where possible, the fabric of the laboratory coat should be splash-resistant and overlap at the front. Laboratory coats can be reusable or disposable, although where reusable coats are used, laundering of the coats must be done by the laboratory or specialist contractor. Laundering must be done regularly, and consideration should be given to autoclaving any visibly contaminated coats before laundering.

Laboratory coats must only be worn in designated areas. When not in use, they should be stored appropriately; they should not be hung on top of other laboratory coats, or in lockers or hooks with personal items. Laboratory coats should not be taken home by personnel.

14.10.2 Pipettes

To prevent the generation of aerosols, pipettes must not be used to blow air or forcibly expel liquids/solutions that contain biological agents. All pipettes and/or the pipette tips should have cotton plugs to reduce contamination of pipetting devices.

14.10.3 Refrigerators and freezers

All containers stored inside refrigerators and freezers must be clearly labelled so that they can be easily identified. An inventory of their contents must be maintained and controlled periodically.

Unlabelled materials must be assumed to be infectious and must be decontaminated and discarded using appropriate waste channels. Unlabelled items should also be reported as a near miss as this indicates a failure of the SOPs and risk assessment.

Do not store food with biological samples.

14.10.4 Incidents

First-aid kits, including medical supplies such as bottled eye washes and bandages, must be available and easily accessible to personnel. These must be checked routinely to make sure products are within their use-by dates and are in sufficient supply. If eyewash stations with piped water are to be used, these should also be checked regularly for correct functioning.

14.11 WASTE MANAGEMENT

Proper waste management in laboratories is crucial for maintaining biosafety, protecting human health, and preventing environmental contamination. Laboratories handle various hazardous materials, including biological agents, chemicals, and sharps, which can pose significant risks if not disposed of correctly. Poor waste management can lead to accidental exposures, infections, and the spread of antimicrobial-resistant organisms, especially in clinical and research settings. Effective

waste disposal ensures compliance with biosafety policies and minimizes the risk of laboratory-acquired infections.

To ensure biosafety, laboratory personnel should receive training on waste handling procedures, and waste disposal should be monitored through standard operating procedures and regulatory compliance checks. Collaboration with certified waste disposal companies further ensures that hazardous waste is treated and disposed of safely. Implementing these practices reduces health risks, maintains laboratory integrity, and supports environmental sustainability.

The following table describes how waste can be treated according to WHO recommendations.

CATEGORY OF LABORATORY WASTE MATERIAL	TREATMENT
Uncontaminated (non-infectious) material	Can be reused or recycled or disposed of as general municipal waste
Contaminated sharps (hypodermic needles, scalpels, knives and broken glass)	Must be collected in puncture-proof containers fitted with covers and treated as infectious
Contaminated material for reuse or recycling	Must be first decontaminated (chemically or physically) and then washed; thereafter it can be treated as uncontaminated (non-infectious) material
Contaminated material for disposal	Must be decontaminated onsite OR stored safely before transportation to another site for decontamination and disposal
Contaminated material for incineration	Must be incinerated onsite OR stored safely before transportation to another site for incineration
Liquid waste (including potentially contaminated liquids) for disposal in the sanitary sewer system	Should be decontaminated before disposal in the sanitary sewer

Table 43: Categories of segregated laboratory waste materials and their recommended treatment. From "Laboratory biosafety manual, fourth edition. Geneva: World Health Organization; 2020 (Laboratory biosafety manual, fourth edition and associated monographs)".

14.12 BIOSECURITY AND BIOTERRORISM

Biosecurity risk control measures aim to safeguard biological material from laboratory biosecurity incidents, such as theft, misuse, or unauthorized access. Biosecurity incidents could lead to serious or even catastrophic outcomes if high-consequence material is involved, resulting in economic repercussions and public concerns and fears.

High-consequence material has the ability to cause harmful effects with severe or even catastrophic consequences. Similar terms for such material in this context are pathogens, valuable biological material, high-impact material and information, potential pandemic pathogens, enhanced potential pandemic pathogens, biological materials with epidemic or pandemic potential, or biological agents.

An Institutional Biosafety Committee should be set up and be commissioned to provide expert knowledge and consultation about biosafety and biosecurity risks and to recommend and implement risk control measures to lower these risks.

A biosafety officer should be appointed to provide advice and guidance to personnel and management on biological safety issues. The role and knowledge of the biosafety officer is key to developing, implementing, maintaining and continually improving a biosafety and biosecurity programme.

Strategies to lower the biosecurity risk (also for biosafety risk) of the laboratory work include:

- using in vitro propagation instead of in vivo models,
- using nucleic acid- and protein-based assays instead of in vitro propagation,
- conducting loss-of-function experiments instead of gain-of-function experiments,
- using synthetic or recombinant materials not sourced from the biological agent with
- biosecurity relevance,
- reducing the scale and/or scope of experiments,
- using attenuated strains or inactivated biological agents instead of wild-type isolates, or
- using molecular models such as pseudo viruses instead of in vitro propagation of the pathogen.

Strategies for the organization undertaking the research project regarding personnel involved in the project to lower biosecurity risk when working include:

- analysing different aspects of one project separately in different biological agents/strains,
- work conducted by independent teams instead of involving the whole team with all aspects of the project,
- undertaking a computer-based ("in silico") analysis instead of working in the laboratory with non-inactivated biological agents,
- limiting the number of personnel involved instead of including the whole team in all aspects of the project, and/or
- separating the project into confidential and non-confidential components with a limited number of personnel involved in the confidential part instead of including the whole team in all aspects of the project.

Physical security measures are biosecurity (and biosafety) risk control measures to ensure personnel can work safely and securely in the laboratory, and access of persons to the laboratory is authorized, regulated, controlled and stopped, if necessary. Furthermore, physical control measures aim to prevent theft, misuse and sabotage of high-consequence material.

Laboratories that store or handle biological agents should keep an updated list of all materials/products that are present in the facility as a best-practice to monitor the location and volume of such products that are always present. For biosecurity-relevant laboratory equipment and/or information, the inventory list may also include laboratory devices, consumables, kits, instruments, reagents and even data with all risk control measures and standard operating procedures applicable. Inventory documents need to be securely handled, properly maintained and regularly audited. Any discrepancies should be investigated and resolved. For equipment, devices and kits, a detailed record of relevant information should be kept, including a logbook of usage and decontamination processes and an archive of data generated.

When conducting daily laboratory work, reliable methods for decontamination and destruction, as well as an appropriate waste management plan that assigns accountabilities, must be available for all biosecurity-relevant material, technology and information, such as biological agents, laboratory equipment and information.

Every laboratory produces electronic information. Most of this information should not be disseminated unrestrictedly and some information needs active protection. The control of information

and possible biosecurity risk control measures to prevent theft, leaks and misuse of information should be addressed.

Biosecurity incidents in laboratories handling or storing high-consequence material need tailored responses informed by the biosecurity risk assessment. Biosecurity emergency response plans for facilities handling or storing high-consequence material need to be developed.

Internationally, policies, standard operating procedures, practices and procedures, such as material transfer agreements, have been designed to reduce the risk of insider and outsider threats during transit. Transport security serves as a control system to reduce the danger of theft from inside and outside while high-consequence material is transported between different jurisdictions.

Agents that could be used for bioterrorism and therefore require particular attention during manipulation and storage include:

- Botulism
- Hendra
- Cholera
- *E. coli* O157:H7
- Hantavirus
- Hepatitis A
- Nipah
- Lassa
- Ricin toxin
- Prions
- Marburg
- Salmonella
- Rabies
- Plague
- Typhus fever
- Yellow fever
- Tickborne encephalitis

References

1. Laboratory biosafety manual, fourth edition. Geneva: World Health Organization; 2020.
2. HSE, Ireland. Guidelines for the Preparation for Transport of Patient Specimens and other Biological Materials. 2019.
3. Laboratory biosecurity guidance. Geneva: World Health Organization; 2024.
4. https://www.bcm.edu/departments/molecular-virology-and-microbiology/emerging-infections-and-biodefense/potential-bioterrorism-agents

Chapter 15: Screening, Triage and Notification of Contagious Diseases

15.1 INTRODUCTION

The spread of contagious diseases poses a significant threat to global public health. Effective management of these diseases relies on the prompt identification, appropriate triage, and timely notification of cases. These steps are crucial to containing outbreaks, minimizing the burden on healthcare systems, and protecting populations from the rapid spread of infectious pathogens. This chapter explores the processes involved in screening, triage, and notification, emphasizing the importance of each in controlling contagious diseases.

15.2 SCREENING FOR CONTAGIOUS DISEASES

Screening is the process of identifying individuals who may be infected with a contagious disease, even if they are asymptomatic. This is typically conducted in various settings, including healthcare facilities, community centers, airports, and workplaces. Effective screening programs can help in the early detection of contagious diseases, enabling timely interventions.

15.2.1 Purpose of screening

1. Early Detection: Early identification of cases allows for prompt treatment and isolation, reducing the spread of disease.
2. Prevention of Outbreaks: Screening can help detect and manage cases before they lead to outbreaks.
3. Risk Assessment: Identifying carriers and individuals at risk can guide public health strategies to focus on high-risk populations.

15.2.2 Methods of screening

1. Clinical Examination: Physical assessment helps to identify symptoms of infectious diseases, such as fever, cough, or rash.
2. Laboratory Tests: Use point-of-care diagnostic tools rapid antigen tests to detect pathogens.
3. Questionnaires and Self-Assessment Tools: Surveys and digital tools help identify symptoms and risk factors.
4. Mass Screening Programs: Organized efforts, such as screening at airports, schools, and large events, particularly during outbreaks, can be carried out.

15.3 TRIAGE OF PATIENTS WITH CONTAGIOUS DISEASES

Triage is the process of assessing and prioritizing patients based on the severity of their symptoms and the urgency of their need for medical attention. It ensures that patients receive timely care and that

healthcare resources are efficiently allocated, especially during outbreaks when resources may be limited.

15.3.1 Principles of triage

1. Assessment of Severity: Patients are evaluated based on the severity of their symptoms, comorbid conditions, and overall health status.
2. Prioritization of Care: Patients are categorized into groups, such as critical, severe, moderate, and mild, to determine who requires immediate care and who can be managed through less intensive means.
3. Resource Allocation: Ensures optimal use of available healthcare resources by prioritizing care for those who need it most.

15.3.2 Triage procedures

1. Initial Assessment: Screening for symptoms like fever, respiratory distress, and other indicators of contagious diseases.
2. Isolation of Suspected Cases: Immediate isolation of suspected cases to prevent transmission within healthcare settings.
3. Notification: Appropriate healthcare personnel should be informed of the presence of suspected or confirmed contagious patients on hospital premises so that a coordinated response can be activated in a timely manner.

15.4 NOTIFICATION AND REPORTING OF CONTAGIOUS DISEASES

Notification refers to the reporting of contagious diseases to public health authorities. Effective notification systems are crucial for the surveillance, monitoring, and control of infectious diseases. Timely notification allows for quick response measures, such as contact tracing, quarantine, and treatment protocols.

15.4.1 Importance of notification

1. Early Response: Timely notification enables rapid public health responses to contain potential outbreaks.
2. Data Collection and Analysis: Helps in the collection of epidemiological data, which can be used to identify trends, plan resources, and develop interventions.
3. Legal Obligation: Mauritius has a list of infectious diseases that are notifiable according to the Public Health Act to ensure public health safety. See annex J for details.

15.4.2 Mechanisms for disease notification

1. Integrated Disease Surveillance Systems: Integrated Disease Surveillance System is a

decentralized, state-based surveillance system that is intended to detect early warning signals of impending outbreaks and help initiate an effective response in a timely manner. It is a framework promoted by WHO that incorporates both Indicator-Based Surveillance (IBS) and Event-Based Surveillance (EBS) approaches to early detection of priority diseases, conditions and events. Integrated disease surveillance is a combination of active and passive systems that use a single infrastructure to gather information about multiple diseases or behaviours of interest using similar structures, personnel and processes. Electronic systems facilitate real-time reporting from healthcare facilities to public health authorities.

2. Case Definitions and Reporting Guidelines: Standardized case definitions and guidelines ensure consistency in reporting and help in identifying confirmed, probable, and suspected cases.

3. International Health Regulations (IHR): Countries are obligated under the IHR to report certain public health events that may be of international concern to the World Health Organization (WHO).

15.5 STEPS TO FOLLOW IN THE EMERGENCY DEPARTMENT

For all patients presenting to the Emergency Department (ED):

1. Step 1: IDENTIFY – patients with an exposure history or symptoms compatible with an infectious disease of concern by using national case definitions defined by the Public Health Department of MOHW.

2. Step 2: ISOLATE – according to national IPC guidelines.

3. Step 3: INVESTIGATE – test as indicated to confirm the disease.

4. Step 4: INFORM – the necessary personnel based on national or local policies and regulations.

Upon arrival at the ED every patient should self-assess or be rapidly assessed for fever (self-reported symptoms of fever should be considered as evidence of fever), cough, skin rash, diarrhea, vomiting or any other symptoms that suggest a clinical picture of infection.

15.6 WHO RECOMMENDATIONS

At the first point of contact with the health system, screening and triage should be performed for all persons wherever feasible.

A simplified questionnaire and screening protocol based on local case definitions can be implemented at the point of entry to hospitals (or during contact tracing) to screen patients.

Medical masks and alcohol-based hand sanitizer should be available for patients presenting at screening areas. Signs should be posted for both respiratory hygiene and hand hygiene and instructions to put on a well-fitting medical mask if any respiratory symptoms.

Screening activities should be conducted maintaining a distance of at least 1 m from patients and using a “no touch” approach.

While waiting, crowding should be prevented between patients and a distance of at least 1 m should be maintained between patients.

Acuity based triage is the action of sorting and prioritizing patients based on the estimation of their severity. This is used to identify patients who require immediate medical intervention and those who can safely wait or who may need to be transported to a specific destination based on their condition. Clinical assessment should focus on identifying signs and symptoms of severe or complicated disease and those at higher risk for severe disease.

15.7 TRANSMISSION-BASED PRECAUTIONS

15.7.1 Patients suspected of having an infection transmitted by droplets

- Patient to wear medical grade mask.
- Practice hand hygiene and respiratory hygiene/etiquette.
- Patient not to be left in main waiting room.
- Point of Care Risk Assessment (PCRA) is conducted prior to any interactions with a patient. If no risk of aerosol generating procedure (AGP):
    - Patient is placed in a private room.
    - If private room is not available patient is placed in bedspace with the privacy curtain/screen drawn. Privacy curtain/screen must be closed around bedspace.
        - Maintain at least 2 metres/6 feet between patients.
- Nurses and doctors wear medical mask before entering the room.
- Encourage the patient to perform respiratory hygiene/etiquette and use Alcohol Based Hand Rinse (ABHR) for hand hygiene.
- Nurse ensures Droplet Precautions signage is posted.
- If risk that an AGP will be required:
    - Nurse ensures patient continues to wear medical grade face mask and escorts patient to private room with door closed.
    - Nurse ensures Airborne Precautions Isolation Signage is posted.
    - Nurses and doctors wear N95 respirators before entering the room.

15.7.2 Patients suspected of having an infection transmitted by airborne route

- Patient to wear medical grade mask or N95 / FFP2 respirator, whichever is easier for the patient.
- Practice hand hygiene and respiratory hygiene/etiquette.
- Patient not to be left in main waiting room.
- Patient is placed in a private room.

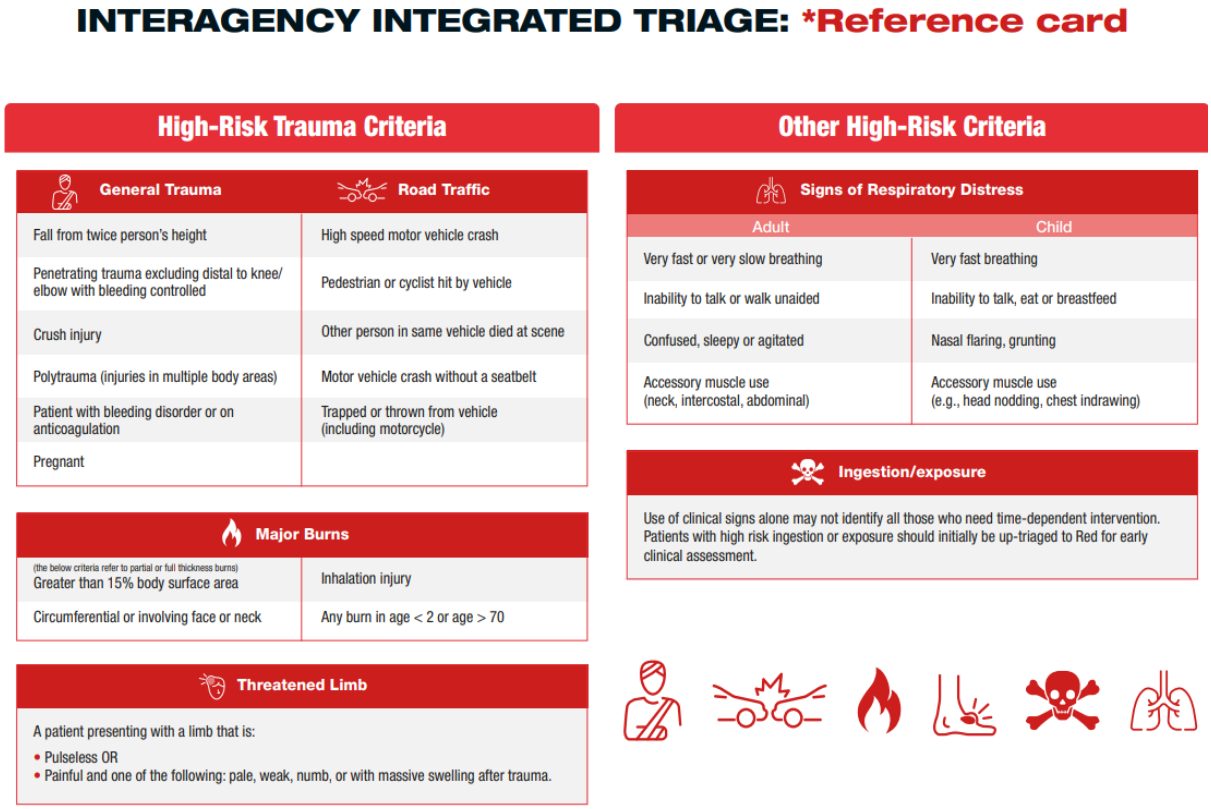
- Nurses and doctors wear N95 / FFP2 respirators before entering the room.
- Use a room with a closed door, good ventilation and attached toilet / bathroom.
- Nurse ensures Airborne Precautions Isolation Signage is posted.

15.7.3 Patients suspected of having an infection transmitted by contact

- Practice hand hygiene.
- Patient not to be left in main waiting room.
- Patient is placed in a private room.
    - If private room is not available patient is placed in bedspace with the privacy curtain/screen drawn. Privacy curtain/screen must be closed around bedspace.
- Nurses and doctors wear gowns and gloves before entering the room.
- Nurse ensures Contact Precautions Isolation Signage is posted.

15.8 TRIAGE TOOLS

A variety of triage tools are available for use in the ED to assess the acuity of care. The following three cards are recommended by the World Health Organization. Once acuity check is completed, screening for contagious illnesses can be started.



INTERAGENCY INTEGRATED TRIAGE: *Reference card

High-Risk Trauma Criteria

General Trauma	Road Traffic
Fall from twice person's height	High speed motor vehicle crash
Penetrating trauma excluding distal to knee/ elbow with bleeding controlled	Pedestrian or cyclist hit by vehicle
Crush injury	Other person in same vehicle died at scene
Polytrauma (injuries in multiple body areas)	Motor vehicle crash without a seatbelt
Patient with bleeding disorder or on anticoagulation	Trapped or thrown from vehicle (including motorcycle)
Pregnant	

Major Burns

(the below criteria refer to partial or full thickness burns) Greater than 15% body surface area	Inhalation injury
Circumferential or involving face or neck	Any burn in age < 2 or age > 70

Threatened Limb

A patient presenting with a limb that is:

- Pulseless OR
- Painful and one of the following: pale, weak, numb, or with massive swelling after trauma.

Other High-Risk Criteria

Signs of Respiratory Distress

Adult	Child
Very fast or very slow breathing	Very fast breathing
Inability to talk or walk unaided	Inability to talk, eat or breastfeed
Confused, sleepy or agitated	Nasal flaring, grunting
Accessory muscle use (neck, intercostal, abdominal)	Accessory muscle use (e.g., head nodding, chest indrawing)

Ingestion/exposure

Use of clinical signs alone may not identify all those who need time-dependent intervention. Patients with high risk ingestion or exposure should initially be up-triaged to Red for early clinical assessment.

Figure 38

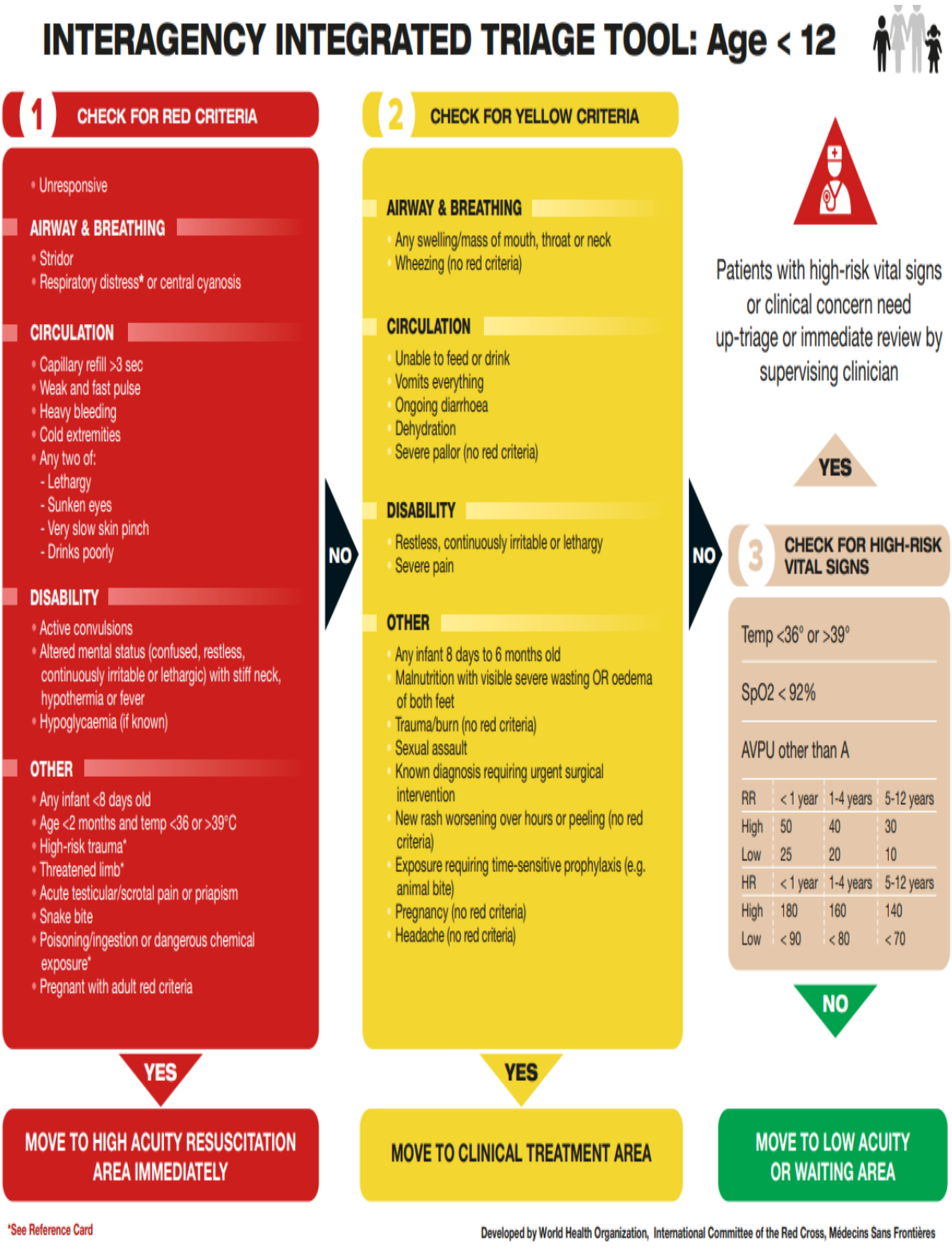

INTERAGENCY INTEGRATED TRIAGE TOOL: Age < 12
1 CHECK FOR RED CRITERIA
• Unresponsive
AIRWAY & BREATHING
• Stridor
• Respiratory distress* or central cyanosis
CIRCULATION
• Capillary refill >3 sec
• Weak and fast pulse
• Heavy bleeding
• Cold extremities
• Any two of:
- Lethargy
- Sunken eyes
- Very slow skin pinch
- Drinks poorly
DISABILITY
• Active convulsions
• Altered mental status (confused, restless, continuously irritable or lethargic) with stiff neck, hypothermia or fever
• Hypoglycaemia (if known)
OTHER
• Any infant <8 days old
• Age <2 months and temp <36 or >39°C
• High-risk trauma*
• Threatened limb*
• Acute testicular/scrotal pain or priapism
• Snake bite
• Poisoning/ingestion or dangerous chemical exposure*
• Pregnant with adult red criteria
YES
MOVE TO HIGH ACUITY RESUSCITATION AREA IMMEDIATELY
NO
2 CHECK FOR YELLOW CRITERIA
AIRWAY & BREATHING
• Any swelling/mass of mouth, throat or neck
• Wheezing (no red criteria)
CIRCULATION
• Unable to feed or drink
• Vomits everything
• Ongoing diarrhoea
• Dehydration
• Severe pallor (no red criteria)
DISABILITY
• Restless, continuously irritable or lethargy
• Severe pain
OTHER
• Any infant 8 days to 6 months old
• Malnutrition with visible severe wasting OR oedema of both feet
• Trauma/burn (no red criteria)
• Sexual assault
• Known diagnosis requiring urgent surgical intervention
• New rash worsening over hours or peeling (no red criteria)
• Exposure requiring time-sensitive prophylaxis (e.g. animal bite)
• Pregnancy (no red criteria)
• Headache (no red criteria)
YES
MOVE TO CLINICAL TREATMENT AREA
NO
Patients with high-risk vital signs or clinical concern need up-triage or immediate review by supervising clinician
YES
3 CHECK FOR HIGH-RISK VITAL SIGNS
Temp <36° or >39°
SpO2 < 92%
AVPU other than A
RR | < 1 year | 1-4 years | 5-12 years
High | 50 | 40 | 30
Low | 25 | 20 | 10
HR | < 1 year | 1-4 years | 5-12 years
High | 180 | 160 | 140
Low | < 90 | < 80 | < 70
NO
MOVE TO LOW ACUITY OR WAITING AREA
*See Reference Card
Developed by World Health Organization, International Committee of the Red Cross, Médecins Sans Frontières

Figure 39

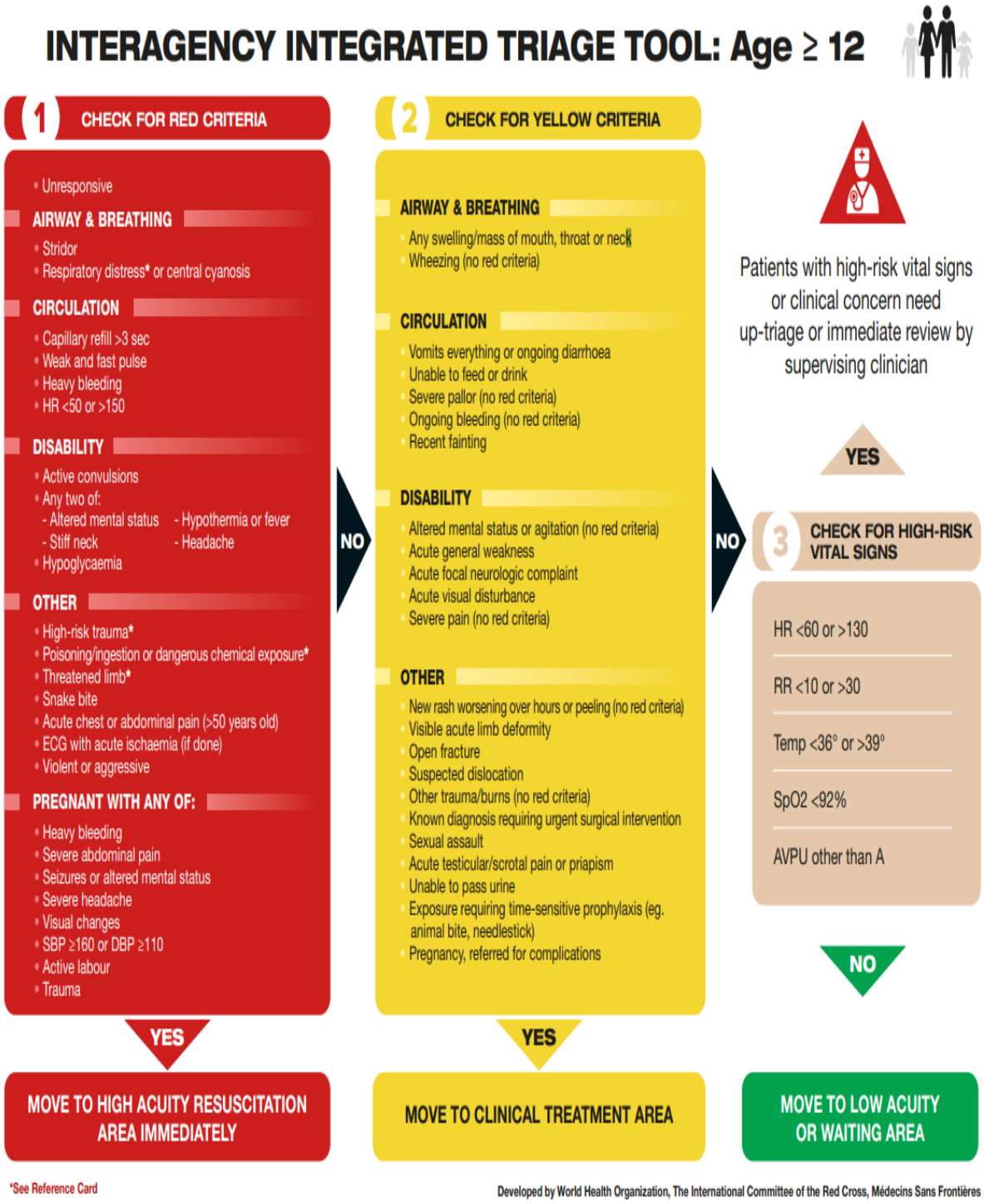


Figure 40

References

1. Horizon Health Network, Canada. Infection Prevention and Control: Emergency Department Triage Protocol for Infectious Diseases.
2. WHO. CLINICAL MANAGEMENT AND INFECTION PREVENTION AND CONTROL FOR MONKEYPOX. 10 June 2022.
3. https://www.who.int/publications/m/item/IITT

Chapter 16: IPC in the Neonatal ICU

16.1 INTRODUCTION

Significant progress has been made over the past two decades in reducing global under-5 mortality. However, mortality in neonates (under 28 days of age) and infants (under 1 year of age) remains disproportionately high (1). It is possible to improve survival and health of newborns and end preventable neonatal deaths by reaching high coverage of quality antenatal care, through skilled care at birth, by improving postnatal care for mothers and babies (2). Among hospital-born infants, hospital-acquired infections (HAI) account for an estimated 4% to 56% of all deaths in the neonatal period, depending on the study and geographical area. An estimated 84% of neonatal deaths due to infections could be prevented through measures such as strict infection control, early diagnosis and timely, appropriate clinical management (3).

16.2 NEONATAL SEPSIS

Neonatal sepsis refers to an infection involving the bloodstream of newborn infants less than 28 days old. It remains a leading cause of morbidity and mortality among infants, especially in middle and low-income countries (5).

16.2.1 Early and late sepsis

Neonatal sepsis is divided into early-onset sepsis (EOS) or late-onset sepsis (LOS) based on the age of presentation after birth with different experts using 72 hours or 7 days as the cut-off. EOS is generally caused by the transmission of pathogens from the female genitourinary system to the newborn or the foetus.

LOS usually occurs via the transmission of pathogens from the surrounding environment after delivery, such as contact from healthcare workers or caregivers. A percentage of LOS may also be caused by a late manifestation of vertically transmitted infection. Infants requiring intravascular catheter insertion, or other invasive procedures that disrupt the mucosa, are at increased risk for developing LOS.

Preterm neonates are at a higher risk for sepsis than term neonates. The increased susceptibility for infections seen in preterm neonates is mainly due to:

- A deficient immune system,
- The increased need for invasive devices (vascular access, endotracheal tube, feeding tubes and urinary tract catheters), and
- Associated severe illnesses (5).

16.2.2 Aetiology of infections amongst newborns

Across the placenta	*Treponema pallidum*, cytomegalovirus, rubella, varicella (chicken pox), *Toxoplasmosis gondii*, HIV

Mother's birth canal	Group B streptococci, *E. coli*, coagulase-negative *Staphylococcus spp., Listeria monocytogenes*, HBV, HIV, HSV
Environment within the health care facility (6)	Gram-negative organisms (e.g., *Klebsiella pneumoniae*) often multidrug resistant, opportunistic infections (e.g., coagulase negative *Staphylococcus spp.),* gram positive organisms (e.g., methicillin-resistant *Staphylococcus aureus*), respiratory viruses, gastrointestinal infections

16.2.3 Care-related risk factors that increase the risk of infection

- Intensive care stay
- Parenteral nutrition
- Overcrowding and understaffing (high patient-to-nurse ratio, bed space less than 1 meter apart)
- Ward layout (e.g., number of sinks)
- Contact with colonized / infected family, visitors, or healthcare workers
- Proximity of colonized neonates
- Increased length of stay
- Low compliance with hand hygiene practices
- Limited resources for isolation or cohorting (grouping babies with the same condition together)
- Lack of trained infection prevention and control (IPC) practitioners and limited opportunities for staff training
- Increasing use of complex medical and surgical procedures
- Increasing use of invasive medical devices (e.g., mechanical ventilators and central intravenous lines)
- Inadvertent contamination of prepared supplies / pharmaceuticals (e.g., intravenous (IV) fluid, infant formula, and general medications)
- Suboptimal cleaning, disinfection, and sterilization practices
- Antibiotic resistance due to the overuse of broad-spectrum antibiotics (6).

Because of all these risk factors, HAI, especially those caused by multi-drug resistant organisms, are particularly common in the NICU.

16.3 INFECTION CONTROL STEP I: PREVENT ENTRY OF MICROBES INTO THE NICU

16.3.1 Screening for group B Streptococcus

With approximately 21 million pregnant women colonized with Group B Streptococcus (GBS) worldwide (this estimation is based on a global colonization of 18% of pregnant women), this pathogen represents the leading cause of neonatal sepsis, although *E. coli* has also recently emerged as a major threat. Together, they account for approximately 70% of cases of all EOS (3).

A number of studies have shown the merit of a universal screening approach to GBS detection over a risk-based approach. One large study showed that universal screening was superior to a risk-based approach to prevent early-onset GBS disease. In 2002, the Centers for Disease Control's (CDC) guidelines for GBS prevention recommended universal screening to guide intrapartum GBS chemoprophylaxis. Current guidelines from the Society of Obstetricians and Gynaecologists of Canada recommend that all women be offered screening for group B streptococcus disease at 35 to 37 weeks' gestation. It has been shown that, in most cases, GBS that is present at 35 to 37 weeks' gestation is highly predictive of GBS colonization at term and delivery (10).

16.3.2 Clean immediate environment

Prevention of infection before delivery

- Use clean examination gloves, wash the perineal area (vulva, perineum and anal region) with soap and clean water.
- Use downward and backward motion while cleaning so that faecal organisms are not introduced into the vagina.
- The anal area should be cleaned last, and the wash towel discarded in a yellow-coded container.
- Perineal / pubic hair should not be shaved; a hair clipper should be used if required. Routine shaving is not recommended by WHO. Shaving has been shown to increase the risk of infection after delivery
- Digital vaginal examination at intervals of four hours is recommended for routine assessment of active first stage of labour in low-risk women.
- A clean pair of gloves should be used for each examination. Sterile gloves are not necessary (11).

Prevention of infection during delivery

- Hand hygiene by hand rub or washing with antiseptic soap and water meticulously up to the elbows and adhering to the seven steps of hand hygiene is important.
- Instruments used during delivery (scissors, cord clamp, needle holder, forceps, tissue forceps, urinary catheter, sutures, etc.) should be sterile or high level disinfected.
- The healthcare workers receiving the baby should clean their hands by performing hand hygiene and wearing clean examination gloves. The baby should be received in a clean towel (11).

Postnatal care of the neonate

- Gloves and plastic / rubber apron should be worn while handling the neonate until, blood, meconium or amniotic fluid has been removed from the neonate's skin.

- The removal of blood and body fluids from the neonate's skin should be done carefully using cotton swabs / soft cotton soaked in boiled warm water, followed by drying the skin to avoid infection.
- Hand hygiene (hand washing or alcohol-based hand rub (ABHR)) should be performed before handling the neonate.
- Equipment for resuscitation in the well-baby area should be clean.
- Bathing or washing of the neonate should be done once the temperature of the neonate has stabilized (usually by 6 hours of birth). The perineal area and buttocks should be kept clean, by washing with a soft cloth and cotton swabs soaked in warm water after every diaper change. Use fresh swabs and a separate bowl for each wash occasion. Perform hand hygiene before and after diaper change (11).
- Keep the baby in a clean area and follow standard precautions for newborn resuscitation. Ensure that resuscitation team wears appropriate PPE as per risk assessment; this may include non-sterile, fluid-proof, long-sleeved gowns, face-shields or goggles and masks, boots (if there is a risk of splashing) and non-sterile gloves. The resuscitation area should have a sink. See the UNICEF guidelines from 2018 for details.

Cord care

- Perform hand hygiene before and after cord care.
- Keep the cord stump clean and dry.
- Do not cover the cord stump with dressing or bandage (11).

16.3.3 Standardize the NICU design

Location of NICU

- The NICU should have a distinct area with controlled access.
- The hospital environment must be visibly clean; free from non-essential items and equipment, dust and dirt; and acceptable to patients, visitors and staff.
- Each infant space should ideally have a minimum of $11m^2$ floor space excluding the hand washing areas and corridors. If space is restricted, not less than $7m^2$ is acceptable.
- There should be a minimum of 1 meter between two infant beds (11).

Other considerations

- An airborne infection isolation room should be available.
- A hands-free hand washing station for hand hygiene and areas for gowning and storage of clean material should be provided near the entrance to the room.
- Relative humidity should be 30-60%. Humidity > 60% may promote the growth of microorganisms.
- According to the American Institute of Architecture (AIA) guideline, the NICU should have a minimum of 6 air changes per hour (ACH) and 12 ACH for the isolation room. Some guidelines suggest up to 15 ACH under specific circumstances.

Hand washing station

- Every infant bed should be within 20 feet of a hands-free hand washing station (one for 10 incubators). The hand washing sink should be large enough to control splashing.
- Pictorial hand washing instruction should be provided.
- Non-absorbent wall material should be used around the sink to prevent the growth of mould on cellulose materials.
- There should be space for soap and paper towel dispensers (11).

Hand hygiene

The CDC recommends hand rubbing before and after contact with every patient for 20-30 seconds and 40-60 seconds of hand washing before entering the NICU.

- Soap does not need to be antibacterial or antiseptic for performing general hand hygiene.
- Prefer liquid soap instead of bar soap.
- For surgical scrub, an approved antiseptic hand cleanser such as 4% chlorhexidine gluconate solution can be used (e.g., Hibiscrub)
- All accessories should be removed prior to performing hand hygiene (i.e., no watch, no bracelet and no rings on the fingers).

Use of alcohol-based hand rubs

- Alcohol can be used as hand hygiene agents if the hands are not visibly dirty or contaminated.
- Alcohol rubs may be used in between patient examination.
- At least 2-3 ml hand rub should be applied to the surface of the palm and fingers.
- ABHR is not useful when the hands are soiled.
- Hand hygiene resources and healthcare worker adherence to hand hygiene guidelines should be audited at regular intervals, and the results should be fed back to healthcare workers to improve and sustain high levels of compliance (11).

Visitors' policy

Occasionally, microbes may enter into the NICU through personnel who come from outside and hence restriction of entry can be useful to avoid cross-infections.

- People with active infection (respiratory, mucocutaneous and gastrointestinal) and children should not be allowed inside the NICU.
- Refer to the national visitation policy for more details.

16.3.4 Gowning to reduce nosocomial infection

Studies have shown no reduction of infection during universal gowning as compared to no gowning. The focus should be on adequate hand washing by all hospital personnel and visitors before handling neonates.

PPE should be worn according to risk assessment and whenever transmission-based precautions are needed e.g., if the baby is infected with a multidrug resistant organism. Abuse of PPE can lead to wastage of resources, discomfort during work, an increase in infection due to incorrect doffing and a reduction in hand hygiene practices.

Five different practices are observed to be in use in the NICUs of Mauritius and despite multiple discussions, there is currently no consensus nationally regarding which one should be followed nationally:

1. Wearing no PPE when walking inside the NICU and when touching babies.
2. Wearing no PPE when walking inside the NICU but wearing disposable gowns and gloves when touching babies.
    a. NICUs often do not have enough PPE to put this into practice for long.
3. Wearing no PPE when walking inside the NICU but wearing reusable one-to-one gowns with or without gloves when touching babies; in such instances, one gown is kept for each baby and the same gown is reused throughout the day by all staff who see the baby.
    a. This reduces the number of PPE needed but staff are likely to get contaminated when donning used PPE.
4. Wearing no PPE when walking inside the NICU but wearing reusable one-to-one gowns with or without gloves when coming close to the incubator whether the baby will be touched or not.
5. Wearing disposable gowns, gloves and masks when going inside the NICU but using the same PPE for every baby, and throwing the PPE away when leaving the NICU.
    a. Using the same PPE for infected and non-infected babies can lead to cross-contamination.

For the sake of standardization, the following should be followed:

- There is no need to wear any PPE when entering the NICU. Proper hand hygiene should be followed as well as the Bare Below the Elbows principle.
    - This means that lab coats should be removed, jewellery and watches below the elbow should not be worn and long sleeves should be pulled up to the elbow prior to entering the NICU.
    - A signage should be present at the entrance of the NICU to ensure proper communication of such practices.
- Staff (or mothers / visitors) who will touch babies or perform procedures on babies should wear disposable (not reusable) gowns and gloves.
    - Studies suggest that skin-to-skin care (i.e., the naked baby in nappies resting against the mother's bare skin) may reduce mortality and is safe in the NICU setting even if the baby is intubated.
    - However, few NICUs practice skin-to-skin care in Mauritius. When carried out, mothers are expected to shower beforehand, and they should not be wearing any PPE when entering the NICU.
- When used, gloves should be changed in between every baby with hand hygiene performed when moving from one baby to another.
- If gowns are in short supply, gowns do not need to be changed if moving from non-infected baby to non-infected baby if the gowns have not been soiled; if gowns are readily available,

change them when moving from one non-infected baby to another non-infected baby. Gowns should always be changed if moving from infected baby to any other baby (whether the latter is infected or not). Always change gowns if soiled.

Hands should always be sanitized before touching neonates and when moving in and out from incubators. Parent gowns should be discarded at the end of the visit.

Gowns should always be worn when entering the infant's area (even if not handling the infant) in the following situations:

- Soiling with blood or body fluids is expected (standard precautions apply).
- The infant is on contact precautions.
- The parents are concerned about their own soiled clothing (11).

16.3.5 Jewellery and fingernails policy

Consensus recommendations are that healthcare workers should not wear artificial fingernails or extenders when being in direct contact with patients and natural nails should be kept short (11).

16.3.6 Uniforms and dress code policy

Only limited data is available that specific dressing codes reduce infections in hospitals. The following is generally recommended through expert consensus in healthcare settings:

- Staff must not wear surgical scrubs outside hospital buildings.
- All dedicated NICU staff should wear surgical scrubs.
- Visiting doctors must remove lab coats and practice the "bare below the elbows" protocol before entering the NICU.
- Hair must be clean and tidy and long hair should be tied back from the face and not able to fall into the patient during care.
- There is no data to show that crocks reduce the rate of infections. However, expert consensus requires that all staff posted in the NICU should wear dedicated shoes (typically crocks) (11). Crocks must be cleaned daily. On the other hand, visiting staff and parents no longer need to wear crocks when entering the NICU – an attempt from 2021 till 2024 to require all visiting staff to wear crocks failed in most NICUs of the country.
- Use of overshoes can lead to an increase in infection through contamination of the hands and should be strongly discouraged in the NICU.

16.3.7 Use of personal protective equipment

- Selection of PPE must be based on an assessment of the:
    - Risk of transmission of microorganisms to the patient or carer;
    - Risk of contamination of healthcare practitioners' clothing and skin by patients' blood or body fluids; and

- Suitability of the equipment for proposed use.

- Gloves must be worn for:
    - Invasive procedures;
    - Contact with sterile sites and non-intact skin or mucous membranes;
    - All activities that have been assessed as carrying a risk of exposure to blood or body fluids; and
    - When handling sharps or contaminated devices.
- Gloves must be:
    - worn as single use items;
    - put on immediately before an episode of patient contact or treatment;
    - removed as soon as the episode is completed;
    - changed between caring for different patients; and
    - disposed of into the appropriate waste colour coded bin (yellow).
- Hands must be decontaminated immediately after gloves have been removed.
- Disposable plastic aprons must be worn when there is a risk that clothing may become contaminated with pathogenic microorganisms, blood or body fluids (11).
- Full-body fluid-repellent gowns must be worn where there is a risk of extensive splashing of blood or body fluids on to the skin or clothing of healthcare workers.
- Plastic aprons / fluid-repellent gowns should be worn as single-use items for one procedure or episode of patient care, and disposed of into the appropriate waste bins.
- Fluid-repellent surgical face masks and eye protection must be worn where there is a risk of blood or body fluids splashing into the face and eyes.
- Appropriate respiratory protective equipment should be selected according to a risk assessment that takes into account the infective microorganism, the anticipated activity and the duration of exposure.

16.4 INFECTION CONTROL STEP II: PREVENT PROLIFERATION OF MICROBES IN THE NICU

Good housekeeping routines are helpful in reducing the proliferation of microbes, thus preventing and curtailing the spread of infections. Avoid wet areas inside the NICU. A dry and clean NICU is unlikely to harbour microbes. The details of the housekeeping routines are described in a tabular form below (11).

16.4.1 Daily and weekly cleaning routines in the NICU

Incubators (when still in use as a daily routine),	Clean using a moist wipe daily. After each use on

warmers, syringe pump, infusion pumps, phototherapy units, mattress, pulse oximeter, multichannel monitors, ventilator, CPAP machine and telephone	a patient, disinfection should be carried out using the appropriate technique. Clean high-touch surfaces at least three times daily.
Suction bottles, water for bubble CPAP machine, suction tubes	Change with distilled water daily. Change suction tubes daily.
Bag and mask	Bag-valve-masks are semi-critical items and require at least high-level disinfection, if not sterilization, before reuse; disposable ones are preferred. Use 2% glutaraldehyde, 0.5% hypochlorite or 7.5% hydrogen peroxide for a contact time of 20-30 minutes. Do not forget to clean the item before disinfecting it.
Incubators / radiant warmers (after being used)	Long-term care infants should be re-placed in clean incubators every 7 days. When the incubators, open care units or bassinets are being cleaned and disinfected, all detachable parts should be removed and scrubbed meticulously. Mattresses should be replaced when the surface covering is broken. Cuffs should be replaced on a regular schedule or cleaned and disinfected frequently.
Laryngoscope handle, masks, stethoscopes, measuring tapes, thermometer, blood pressure cuff, temperature and SpO_2 probes, torches, weighing scales	Wipe with alcohol daily.
Laryngoscope blade	Laryngoscope blades are semi-critical items and require high-level disinfection before reuse. Use 2% glutaraldehyde, 0.5% hypochlorite or 7.5% hydrogen peroxide for a contact time of 20-30 minutes. Do not forget to clean the item before disinfecting it.
Floor, wash basins	Cleaning should follow the 3-bucket technique. This is described in the national IPC guidelines and the standard operating procedure on cleaning. Disinfect floor with 0.5% chlorine in each shift. Windows, storage shelves and similar non-critical surfaces should be scrubbed periodically with a disinfectant / detergent solution. Sinks should be scrubbed clean at least daily with a detergent. Always progress from the least soiled areas to the most soiled areas and from high to low areas. Floors and toilets should be cleaned at least three times a day and whenever soiled.
Dust bins, buckets, waste	Empty during each shift and clean with soap and water.
Ventilator and CPAP circuits	Change with a new circuit every week or after each use.
Procedure sets	Autoclave after every use.
Incubator humidifier water reservoir	Emptied, washed, dried and refilled every 24 hours (46)

Feeding utensils	High level disinfection using a thermal disinfector (90°C for 1 minute or 80°C for 10 minutes). Some units use troclosene (= sodium dichloroisocyanurate 35-70%, NaDCC), under the trade name Sterinova to sterilize baby bottles.

Table 44: Adapted from: Infection control protocol in NICU suitable for a peripheral newborn care unit – New Indian Journal of Pediatrics, 2017; and from: Sydney Local Health District Department, Women and Babies: Disinfection and Cleaning of Feeding Equipment within Newborn Care, 2019.

Always clean items before disinfecting them.

The national standard operating procedure on the cleaning of incubators should be strictly followed.

16.5 INFECTION CONTROL STEP III: BREASTMILK / BREASTFEEDING AND CORRECT PREPARATION OF FORMULA MILK (WHEN INDICATED)

16.5.1 General recommendations

- It is important to support breastfeeding and promote its benefits to infants and young children.
- Encourage the use of colostrum and trophic feeds with expressed breastmilk and non-nutritive sucking by the infant.
- Mother's entry into the NICU and pumping of milk to ensure adequate breastmilk for the infant should be encouraged.
- However if the infant needs formula feed, the FAO/WHO expert working groups (2004 & 2006) recommend that temperature of water should not be less than 70^{o}C at the point of reconstitution of formula and a decrease in the holding and feeding times would effectively reduce the risk of contamination (11).
- For mothers expressing, ensure hand hygiene and expression of milk into sterile containers. Clean the containers with hot, soapy water after each use, before they are sterilized.
- For mothers using a breast pump dedicated to one mother:Wash all pump components that are in contact with milk with hot, soapy water after each use, dry thoroughly, and store in a clean place. Sterilize or high-level disinfect pump components daily.
- For a breast pump shared between mothers:Wash all pump components that are in contact with milk with hot, soapy water after each use, then sterilize or high-level disinfect before use by a different mother.
- Store milk in sterile, labelled containers covered securely Label with infant's name, medical record number, date of birth and date of pumping. When stored in a refrigerator or freezer with milk for other infants, place all the feeds for each infant into a larger, labelled, cleanable bin or zip-lock bag, one for each infant.
- If breast milk is given to the wrong infant, treat as a blood/body fluid exposure (45).

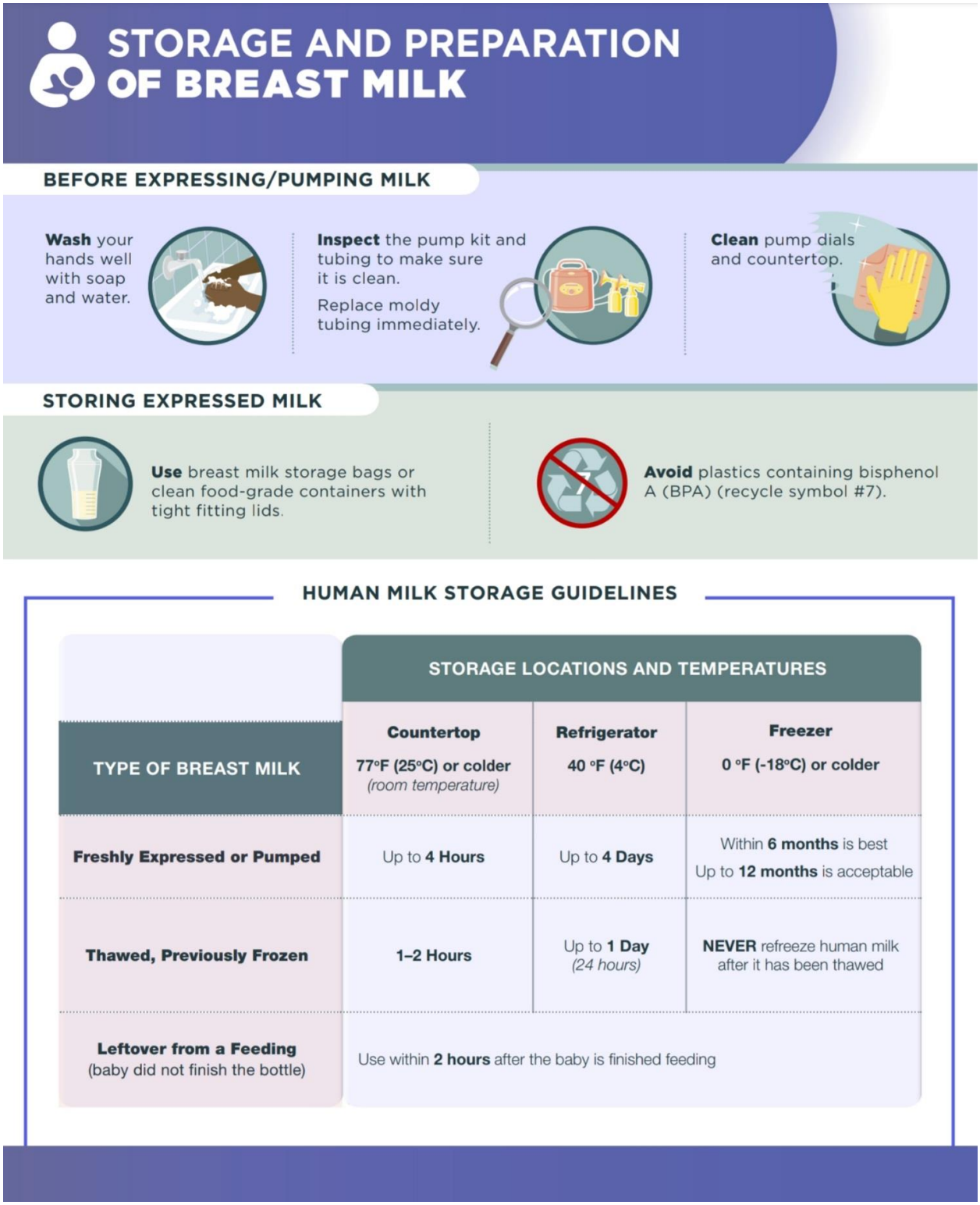
16.5.2 Storage of breastmilk

Fresh Breast milk storage

Location	Temperature	Length of time	Details
Room temperature (fresh)	16–29°C [61–84°F]	Storage time: 3–4 hours (less in hotter environments) Hang time for feeds: < 4 hours. Replace entire feeding set every 4 hours.	• Potential for contamination if stored at bedside awaiting use • Use containers covered with a lid or tied at the top • Label with infant's name, medical record number and date of birth
Refrigerator	4°C [39°F] or below	72 hours	• Use containers covered with a lid or tied at the top • Label with infant's name, medical record number, and date of birth • Place all the feeds for each infant into a larger, labelled, cleanable container, one for each infant

Table 45

16.5.3 Preparation of breastmilk



TYPE OF BREAST MILK	STORAGE LOCATIONS AND TEMPERATURES		
	Countertop 77°F (25°C) or colder *(room temperature)*	**Refrigerator** 40 °F (4°C)	**Freezer** 0 °F (-18°C) or colder
Freshly Expressed or Pumped	Up to **4 Hours**	Up to **4 Days**	Within **6 months** is best Up to **12 months** is acceptable
Thawed, Previously Frozen	**1–2 Hours**	Up to **1 Day** *(24 hours)*	**NEVER** refreeze human milk after it has been thawed
Leftover from a Feeding (baby did not finish the bottle)	Use within **2 hours** after the baby is finished feeding		

Figure 41: Proper Storage and Preparation of Breast Milk | Breastfeeding | CDC-- 2021 (16)

STORE

Label milk with the date it was expressed and the child's name if delivering to childcare.

Store milk in the back of the freezer or refrigerator, not the door.

Freeze milk in **small amounts of 2 to 4 ounces** to avoid wasting any.

When freezing leave an inch of space at the top of the container; breast milk expands as it freezes.

Milk can be stored in an insulated cooler bag with frozen ice packs for **up to 24 hours** when you are traveling.

If you don't plan to use freshly expressed milk **within 4 days**, freeze it right away.

THAW

Always thaw the oldest milk first.

Thaw milk under lukewarm running water, in a container of lukewarm water, or overnight in the refrigerator.

Never thaw or heat milk in a microwave. Microwaving destroys nutrients and creates hot spots, which can burn a baby's mouth.

Use milk **within 24 hours** of thawing in the refrigerator *(from the time it is completely thawed, not from the time when you took it out of the freezer).*

Use thawed milk **within 2 hours** of bringing to room temperature or warming.

Never refreeze thawed milk.

FEED

Milk can be **served cold, room temperature, or warm.**

To heat milk, place the sealed container into a bowl of warm water or hold under warm running water.

Do not heat milk directly on the stove or in the microwave.

Test the temperature before feeding it to your baby by putting a few drops on your wrist. It should feel warm, **not hot.**

Swirl the milk to mix the fat, which may have separated.

If your baby did not finish the bottle, leftover milk should be used **within 2 hours.**

CLEAN

Wash disassembled pump and feeding parts in a clean basin with soap and water. **Do not wash directly** in the sink because the germs in the sink could contaminate items.

Rinse thoroughly under running water. Air-dry items on a clean dishtowel or paper towel.

Using clean hands, store dry items in a clean, protected area.

For extra germ removal, sanitize feeding items daily using one of these methods:

- clean in the dishwasher using hot water and heated drying cycle *(or sanitize setting).*
- boil in water for 5 minutes *(after cleaning).*
- steam in a microwave or plug-in steam system according to the manufacturer's directions *(after cleaning).*

Figure 42: Proper Storage and Preparation of Breast Milk | Breastfeeding | CDC-- 2021 (16)

16.6 INFECTION CONTROL STEP IV: PREVENTING INFECTION SPREAD FROM PROLIFERATION SITES TO BABY AND FROM ONE BABY TO OTHER

This is the most important step in preventing the spread of microbes from proliferative sites to baby and from one baby to another baby (cross-contamination). The following steps are important in this regard.

16.6.1 Nurse to patient ratio

All units undertaking neonatal intensive and high-dependency care should have an appropriate number of neonatal nurses. Dedicated staff should be used if babies have multidrug resistant microbes. The recommended ratio of staff to babies is 1:1 but during scarcity of staff, 1:2 can be accepted (11).

16.6.2 Use disposable items

To break the transmission of microbes, prefer the use of disposable items.

- A different syringe should be used to prepare each medication for each baby.
- Open suctioning catheters should be thrown away after use. Do not reuse these catheters.
- For each baby, separate gloves should be used.
- Do not keep fomites e.g., files, x-ray films, and pens on the baby cot.
- For flushing of catheters / lines, stock solution should not be used. Epidemics of *Enterobacter cloacae* in the NICU with use of multidose antibiotic vials has been reported. Pre-filled syringes must be used if available – repeatedly pricking a litre of saline can contaminate the fluid (11).

16.6.3 Laminar flow system for drugs, fluids and total parenteral nutrition preparation

- Use of laminar flow (if available) for the preparation of total parenteral nutrition and other IV medications decreases the local complication rate (thrombophlebitis, gangrene, and abscess) and sepsis.
- If laminar flow is not available:
    - A designated area should be defined only for medicine preparation.
    - Nothing other than medicine, the material needed during preparation and a safety container to throw away waste should be in the working area (no paper, no paperboard, no waste materials, no patient contaminated materials, etc.).
    - The work surface should be cleaned and disinfected before use.
    - There should be no interruptions during medicine preparation.
    - Hand hygiene before and after medicine preparation is essential. The use of gloves and sterile apron is recommended.

- Before the medicine preparation starts, a visual inspection of the ampoule and vial is needed. Lack of particles on the surface should be assured. The next step should be surface disinfection with 70% alcohol. Cleaning should be done in one direction to assure all particles are eliminated. Alcohol must have evaporated before starting medicine preparation. High risk contamination areas should never be touched (syringe tip, ampoule neck and vial elastomeric area) after disinfection. (11), (13).

16.6.4 Dedicated isolation areas for neonates infected with multidrug resistant organisms

- The NICUs of Mauritius are increasingly facing a major challenge with respect to multidrug resistant organisms, partly due to the abuse of antibiotics, and partly due to the absence of isolation rooms.
- Infected infants should be managed in an isolation room (11).
- All babies who are identified as being infected or colonized with multidrug resistant organisms should be separated at least 2 meters away from other babies as soon as possible after receiving the culture results (usually within an hour).
- The isolation space should have a proper signage to indicate the need for contact precautions.
- The area should also be equipped with a pedal-operated bin, a station with personal protective equipment for donning and sanitizers.
- The charge nurse or ward manager should ensure that doctors and visitors alike follow contact precautions when taking care of the neonate.

16.6.5 Use of reusable items

- Each baby must have his / her own stethoscope which is kept near his / her incubator. The stethoscope must be cleaned as explained above.
- A measuring tape, thermometer, a clean set of laryngoscopes and an Ambu bag with appropriate face mask should be available at each bed.

16.7 INFECTION CONTROL STEP V: PREVENT ENTRY OF MICROBES INTO THE INFANT

Once microbes colonize the skin and umbilical cord, they enter the circulation if there is any breach in aseptic precautions. Hence, proper hygiene during procedures is crucial.

16.7.1 Cord care

Cord infections can be prevented through promoting clean cord care and reducing harmful cord applications.

The WHO currently recommends dry cord care in developed countries and the use of soap and water solution to clean the cord if visibly soiled.

In low-income and developing countries, as per WHO recommendations, 7.1% chlorhexidine digluconate should be administered for daily cleaning of the umbilical stump.

16.7.2 Skin care

Skin injury should be prevented by applying less adhesive tape, using Tegaderm between skin and adhesive, taking precautions during adhesive removal and by using skin friendly adhesives (11).

16.7.3 Guidelines for preventing infections associated with the use of short-term indwelling urethral catheters

- Only use a short-term indwelling urethral catheter in patients for whom it is clinically indicated.
- Assess and record the reasons for catheterisation every day. Remove the catheter when no longer clinically indicated.
- Select a catheter that minimises urethral trauma, irritation and patient discomfort, and is appropriate for the anticipated duration of catheterisation.
- Clean the urethral meatus with sterile, normal saline prior to the insertion of the catheter.
- Use lubricant from a sterile single use container to minimise urethral discomfort, trauma and the risk of infection. Ensure the catheter is secured comfortably.
- Connect a short-term indwelling urethral catheter to a sterile closed urinary drainage system.
- Change short-term indwelling urethral catheters and / or drainage bags when clinically indicated.
- Decontaminate the hands and wear a new pair of clean non-sterile gloves before manipulating each patient's catheter. Decontaminate hands immediately following the removal of gloves.
- Position the urinary drainage bag below the level of the bladder on a stand that prevents contact with the floor.
- Meatal cleansing with sterile water should be done at least daily (or whenever required) (11), (13).

16.8 INFECTION CONTROL STEP VI: DECREASING SUSCEPTIBILITY OF THE BABY TO INFECTIONS

In a Cochrane meta-analysis of stabilized low birthweight infants, kangaroo mother care was associated with a statistically significant reduction in severe infection / sepsis at latest follow-up, nosocomial infection / sepsis at discharge or at 40-41 weeks of corrected gestational age (17).

16.8.1 Early breast feeding / use of colostrum / minimal enteral nutrition

Numerous studies have linked own mother's milk and colostrum feedings with a lower incidence and severity of nosocomial infection or late-onset sepsis in premature (< 37 weeks gestation) infants.

Trophic feeding has benefits which include improved milk tolerance, greater postnatal growth, reduced systemic sepsis and shorter hospital stay (11). As far as possible, all babies should be breastfed in Mauritius.

16.8.2 Immunomodulators

Current evidence does not support the use of intravenous immunoglobulins and granulocyte macrophage-colony stimulating factor for the prevention of nosocomial infections. The role of probiotics is promising but the right choice, the right dose and the right patient is still under review (11).

16.8.3 Antifungal prophylaxis

Antifungal prophylaxis is recommended for all extremely low birth weight babies. A Cochrane meta-analysis suggests that there will be one fewer death in every nine infants treated with this intervention (11).

16.9 VENTILATOR ASSOCIATED PNEUMONIA

Ventilator associated pneumonia (VAP) develops in mechanically ventilated patients 48 hours or more after the patient has been put on mechanical ventilation, and it is the second most common nosocomial infection in neonatal intensive care units (18).

The diagnosis of VAP (according to the CDC) is as follows:

1. Date of event is > 48 hours after intubation or < 48 hours after extubation
2. Either fever, hypopyrexia, leukocytosis or leukopenia
3. At least 2 of several criteria including the presence of pathogenic bacteria in the secretion of bronchus, hypoxia and respiratory symptoms (19).

Prevention of VAP can be achieved by the “bundle approach”; also endorsed by WHO, this involves the simultaneous application of several preventive strategies for all patients (20).

16.9.1 Key practice recommendations

General considerations

Following the steps below can reduce the rate of VAP (20), (22), (23), (19), (24), (18):

- Adherence to hand hygiene guidelines and the correct use of gloves prior to the management of ventilation equipment / supplies.
- Use non-invasive positive pressure ventilation whenever possible.
- Drain ventilator circuit water away from patient every 2-4 hours or before repositioning or when condensate accumulates.
- A good endotracheal (ET) tube stabilization - this will reduce the regular handling of the ET tube.

- Minimize intubation and re-intubations (that is, to put more focus on non-invasive ventilation).
- Minimize duration of ventilation.
- Avoid unplanned extubation and reintubation.
- Avoid opening and disconnecting the ventilator equipment.
- Wear sterile gloves for intubation.
- Wear gowns, gloves and mask when administering surfactant.
- Endotracheal tubes should stay in the sterile pack till the point of use. Don't touch the tracheal tip of the tube.
- The need for mechanical ventilation needs to be daily re-evaluated.
- Clean reusable resuscitation bags at least once per week and after each use.

Suction

Suctioning should be conducted by two nurses to guarantee aseptic technique, only when ET is obstructed and only when indispensable and with a closed in-line suction system. Always use separate suction tubing for oral suctioning and ET suctioning. Whenever possible, use a separate suction canister also. Suction oral pharynx prior to ET tube suctioning. Do not routinely instil normal saline prior to suctioning. Insert the suction catheter only to the end of the ET tube to prevent airway trauma. Preoxygenate 30-60 sec prior to suctioning. The national standard operating procedure on suctioning of intubated patients should be strictly followed.

Oral care

The cleaning of gums, tongue, and lips with a sterile swab or gauze coated in distilled water should be performed every 3–4h, and before gastric tube insertion, and ET repositioning to prevent and reduce microbial inoculation.

Positioning

To decrease gastric micro-aspirations, postural changes i.e., alternating lateral position with supine / prone should be performed. Whenever gastroesophageal reflux is observed the head of the bed need to be elevated 15°–30°.

Feeding

Tube feeding in aliquots is preferred over continuous feeding. Continuous feeding has been related to changes in gastric pH which could promote gram-negative bacterial colonization.

Routine and regular expressed breast milk swabbing

- It significantly reduces the occurrence of VAP and necrotising enterocolitis in very low birthweight infants.
- It may reduce the incidence of VAP and necrotising enterocolitis by increasing IgA levels.

Care of the ventilator circuit

- The breathing circuit of the ventilators should be changed when visibly soiled or malfunctioning.

- Drain the condensation from the ventilator circuit every 2-4 hours.
- Drain the ventilator circuit before repositioning the neonate.

16.10 CENTRAL LINES ASSOCIATED BLOODSTREAM INFECTIONS (CLABSI)

16.10.1 Introduction

- Bloodstream infections (BSIs) are the most common type of HAI occurring in the NICU.
- LOS occurring after 3 days of birth occurs in 20%–36% of very low birthweight babies.
- Most cases of LOS are caused by central venous catheters (CVCs).
- Premature infants who experience catheter-related infections have a high mortality rate, poor growth and neurodevelopmental outcomes, as well as prolonged hospital stay, leading to increased medical costs.
- Therefore, more efforts are needed to reduce the incidence of CVC-related infections among NICU patients, and to enhance their survival and prognosis (25).

We will focus on the basic concepts of catheter-related BSIs in NICUs and briefly review strategies for preventing them.

16.10.2 Definition of catheter-related bloodstream infections

There are 2 major definitions of BSIs associated with CVCs: (25)

a. catheter-related bloodstream infection (CRBSI) and

b. central line-associated bloodstream infection (CLABSI).

   - CRBSI refers to the presence of bacteremia originating from the IV catheter and is more of a clinical definition.
   - CLABSI, on the other hand, refers to a primary BSI that has not been associated with infection at other sites in a patient who had a central line within 48 hours of symptom onset.
   - Culturing the catheter tip is not a criterion for CLABSI.

16.10.3 Pathogenesis of CLABSI

There are several potential pathways and sources causing CLABSI.

- First, the catheter insertion site can serve as a port of entry for organisms. In this case, endogenous skin flora of the patient and extrinsic organisms from the hands of healthcare workers or even from contaminated disinfectants are potential sources.
- Second, during catheter hub operation it can be contaminated with organisms from the patient's skin flora or the healthcare workers' hands.

- Third, fluids or drugs can be contaminated during the preparation process or the manufacturing process of the company.
- Finally, there may be a secondary infection that causes catheter infection due to hematogenous dissemination of infection in other parts of the body (25).

16.10.4 Prevention strategies for CLABSI in the NICU

Education, training, and staffing

- It is very important to educate healthcare professionals regularly and repeatedly about the indications for IV catheter use, the appropriate practices during catheter insertion and maintenance, and other policies for catheter-related infection prevention.
- It is also necessary to regularly assess how well all staffs involved in the insertion and maintenance of IV catheters are aware of the guidelines and how well they are practicing them.
- It should also be ensured that appropriate patient-to-nurse ratios are maintained within the NICU, as elevated patient-to-nurse ratios are associated with increased CLABSI incidence (25).

Selection of the PICC site

- There is no preferred location of the upper or lower limb as a PICC location.
- Use of in-line bacterial filters is not mandatory.

Intervention bundle for CVC insertion and maintenance

- To prevent CLABSI, an intervention bundle is recommended for insertion and maintenance of CVC (see the table below).
- When using an intervention bundle, it is better to use a checklist to encourage compliance with medical staff training and recommendations.

Skin antiseptics in infants and neonates

- Before inserting a peripheral venous catheter, it is recommended to disinfect the skin using 70% alcohol or alcoholic chlorhexidine gluconate (CHG) solution.
- Before inserting the CVC or peripheral arterial catheter and changing the dressing, it is necessary to disinfect the skin with > 0.5% CHG with alcohol or 70% alcohol (25).

Catheter dressing regimens

- Gauze dressing and transparent-semipermeable dressing are both available. If the patient is sweating or the site is bleeding or oozing, gauze dressing should be used until this is resolved (25).
- Topical antibiotics should not be used on the insertion site because they have the potential to promote fungal infection and antibiotic resistance.
- Regarding gauze dressings used on short-term CVC sites, it is recommended to change them every 2 days.

- It is recommended that transparent dressing used on short-term CVC sites be changed every 7 days, except when infants are more likely to lose their catheter while replacing dressings (25).

Umbilical catheters

- Umbilical arterial (UA) or umbilical venous (UV) catheter is commonly used in the management of sick neonates, but they can lead to serious complications including infection.
- To prevent catheter-related infection, before inserting an umbilical catheter, it is recommended to disinfect the insertion site with antiseptics.
- Topical antibiotics at the site of insertion are also contraindicated in the umbilical catheter. It is recommended that low-doses of heparin (0.25–1.0 U/mL) be added to the fluid injected into the UA catheter to maintain its patency.
- If UA and UV catheters are no longer needed, they should be removed as soon as possible.
- The total period of catheter use should not exceed 5 days for UA catheter, or 7 days for UV catheter.
- When CRBSIs occur or signs of vascular insufficiency or thrombosis are seen, UA or UV catheters should be removed and never be replaced (25).

Systemic prophylactic antimicrobials

In a meta-analysis on the use of prophylactic systemic antibiotics in neonates with CVCs, its use was not effective in reducing overall mortality. In addition, there is a lack of evidence on long-term neurodevelopmental outcome and the use of antibiotics has led to concerns about the selection of resistant organisms (25). This topic is further elaborated in the chapter on antimicrobial stewardship (AMS) later.

Antimicrobial locks

- There have been reports that using antibiotic lock solutions have been effective in lowering CRBSIs in neonates.
- There are data on newborns in which fusidic acid, vancomycin, or amikacin was used.
- However, its use did not effectively lower mortality and there were insufficient data on long-term effects on antimicrobial resistance.
- Therefore, prophylactic antimicrobial lock solution can be considered in patients with long-term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic technique (25).

Replacement of administration sets

Change of extension sets

- Extension sets are to be changed when the access device is changed or immediately upon suspected contamination or when there is any break in integrity.
- Extension sets are to be primed and attached to the cannula at the time of IV insertion using an aseptic non touch technique.
- When exiting the flushing of extension set, you must use a positive pressure clamping technique.

- When not in use, extension sets must be clamped (25).

Line changes

- Infusion lines (infusion with or without additives) are replaced every day using standard aseptic technique.
- Administration sets that have been disconnected (either accidentally or planned) are no longer sterile and should be discarded and replaced.
- If using fresh blood or fresh blood products, replace line(s) at the end of the infusion.
- If lipid emulsion is being infused, change the lipid syringe / bag and line every 24 hours (25), (26).

16.10.5 Suggested elements of the bundles for insertion and maintenance of central catheters to prevent catheter-related infections

Insertion bundle	Maintenance bundle
Establish a central catheter kit or cart with all the items required for the procedure.	Perform hand hygiene with an alcohol-based product or disinfectant containing soap before or after accessing the catheter, or before or after changing the dressing.
Perform hand hygiene with an alcohol-based product or disinfectant-containing soap before and after palpating insertion sites and before and after inserting the central catheter.	Check the catheter insertion sites daily to identify signs of infection and dressing integrity.
Use barrier precautions (sterile gown, sterile gloves, and large sterile drape). Full facial protection is worn if there is a risk of splashed blood or other bodily fluids.	If the dressing is damp, soiled or loosened, change the dressing aseptically and disinfect the skin around the insertion site with a suitable disinfectant (e.g., 2% chlorhexidine or 70% alcohol).
Disinfect the skin with a proper antiseptic (e.g., 2% chlorhexidine, 70% alcohol) before catheter insertion.	Develop and use standardized IV tubing setup and changes.
Use either a sterile transparent semipermeable dressing or sterile gauze to cover the insertion site.	Maintain aseptic technique and scrub the hub using appropriate disinfectant when replacing intravenous tubing and when accessing the catheter.
	Review the need for the catheter daily and remove it as soon as it is no longer needed.

Table 46: Adapted from: Journal of Perinatology, 2009 (27).

16.10.6 Additional elements of the neonatal bundle of care in case of uncontrolled outbreaks in the NICU

- Use silver impregnated / antibiotic coated umbilical catheters and PICCs (28).
- The use of alcohol-impregnated barrier caps to close IV cannulas and central lines is preferred.
- Use of needle-free connector hubs is not mandatory.

16.11 PATIENT ISOLATION PRECAUTIONS

In addition to standard precautions, some infections and disease conditions require additional measures (contact, airborne, droplet, and contact plus precautions) to prevent the transmission of microorganisms.

Isolation rooms adequately designed to care for airborne infections should ideally be available in any hospital with a NICU. In most cases, this is situated within the NICU but, in some circumstances, utilization of an isolation room elsewhere in the hospital may be suitable.

An airborne infection isolation room should be available for NICU infants, and should provide a minimum of 150 square feet (14 square meters) of clear floor space, excluding the entry work area (42).

A hands-free handwashing station for hand hygiene and areas for gowning and storage of clean and soiled materials shall be provided near the entrance to the room.

Airborne infection isolation rooms shall have self-closing devices on all room exit doors.

Glass partitions should be limited to that which are necessary for safe visualization.

Use disposable or dedicated patient-care equipment (e.g., blood pressure cuffs). If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient (43).

16.11.1 Contact precautions

Infants colonized or infected with multidrug resistant organisms like methicillin-resistant *Staphylococcus aureus* or vancomycin-resistant enterococci, or neonatal herpes simplex are cared for in a private room or isolation room (44).

a) The infant should be placed in an incubator,

b) A contact precautions sign should be affixed to the incubator,

c) Alcohol-based hand rub (e.g., Purell) must available near the incubator, and

d) The incubator is spaced as far away as possible from other cribs or incubators.

16.11.2 Droplet precautions

Neonates with influenza should be cared for in a private room or isolation room.

If this is not possible:

a) Place infants in an incubator at least 3 feet away from other babies in NICU area,

b) Affix droplet precautions sign to the incubator,

c) Ensure that surgical masks are available near the incubator, and

d) Ensure that alcohol-based waterless hand gel is available near the incubator (44).

16.11.3 Airborne precautions

Neonates with influenza should be cared for in a private room or isolation room.

a) Affix airborne precautions sign,

b) Wear N95 / FFP2 respirators when entering the room, and

c) Ensure that alcohol-based waterless hand gel is available near the incubator.

See the next table for additional information.

Recommendations for Transmission-Based Precautions for Hospitalized Patients

Category of Precautions	Hand Washing for Patient Contact	Single Room	Masks	Gowns	Gloves
Airborne	Yes	Yes, with negative-pressure ventilation	Yes	No	No
Droplet	Yes	Yes*	Yes, for those close to patient	No	No
Contact	Yes	Yes*	No	Yes	Yes
*Preferred but not required for crib-confined patients. Cohorting of children infected with the same pathogen is acceptable.					

Table 47: Adapted from: PEDIATRIC NEWBORN MEDICINE CLINICAL PRACTICE GUIDELINES Newborn Infection Control & Prevention Guidelines, 2015.

16.12 BUNDLE OF CARE FOR THE PREVENTION OF NEONATAL SEPSIS

Application of bundles of care in some countries have been shown to reduce the incidence of neonatal sepsis. Controversies exist regarding the efficacy of individual elements in the bundle of care and the grade of evidence is variable. A typical bundle of care may consist of the following[47-49]:

1. Proper feeding of the neonate including breastfeeding
2. Using chlorhexidine gluconate for cord care
3. Implementing kangaroo mother care
4. Following the aseptic technique when connecting and disconnecting peripheral and central lines
5. Reinforcing alcohol-based hand sanitization
6. Weekly bathing of neonates > 1.5 kg with 2% chlorhexidine
7. Targeted environmental cleaning with proper training

8. SMS reminders of IPC messages
9. Following strict contact precautions and isolating contagious neonates rapidly
10. Strictly adhering to aseptic medication preparation

References

1. Leroy V, Thairu L, Liotta G, Wiens MO, Liang L, Kotadia N, et al. Predictors of Mortality in Neonates and Infants Hospitalized With Sepsis or Serious Infections in Developing Countries: A Systematic Review. Front Pediatr [Internet]. 2018;6:277. Available from: www.frontiersin.org
2. Newborns: improving survival and well-being [Internet]. [cited 2021 Dec 15]. Available from: https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality
3. Global report on the epidemiology and burden of sepsis: current evidence, identifying gaps and future directions [Internet]. [cited 2021 Dec 15]. Available from: https://apps.who.int/iris/handle/10665/334216
4. Mauritius [Internet]. [cited 2022 Jan 2]. Available from: https://health.govmu.org/Pages/Statistics/Health/Mauritius.aspx
5. Singh M, Alsaleem M, Gray CP. Neonatal Sepsis. StatPearls [Internet]. 2021 Oct 10 [cited 2021 Dec 15]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK531478/
6. UNICEF. Healthy Newborn Network – Addressing critical knowledge gaps in newborn health. [Internet]. [cited 2021 Dec 15]. Available from: https://www.healthynewbornnetwork.org/
7. Preventing Infections in the NICU > Fact Sheets > Yale Medicine [Internet]. [cited 2021 Dec 28]. Available from: https://www.yalemedicine.org/conditions/preventing-infections-in-the-nicu
8. Polin RA, Denson S, Brady MT, Papile LA, Baley JE, Carlo WA, et al. Strategies for prevention of health care-associated infections in the NICU. Pediatrics [Internet]. 2012 [cited 2021 Dec 15];129(4). Available from: https://pubmed.ncbi.nlm.nih.gov/22451712/
9. Evidence-based: 3 systematic reviews-Evidence selection based on quality-Based on country experience and expert consensus Commitment to supporting implementation in low-and-middle-income countries.
10. Prevention of Early-onset Neonatal Group B Streptococcal Disease: Green-top Guideline No. 36. BJOG An Int J Obstet Gynaecol [Internet]. 2017 Nov 1 [cited 2022 Jan 2];124(12):e280–305. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg36/
11. Infection control protocol in NICU suitable for a peripheral newborn care unit – New Indian Journal of Pediatrics [Internet]. [cited 2021 Dec 28]. Available from: https://nijp.org/infection-control-protocol-in-nicu-suitable-for-a-peripheral-newborn-care-unit/
12. Hand Hygiene Information | Hull University Teaching Hospitals NHS Trust [Internet]. [cited 2021 Dec 28]. Available from: https://www.hey.nhs.uk/patient-leaflet/hand-hygiene-information/
13. Loveday HP, Wilson JA, Pratt RJ, Golsorkhi M, Tingle A, Bak A, et al. epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. J Hosp Infect [Internet]. 2014 [cited 2021 Dec 28];86(1):1–70. Available from: www.sciencedirect.com
14. Giraffe Incubator Service Manual Rev ZAC PDF download [Internet]. [cited 2021 Dec 28]. Available from: https://www.bioclinicalservices.com.au/ge-healthcare/giraffe-lullaby-and-panda-neonatal-systems/giraffe-incubator-service-manual-rev-zac
15. Isolette® 8000 plus [Internet]. [cited 2021 Dec 28]. Available from: https://www.draeger.com/en-us_us/Products/isolette-8000-plus
16. Proper Storage and Preparation of Breast Milk | Breastfeeding | CDC [Internet]. [cited 2021 Dec 28]. Available from: https://www.cdc.gov/breastfeeding/recommendations/handling_breastmilk.htm
17. Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane database Syst Rev [Internet]. 2014 Apr 22 [cited 2021 Dec 28];2014(4). Available from: https://pubmed.ncbi.nlm.nih.gov/24752403/
18. CDC, Ncezid, DHQP. Pneumonia (Ventilator-associated [VAP] and non-ventilator-associated Pneumonia [PNEU]) Event. 2022.
19. Ventilator-associated Pneumonia (VAP) | HAI | CDC [Internet]. [cited 2022 Jan 3]. Available from: https://www.cdc.gov/hai/vap/vap.html
20. Pinilla-González A, Álvaro Solaz-García •, Parra-Llorca A, Lara-Cantón I, Gimeno A, Izquierdo I, et al. Preventive bundle approach decreases the incidence of ventilator-associated pneumonia in newborn infants. J Perinatol [Internet]. 2021;41:1467–73. Available from: https://doi.org/10.1038/s41372-021-01086-7
21. Ma A, Yang J, Li Y, Zhang X, Kang Y. Oropharyngeal colostrum therapy reduces the incidence of

ventilator-associated pneumonia in very low birth weight infants: a systematic review and meta-analysis. Pediatr Res [Internet]. 2021 Jan 1 [cited 2021 Dec 28];89(1):1. Available from: /pmc/articles/PMC7223528/
22. Klompas M, Branson R, Eichenwald EC, Greene LR, Howell MD, Lee G, et al. Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update. Infect Control Hosp Epidemiol. 2019 Aug;35(8):915–36.
23. Creating and Implementing a Bundle to Reduce VAP in the NICU | IHI - Institute for Healthcare Improvement [Internet]. [cited 2021 Dec 28]. Available from: http://www.ihi.org/resources/Pages/ImprovementStories/CreatingandImplementingaBundletoReduceVAPintheNICU.aspx
24. Azab SFA, Sherbiny HS, Saleh SH, Elsaeed WF, Elshafiey MM, Siam AG, et al. Reducing ventilator-associated pneumonia in neonatal intensive care unit using "VAP prevention Bundle": A cohort study. BMC Infect Dis [Internet]. 2015;15(1). Available from: http://dx.doi.org/10.1186/s12879-015-1062-1
25. Cho HJ, Cho HK. Central line-associated bloodstream infections in neonates. Korean J Pediatr [Internet]. 2019 Mar 1 [cited 2021 Dec 29];62(3):79. Available from: /pmc/articles/PMC6434225/
26. Clinical Guidelines (Nursing) : Peripheral intravenous (IV) device management [Internet]. [cited 2022 Jan 3]. Available from: https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Peripheral_Intravenous_IV_Device_Management/
27. Schulman J, Stricof RL, Stevens TP, Holzman IR, Shields EP, Angert RM, et al. Development of a statewide collaborative to decrease NICU central line-associated bloodstream infections. J Perinatol [Internet]. 2009 [cited 2022 Jan 3];29(9):591–9. Available from: https://pubmed.ncbi.nlm.nih.gov/19262569/
28. Coskun Y, Kayas K, Ercin S, Gursoy T. Use of silver-impregnated umbilical venous catheters for prevention of catheter associated bloodstream infection in neonates. Ann Med Res [Internet]. 2021 Dec 23 [cited 2022 Jan 3];28(12):2195–200. Available from: https://annalsmedres.org/index.php/aomr/article/view/4000
29. Casimero C, Ruddock T, Hegarty C, Barber R, Devine A, Davis J. Minimising Blood Stream Infection: Developing New Materials for Intravascular Catheters. Med (Basel, Switzerland) [Internet]. 2020 Aug 26 [cited 2021 Dec 29];7(9):49. Available from: https://pubmed.ncbi.nlm.nih.gov/32858838/
30. Gkentzi D, Dimitriou G. Antimicrobial Stewardship in the Neonatal Intensive Care Unit: An Update. Curr Pediatr Rev [Internet]. 2019 Jan 18 [cited 2021 Dec 21];15(1):47. Available from: /pmc/articles/PMC6696821/
31. Fuchs A, Bielicki J, Mathur S, Sharland M, Van Den Anker JN. Antibiotic Use for Sepsis in Neonates and Children: 2016 Evidence Update WHO-Reviews.
32. Powers RJ, Wirtschafter DW. Decreasing Central Line Associated Bloodstream Infection in Neonatal Intensive Care. Clin Perinatol. 2010 Mar 1;37(1):247–72.
33. Wang B, Li G, Jin F, Weng J, Peng Y, Dong S, et al. Effect of Weekly Antibiotic Round on Antibiotic Use in the Neonatal Intensive Care Unit as Antibiotic Stewardship Strategy. Front Pediatr. 2020 Dec 15;8.
34. Probst V, Islamovic F, Mirza A. Antimicrobial stewardship program in pediatric medicine. Pediatr Investig [Internet]. 2021 Sep 1 [cited 2022 Jan 4];5(3):229. Available from: /pmc/articles/PMC8458720/
35. PIDAC: Best Practices for Infection Prevention and Control in Perinatology |. 2015 [cited 2022 Jan 4]; Available from: www.publichealthontario.ca.
36. Eglash A, Simon L. ABM clinical protocol #8: Human milk storage information for home use for full-term Infants, Revised 2017. Breastfeed Med [Internet]. 2021 Sep 1 [cited 2021 Dec 28];12(7):390–5. Available from: https://www.cdc.gov/breastfeeding/recommendations/handling_breastmilk.htm
37. Ghirardi B, Pietrasanta C, Ciuffini F, Manca MF, Uccella S, Lavizzari A, et al. [Management of outbreaks of nosocomial pathogens in neonatal intensive care unit]. Pediatr Med Chir [Internet]. 2013 [cited 2021 Dec 20];35(6):263–8. Available from: https://pubmed.ncbi.nlm.nih.gov/24620553/
38. Skinner S. The 6th Annual Perinatal Conference A collaboration of the Midlands and East Neonatal and Perinatal Networks Friday 25th. 2013;
39. Pammi M, Davis RJ, Gordon A, Starke J. Infant isolation and cohorting for preventing or reducing transmission of healthcare-associated infections in neonatal units. Cochrane Database Syst Rev [Internet]. 2016 Dec 20 [cited 2022 Jan 4];2016(12). Available from: /pmc/articles/PMC6472529/
40. Siegel JD, Rhinehart E, Jackson M, Linda ; Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings (2007). 2019;
41. Srivastava S, Shetty N. Healthcare-associated infections in neonatal units: lessons from contrasting worlds. J Hosp Infect [Internet]. 2007 Apr [cited 2022 Jan 4];65(4):292. Available from: /pmc/articles/PMC7172768/

42. Standard 7: Airborne Infection Isolation Room(s) | NICUDesignStandards [Internet]. [cited 2022 Jan 4]. Available from: https://sites.nd.edu/nicu-design-std-kjsk/2017/12/11/standard-7-airborne-infection-isolation-rooms/
43. White RD. Recommended standards for newborn ICU design. J Perinatol [Internet]. 2006 [cited 2022 Jan 4];26:S2–18. Available from: https://www.researchgate.net/publication/232789526_Recommended_standards_for_newborn_ICU_design
44. PEDIATRIC NEWBORN MEDICINE CLINICAL PRACTICE GUIDELINES Newborn Infection Control & Prevention Guidelines.
45. UNICEF. Infection Prevention and Control at Neonatal Intensive Care Units. 2018. Available from: https://www.healthynewbornnetwork.org/hnn-content/uploads/Infection-Prevention-and-Control-at-NICU-Slide-Deck-2.8.2018.pdf
46. East of England Neonatal Benchmarking Group, NHS. Clinical Guideline: Management of a baby requiring humidity Version 2.0: Humidity for infants <30 weeks gestation. 16 June 2021.
47. Fitzgerald FC, Zingg W, Chimhini G, Chimhuya S, Wittmann S, Brotherton H, Olaru ID, Neal SR, Russell N, da Silva ARA, Sharland M, Seale AC, Cotton MF, Coffin S, Dramowski A. The Impact of Interventions to Prevent Neonatal Healthcare-associated Infections in Low- and Middle-income Countries: A Systematic Review. Pediatr Infect Dis J. 2022 Mar 1;41(3S):S26-S35. doi: 10.1097/INF.0000000000003320.
48. Hamer, D. et al. Sepsis prevention in neonates in Zambia study: Impact of an infection prevention bundle on neonatal sepsis and mortality. International Journal of Infectious Diseases, Volume 73, 43.
49. Almeida, Catarina Cardoso de; Pissarra da Silva, Susana Maria Saraiva; Flor de Lima Caldas de Oliveira, Filipa Silveira Dias; Guimarães Pereira Areias, Maria Hercília Ferreira . (2016). Nosocomial sepsis: evaluation of the efficacy of preventive measures in a level III Neonatal Intensive Care Unit. The Journal of Maternal-Fetal & Neonatal Medicine, (), 1–18. doi:10.1080/14767058.2016.1236245

Chapter 17: Food Safety and Clean Water in Healthcare Facilities

17.1 IMPORTANCE OF SAFE WATER AND FOOD

The quality of food and water is safe for consumption and routine use in Mauritius. However, it should be noted that some dispensaries, especially in rural or suburban areas, can face water shortages. It is advised that these healthcare facilities take all necessary precautions by keeping an adequate storage of water in tanks.

Water quality in public healthcare facilities is tested regularly at the Central Health Laboratory. Moreover, water used for hemodialysis is also checked for contaminants frequently and if any issue arises, the relevant authorities are informed.

The quality of food is considered generally satisfactory on the island with occasional outbreaks of gastroenteritis from salmonellosis or pathogenic *Escherichia coli*, especially after heavy rainfall, prompting investigations. However, the disposal of food in hospitals should follow the proper standards so as not to attract pests like rats and cockroaches.

17.2 HOSPITAL KITCHENS

Hospital kitchens are a key area of focus for IPC because they are responsible for preparing meals that will be consumed by patients, healthcare workers, and visitors. The presence of vulnerable patients with compromised immune systems makes it essential to have stringent IPC measures in place in these kitchens to prevent foodborne illnesses and cross-contamination.

17.2.1 Key principles of IPC in hospital kitchens

Effective IPC in hospital kitchens revolves around several fundamental principles, including:

- Personal hygiene of kitchen staff
- All kitchen staff must adhere to strict personal hygiene practices, including frequent handwashing with soap and water, wearing clean uniforms, and using hairnets and gloves where appropriate.
- Staff must be trained to avoid touching their face, hair, or any non-food surfaces when preparing food to prevent cross-contamination.
- Anyone exhibiting symptoms of infectious illnesses (e.g., diarrhea, vomiting, fever) should not be permitted to work in the kitchen until fully recovered.

17.2.2 Food safety practices

- Temperature Control: Maintaining proper temperatures for storing, cooking, and serving food is crucial. Cold foods should be kept below 5°C, and hot foods should be maintained above 60°C to prevent bacterial growth. Cooking food to the appropriate internal temperature (e.g., 75°C for poultry) is also necessary.
- Separation of Raw and Cooked Foods: Cross-contamination is a significant risk in kitchens.

Raw meats, poultry, and seafood should be stored separately from cooked foods and ready-to-eat items. Separate cutting boards, knives, and utensils should be used for handling raw and cooked food products.

- Cleaning and Sanitization: All surfaces, equipment, and utensils should be cleaned and sanitized regularly to eliminate pathogens. This includes frequent disinfection of cutting boards, counters, sinks, and kitchen machinery.

17.2.3 Environmental hygiene

- Cleaning and Disinfection: Hospital kitchens must adhere to strict cleaning protocols. This involves daily cleaning of floors, countertops, and storage areas, along with regular deep cleaning of appliances, hoods, and vents.
- Pest Control: Pests such as rodents, cockroaches, and flies can introduce pathogens into the kitchen. A comprehensive pest control program, including regular inspections and preventive measures, is essential to maintain a sanitary environment.

17.2.4 Proper waste management

- Segregation and Disposal: Kitchen waste should be segregated (e.g., organic waste, plastics, glass) and disposed of promptly to prevent the attraction of pests and the growth of harmful bacteria. Waste containers should be covered, clearly labeled, and emptied regularly.
- Recycling and Sustainability: While prioritizing hygiene, kitchens should also incorporate sustainable practices, including recycling and reducing food waste where feasible.

17.3 FOOD STORAGE

- FIFO System (First In, First Out): Implementing a FIFO system ensures that older stock is used before newer stock, reducing the chances of food spoilage.
- Proper Labeling: All food items should be labeled with preparation and expiration dates to prevent the use of expired ingredients.
- Regular Inventory Checks: Conducting regular inventory checks ensures that food storage guidelines are being followed and that expired or spoiled items are discarded promptly.
- Supervisors should conduct routine checks of temperature logs, cleaning schedules, and waste management practices.

17.4 OUTSIDE FOOD

17.4.1 Food patients cannot bring into the hospital

If not handled correctly the following items may pose a risk to patients and are therefore restricted onto hospital grounds:

- Meats and meat products,
- Fish paste and fish products,

- Fresh or synthetic cream or cream products,
- Eggs, and
- Take-away meals from restaurants.
    - Due to the varying quality and ingredients contained within fast food and take-away meals, patients should be discouraged from ordering these for delivery into inpatient sites.

However, upon orders received from treating doctors or dieticians, the above food items may be brought into Mauritian hospitals in exceptional circumstances e.g., when patients are unable to tolerate hospital food.

17.4.2 Foods patients can bring into the hospital

- Provided the patient's diet allows, the following items may be brought into hospitals by the patient or patient's relative/visitor:
    - Individual cartons of fresh fruit juice,
    - Fresh & dried fruit,
    - Canned or bottled soft drinks,
    - Crisps, nuts and crackers / biscuits, and
    - Cereal bars.
- Given dietary restrictions in Mauritius due to religious and cultural practices, there are occasions when it is beneficial to the individual to have specific items of food brought in from an outside source for their consumption. This includes family bringing home-cooked food.
    - These foods cannot be reheated in the microwave.
    - If these foods are to be stored in the kitchen or the common refrigerator found in the ward, they must be date coded when they are opened, have a use by date and bear the patients name and be stored according to this policy. Otherwise, keep the food at the patient's table.
    - Relatives must strictly comply with doctors' or dieticians' orders when bringing in home-made food.

17.5 FOOD HANDLING PRACTICE

- Hands must be washed thoroughly before starting work, before handling food or equipment, after visiting the toilets, after sneezing, coughing or using a handkerchief and after touching ears, nose, mouth or hair.
- Keep cuts and burns covered with a bright colored waterproof dressing.
- Do not lick your fingers.
- Do not pick your nose, teeth or ears, or scratch your backside.
- Do not cough or sneeze over food.
- Do not smoke, eat, drink or chew gum in food areas.

- Do not scratch your head.
- Do not use overalls, apron or cloth to dry your hands.
- Handle food as little as possible.

17.6 WARD KITCHENS

- Only authorized staff (domestic, auxiliary and nursing staff from that ward) are allowed access into ward kitchens.
- On no account should patients have access to ward kitchens unless it is part of a recognized occupational/rehabilitation session, and they are being supervised appropriately.
- Ward refrigerators should be of robust design and be capable of operating below 5 ºC.
- Temperatures should be checked AM and PM and recorded.
- Under no account should raw products be stored in unit kitchens.
- Patient food should be labelled correctly and checked daily when stored in common refrigerators.
- Expired food should not be kept in the kitchen and should be disposed of as soon as possible.

17.7 PATIENT MEAL SERVICE

The following key points must be adhered to regarding patient meals:

- Patients should preferably be served food prepared in the hospital. See the above note for food that caregivers may bring into the hospital.
- Patient meals must never be reheated or retained for use later.
- All patient meals, used or unused, must be disposed of correctly, i.e., thrown away in a black bag inside a covered bin to prevent attracting pests like rodents.

The hospital should have a clear policy regarding what to do with used crockery and cutlery, e.g., return them to the central kitchen for cleaning or provision of resources (like sinks and dish washing agents) to patients and their caregivers to clean cutlery inside the ward.

17.8 WHO'S 5 KEYS TO FOOD SAFETY

Unsafe food poses risk in many parts of the world. WHO defines the following five keys to food safety:

1. Keep food preparation areas clean;
2. Separate raw and cooked food;
3. Cook food thoroughly;
4. Keep food at safe temperatures; and
5. Use safe water and raw materials.

17.9 WATER, SANITATION, AND HYGIENE

Water, Sanitation, and Hygiene (WASH) is a cornerstone of Infection Prevention and Control (IPC), playing a critical role in safeguarding public health, especially in healthcare settings. The availability of safe water, proper sanitation facilities, and adequate hygiene practices significantly reduces the risk of infections, including healthcare-associated infections (HAIs) and antimicrobial resistance (AMR).

Effective WASH measures are essential for breaking the chain of infection transmission by ensuring clean environments, proper hand hygiene, and safe management of waste and wastewater. Hand hygiene alone is one of the most effective and low-cost IPC measures to prevent infections. However, its success relies heavily on consistent access to clean water, soap, and handwashing stations.

In healthcare settings, WASH infrastructure supports critical IPC practices such as sterilization of medical equipment, environmental cleaning, and proper disposal of infectious waste. Without these basic services, healthcare facilities become high-risk environments for both patients and healthcare workers, contributing to the spread of infections and increasing the burden of antimicrobial-resistant pathogens.

Moreover, during disease outbreaks, natural disasters, and public health emergencies, WASH interventions are vital in preventing secondary infections and controlling the spread of diseases such as cholera, gastroenteritis, and respiratory infections.

Investing in WASH not only strengthens IPC programs but also enhances health system resilience, improves patient safety, and contributes to global health security. It is a fundamental component of achieving Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs), particularly Goal 3 on health and Goal 6 on clean water and sanitation.

Therefore, integrating WASH into national IPC policies and ensuring its implementation across all healthcare facilities is essential to improve health outcomes, reduce healthcare-associated infections, and combat the growing threat of antimicrobial resistance.

Proper food safety starts with good hand hygiene and sanitation. The WASH Facility Improvement Tool (WASH-FIT) is used to assess whether healthcare facilities meet the expected standards.

Some components forming part of WHO’s WASH-FIT tool are shown in the next table.

Area	Immediate low cost or no cost	Longer-term or higher cost	Behaviour change, operation and maintenance considerations
Water	• Repair leaking pipes and taps • Install drinking-water stations (covered bucket with tap)	• Install solar-powered pump in borehole • Raise water tanks to make them climate-resilient	• Regularly inspect system for leaks, compromised water quality, etc. • Ensure regular water treatment (e.g. chlorine dosing)
Sanitation	• Install or fix stormwater drains to divert water in flood-prone areas • Install railing in toilets • Provide menstrual hygiene bins • Install locks on doors	• Install septic tanks with raised or reinforced walls to protect against floods	• Regularly inspect septic tank
Hand hygiene	• Ensure rational glove use (e.g. use only when there is a risk of blood or body fluid exposure, as per the glove pyramid *(33)*) through hand hygiene education and training, and behaviour change approaches • Provide hand hygiene reminder posters (and associated resources) • Use covered buckets with taps, soap and towels (or other hand-drying methods) – aim for point of care	• Provide sinks with soap and refillable alcohol-based hand rub dispensers	• Ensure training and regular monitoring • Regularly engage with leadership
Health care waste	• Reduce unnecessary PPE use to reduce waste • Install waste segregation bins and implement training • Provide segregation reminder posters • Fence off waste storage and treatment/disposal infrastructure	• Install non-burn technologies • Establish centralized waste treatment systems and regular waste collection	• Ensure regular training and support for waste generators, cleaners and operators of incinerators/ autoclaves
Environmental cleaning	• Use less toxic and more environmentally friendly detergents and disinfectants[a] • Provide buckets and mops		• Ensure regular (annual?) training on cleaning techniques and processes (e.g. cleaning checklist)

Table 48: Examples of interventions that can be considered in a healthcare facility to maintain a good standard of WASH. From "Water and Sanitation for Health Facility Improvement Tool (WASH FIT): a practical guide for improving quality of care through water, sanitation and hygiene in health care facilities, second edition. Geneva: World Health Organization; 2022."

Some relevant indicators on food hygiene and water safety in WASH-FIT include:

- Food is safely prepared and handled with clean hands, on clean surfaces and with clean utensils.
    - Surfaces used for food preparation should be washed with detergent and safe water and then rinsed or wiped with a clean cloth that is frequently washed.
    - Scraps of food should be disposed of rapidly, as they are potential reservoirs for bacteria and can attract insects and rodents.
    - Refuse should be kept in covered bins and disposed of quickly and safely.
- Kitchen stores and prepared food are protected from flies, other insects and rats.
- The facility has tanks to store water in case of disruption to the main supply, and water storage tanks are protected (e.g. from climate-related extreme weather events) and adequately managed (e.g. inspected, cleaned/disinfected regularly), and are sufficient to meet the needs of the facility for 2 days.
- Drinking water has appropriate free chlorine residual (≥0.2 mg/L or ≥0.5 mg/L in emergencies or as per national regulation).

- Water supply poses low or no risk to public health, as measured by the absence of *E. coli* per 100 mL (or lower as per national standards).

17.10 LEGIONELLOSIS

Legionella infections, particularly Legionnaires' disease, can pose a risk in healthcare facilities, especially for vulnerable populations such as immunocompromised patients, the elderly, and those with chronic illnesses. Legionnaires' disease is a severe form of pneumonia caused by inhalation of water droplets contaminated with Legionella bacteria, commonly found in water systems such as hot water tanks, cooling towers, and air conditioning systems.

It is noted that outbreaks of Legionnaire's disease are known to occur rarely in hotels in Mauritius but hospital-acquired Legionella is not a known phenomenon in the country.

The following table describes some of the interventions that can be undertaken to prevent the spread of Legionella in hospitals apart from reducing the presence of warm spots of water like decorative water fountains in healthcare facilities.

Technology	Mechanism/Characteristics	Efficiency
Temperature Control	Domestic water systems should keep cold water below 25°C and hot water above 45°C to inhibit Legionella growth. Thermostatic mixing valves can help maintain temperatures at the supply or point-of-use. However, higher temperatures may cause scalding, requiring regulatory temperature limits.	Efficient against both culturable and viable but nonculturable-like cells (live bacteria that do not grow or divide) of Legionella pneumophila.
Disinfection	Adding chemical disinfectants (e.g., chlorine, chlorine dioxide, chloramine, ozone) to water systems helps penetrate and inactivate microorganisms associated with biofilms.	Efficiency depends on the condition of Legionella, their host protozoa, and the physicochemical characteristics of the water.
Copper-Silver Ionization	Electrolysis introduces copper and silver ions into the water system. Copper ions penetrate the bacterial cell wall, while silver ions bind to parts of the bacterium, immobilizing the cell and curtailing cell division. This method is non-toxic to humans.	Efficient for controlling Legionella in potable water systems, cooling towers, and other building plumbing systems.
Nutrient Limitation	Controlling biofilm, iron corrosion, and inorganic nutrients by measuring assimilable organic carbon (AOC) and biodegradable dissolved organic carbon levels.	Lower AOC levels (5 to 10 µg/L) are associated with lower Legionella pneumophila levels in drinking water distribution systems.
Distal Plumbing Design and Plumbing Materials	Use small diameter piping to maximize water circulation and prevent stagnation. Install point-of-use filters, flash disinfection devices, and thermostatic mixing valves close to points-of-use. Material selection (copper, iron, plastics) influences biofilm growth.	Extended-life faucet filters can remove Legionella for several weeks. Proper corrosion control and awareness of iron in pipes are key to reducing risks.
Aerosol Control	Replace faucet aerators with laminar flow devices or showerheads producing larger water streams with micro-biofilters (<0.45-µm pore size). Regular cleaning of devices reduces bacterial contamination.	Changes in aeration technology (e.g., fine bubble diffusers) or covering aeration basins can reduce aerosol formation and transport.
Reducing Water Age	Regular flushing techniques increase water flow and prevent stagnation, especially in unoccupied buildings.	Reducing water age and stagnation improves disinfectant

and Stagnation	Removal of dead legs (unused pipes) is also recommended.	delivery and helps prevent Legionella growth.

Table 49: Taken from the National Institutes of Health of USA. Ways to control Legionella in healthcare facilities.

During outbreaks, consider the following:

- Heat shock therapy: heat the water to 70°C for 30-60 minutes – this will disrupt biofilms. Be careful of scalding injuries. Ensure that no staff turn on the water systems for use during this time.
- Shock chlorination: Maintain a concentration of 50 mg/L of free chlorine for one hour at distal sites. Chloramines are used in some instances because they are more stable.
- Alternatives include ozone treatment, placing ultraviolet lights at faucets, using hydrogen peroxide, introducing copper and silver ions.

References

1. NHS Foundation Trust. Food Safety and Hygiene Policy. Jan 2021. V 3.0.
2. Water and Sanitation for Health Facility Improvement Tool (WASH FIT): a practical guide for improving quality of care through water, sanitation and hygiene in health care facilities, second edition. Geneva: World Health Organization; 2022.
3. National Institutes of Health, USA. Combatting Legionella in Healthcare Facilities Part II: Controlling Legionella. News to Use. September 2022.
4. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Division on Earth and Life Studies; Board on Population Health and Public Health Practice; Board on Life Sciences; Water Science and Technology Board; Committee on Management of Legionella in Water Systems. Management of Legionella in Water Systems. Washington (DC): National Academies Press (US); 2019 Aug 14. 4, Strategies for Legionella Control and Their Application in Building Water Systems.

Chapter 18: IPC in Other Areas of the Healthcare Facility

18.1 IPC IN THE OUTPATIENT

The first point of contact for some patients seeking care is the registration desk facilities of the outpatient department (OPD). Recognition of transmissible illness and moving the infectious patients to the appropriate examination room as quickly as possible is important.

Frontline staff at the registration desk should be trained to recognize patients showing signs and symptoms of transmissible diseases. Visual alerts and posters indicating the signs and symptoms of transmissible diseases should be displayed at the entrance.

Staff in the OPD should strictly adhere to hand hygiene, respiratory hygiene and the cough etiquette. During outbreaks of contagious illnesses, ample space should be present in the waiting area to practice physical distancing. Disposable towels, disposable gloves and alcohol hand rubs must be readily available.

18.2 IPC IN EMERGENCY DEPARTMENT

The emergency department is a busy place subject to rapid patient turnover and overcrowding; most or all admissions to the hospital are from the emergency. Patients admitted through the emergency are sicker than those who report to the OPD.

Infection prevention is a major challenge in the emergency department due to the following:

1. High-volume of patients, many needing rapid interventions;
2. Patients present with undifferentiated illnesses of various types and the condition ranges from the otherwise healthy to the critically ill;
3. Risk recognition and decision-making are often based on limited and changing data; and
4. Insufficient spacing.

The key to preventing HAI in the casualty is to have a rapid and accurate triage system, to isolate contagious patients promptly and to have an adequate supply of PPE. See the chapter on triage for details.

18.3 IPC IN THE RADIOLOGY DEPARTMENT

18.3.1 Mechanisms of infection

- Radiology rooms are used for both inpatients and outpatients, which often leads to contamination of surfaces, apparatuses, and equipment.
- Portable radiology units usually are contaminated and represent vehicles of microorganisms' transmission.
- Adhesive tape (markers), and lead aprons can be colonized, and serve as reservoirs for infection.
- Filmcards used in radiation therapy become contaminated through direct and indirect contact and are a potential source of cross-infection.

- Syringes and other disposables may be shared between patients to minimize set up time, thus creating contamination hazards.
- Waiting areas lead to prolonged exposure of patients and accompanying family members, especially in a suboptimal ventilated setting, raises an inevitable possibility of infection transmission**.**
- Workstations used by physicians and technologists to capture, edit, and save images can be contaminated with microorganisms. Ultrasound probes and gel can also become colonized.

18.3.2 Reducing risks of infection

Ways to protect staff and patients include:

- Regular and frequent cleaning of high touch surfaces at least thrice a day at fixed times and whenever required.
- Reduce the patient's stay in the waiting area as much as possible.
- Clean X-ray equipment, cassettes, and all other equipment with alcohol wipes between examinations.
- Cover surfaces coming into direct contact with patients, with a disposable sheet that is changed between patients e.g., for couches.
- Use equipment-compatible disinfectants to disinfect MRI, CT, etc. (0.05% Javel, 2% quaternary ammonium compounds, 75% alcohol, etc.) in between patients for parts touching patients, especially if the patient is labelled as contagious or else at least 2x/d.
- Use syringe, tube, and connector of the automatic injectors for only one patient.
- Disinfect transducer probes after contact with skin using alcohol or other compatible disinfectants; after contact with mucosa, sterilize the transducer probe or use high-level disinfection whichever is recommended by the manufacturer.
- Prefer to use transducer covers instead directly placing the probe on the patient's skin.
- Follow isolation precautions whenever the patient is contagious.

18.3.3 Proper use of ultrasound gel

- Ensure gel and containers are physically intact and have not exceeded the expiry date.
- Single use can be expensive in some cases but is preferred.
- If multi-use:
    - Ensure the tip of the bottle does not come in contact with anything.
    - Discard after use in an isolation precaution setting.
    - Use a dispensing device for filling.
    - Label the bottle with the date of refilling, discard after one week or when physically soiled.

18.3.4 Disinfection of transducer probes

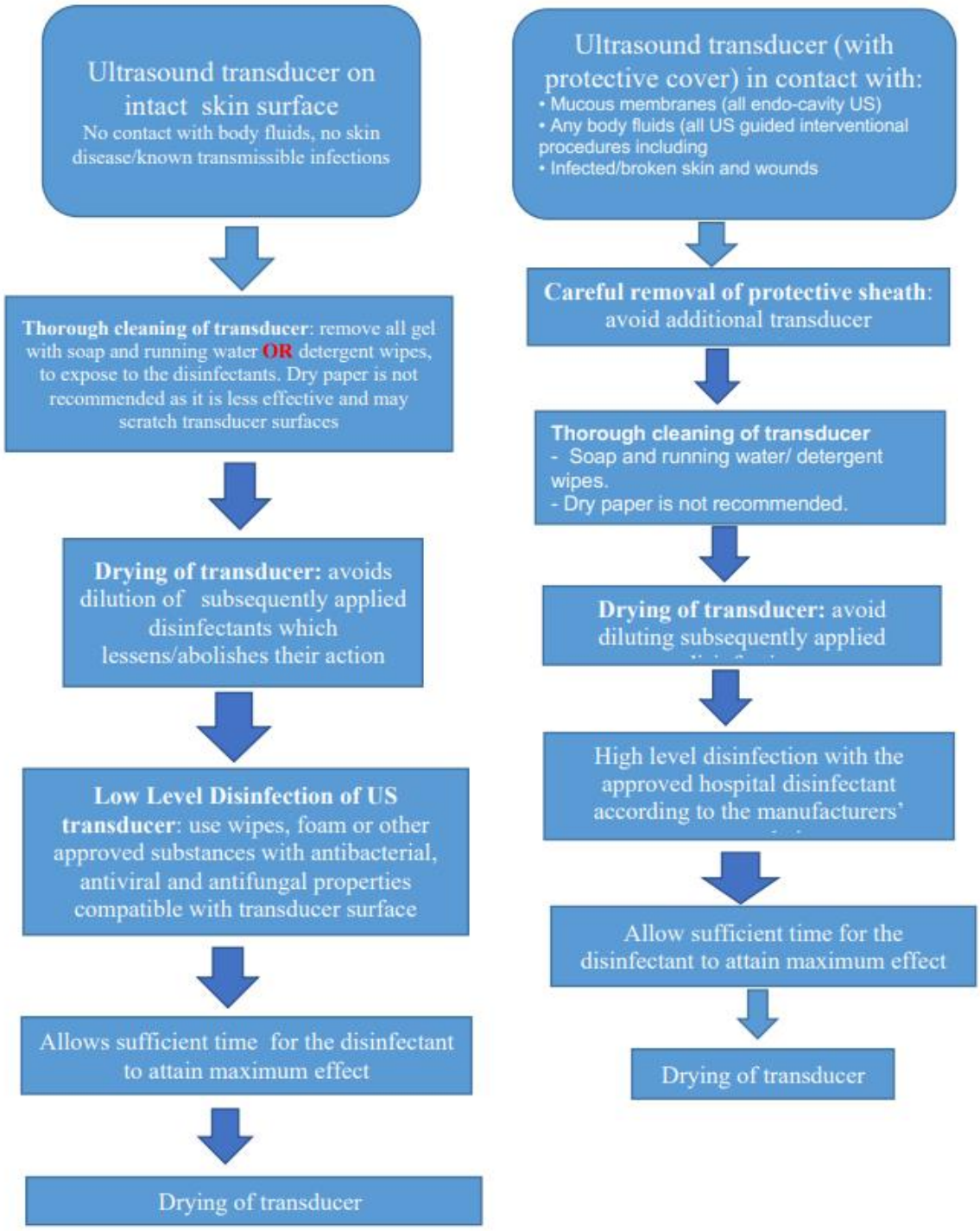


Figure 43

Preparation of external transducers between patients requires a low level disinfection process while preparation of internal transducers between patients requires routine mandatory high-level disinfection and the use of a high-quality single-use transducer cover during each examination.

18.4 IPC FOR IMMUNOCOMPROMISED PATIENTS

The recognition of infections in immunocompromised patients is a challenge as the signs and symptoms of infection are suppressed and may even be absent.

The importance of hand hygiene should be emphasized to the patient, relatives and staff.

18.4.1 General recommendations

Certain precautions should be taken when caring for such patients to reduce the risk of acquiring a HAI:

1. Vase water and soil in plants contain large concentrations of potential pathogens and decaying organic matter may contain fungi. Live plants and flowers are restricted from immunocompromised patients' rooms. Fake plants and flowers are discouraged due to dust collection.
2. Healthcare workers with acute infections are restricted from working with immunocompromised patients.
3. Single occupancy rooms with a hand washing sink and private bathroom are preferred.
4. Minimize invasive procedures (e.g., bladder catheterization, IV catheter insertions, or IV-line cannulations).
5. Pediatric patients should not have their temperature taken by either oral or rectal routes; axillary temperature checks are allowed.
6. Neutropenic patients should preferably be in a separate room with an attached bath and toilet.
7. Lower dust levels by using smooth, non-porous surfaces and finishes that can be scrubbed, rather than textured material (e.g., upholstery).
8. Avoid carpeting in hallways and patient rooms in areas.
9. Patients should wear N95 / FFP2 respirators when being moved into dusty areas.

18.4.2 Protective Environments

For very high-risk patients (typically stem cell transplant patients or critically neutropenic patients), it is recommended that an environment that is fully HEPA filtered and at positive pressure is provided i.e., a Protective Environment.

A pressure differential for positive pressure areas of >2.5 pascals (ideal pressure differential of >8 Pa) is required.

Note that most patients on chemotherapy or on steroids or AIDS patients do not require a Protective Environment i.e., they don't need to be isolated in a positive pressure room with HEPA filtration.

See the chapter on IPC in the oncology unit for more details.

18.5 IPC DURING CONSTRUCTION: PREVENTION OF ASPERGILLUS INFECTIONS

Aspergillus species are ubiquitous fungi that commonly occur in soil, water, organically enriched debris and decaying vegetation. Many species of Aspergillus have been recognized in nature but only a few have been associated with human disease. Aspergillus species are responsible for a wide spectrum of human illnesses ranging from colonisation of the bronchial tree to rapidly invasive and disseminated diseases.

Certain types of demolition and construction activities can result in increased incidence of invasive Aspergillosis (a condition in which pneumonia caused by inhalation of Aspergillus spores is established and the fungus is disseminated to other organs) among immunosuppressed/vulnerable patients.

Nosocomial (i.e. hospital acquired) outbreaks of Aspergillosis are a well-recognized complication of construction, demolition or renovation work in or near hospital wards in which immuno-suppressed patients are accommodated.

The key to eliminating Aspergillus infection is first to minimise the dust generated during construction activity and second, to prevent dust infiltration into adjacent patient care areas. Measures include:

- The erection of airtight plastic and dry wall barriers around the construction sites,
- The use of negative-pressure ventilation in the construction area,
- Covering of all air intake and exhaust vents in the construction zone to prevent the introduction of contaminated air into the hospital heating (e.g., through use of HEPA filters), ventilation and air conditioning systems,
- Capping the open ends of any existing ventilation ducts in the construction zone,
- Redirection of construction traffic away from patient areas,
- Regular removal of the construction debris from the site in sealed containers or at least covered by a damp cloth,
- The use of sticky mats, and
- Regular damp cleaning.

A mat with a sticky surface or moist carpet should be placed inside the exit from the construction zone to trap dust. This should be vacuumed/changed daily or more frequently when visibly soiled.

Patients who are at risk should be moved to an area away from the construction zone if the air quality cannot be guaranteed during construction. At-risk patients should wear protective masks (N95 / FFP2) if it is necessary to transport them through a construction area.

Prior to starting construction work, IPC teams should be informed so that appropriate measures are taken based on patient risk and type of construction work – see the Irish National Guidelines for the Prevention of Nosocomial Aspergillosis for more details.

18.6 IPC IN THE PHARMACY AND DURING MEDICATION PREPARATION AND ADMINISTRATION

Hospital pharmacies play a critical role in the safe preparation, storage, and dispensing of medications, including sterile products such as intravenous (IV) solutions, injectables, and compounded medications. Ensuring a contamination-free environment in the pharmacy is vital to prevent healthcare-associated infections (HAIs) and maintain patient safety.

- Aseptic Technique: The practice of aseptic technique is fundamental in pharmacies, especially when preparing sterile products. This involves procedures that minimize the risk of introducing pathogens during medication preparation. It includes using sterile equipment, practicing proper hand hygiene, and working within a controlled environment.
- Cleanroom Environment: Sterile compounding should take place in a cleanroom or a dedicated sterile preparation area with ideally a laminar airflow hood (especially when

preparing medications for use intravenously). The cleanroom should preferably maintain a positive pressure environment to prevent the entry of contaminants. A HEPA filter can reduce the amount of contaminants in the air.

    - It is however noted that the efficacy of laminar flow in healthcare facilities to prevent infections is controversial. The use of laminar flow in the industrial preparation of medications is believed to be much more important. However, some authorities prefer that the preparation of total parenteral nutrition in hospitals be carried out in a laminar airflow hood. On the other hand, laminar flow can be important when working with carcinogenic drugs (like chemotherapies) to protect staff from the dangers of exposure.

- Hand Hygiene: Effective hand hygiene is one of the simplest yet most important measures for preventing infection. Pharmacists and pharmacy technicians must wash their hands thoroughly before entering the compounding area and before handling medications.
- Personal Protective Equipment (PPE): Appropriate PPE, such as gloves, masks, gowns, and hairnets, should be worn when preparing sterile products to prevent contamination. PPE must be changed regularly and disposed of correctly to minimize the risk of infection.
- Sterilization Processes: All equipment, instruments, and materials used in sterile compounding must be thoroughly sterilized if reused. Syringes, vials and needles should be single-use and should be disposed of properly as soon as they are no longer needed. Sterilization can be achieved through autoclaving, filtration, or chemical means, depending on the type of equipment.
- Use of Single-Use Devices: Where possible, single-use devices should be used to minimize the risk of contamination. Reusable equipment must undergo stringent cleaning and sterilization between uses.
- Temperature Control: Medications, especially those that are temperature-sensitive, must be stored under strict conditions to maintain their efficacy and prevent degradation. Pharmacy refrigerators, freezers, and storage rooms should be monitored to ensure they maintain appropriate temperatures.
- Segregation of Medications: High-risk medications, such as chemotherapeutics or immunosuppressants, should be stored separately from other drugs to prevent cross-contamination. Medications requiring sterile preparation should be handled and stored in a designated sterile environment.
- Safe Handling of Hazardous Drugs: Pharmacies must follow special precautions when handling hazardous drugs to prevent exposure to healthcare workers and the environment. This includes using closed-system transfer devices (CSTDs) and containment primary engineering controls (C-PECs).

Incorrect practices during the preparation of medications, especially in wards, and during their administration can lead to fatal infections. Precautions that should be taken include:

- A designated area should be defined only for medicine preparation. Nothing other than medicine, material needed during preparation and a safety container to throw away waste should be in the working area (no paper, no paperboard, no waste materials, no patient contaminated materials, etc.).

    - Injections should be prepared using aseptic technique in a clean area that is not adjacent to potential sources of contamination (e.g., at least one meter from sinks or other water sources; free from items that could have come in contact with blood or body fluids).

- The work surface should be cleaned and disinfected daily. Cleaning should be done in one

direction to assure all particles are eliminated. Alcohol must have evaporated before starting medicine preparation.

- There should be no interruptions during medicine preparation.
- Hand hygiene before and after medicine preparation is essential.
- Before the medicine preparation starts, a visual inspection of the ampoule and vial is needed. Lack of particles on the surface should be assured.
- High risk contamination areas should never have been touched (syringe tip, ampoule neck and vial elastomeric area) after disinfection.
- The medicine preparation process finishes with correct labelling. The only situation in which not labelling is permitted is when medicine is prepared at the bedside and immediately administered (intravenous push injection) to the patient without any break in the process.
    - Labels should contain the following information: medicine name, dosage (amount of drug and drug concentration in solution), administration route, speed and duration of administration (if applicable), final volume (if applicable), date and time of preparation, expiration, and name or initial of preparer. In addition, each preparation must be identified with the patient's label (full name, number of clinical note, bed and location).
- The stability of medicines prepared in clinical areas lasts for 1–2 hours due to the risk of microbiological contamination. Therefore, administration should take place within 1–2 hours after preparation.
    - Compounded sterile preparations should be used within 4 hours following the start of the preparation.
- Medicine remaining in ampoules should be thrown away after its use because medicine is easily contaminated once ampoules are opened.
- A label should indicate opening and discarding dates (for multi-use vials).
    - Discard within 28 days unless the manufacturer specifies a different (shorter or longer).
- Never leave needles inserted in the vial.
- Check whether the product needs to be stored in the refrigerator in order to keep it stable.
- Perform hand hygiene prior to preparing or administering an injectable medication.
- Needles and syringes should be used for only one patient.
- The rubber septum on a medication vial should be disinfected prior to piercing.
- Medication containers should be entered with a new needle and a new syringe, even when obtaining additional doses for the same patient/resident.
- Single dose medication vials, ampoules, and bags or bottles of intravenous solution should be used for only one patient.
- Use aseptic technique when accessing injection ports to avoid introducing microorganisms which can result catheter-associated blood stream infections.
- Closed needleless injection ports with valves are preferred to open lumen stopcocks because closed ports can be effectively disinfected before access.

- If open lumen access ports are used, cover the port with a sterile cap or syringe when not in use.
- Disinfect closed lumen needleless access ports by either:
    - Scrubbing with a 70% isopropyl alcohol swab for at least 5 seconds followed by drying.
    - Using Luer-lock caps containing isopropyl alcohol-impregnated pads.

SOPs on the proper preparation and administration of medications can be found at https://clinicalgate.com/10-preparing-and-administering-medications/, 24-480_administration_of_medicines_mar_2024_redacted.pdf and https://picscheme.org/docview/3443.

18.7 IPC IN THE ANESTHESIA UNIT

18.7.1 Injection safety

- Avoid recapping of needles and discard used needles and syringes into a punctureresistant sharps container.
- Use syringes, needles, and needleless access devices only once.
- Do not refill a syringe once used, even for the same patient.
- Efforts should be made to keep syringes prepared for single patient use under direct observation, or locked securely, with a patient identification label attached.
- Use infusion, pump syringe, and intravenous administration sets only once.
- Do not use bags or bottles of intravenous solution as a common source of diluent for multiple patients.
- Clean and process intravenous infusion and syringe pumps according to manufacturer recommendations between patients.
- When available, prevent coring and particulate contamination by applying in-line final filtration using a 45µ rater.
- Use 70 percent alcohol to clean the access diaphragm of medication vial or to clean the outside of an ampule prior to insertion of a device or needle into the vial.
- Use 70 percent alcohol to clean the diaphragm prior to access when removing the cap from a new vial.
- Use single-dose vials for medications when possible.
- Do not combine or save leftover medications from single-dose vials/ampules for later use.
- Discard single-dose medication vials, ampules, and intravenous infusion bags safely after use on a single patient.
- Dedicate multi-dose vials to a single patient when possible.
- Use a syringe or needle only once to withdraw medication from a multi-dose vial.
- Label the date on the multi-dose vial once opened.
- Do not keep multi-dose vials in the immediate patient treatment area (e.g., patient rooms or bays, operating rooms, anesthesia carts).

- If a multi-dose medication vial enters a patient treatment area, it should be treated as a single-use vial and discarded at the end of the individual case.
- Discard multi-use medication vials if sterility is compromised or questionable.
- Discard multi-use medication vials within 28 days of opening or as directed by the manufacturer.

18.7.2 Gels, lubricants and ointments

- Dedicate ointments, gels, and lubricants to a single patient when possible.
- Use sterile skin prep agents when indicated.

18.7.3 The anesthesia machine and breathing system

Although there is no direct contact between anesthesia machine controls and the patient, microorganisms can be transferred between the machine and patient by the healthcare provider. Refer to the manufacturer's instructions regarding:

- Cleaning and disinfecting the anesthesia machine.
- Pasteurizing or autoclaving of valves.
- Disassembling and disinfecting adjustable pressure-limiting valves.

In general:

- Clean, then spray or wipe anesthesia machine surfaces and knobs with an appropriate germicide between cases and at the end of each day.
- Take protective measures to prevent materials stored on the anesthesia machine from becoming inadvertently contaminated by airborne debris (e.g., blood).
- Remove equipment from drawers, clean and disinfect drawers regularly.
- Place a clean covering on the top of the anesthesia cart at the beginning of each case.
- Wipe small surfaces with 70 percent isopropyl alcohol to reduce bacterial contamination.
- Clean carbon dioxide and soda lime absorbers when the absorber is changed and remove debris from the screens.
- When a patient with a respiratory infection must be given inhalational anesthesia, a filter should be used.
- Practitioners may choose to place a high-efficiency filter on the inspiratory limb of the breathing circuit to protect the patient from the anesthesia machine, and to place a high-efficiency filter in the expiratory limb to protect the anesthesia machine from the patient.
- Use circuit filters and follow-up with post-anesthesia machine disinfection after caring for patients with known pulmonary infection or trauma.
- Follow the manufacturer instructions for disassembly, cleaning, and sterilization of carbon dioxide absorbers.
- Clean canisters when the absorbent is changed and carefully remove debris from the screens.
- Discard disposable plastic canisters.

- Bellows, unidirectional valves, and carbon dioxide absorbers should be cleaned and disinfected periodically.
- At a minimum, provide high-level disinfection for multiple-patient use breathing circuits.
- The outer surface of the circuit can become easily contaminated when the system is not changed between patients and therefore should be disinfected between each use.
- End- tidal carbon dioxide tubing should be changed between patients.
- Following anesthesia care of a patient with pulmonary infection or trauma, disinfection of the internal and respiratory system anesthesia machine components is mandatory.
- Heat and moisture exchangers alone are not effective in decreasing the transmission of microorganisms to the anesthesia breathing system.
- If possible, use disposable single-use device laryngeal mask airways (LMAs) due to the extreme difficulty in completely eradicating protein deposits from reusable LMAs.
- Reusable LMAs should be rinsed and soaked in enzymatic detergent prior to autoclaving to remove occult blood.
- Numerous studies have demonstrated that protein deposits are extremely difficult to eradicate completely from reusable LMAs.
- Consult manufacturer directions for cleaning and sterilizing supraglottic airway devices.

18.8 IPC FOR THE HOSPITAL YARD

IPC extends beyond the internal environment of a hospital to include outdoor spaces, such as hospital yards, gardens, parking areas, and walkways. While the risk of infection transmission is often associated with clinical areas, maintaining cleanliness and hygiene in outdoor spaces is equally important. Unkempt and unsanitary hospital yards can harbor pests, facilitate the spread of pathogens, and negatively impact the overall image and safety of the healthcare facility.

- Pests as Disease Vectors: Hospital yards can attract pests such as mosquitoes, rodents, and flies, which are known vectors for diseases like malaria, dengue fever, and leptospirosis. Effective sanitation and pest control measures are crucial to minimizing the presence of these vectors and reducing the risk of disease transmission. Blocked ditches or drains, waste that is incorrectly disposed of, tall grass and stagnant water on hospital grounds are unacceptable.
- Breeding Grounds: Standing water, overgrown vegetation, and accumulated waste can create breeding grounds for insects and other pests. Regular maintenance of outdoor areas helps to prevent such conditions.
- Perception of Hygiene: A clean, well-maintained hospital yard contributes to the perception of safety and care quality within the hospital. It also has a positive psychological impact on patients and visitors.
- Preventing Accidents: Maintaining clean and orderly pathways in the yard helps reduce the risk of slips, trips, and falls, contributing to the safety of patients, visitors, and staff.
- Routine Cleaning Schedules: Hospital yards should be cleaned regularly according to a well-documented schedule. This includes sweeping walkways, removing litter, and cleaning benches, signage, and other outdoor fixtures. Areas prone to high foot traffic, such as entrances, should receive additional attention.
- Grass and Vegetation Maintenance: Overgrown grass and bushes can provide shelter for pests. Regular trimming and pruning are essential to prevent the yard from becoming a habitat

for rodents, snakes, and insects. Well-maintained green spaces also enhance the aesthetic appeal of the hospital environment.

- Waste Segregation and Disposal: Waste generated in hospital yards must be properly segregated into categories (e.g., general waste, recyclable waste, and biohazardous waste). Waste containers should be placed at convenient locations around the yard, clearly labeled, and regularly emptied.
- Covered Waste Bins: All waste bins should have lids to prevent pests from accessing the contents. Overflowing bins should be avoided, as they can attract rodents, birds, and insects that may carry pathogens.
- Pest Management Programs: A robust pest management program is essential to keep hospital yards free from pests that can spread diseases. This includes regular inspections, the use of traps, and, if necessary, professional pest control services.
- Proper Drainage Systems: Ensuring that hospital yards have proper drainage systems is key to preventing the accumulation of stagnant water. Regular inspection and cleaning of drains and gutters help prevent waterlogging, which can become a breeding ground for mosquitoes and other insects.
- Maintenance of Water Features: If the hospital yard has water features such as fountains or ponds, these should be regularly cleaned and treated to prevent the growth of algae, bacteria, and insects.
- Sustainable Landscaping: Choosing plants that are easy to maintain, do not attract pests, and are resistant to local diseases can contribute to yard hygiene. Landscaping should also be designed to facilitate easy cleaning and maintenance.
- Use of Environmentally Friendly Cleaning Products: When cleaning outdoor areas, hospitals should opt for environmentally friendly products that do not harm plants or wildlife. These products should be effective in disinfecting surfaces without causing environmental damage.

18.9 NATIONAL CHECKLIST ON IPC IN SPECIAL AREAS

For ease of reference, the table below describes the national checklist utilized to assess various areas of a healthcare facility in Mauritius.

Sn	Items	Description
1	Triage	a. Is there a triage desk that is manned? b. Can the staff hand over an approved algorithm for triage of infectious diseases? c. Is a functional non-touch thermometer available? d. Is the thermometer being used and if so, can the staff provide a register listing how many patients had fever recently? e. Can the staff list the symptoms of some contagious illnesses and is a standardized triage questionnaire in use? f. Can the staff list some countries where outbreaks are ongoing, and can he / she mention which infections are in those countries? g. Does the staff know what constitute an exposure and can the staff hand over a questionnaire on exposure assessment? h. Can the staff provide a guideline which explains, after triage, who should be isolated, who should be sent to the flu clinic and who

		should be sent urgently to see a doctor? i. Is it indicated that patients should stay > 1 meter away from the staff? j. Does the triage desk have sanitizers for patients and for the staff? k. Does the triage desk have masks that they can give to patients if needed? l. Does the triage desk have tissue paper for patients together with a bin? m. Is a barrier present at the triage desk (plastic or glass screen)? n. Are visual alerts about respiratory hygiene present at the triage desk? o. Is a waiting area with > 1m separation available for specific patients? p. Is triage carried out in a confidential & private manner?
2	Kitchen	a. Are all kitchen wastes thrown away in bins that are closed? b. Does the kitchen appear grossly clean to the naked eye and free from spillage? c. Is the kitchen floor mopped at least twice a day? d. Are there no insects and no rodents inside the kitchen? e. Is food stored on racks / cupboards that are closed or inside packs / containers so as not to attract pests? f. Are the refrigerators, ovens and microwaves clean? g. Is a sink available with soap and water? h. Are facilities available to clean utensils?
3	Waste disposal	a. Staff wear appropriate PPE (gloves, rubber boots, protective aprons and masks) when handling, separating, or transporting infectious waste b. Infectious waste is kept in a dedicated and secluded area c. A biohazard sign is present at the dumping shed d. The dumping shed for infectious waste is locked e. The dumping area is not overflowing with waste i.e., waste is transported regularly to the disposal site f. Items are not falling out of the infectious bags or seen on the floor of the shed e.g., PPE, syringes or needles
4	Water storage	a. Clean water is available 24 hours a day b. A storage tank for water is available in case of shortage and can keep up with the demand for at least 48 hours c. The water tank is cleaned and maintained regularly
5	Yard cleanliness and hygiene	a. Mosquitoes do not abound in the yard b. Stagnant water is absent on the premises c. Garbage and litter cannot be found on the hospital premises d. Ditches are not blocked (if present) e. Holes are closed so as not to attract rodents

6	Linen facility	a. Soiled linen is stored separately (in red bags) from used linen (in white bags) b. A washing machine is available c. The temperature is set at 60-90°C on the machine d. A wash cycle is ≥ 10 minutes if the temperature is 65°C and ≥ 3 minutes if 71°C e. Javel is properly diluted to 0.05% (if used) f. Soaking time in Javel is 30 minutes g. Linen attendants wear the proper PPE (rubber gloves, apron, goggles / face shields & boots) when cleaning very soiled linen h. Clean linen is carried on a clean trolley
7	Central Supplies and Sterilization Department	a. The sterilizer is functional b. Proper cleaning of items is ensured before sterilization starts c. A log of the sterilization conditions is available after the sterilizer is used d. Sterile wrap paper is available e. Chemical indicators are used f. Biological indicators are used g. Containers where sterile items are kept are clean h. Air holes of the containers are closed once sterilization is complete i. Sterile items are stored above the ground in dry conditions and away from non-sterile items j. Sterile items are carried on clean trolleys
8	Pharmacy	a. Medication preparation area appears clean and without clutter b. Medication refrigerators are available and medications that need to be in fridge are not kept outside c. Refrigerators are equipped with thermometers d. A log of temperatures of the refrigerator is kept (especially for vaccines) and the temperatures are within acceptable limits e. Storage areas for medications appear clean and are above the ground and away from windows or wet areas f. A laminar flow hood or cabinet is available for preparation of medications g. Disposable items used for compounding are not reused (e.g., syringes and burettes) h. Clutter and overcrowding is absent in the compounding area i. Handwashing station is available j. Sanitizers are available k. Appropriate PPE is worn during compounding l. Yellow bins are available
9	Biosafety / laboratory	a. A person responsible for biosafety has been identified b. Staff can hand over a biosafety manual that has been approved by the Ministry

		c. Lab staff has sufficient quantity of PPE d. Staff can be seen wearing gloves when manipulating blood and other organic specimens e. Microbiological waste is autoclaved prior to disposal f. All microbiological specimens and blood are thrown away in yellow bags g. All staff have been trained in biosafety h. Staff can show they have an SOP on what to do in case of biological spills i. Staff can show they have an SOP on how to disinfect a biosafety cabinet j. Soap and paper towel are available at each sink k. An eyewash station is available l. Benchtops are impervious to water, acid and alkali m. All staff wear lab coats inside the lab (outside of administrative areas) n. Biosafety cabinets are certified and maintained annually o. An SOP is available for the manipulation of biosafety level 2 agents p. An SOP is available on how to decontaminate the biosafety cabinets q. Lab samples are delivered in biohazard bags r. A biohazard sign is placed near to places that manipulate biosafety level 2 or 3 agents s. Sharps boxes are available and when checked, they are not full beyond ¾ t. Sharps are not left lying around u. A protocol is in place regarding what to do in case of an exposure to an infectious agent v. Windows close to specimens are fitted with fly screens w. Staff eat and drink in a separate area and not inside the testing area x. Food is stored separately from lab specimens in refrigerators y. Access to the laboratory is controlled z. Mechanical ventilation with HEPA filtration is available in areas where biosafety level 3 agents are manipulated aa. The place appears clean, without pests and without clutter bb. Staff know what protocol to follow if they are asked to manipulate a sample from a highly infectious patient (e.g., infected with Ebola Virus Disease) cc. Regular disinfection e.g., with formaldehyde, is carried out in areas where biosafety level 3 agents are manipulated

18.10 IPC DURING PUBLIC HEALTH EMERGENCIES

IPC is a cornerstone of public health response during emergencies, ensuring the containment of disease transmission while safeguarding the health of affected populations and frontline workers. During public health emergencies (PHE) such as pandemics, disease outbreaks, or natural disasters, robust IPC measures are critical to minimize the risk of infections and reduce morbidity and mortality.

The IPC program during a PHE helps to enhance preparedness, operational readiness and response measures.

18.10.1 Rapid risk assessment

- Early identification of pathogens and their modes of transmission is essential to design targeted IPC interventions.
- Surveillance systems and diagnostic capacities should be enhanced to provide timely and accurate information.

18.10.2 Healthcare facility preparedness

- Facilities must establish clear protocols for isolation, triage, and management of suspected and confirmed cases.
- Ensure the availability of personal protective equipment (PPE), hand hygiene supplies, and disinfection materials.

18.10.3 Community-based IPC measures

- Educating communities on personal hygiene practices, such as handwashing and mask use, can significantly reduce transmission.
- Safe burial practices and community engagement in case identification and reporting are vital in outbreaks like Ebola.

18.10.4 Workforce training and support

- Healthcare workers and responders must receive adequate training on IPC protocols tailored to the specific emergency.
- Psychological support and measures to prevent burnout are necessary to sustain workforce effectiveness.

18.10.5 Infection surveillance and outbreak containment

- Real-time surveillance helps detect healthcare-associated infections and implement corrective measures promptly.
- Quarantine and contact tracing can limit the spread of highly contagious diseases.

18.10.6 WASH (Water, Sanitation, and Hygiene) integration

Access to clean water, adequate sanitation, and waste management systems is indispensable for IPC, especially in resource-limited settings.

18.10.7 Supply chain management

Ensuring a steady supply of IPC materials, including PPE, vaccines, and essential medications, mitigates disruption during emergencies.

18.10.8 Collaboration and coordination

- Incorporating IPC measures into emergency preparedness plans can enhance readiness and response.
- Multisectoral collaboration is essential, involving public health authorities, private sectors, and communities.

18.10.9 General recommendations during emergencies

- Establish an IPC coordination body within broader coordination structures to develop, revise, adapt, and disseminate policies, guidelines, trainings, and other IPC-related information across all levels of the healthcare system (e.g., national, sub-national, and facility).
- Develop an information sharing platform to communicate across all levels of the healthcare system
- Identify HCW to help in cases of surges of patients.
- Establish a national stockpile of medical supplies and equipment, including PPE and other consumables, and develop triggers and plans for deployment of stockpiled supplies.
- Anticipate supply shortages and coordinate with vendors and HCFs about availability and prioritization of supplies.
- Provide contingency plans to respond to limited resources or stockouts.
- Provide guidance and allocation of resources for development and use of isolation or cohorting space
- Help to develop service restriction plans in case of staff shortages or increased demand.
- Disseminate public health messaging and risk communication regarding precautions that communities should take.
- Have a surveillance plan to monitor hospital-acquired infections related to the ongoing outbreak.

18.11 IPC IN SCHOOLS AND OTHER CHILDCARE SETTINGS

In schools and childcare settings, where children, staff, and families interact closely and frequently, implementing effective IPC measures is essential to maintain a safe and healthy environment.

Young children are especially vulnerable to infections due to their developing immune systems, close physical contact during play, and limited understanding of personal hygiene. Educational institutions and childcare facilities, therefore, play a critical role in reducing the transmission of illnesses such as influenza, gastrointestinal infections, respiratory viruses, and skin infections.

IPC in these settings encompasses a range of measures, including hand hygiene, respiratory etiquette, cleaning and disinfection of surfaces, appropriate management of waste, exclusion policies for sick children and staff, and immunization promotion. Staff training and awareness, as well as communication with parents and guardians, are also key components of a successful IPC programme.

18.11.1 Rashes

Rashes and skin infections	Recommended period to be kept away from school, nursery or childminders	Comments
Athlete's foot	None	Athlete's foot is not a serious condition. Treatment is recommended
Chickenpox*	Until all vesicles have crusted over	See: Vulnerable children and female staff – pregnancy
Cold sores, (Herpes simplex)	None	Avoid kissing and contact with the sores. Cold sores are generally mild and self-limiting
German measles (rubella)*	Four days from onset of rash	Preventable by immunisation (MMR x 2 doses). See: Female staff – pregnancy
Hand, foot and mouth	None	Contact the school head if a large number of children are affected. Exclusion may be considered in some circumstances
Impetigo	Until lesions are crusted and healed, or 48 hours after commencing antibiotic treatment	Antibiotic treatment speeds healing and reduces the infectious period
Measles*	Four days from onset of rash	Preventable by vaccination (MMR x 2). See: Vulnerable children and female staff – pregnancy
Molluscum contagiosum	None	A self-limiting condition
Ringworm	Exclusion not usually required	Treatment is required
Roseola (infantum)	None	None
Scabies	Child can return after first treatment	Household and close contacts require treatment
Scarlet fever	Child can return 24 hours after commencing appropriate antibiotic treatment	Antibiotic treatment recommended for the affected child. If more than one child has scarlet fever contact the school head for further advice
Slapped cheek (fifth disease or parvovirus B19)	None once rash has developed	See: Vulnerable children and female staff – pregnancy
Shingles	Exclude only if rash is weeping and cannot be covered	Can cause chickenpox in those who are not immune i.e. have not had chickenpox. It is spread by very close contact and touch. If further information is required, contact the school head. SEE: Vulnerable Children and Female Staff – Pregnancy
Warts and verrucae	None	Verrucae should be covered in swimming pools, gymnasiums and changing rooms

*Table 50: * Notifiable diseases*

18.11.2 Gastroenteritis and respiratory infections

Diarrhoea and vomiting illness	Recommended period to be kept away from school, nursery or childminders	Comments
Diarrhoea and/or vomiting	48 hours from last episode of diarrhoea or vomiting	
E. coli O157 VTEC* Typhoid* [and paratyphoid*] (enteric fever) Shigella* (dysentery)	Should be excluded for 48 hours from the last episode of diarrhoea Further exclusion may be required for some children until they are no longer excreting	Further exclusion is required for young children under five and those who have difficulty in adhering to hygiene practices Children in these categories should be excluded until there is evidence of microbiological clearance. This guidance may also apply to some contacts of cases who may require microbiological clearance Please consult the Duty Room for further advice
Cryptosporidiosis	Exclude for 48 hours from the last episode of diarrhoea	Exclusion from swimming is advisable for two weeks after the diarrhoea has settled

Respiratory infections	Recommended period to be kept away from school, nursery or childminders	Comments
Flu (influenza)	Until recovered	See: Vulnerable children
Tuberculosis*	Always consult the Duty Room	Requires prolonged close contact for spread
Whooping cough* (pertussis)	48 hours from commencing antibiotic treatment, or 21 days from onset of illness if no antibiotic treatment	Preventable by vaccination. After treatment, non-infectious coughing may continue for many weeks. The Duty Room will organise any contact tracing necessary

*Table 51: * - notifiable disease. Duty Room – responsible person in the school e.g., the headmaster.*

18.11.3 Other infections

Other infections	Recommended period to be kept away from school, nursery or childminders	Comments
Conjunctivitis	None	If an outbreak/cluster occurs, consult the Duty Room
Diphtheria *	Exclusion is essential. Always consult with the Duty Room	Family contacts must be excluded until cleared to return by the Duty Room. Preventable by vaccination. The Duty Room will organise any contact tracing necessary
Glandular fever	None	
Head lice	None	Treatment is recommended only in cases where live lice have been seen
Hepatitis A*	Exclude until seven days after onset of jaundice (or seven days after symptom onset if no jaundice)	The duty room will advise on any vaccination or other control measure that are needed for close contacts of a single case of hepatitis A and for suspected outbreaks.
Hepatitis B*, C, HIV/AIDS	None	Hepatitis B and C and HIV are bloodborne viruses that are not infectious through casual contact. For cleaning of body fluid spills. SEE: Good Hygiene Practice
Meningococcal meningitis*/ septicaemia*	Until recovered	Some forms of meningococcal disease are preventable by vaccination (see immunisation schedule). There is no reason to exclude siblings or other close contacts of a case. In case of an outbreak, it may be necessary to provide antibiotics with or without meningococcal vaccination to close contacts. The Duty Room will advise on any action needed.
Meningitis* due to other bacteria	Until recovered	Hib and pneumococcal meningitis are preventable by vaccination. There is no reason to exclude siblings or other close contacts of a case. The Duty Room will give advice on any action needed
Meningitis viral*	None	Milder illness. There is no reason to exclude siblings and other close contacts of a case. Contact tracing is not required
MRSA	None	Good hygiene, in particular handwashing and environmental cleaning, are important to minimise any danger of spread. If further information is required, contact the Duty Room
Mumps	Exclude child for five days after onset of swelling	Preventable by vaccination (MMR x 2 doses)
Threadworms	None	Treatment is recommended for the child and household contacts
Tonsillitis	None	There are many causes, but most cases are due to viruses and do not need an antibiotic

*Table 52: * - notifiable disease. Duty Room – responsible person in the school e.g., the headmaster*

18.11.4 Good hygiene practice

- **Handwashing** is one of the most important ways of controlling the spread of infections, especially those that cause diarrhoea and vomiting, and respiratory disease. The recommended method is the use of liquid soap, warm water and paper towels. Always wash hands after using the toilet, before eating or handling food, and after handling animals. Cover all cuts and abrasions with waterproof dressings.

- **Coughing and sneezing** easily spread infections. Children and adults should be encouraged to cover their mouth and nose with a tissue. Wash hands after using or disposing of tissues. Spitting should be discouraged.

- **Personal protective equipment (PPE)**. Disposable non-powdered vinyl or latex-free CE-marked gloves and disposable plastic aprons must be worn where there is a risk of splashing or contamination with blood/body fluids (for example, nappy or pad changing). Goggles should also be available for use if there is a risk of splashing to the face. Correct PPE should be used when handling cleaning chemicals.

- **Cleaning** of the environment, including toys and equipment, should be frequent, thorough and follow national guidance. Monitor cleaning contracts and ensure cleaners are appropriately trained with access to PPE.

- **Cleaning of blood and body fluid spillages.** All spillages of blood, faeces, saliva, vomit, nasal and eye discharges should be cleaned up immediately (always wear PPE). Use products as per manufacturer's instructions and ensure they are effective against bacteria and viruses and suitable for use on the affected surface. Never use mops for cleaning up blood and body fluid spillages – use disposable paper towels and discard clinical waste as described below. Use of spillage kits can be helpful.

- **Laundry** should be dealt with in a separate dedicated facility. Soiled linen should be washed separately at the hottest wash the fabric will tolerate. Wear PPE when handling soiled linen. Children's soiled clothing should be bagged to go home, never rinsed by hand.

- **Clinical waste.** Always segregate domestic and clinical waste, in accordance with local policy. Used nappies/pads, gloves, aprons and soiled dressings should be stored in correct clinical waste bags in foot-operated bins. All clinical waste bags should be less than two-thirds full and stored in a dedicated, secure area while awaiting collection.

- **Sharps, eg needles**, should be discarded straight into a sharps bin conforming to BS 7320 and UN 3291 standards. Sharps bins must be kept off the floor and out of reach of children.

- **Sharps injuries and bites**: If skin is broken as a result of a used needle injury or bite, encourage the wound to bleed/wash thoroughly using soap and water. Contact treating doctor or occupational health or go to A&E immediately. Ensure local policy is in place for staff to follow. Contact the school head for advice, if unsure.

- **Animals in schools**: Animals may carry infections, so wash hands after handling animals. Ensure animals' living quarters are kept clean and away from food areas. Waste should be disposed of regularly, and litter boxes not accessible to children. Children should not play with animals unsupervised. Hand-hygiene should be supervised after contact with animals and the area where visiting animals have been kept should be thoroughly cleaned after use. Veterinary advice should be sought on animal welfare and animal health issues and the suitability of the animal as a pet. Reptiles are not suitable as pets in schools and nurseries, as all species carry salmonella.

- **Visits to farms**: Seek veterinary advice before exposing children to farm animals.

- **Immunization:** Ensure both staff and students have received all the necessary vaccines according to national protocols.

18.11.5 Vulnerable children

Some medical conditions make children vulnerable to infections that would rarely be serious in most children, these include those being treated for leukaemia or other cancers, on high doses of steroids and with conditions that seriously reduce immunity.

Schools and nurseries and childminders will normally have been made aware of such children. These children are particularly vulnerable to chickenpox, measles and parvovirus B19 and, if exposed to either of these, the parent/carer should be informed promptly and further medical advice sought.

It may be advisable for these children to have additional immunisations, for example pneumococcal and influenza. In some instances, the children may need further precautions to be taken, which should be discussed with the parent or carer in conjunction with their medical team and school health.

18.11.6 Pregnant female staff in school or pregnant student

If a pregnant woman develops a rash or is in direct contact with someone with a potentially infectious rash, this should be investigated by a doctor. The greatest risk to pregnant women from such infections comes from their own child/children, rather than the workplace.

Chickenpox can affect the pregnancy if a woman has not already had the infection. Report exposure to the treating doctor at any stage of pregnancy. The GP and antenatal carer will arrange a blood test to check for immunity.

Shingles is caused by the same virus as chickenpox, so anyone who has not had chickenpox is potentially vulnerable to the infection if they have close contact with a case of shingles.

German measles (rubella). If a pregnant woman comes into contact with German measles she should inform her doctor and antenatal carer immediately to ensure investigation. Infection may affect the developing baby if the woman is not immune and is exposed in early pregnancy.

Slapped cheek disease (fifth disease or parvovirus B19) can occasionally affect an unborn child. If exposed early in pregnancy (before 20 weeks), inform whoever is giving antenatal care to ensure investigation.

Measles during pregnancy can result in early delivery or even loss of the baby. If a pregnant woman is exposed, she should immediately inform whoever is giving antenatal care to ensure investigation.

References

1. https://www.cdc.gov/coronavirus/2019-ncov/downloads/hcp/COVID-19-pandemic-plan-IPC-considerations-050820.pdf
2. National Health Services, UK. Prevention of Nosocomial Invasive Aspergillosis Policy V2.0. 28 August 2024.
3. Health Protection Surveillance Centre, Ireland. National Guidelines for the Prevention of Nosocomial Aspergillosis. January 2018.
4. International Society for Infectious Diseases. Guide to Infection Control in the Healthcare Setting: Infection Prevention and Control in the Radiology Department/Service. September 2021.
5. American Association of Nurse Anesthesiology, USA. Infection Prevention and Control Guidelines for Anesthesia Care. 2015.

6. https://www.asahq.org/standards-and-practice-parameters/statement-on-recommendations-for-safe-injection-practices
7. https://www.cdc.gov/infection-control/media/pdfs/icar-ipc-obs-form-inject-safety-508.pdf
8. Campino A, Sordo B, Pascual P, Arranz C, Santesteban E, Unceta M, Lopez-de-Heredia I. Intravenous medicine preparation technique training programme for nurses in clinical areas. Eur J Hosp Pharm. 2018 Nov;25(6):298-300. doi: 10.1136/ejhpharm-2016-000947.
9. Robert Garcia, Edward J Septimus, Jack LeDonne et al. Prevention of Vascular Access Device–Associated Hospital-Onset Bacteremia and Fungemia: A Review of Emerging Perspectives and Synthesis of Technical Aspects, Clinical Infectious Diseases, Volume 80, Issue 2, 15 February 2025, Pages 444–450, https://doi.org/10.1093/cid/ciae245.
10. Public Health Agency, UK. Guidance on infection control in schools and other childcare settings. March 2017.

Chapter 19: Surveillance of Healthcare Associated Infections

19.1 INTRODUCTION

The development of a surveillance programme to monitor the prevalence of HAI and multidrug resistant organisms (MDRO) is an essential first step to identify local priorities, and to evaluate the effectiveness of infection control measures. Surveillance, by itself, is an effective process to decrease the frequency of HAI. Moreover, it helps to identify outbreaks, to detect notifiable diseases and to investigate emerging diseases.

Currently, surveillance of HAIs is not being conducted in any systematic manner in Mauritius. However, efforts should be undertaken to set up a proper surveillance system in the country. It is nonetheless highlighted that surveys on HAI have been conducted intermittently in public healthcare facilities.

19.2 ESSENTIAL ELEMENTS OF SURVEILLANCE

Outcome surveillance focuses on the rate of HAI while process surveillance evaluates patient care practices that can prevent HAI.

Before starting surveillance, the observation time period, case definitions and the surveillance methodology should be determined. Standardized definitions should be created for all data that will be collected.

After the data analysis is finalized, a report should be forwarded to all stakeholders.

19.3 SURVEILLANCE METHODOLOGY

Routine HAI surveillance in most in-patient healthcare facilities should be conducted by an infection control professional (ICP) in an active, patient-based, prospective, priority-directed manner that yields risk-adjusted incidence and prevalence rates.

Active surveillance involves having the ICP look for patients with HAI by assessing patients directly or by going through their folders prospectively or retrospectively. On the other hand, passive surveillance requires HCW to detect and report HAI to the IPC team. Passive surveillance usually fails to detect most HAI and is unreliable.

Targeted surveillance focuses on specific organisms (e.g., those with a high mortality or causing outbreaks), events or patient populations (e.g., ICU cases). Comprehensive surveillance assesses all organisms in all populations.

Periodic surveillance evaluates incidence rates at specific times of the year while continuous monitoring is carried out throughout the year.

19.4 NUMERATOR DATA COLLECTION

Numerator (N) is the number of patients who develop infections or the number of infections detected (overall infections or a specific type).

Personnel other than ICPs may be trained to screen data sources for HAI, or automated screening of electronic databases may be used, as long as the ICP makes the final determination of the presence of HAI according to the criteria for defining HAIs.

The 3 main numerators collected are:

1. Number of patients with at least one HAI;
2. Number of HAI identified through active surveillance; or
3. Number of HAI identified by laboratory results alone (e.g., multidrug resistant organisms).

Sources of data include admission / discharge / transfer records, microbiology laboratory records, visits to patient wards for observation and discussion with caregivers, imaging studies and the drug Kardex.

19.5 DENOMINATOR DATA COLLECTION

The denominator (D) is the number of patients at risk or the number of procedures in the follow-up period (e.g., the total admissions or the number of patients who had surgery and completed follow-up).

Denominator data may be collected by someone other than the ICP as long as that person is trained. When denominator data are available from electronic databases (e.g., patient tracking systems or respiratory therapy database), these sources may be used if the counts are not substantially different from those collected manually.

To determine the denominator, the total size of the cohort of patients should be calculated. For device-associated HAI, the number of days that the patient had the device should also be known.

Knowing these numbers allows one to calculate the incidence (N/D).

19.6 REPORT WRITING

Data quality should be ensured prior to interpretation and report writing. Hospitals should keep track of the most frequently missed types of data and enhance efforts to ensure completeness. Hospitals can also conduct audits to ensure all data items are collected and the data set is complete. Timeliness of case documentation can also be assessed by calculating the time from onset of infections to the time when they are entered into the surveillance data set.

HAI rates may be compared to previous HAI data based on time periods (month, quarter or year) or compared between different wards or facilities. It can also be compared to last prevalence surveys. In order to achieve effective and accurate comparison, the same case finding methods and definitions should be used. Data interpretation aims to identify areas where improvement is needed to lower the risk of HAI.

A surveillance report should be shared with all stakeholders once the data has been analyzed. The report should mention the methodology used, goals of surveillance and the outcomes that were observed. Tables and graphs can provide additional clarity to the data collected.

A description of recommended actions should also be provided.

19.7 OBJECTIVES OF HAI SURVEILLANCE

1. Identify and track infections: Detect and document HAIs to understand their prevalence and incidence within the facility.
2. Monitor trends over time: Analyze data to identify patterns, trends, and potential outbreaks.
3. Evaluate the effectiveness of infection control programs: Assess the success of existing infection prevention measures and identify areas for improvement.
4. Facilitate early detection of outbreaks: Ensure timely intervention to control and contain infection outbreaks.
5. Provide data for reporting and compliance: Meet regulatory requirements and contribute to national or global infection control initiatives.

19.8 KEY COMPONENTS OF HAI SURVEILLANCE

1. **Establish a Surveillance Team**
    - **Infection Control Committee (ICC)**: Form an Infection Control Committee composed of infection preventionists, epidemiologists, microbiologists, physicians, nurses, and representatives from other relevant departments (e.g., pharmacy, housekeeping).
    - **Dedicated Infection Preventionists (IPs)**: Appoint trained infection preventionists responsible for leading surveillance activities, data collection, analysis, and reporting.
2. **Define the Scope of Surveillance**
    - **Targeted Surveillance**: Focus on specific types of infections (e.g., surgical site infections, catheter-associated urinary tract infections, ventilator-associated pneumonia) that are of particular concern or occur frequently in the facility.
    - **Comprehensive Surveillance**: Monitor all types of HAIs across all departments. This approach is resource-intensive but provides a complete picture of the infection burden.
    - **Risk-Based Surveillance**: Prioritize surveillance based on areas with the highest risk, such as Intensive Care Units (ICUs) or areas with immunocompromised patients.
3. **Develop Standardized Case Definitions**
    - **Standard Criteria**: Use consistent and standardized definitions for different types of HAIs (e.g., definitions from the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), or the European Centre for Disease Prevention and Control (ECDC)). Clear definitions help in accurately identifying cases and enable data comparability.
    - **Symptom-Based Identification**: Define the clinical and microbiological criteria that will be used to diagnose infections. For example, urinary tract infections should be diagnosed based on a combination of symptoms and positive urine cultures.
4. **Data Collection Methods**
    - **Prospective Surveillance**: Actively monitor patients during their hospital stay, collecting data in real time. This approach allows for early detection of HAIs and timely interventions.

- **Retrospective Surveillance**: Review patient records, lab results, and discharge summaries after patients have been discharged. While less resource-intensive, it may miss infections that develop post-discharge.
- **Point Prevalence Surveys**: Conduct periodic surveys to determine the proportion of patients with HAIs at a specific point in time. This method provides a snapshot of the infection burden.
- **Automated Surveillance Systems**: Utilize electronic health records (EHRs) and data management software to streamline data collection and analysis. Automated systems can help reduce human error and improve data accuracy.

5. **Data Sources**
   - **Patient Records**: Review patient charts, admission notes, progress notes, and discharge summaries for relevant information.
   - **Microbiology Lab Results**: Track culture and sensitivity reports to identify positive cases and monitor pathogen trends, including antimicrobial resistance.
   - **Clinical Observations**: Collect information from direct clinical assessments of patients by healthcare providers.
   - **Radiological Reports**: Consider diagnostic imaging findings that may indicate infections, such as pneumonia.
6. **Data Management and Analysis**
   - **Data Standardization**: Ensure that data is collected uniformly using standardized forms or templates to facilitate consistency and ease of analysis.
   - **Data Analysis**: Analyze data to determine the incidence rate, prevalence, and types of infections. Use metrics such as incidence per 1,000 patient-days, procedure-specific infection rates (e.g., infections per 100 surgeries) or incidence by device-days.
   - **Benchmarking**: Compare the facility's data against local, national, or international benchmarks to assess performance and identify areas for improvement.
7. **Reporting and Feedback**
   - **Regular Reporting**: Share surveillance data with the Infection Control Committee, hospital administration, and relevant departments on a regular basis (e.g., monthly or quarterly). Reports should include data trends, infection rates, and any identified outbreaks.
   - **Feedback to Clinical Staff**: Provide timely feedback to healthcare providers and departments on HAI rates and specific cases. Use the information to reinforce adherence to infection prevention practices.
   - **Outbreak Reporting**: Immediately report any suspected outbreaks to the Infection Control Committee and relevant public health authorities for further investigation and response.
8. **Implementing Control Measures Based on Surveillance Findings**
   - **Targeted Interventions**: Use surveillance data to develop and implement targeted interventions aimed at reducing specific HAIs. For example, if data indicates a high rate of catheter-associated infections, implement stricter catheter care protocols.

- **Training and Education**: Educate healthcare staff on the findings from surveillance data and reinforce training on IPC measures. Continuous education is crucial to sustaining long-term improvement.
- **Evaluation of Interventions**: Monitor the impact of implemented control measures by comparing pre- and post-intervention HAI rates. This helps determine the effectiveness of the strategies and the need for further adjustments.

19.9 SURVEILLANCE OF MULTIDRUG-RESISTANT ORGANISMS (MDROS) IN HEALTHCARE FACILITIES

Multidrug-resistant organisms (MDROs) represent a critical global health threat, especially in healthcare settings where they contribute to increased morbidity, mortality, and healthcare costs. Effective surveillance of MDROs in healthcare facilities is fundamental for infection prevention and control (IPC), guiding policy interventions, and enhancing antimicrobial stewardship programs.

MDROs, such as methicillin-resistant Staphylococcus aureus (MRSA), carbapenem-resistant Enterobacterales (CRE), and vancomycin-resistant Enterococci (VRE), thrive in healthcare environments due to selective pressure from antimicrobial use and close contact between patients and healthcare workers. Surveillance helps in:

- Early detection: Identifying MDRO outbreaks promptly to prevent widespread transmission.
- Risk assessment: Understanding the burden and risk factors associated with MDRO infections.
- Data-driven interventions: Informing IPC practices, resource allocation, and training programs.
- Benchmarking: Monitoring trends over time and comparing performance across facilities or regions.

In Mauritius, the National One Health Antimicrobial Resistance Monitoring (NOHARM) system as well as WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) are in use to monitor the prevalence and diagnostic rates of MDRO in public healthcare facilities.

19.10 OUTBREAKS

19.10.1 Introduction

An outbreak can be identified by regular reviews of surveillance and laboratory data. Clinician reports of notifiable diseases can provide an alert to an unusual increase in diseases. In many outbreaks due to commonly encountered pathogens, comparison is made with previous occurrence of the same infection – an increase in incidence can signal the start of an outbreak.

Outbreaks should be investigated to:

- Define the magnitude of the outbreak in terms of time, place and person;
- Identify the cause of the outbreak and mode of transmission;
- Control the outbreak;
- Prevent similar outbreaks in the future; and

- Evaluate existing infection prevention and control strategies.

The following figure illustrates some of the steps that should be followed in the surveillance cycle.

Figure 44: PDSA cycle – steps that can help in the surveillance process. From https://www.weahsn.net/toolkits-and-resources/quality-improvement-tools-2/model-for-improvement-pdsa/

19.10.2 Definition

An outbreak is defined as:

1. For common infections: A greater than expected incidence of infection compared to the usual background rate for the particular location (e.g., gastroenteritis); or
2. For infrequent infections: An incident in which two or more people experience a similar illness that are linked in time or place (e.g., dengue); or
3. For rare infections: A single case for certain rare diseases that have never occurred in a particular location (e.g., Ebola Virus Disease).

To determine whether an event is an outbreak, consider whether:

1. The reported cases are more than the expected cases;
2. Cases are clustered in time, place and person;
3. This poses a concern from involved health care workers, schools, institution or even the media.

19.10.3 Objectives of outbreak investigations

Once an outbreak has been detected by the surveillance system, an outbreak investigation should be carried out.

Outbreak investigations in healthcare settings aim to identify and control sources of infection, reduce the spread of pathogens, and implement preventive measures. The primary objectives include:

- Identifying the etiological agent: Determining the infectious agent responsible for the outbreak and understanding its characteristics, such as transmissibility, resistance profile, and survivability in healthcare environments.
- Assessing the scope and scale: Defining the outbreak's extent by identifying the number of affected patients, healthcare workers, and potential environmental contamination. The trend should also be monitored. Sudden changes in the epidemiological curve should be assessed.
- Determining the source and route of transmission: Tracing the infection's origin, whether it is through direct contact, medical devices, the healthcare environment, or contaminated products.
- Implementing control measures: Introducing immediate infection control interventions to limit further spread and protect patients and healthcare workers.
- Documenting and learning: Analyzing the outbreak data to identify gaps in current infection control practices and improve future prevention and response efforts.

19.10.4 Key steps in conducting an outbreak investigation

An effective outbreak investigation follows a systematic, stepwise approach to accurately identify the source and implement control measures.

Step 1: Recognize the outbreak

Early detection of an outbreak is crucial. The outbreak can be identified by observing an unexpected increase in infection cases with similar characteristics or the emergence of a rare or resistant organism. Clinical laboratories and infection control departments often play a key role in alerting healthcare teams when unusual patterns or clusters are detected. Tools such as hospital surveillance systems and alerts from national health agencies contribute to early outbreak detection.

Step 2: Confirm the diagnosis and define the cases

Confirming the diagnosis involves laboratory testing to identify the pathogen and its characteristics, including resistance patterns and molecular typing if possible. The development of a case definition is essential to distinguish outbreak cases from sporadic infections. This includes defining the criteria for a case, which may involve specific clinical symptoms, diagnostic test results, and epidemiological information (e.g., hospital unit, procedures undergone).

Step 3: Perform descriptive epidemiology

Descriptive epidemiology helps in understanding the outbreak's dynamics by analyzing the "who, when, where, and what" of the cases. Data should include:

- Person: Characteristics of affected patients, including demographics, underlying health conditions, and procedures undergone.
- Place: Location within the hospital where cases are occurring (e.g., ICU, surgical wards, etc.).
- Time: Timeline of infection onset, which can help in identifying exposure periods and possible common sources.

Mapping cases with epidemiological links, such as shared rooms, healthcare workers, or medical devices, is essential in visualizing the outbreak pattern.

Step 4: Develop and test hypotheses

Based on the data gathered, hypotheses are developed about the possible sources and modes of transmission. Hypotheses can be tested through environmental sampling, examining medical equipment, reviewing healthcare worker practices, and interviewing staff and patients. For instance, in an outbreak of a multi-drug-resistant organism (MDRO), investigators may hypothesize a link to inadequate hand hygiene practices or shared medical devices.

Step 5: Implement control and prevention measures

Implementing infection control measures must be prioritized to reduce transmission. Key interventions include:

- Standard precautions: Reinforcing hand hygiene, use of personal protective equipment (PPE), and cleaning protocols.
- Contact isolation: Placing infected patients in isolation or cohorting them to limit the spread.
- Device management: Ensuring proper sterilization or replacement of potentially contaminated devices.
- Antibiotic stewardship: Reviewing and optimizing antibiotic usage, especially if the outbreak involves resistant pathogens.

Step 6: Analyze data and refine interventions

Continuous data collection during the intervention phase helps assess the effectiveness of control measures. If cases continue to emerge, additional investigations are conducted, potentially revisiting hypotheses, re-examining environmental sources, or performing further molecular typing to identify links among cases.

Step 7: Communicate findings and implement long-term measures

Once the outbreak is controlled, it is essential to communicate findings to all relevant stakeholders, including healthcare workers, facility leadership, and public health authorities. A detailed report should summarize the investigation process, findings, implemented measures, and recommendations. Long-term measures may include updating infection control protocols, conducting regular staff training, and strengthening surveillance to prevent future outbreaks.

Examples

- Outbreaks of organisms that often colonize humans like MRSA tend to be caused by lapses in hand hygiene, improper disinfection of high-touch surfaces or sterilization of medical devices.
- Outbreaks of organisms that live in the environment e.g., *Acinetobacter baumannii*, are usually caused by inadequate cleaning and disinfection of hospital surfaces or medical equipment.
- Outbreaks of microbes that are transmitted by droplets or in the air are due to inadequate isolation, incorrect use of PPE or poor ventilation.

19.10.5 Phases of an outbreak investigation

The following sections describe the steps to take to investigate an outbreak. Not all steps have to be followed for all outbreaks. The order of the steps may change depending on the setting.

Descriptive phase

Prepare for fieldwork

- Form a team
- Learn about the disease
- Make necessary administrative, personnel, and logistical arrangements
- Coordinate with partner agencies and local contacts

Confirm existence of an outbreak

- Reviewing the reports or data
- Confirming that cases are the same disease
- Confirming that the number of cases exceeds the usual or expected number

Verify the diagnosis

- Laboratory confirmation is the most definitive method for verifying diagnosis
- Pathogens have characteristic incubation periods that may help identify exposure period
- Investigators don't always have to wait for a laboratory diagnosis to proceed

Construct a case definition

- Divide the cases into suspected, probable and confirmed ones

Find cases systematically and record information

- Symptoms: what the patient feels
- Signs: what the clinical exam reveals
- Laboratory results: clinical results
- Always mention the time, place and person

Perform descriptive epidemiology

- Draw an epidemiological curve
- Evaluate the period of exposure:
    - Look up the average and minimum incubation periods of the disease
    - Identify the peak of the outbreak or the median case and count back on the x-axis one average incubation period
    - Note the date
    - Start at the earliest case of the epidemic and count back the minimum incubation period and note this date as well
- Incubation period
    - If the time of exposure and the times of onset of illness are known but the cause has not yet been identified, subtract the time of onset of the earliest cases from the time of exposure to estimate the minimum incubation period

    - Subtract the time of onset of the median case from the time of exposure to estimate the median incubation period
    - These incubation periods can be compared with a list of incubation periods of known diseases to narrow the possibilities
- Check whether the this is a continuous source outbreak, point source outbreak or propagated outbreak based on the epidemiological curve
- Draw hotspots and heatmaps to understand the geographical distribution of the disease
- Analyze the data by age, sex, occupation, and other potential risk factors

Explanatory phase

- Develop hypotheses
- Evaluate hypotheses epidemiologically
- Reconcile epidemiology with laboratory and environmental findings
- Conduct additional studies as necessary

Response phase

- Implement and evaluate prevention and control measures
- Initiate or maintain surveillance
- Communicate findings

Actions

Actions that should be taken whenever an outbreak is suspected include:

1. Notify the supervisor or responsible party about the event
2. Perform a preliminary investigation to establish the existence of the outbreak
3. Once the outbreak is confirmed, report back to the authorities
4. Disseminate the case definition to healthcare facilities and other stakeholders
5. Start an investigation to identify people of interest that meet the criteria for the case definition (suspected cases)
6. Laboratory testing to confirm the diagnosis should be considered whenever feasible to optimize the accuracy of the data
7. Contact screening can be carried out to identify more cases and speed up isolation
8. Complete a descriptive epidemiological analysis
9. Based on the analysis, develop a hypothesis regarding the outbreak
10. Perform another study to confirm the hypothesis e.g., do a surveillance study
11. Once the hypothesis is confirmed, communicate the findings to the stakeholders
12. Implement IPC measures to stop the outbreak; if possible, such actions should be instituted at the start of the outbreak to reduce the harm caused by the infections; treatment measures and infection control measures should not be delayed

Whenever cultures are being sent as part of an outbreak investigation, the microbiologist should be informed in advance to ensure that sufficient supplies of lab reagents are available to carry out the tests.

Actions that are usually counterproductive are:

1. Generalized microbiological screening with no prior hypothesis of the infection source;
2. Non-specific antimicrobial prophylaxis;
3. Fumigation of premises;
4. Disinfecting floors, walls, ceilings and other low-touch surfaces;
5. Self-spraying or spraying others with disinfectants;
6. Wearing an excessive amount of PPE in a manner not aligned with evidence-based IPC practices e.g., wearing caps, overshoes and coveralls when these are not recommended by IPC;
7. Not allowing visitors and relatives access to the healthcare facility; and
8. Closing the ward or hospital to admission (unless this is absolutely necessary to ensure patient safety).

Exceptions to the above usually futile actions may exist and should be discussed with a microbiologist, infection control specialist and / or infectious disease specialist before they are implemented in any healthcare facility.

Chapter 20: Antimicrobial Stewardship

20.1 BACKGROUND

Since the discovery of antibiotics in the mid-1900s, the world found relief with the use of antibiotics in the treatment of bacterial infections. Due to the excessive use of antimicrobials, organisms started developing resistance.

The term 'antimicrobial resistance' is defined as the 'loss of effectiveness of any anti-infective agent, including antiviral, antifungal, antibacterial and anti-parasitic medicines'. Some bacteria have even become resistant to most antibiotics. Resistant bacteria may cause increased morbidity and death, especially among immunocompromised patients. Patients with resistant organisms have a more prolonged hospital stay. Also, antibiotics used to treat resistant organisms are costlier. These increase the financial burden on the patient, the state or insurance companies.

Factors favoring development of antimicrobial resistance include, but are not restricted to:

1. Overprescribing;
2. Administration of suboptimal doses;
3. Prolonged duration of treatment; and
4. Inappropriate antibiotic choice.

These factors also apply to Mauritius, be it in the public or private health institutions. In the hospital setting, the spread of resistant organisms is favored by poor hand hygiene, inadequate barrier precautions, and suboptimal equipment cleaning.

20.2 STATISTICS

Antimicrobial resistance poses a significant threat to public health. Antimicrobial-resistant infections result in at least 700,000 deaths worldwide each year (IACG, 2019).

In Mauritius, according to data obtained from the Central Health Laboratory, Victoria Hospital, isolates belonging to the family *Enterobacteriaceae* recovered from urine specimens showed a rise in resistance to ciprofloxacin from 1% in 1998 to 61% in 2014. Susceptibility testing of *Enterobacteriaceae* also demonstrated an increase in resistance to meropenem from 0.5% in 2010 to 5.3% in 2014 among hospitalized patients.

For inpatients, the resistance of *Escherichia coli* to cefotaxime has increased from 17% in 2005 to 46% in 2014. Given the rise in resistance to meropenem, colistin use has dramatically escalated in the last few years.

In the AMR Global Report on Surveillance, the following rates of resistance has been reported in hospital isolates collected during a point-prevalence study over a month in 2012:

- 43.5% and 57.6% resistance of *E. coli* (n=184) to 3rd generation cephalosporins and fluoroquinolones respectively,
- 55.8% and 1.9% resistance of *K. pneumoniae* (n=104) to 3rd generation cephalosporins and carbapenems respectively, and,
- 51.5% resistance to methicillin in *S. aureus* (n=171).

Organism	Prevalence in the ICU	Mortality rate

Extended spectrum beta-lactamase producing *Enterobacteriaceae*	78%	67%
Carbapenem-resistant A*cinetobacter baumannii*	86%	87%
Carbapenem-resistant *Enterobacteriaceae*	30%	80%
Carbapenem-resistant *Pseudomonas aeruginosa*	80%	83%
Methicillin-resistant *Staphylococcus aureus*	53%	60%

Table 53: The prevalence of and mortality rate associated with various multi-drug resistant organisms in the ICU of Mauritius. For details, see "Nuckchady DC, Boolaky SH. The Prevalence of Multi-Drug Resistant Organisms and Their Outcomes in an ICU in Mauritius: An Observational Study. Asian J Med Health. 2020 Dec 21;71–8."

See annex A for an antibiogram of the microbes isolated in Mauritius.

20.3 ANTIMICROBIAL DEVELOPMENT

Regarding antibiotic innovation, there has been a decline in new antimicrobial development in the last few decades. Over the last few decades, few antibiotics have been approved and even less have new targets of action. It has become more and more difficult to develop new antimicrobials with different mechanisms of action.

Also, pharmaceutical companies do not find it lucrative to indulge in new antimicrobial development. Every new generation of antibiotics has proven exponentially more expensive than its predecessors.

As a result, our arsenal of antimicrobials is getting depleted and we may once again go back into the time before antibiotics, since we are going to be left with a lot of ineffective antimicrobials. It is therefore of utmost importance that all is done to preserve the efficacy of our antibiotics.

20.4 DEFINITION OF ANTIMICROBIAL STEWARDSHIP

All health institutions that provide healthcare must share responsibility in preventing the emergence of antimicrobial resistance. This includes accountable leadership, development and implementation of surveillance systems and setting up monitoring and auditing teams and systems. All these modalities would be integrated in an antimicrobial stewardship program, which should be part of every healthcare facility (at least in regional public hospitals) to ensure judicious antimicrobial prescribing.

Antimicrobial stewardship refers to an organizational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobial drugs to preserve their future effectiveness.

20.5 ANTIMICROBIAL STEWARDSHIP PROGRAMS

Antimicrobial stewardship programs document the evidence-based use of antibiotics in all departments and services of the hospital.

All administrators (including medical superintendents and regional health directors) should ensure the presence and functioning of an antimicrobial stewardship program within their healthcare setup.

At ward levels, number of days for which a patient is placed on an antibiotic should be recorded.

Ideally an antimicrobial stewardship program should include:

1. Monitoring and evaluating antimicrobial prescribing based on local resistance patterns;
2. Providing regular feedback to prescribers in all care settings about their antimicrobial prescribing pattern and about patient safety incidents related to antimicrobial use;

3. Providing education and training to healthcare practitioners about antimicrobial stewardship and antimicrobial resistance;
4. Integrating audit into existing quality improvement program; and
5. Clearly defining roles, responsibilities and accountabilities of each member of the antimicrobial stewardship program.

20.6 ANTIMICROBIAL STEWARDSHIP TEAMS

Healthcare settings should ensure that the antimicrobial stewardship team has core members who have antimicrobial knowledge and are dedicated to the cause.

Antimicrobial stewardship teams should have the administrative and financial support of administrators to promote education for prescribers and assist the local formulary decision-making group with recommendations pertaining to antimicrobial prescription.

Core members of the antimicrobial stewardship team include a specialist (typically in internal medicine or in infectious diseases), a pharmacist (who has been trained in the use of antimicrobials), a microbiologist and an IPC team member (e.g., a nursing officer or doctor).

20.7 COMMUNICATION

Local networks across all care settings should be developed to communicate information on all aspects of antimicrobial stewardship. Local guidelines on antimicrobial prescribing should be disseminated among all prescribers, providing updates if the guidelines change. Education and training of health professionals and consumers about antimicrobial stewardship and antimicrobial resistance need to be ongoing.

20.8 LABORATORY WATCHDOG FUNCTION

The laboratory is expected to assist with:

1. Antimicrobial testing in line with local treatment guidelines;
2. The choice of antimicrobials in the local formulary;
3. Advice on antimicrobial prescription;
4. Providing rapid tests to exclude bacterial infections as a differential diagnosis and support the diagnosis of other infections; and
5. The regular publishing of antimicrobial susceptibility data to aid antimicrobial stewardship surveillance.

20.9 RECOMMENDATIONS FOR PRESCRIBERS

Key principles that prescribers should follow when prescribing antimicrobials are:

1. Follow local guidelines when treating infections.
2. When deciding whether or not to prescribe an antimicrobial, consider the risk of antimicrobial resistance for individual patients and the population as a whole.
3. For patients admitted in hospital who have suspected infections, take microbiological samples before prescribing an antimicrobial and review the prescription when the results are available.

Blood cultures should be taken aseptically so that coagulase negative staphylococcus is not isolated frequently.

4. Gram stain results from blood cultures should be communicated to treating doctors within 24h.
5. The time to first dose of antibiotic in septic patients should be less than 1 hour.
6. Consider shifting practice from using “test dose” at ward level before starting antimicrobials to ensure antimicrobials are started at judicious time for patients in need of prompt antimicrobial therapy. Such allergy testing often gives fallacious results.
7. For patients in primary care who have recurrent or persistent infections, consider taking microbiological samples when prescribing an antimicrobial and review the prescription when the results are available.
8. Antibiotic duration or stop date should be specified on the prescription.
9. Vancomycin, colistin, gentamicin and amikacin serum levels should be used to adjust dose if available.
10. Prescribers should take time to discuss with the patient and their family members or carers about:
    a. the likely nature of the illness;
    b. why prescribing an antimicrobial may not be the best option;
    c. alternative options to prescribing an antimicrobial;
    d. the benefits and harms of immediate antimicrobial prescribing; and
    e. what they should do if their condition deteriorates.
11. A narrow spectrum agent should be used as far as possible.
12. The appropriate antibiotic should be prescribed at the right dose and the right duration. Adjust the dose of antibiotics for patients with kidney disease.
13. Prescribe single-dose antibiotics for surgical prophylaxis 30 minutes to 120 minutes before incision.
14. Always review intravenous antimicrobial prescriptions at 48–72 hours to decide for de-escalation or switching to an oral form of the antimicrobial.
15. Preauthorization (usually by a member of the antimicrobial stewardship team) and prospective audit with feedback are key interventions that help reduce antibiotic abuse.

Chapter 21: Occupational Safety and Employee Health

21.1 INTRODUCTION

Occupational health and safety is an interdisciplinary activity concerned with the prevention of occupational risks inherent to each work activity. All medical and paramedical staff are at risk.

The aim of occupational health is to protect health, safety and wellbeing of workers and people at work through:

1. Primary prevention and control of occupational hazards;
2. Monitoring the health of workers in relation to their work; and
3. Promoting healthy behaviors, physical and mental wellbeing among workers.

21.2 HAZARDS IN THE HEALTHCARE ENVIRONMENT

The different hazards are as follows:

1. Physical e.g., injuries while lifting or shifting patients, or falls;
2. Chemical e.g., exposure to toxic chemicals such as disinfectants;
3. Biological e.g., infections transmitted in the healthcare environment;
4. Radiation e.g., radiation in x-ray and radiotherapy units;
5. Psychological e.g., stress due to understaffing; and
6. Ergonomic e.g., backache, neck pain or eye strain due to poorly designed seats or computer workstations.

Biological hazards refer to organisms or organic material produced by these organisms which are harmful to human health. These include parasites, viruses, bacteria, fungi and proteins. Examples of biological hazards are HIV, hepatitis viruses, tuberculosis, viral hemorrhagic fevers, etc.

21.3 OCCUPATIONAL HEALTH PROGRAMME

The components of an effective occupational health programme are:

1. Conducting pre-placement medical evaluations;
2. Ensuring all HCW are immunized appropriately;
3. Assessing and reducing the risks of infections among HCW;
4. Ascertaining that the work environment is safe;
5. Carrying out post-exposure management whenever necessary; and
6. Supervising training and education in occupational health.

21.3.1 Pre-placement medical evaluations

Before being allowed to work, all staff should be provided with pre-placement medical evaluations. This includes:

1. Documenting the baseline health status of HCW (e.g., details of medical history, particularly for infectious diseases such as rubella, measles, mumps, chickenpox, hepatitis B, immune disorders, skin conditions, and prior exposure to tuberculosis);
2. Being offered laboratory and other pre-placement testing;
3. Being vaccinated for specific infectious diseases; and
4. Assessing job placement and providing "clearance for duty".

21.3.2 Immunization programmes

Immunization programmes provide a set of services that ensure immunity to vaccine-preventable diseases.

Pre-vaccination screening

Pre-vaccination screening should be done with HCW to:

1. Ensure that they have the right person to be vaccinated;
2. Check which vaccine(s) are indicated, including any missed vaccine doses;
3. Consider whether the person needs alternative or additional vaccines;
4. Check whether there are any contraindications to the vaccines;
5. Ensure that the person to be vaccinated is the appropriate age for the vaccines they are receiving; and
6. Check that the correct time interval has passed since the person received any previous vaccine(s) or blood products.

Occupational vaccination programme

Employers should take all reasonable steps to ensure that staff members are protected against vaccine-preventable diseases.

Where healthcare workers may be at significant occupational risk of acquiring or transmitting a vaccine-preventable disease, a comprehensive occupational vaccination programme should be implemented. Such a programme should include:

1. An approved vaccination policy;
2. The maintenance of current staff vaccination records;
3. The provision of information about the relevant vaccine-preventable diseases; and
4. The management of vaccine refusal (which should, for example, include reducing the risk of a healthcare worker transmitting disease to a vulnerable patient).

The recommended immunizations for HCW include:

1. SARS-CoV-2,
2. Influenza virus,
3. Hepatitis B virus,

4. Measles / mumps / rubella,
5. Diphtheria / tetanus,
6. Pertussis, and
7. Poliomyelitis.

Refer to national guidelines for more details.

Strategies to increase immunization coverage

Vaccine reluctance has become a major problem globally. Some strategies can be put in place to increase vaccine coverage to HCW:

1. Use organizational leaders as role models;
2. Conduct education or organizational campaigns to promote awareness and knowledge about vaccines;
3. Provide free access to vaccines;
4. Provide incentives to encourage immunization; and
5. Offer flexible worksite vaccine delivery (e.g., at multiple locations and times).

Staff records

Employers and healthcare facilities need to retain details of screening results and immunizations provided, including vaccine preventable disease history, date and results of serology, record of immunizations consented / refused, date given, batch number, type and brand name of vaccine.

Records need to be kept confidential and accessible by authorized personnel when needed, updated when relevant events occur and maintained in accordance with confidentiality and privacy laws.

21.4 ASSESSMENT OF RISKS FOR INFECTIONS AMONG HCW

HCW are at risk of exposures to infections in the workplace that vary depending on their job duties and other factors. Assessments should be conducted to identify actual or potential infection risks for populations of HCW and to inform measures that reduce those risks.

Controlling exposures to occupational infections is a fundamental method of protecting HCW. A hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions as shown in figure 25.

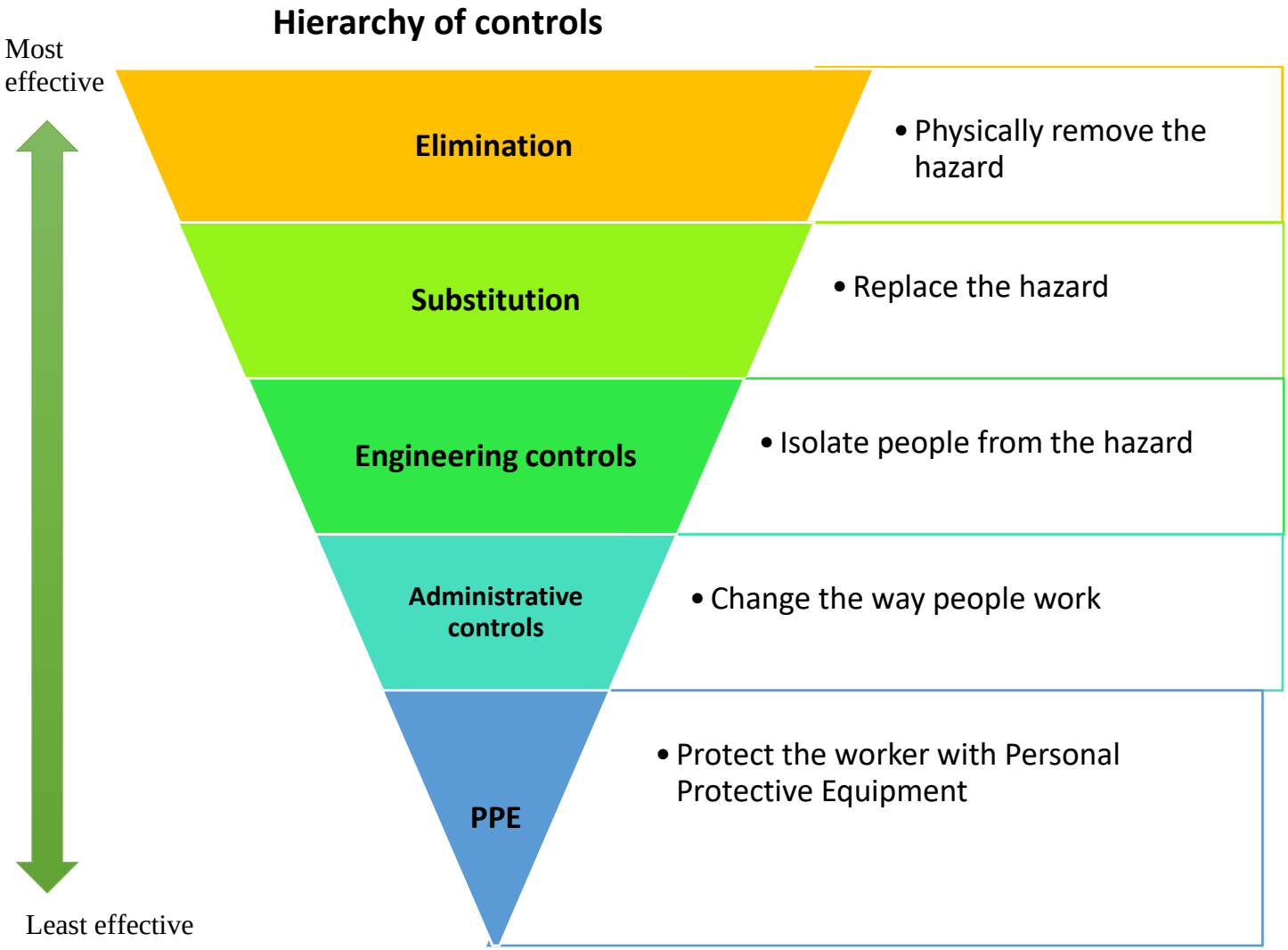


Figure 45: Hierarchy of controls for exposures to occupational infections.

Some requirements related to the assessment and reduction of occupational infection risks are:

1. Maintenance of logs of infectious diseases exposures and illnesses;
2. Ongoing review of these logs to identify trends in occupational exposures or acquired infectious diseases among HCW that warrant mitigation;
3. Conduction of workplace evaluations to assess implementation of an Exposure Control Plan for all affected employees;
4. Evaluation of respiratory hazards in the workplace, and implementation of a respiratory protection program; and
5. Establishing a vaccination programme for staff and reporting of immunization coverage of HCW.

HCW should be provided with access to periodic and episodic medical evaluations during the course of employment. If they present with symptoms of a contagious illness like influenza, they should not come to work or they should take necessary precautions (e.g., wear a mask) to protect patients and other HCW at the workplace.

21.5 POST AND PRE-EXPOSURE MANAGEMENT

Appropriate management of potentially infectious exposures and illnesses among HCW can prevent the development and transmission of infections.

Effective management of exposures and illnesses includes:

1. Promptly assessing exposures and diagnosing illness;
2. Monitoring for the development of signs and symptoms of disease;
3. Providing appropriate post-exposure prophylaxis and illness management; and
4. Counselling to address concerns, adverse effects of post-exposure prophylaxis, and work restrictions.

After exposure to vaccine-preventable infections, susceptible HCW should get immunized as soon as possible if no absolute contraindications exist.

HCW who are exposed to tuberculosis should be offered a Mantoux test and a chest x-ray.

When exposed to a patient infected with SARS-CoV-2, the HCW should contact the pertinent public health representatives so that timely guidance can be provided regarding the need for quarantine or self-isolation.

For details regarding post-exposure prophylaxis after needlestick injuries, please see the relevant section in chapter 4 and the national SOP.

With respect to the prevention of transmission of HIV after an exposure, a 28-day course of medication consisting of three antiretroviral drugs can be administered. This must be taken without interruption. It is recommended to initiate the medications at the earliest after any potential exposure to HIV contaminated body fluids. It should be taken within 72 hours after any accidental occupational or non-occupational exposure to the virus. Occupational exposure occurs mostly in healthcare settings i.e., needle-stick injuries, blood or blood-stained body fluids splash to the eyes, nose or oral cavity. Non-occupational exposure occurs during unprotected sexual intercourse or sexual assault.

Of note, post-exposure prophylaxis for HIV is not recommended if the source person is HIV positive, has been on antiretroviral drugs for at least six months and has an HIV viral load undetectable (at time of last measurement and within the last six months prior to exposure) and with good adherence.

On a related note, HIV pre-exposure prophylaxis (PrEP) is an additional prevention tool for people who do not have HIV but are at substantial risk (>3%) of getting it. It is prescribed for HIV negative individuals who are exposed to HIV through high-risk behaviors or for people who are in an on-going sexual relationship with a partner living with HIV. It consists of a once-daily pill with two highly effective medications against HIV. When taken as indicated, PrEP reduces the risk of getting HIV infection from sex by 99%. In Mauritius, PrEP is available through the Day Care Centres for the Immunosuppressed, AIDS Unit. It is provided at no cost to patients deemed at risk of HIV infection according to the national PrEP protocol.

With regards to PEP for HBV, susceptible patients who have been exposed to the virus should be vaccinated. High risk patients (e.g., HCW) should be vaccinated before performing hazardous procedures.

21.6 EXCLUSION PERIODS FOR HCW WITH ACUTE INFECTIONS

Every healthcare facility should have comprehensive written policies regarding disease-specific work restriction and exclusion, which include a statement of authority defining who can implement such policies.

Employees who have an infectious disease should consult with an appropriate doctor to determine whether they are capable of performing their tasks without putting patients or other workers at risk and they should undergo regular medical follow-up. The next table shows the list of precautions to take when certain HCW are infected with the following microbes:

Microbes	Precautions
Infective conjunctivitis	Avoid patient care while discharge is present or until 24 hours after antibiotic has been started for a bacterial cause.
Gastroenteritis from *Clostridioides difficile*, *Escherichia coli*, *Salmonella* spp. and *Shigella* spp.	Must not come to work while symptomatic (e.g., diarrhoea or vomiting) and until 24 hours after symptoms have resolved.
Herpes zoster (shingles)	Must not provide direct patient care if lesions cannot be covered (e.g., ophthalmic zoster). If active lesions can be covered, can provide care to all patients except for pregnant women, neonates, severely immunocompromised patients, burns patients and patients with extensive eczema.
Influenza and SARS-CoV-2	HCW should remain off work until at least 24 hours since the resolution of fever and three days have elapsed since the onset of respiratory symptoms. Wear a mask at work while the cough is persisting.
Scabies and lice	Healthcare workers should remain off work until 24 hours after treatment has started.
Staphylococcal infection	Any staphylococcal lesions (e.g., boils and wound infections) must be covered with an occlusive dressing while at work. If lesions cannot be covered, HCW must not perform patient care or prepare hospital food until they have received appropriate antibiotic therapy and the infection has resolved.
Streptococcal infection	Any HCW with streptococcal lesions (e.g., impetigo or streptococcal tonsillitis) must ensure that lesions are covered with an occlusive dressing while at work. If lesions cannot be covered, healthcare workers must not provide direct patient care nor prepare hospital food until 24 hours after commencement of appropriate antibiotic therapy. HCW with pharyngitis / tonsillitis should avoid patient contact for at least 24 hours after starting appropriate antibiotic therapy.
Tuberculosis	If tuberculosis is suspected or is present, the case should be notified to a chest physician. Any personnel with pulmonary tuberculosis is to be excluded from the workplace until cleared by the chest physician.
Measles, mumps, rubella and chickenpox	Remain off work until serological evidence of immunity is confirmed, until symptoms resolve or until blisters are dry.
Viral respiratory tract infections (e.g., common cold)	Wear a mask when providing patient care. Avoid caring for immunosuppressed patients. Practice social distancing.

Table 54: List of precautions to take when certain HCW are infected with certain microbes. This table provides guidance only – refer to directives or policies of the Ministry of Health and Wellness for more information. Readers can also ask their next-level supervisor for assistance.

21.7 SPECIFIC CIRCUMSTANCES

HCW are encouraged to disclose their background medical illnesses during pre-employment screening to determine the safest workplace arrangements.

Where an HCW is known to be particularly susceptible to HAI, work duties are assessed to ensure that the welfare of that person, patients and other healthcare workers is safeguarded.

This may involve appropriate work placements, adjustments or restrictions, or deployment to a role involving less risk.

21.7.1 Pregnant HCW

All pregnant healthcare workers should adhere to standard and transmission-based precautions and ensure that they are appropriately vaccinated. However, pregnant HCW should be given the opportunity to avoid patients with specific infections that can be more lethal during pregnancy or cause congenital infections like varicella.

21.7.2 Immunocompromised HCW

HCW with immune deficiencies are more at risk of acquiring infections. The type of employment they can undertake should include only duties that will minimize their exposure to infections.

21.7.3 HCW with skin conditions

When staff members have damaged skin or weeping skin conditions (e.g., eczema, psoriasis or exfoliating dermatitis), they may be readily colonized by healthcare-associated microorganisms and may become a vehicle for disseminating these organisms. HCW in this situation should be identified by personal history screening when they start employment and need to be informed of the risks they may pose to patients. Any damaged skin must be appropriately covered before they carry out procedures. Consideration must be given to providing these staff members with appropriate, individual PPE such as specific types of gloves, hand hygiene products and moisturizing lotion.

21.7.4 HCW living with a blood-borne virus

HCW living with a blood-borne virus (BBV) including hepatitis B, hepatitis C and HIV; must be under the care of a treating doctor and must be tested for the respective BBV viral load levels, as well as for other BBVs. HCW living with a BBV deserve a supportive work environment, including retraining if required, counselling and appropriate infection control measures.

Chapter 22: Management of Corpses

22.1 INTRODUCTION

Understanding and practicing infection prevention and control (IPC) measures during the burial of contagious corpses is crucial to preventing the spread of infectious diseases within communities. Corpses of individuals who died from infectious diseases, such as Ebola, COVID-19, and cholera, can carry residual pathogens that remain active for days or even weeks. Without proper IPC measures, these pathogens can infect those who handle or come into contact with the body, increasing the risk of outbreaks in the surrounding community.

Proper IPC practices, including the use of personal protective equipment (PPE), disinfection of the body and burial equipment, and safe handling techniques, help minimize direct contact with infectious fluids or surfaces contaminated by the pathogen. Additionally, controlled burials ensure that the environment, water sources, and soil remain free from contamination, which is vital in protecting public health and environmental safety.

Equipping burial teams and health workers with training on IPC protocols also ensures that they can safely conduct burials without endangering themselves or the broader community. Thus, understanding and adhering to IPC measures during the burial of contagious corpses is not just a matter of protecting individual health but also a critical component of effective public health management, helping to limit disease transmission and sustain community well-being.

22.2 STANDARD PRECAUTIONS

All dead bodies are potentially infectious and "STANDARD PRECAUTIONS" should be implemented for every case. Although most organisms in the dead body are unlikely to infect healthy persons, some infectious agents may be transmitted when persons are in contact with blood, body fluids or tissues of dead body of person with infectious diseases. To minimize the risks of transmission of known and also unsuspected infectious diseases, dead bodies should be handled in such a way that workers' exposure to blood, body fluids and tissues is reduced.

22.3 BIOHAZARD CATEGORIES

Precautions to take when manipulating infected dead bodies can be divided into 3 categories or biohazard groups:

1. Category 1: Standard precautions apply. Most infections fall in this category – they have a low chance of spreading from the dead body if basic precautions are taken e.g., community-acquired pneumonia.
2. Category 2: Transmission-based precautions should be followed as well as standard precautions. Embalming should be avoided. Single layer bagging is needed because of the possibility of leakage of contagious body fluids. Most of the infections in this category have a low chance of spreading from the corpse but treatment options are limited or complex e.g., HIV. Alternatively, some of the microbes have a moderate chance of spreading from fluids leaking from the corpse but treatment options are available e.g., cholera.
3. Category 3: Maximum contact precautions should be taken. Cleaning (hygienic preparation) and embalming of the body are strictly prohibited. Minimize manipulation of the corpse.

Viewing inside the funeral parlor is not allowed (but viewing from outside through a transparent screen is acceptable). Double bagging is needed, and the body should then be placed in a casket. Infections that fall into this category are those that have a high chance of spreading from the dead body and have a high mortality rate e.g., Ebola Virus Disease.

Of note, category 0 corpses are those that did not have a recent infection when alive.

The following table summarizes the above:

Infectious category	PPE†	Plastic bagging (leak-proof)	Viewing	Embalming	Hygienic practices	Post-mortem	Disposal
0	Gloves and gowns if in contact with body fluids	Not necessary (use a white cotton linen sheet)††	Yes	Yes	Yes	Allowed – follow standard precautions	Burial or cremation
1	As per transmission-based precautions (usually gloves, gowns and mask)¶	Not necessary (use a white cotton linen sheet)††	Yes	Yes	Yes	Allowed with transmission-based precautions	Burial or cremation
2	Gloves, water resistant gowns and N95 / FFP2 respirators or masks***	Single layer (a mortuary or linen sheet is added first)	Yes	No¶¶	Yes with precautions	Allowed with transmission-based precautions	Burial or cremation
3	Hazmat suit, apron, double gloves, face shields or goggles, boots and N95 / FFP2 respirators	Double layer plastic bag with casket / coffin	No*	No	No	Avoided	Burial or cremation **

*Table 55: * Viewing from within the funeral parlor or by opening the bag is not allowed. Viewing from another room through a window without any air passing from one room to another is allowed. † PPE should be worn when manipulating the corpse; in all cases, additional PPE may be required (like goggles & boots) depending on risk assessment (in line with standard precautions). ¶ Standard precautions are especially important when there is a chance of contact with body fluids; use goggles if splash injury is possible (which is part of standard precautions also). ** Most international organizations allow burial of leak-proof coffins in order to adhere to local religious practices but cremation may be preferred in Mauritius to increase safety. ¶¶ Many countries allow embalming for category 2 but multiple precautions have to be very carefully taken; it is preferable to avoid it in Mauritius. *** Use respirators if the microbe can be transmitted via the airborne route or else use masks. †† Use a leak-proof body bag if the corpse will be kept in the mortuary for a long time; also use a leak-proof body bag if it is unclear whether the patient died from an infection or if relatives request so or if death is from leptospirosis or tetanus.*

22.4 SPECIFIC SAFETY PRECAUTIONS

A few points should be highlighted:

1. Hepatitis B vaccination is recommended for all personnel who are likely to come into contact with dead bodies, such as health care worker, mortuary staff and funeral workers.
2. During the burial process, do NOT smoke, drink or eat, and do NOT touch your eyes, mouth or nose.
3. Avoid serving food during ceremonies if the death is due to a foodborne illness or an infection that can be transmitted by the fecal-oral route like cholera.
4. All surfaces which may be contaminated should be wiped with 0.1% hypochlorite or 70% alcohol. Soiled areas (including those with fluids) require special attention – 0.5% hypochlorite is needed then. These concentrations may be higher for certain microorganisms – check the section on spills in this guideline or in the national standard operating procedures on antimicrobial spectra of local disinfectants for more details on specific infections. The contact time of hypochlorite is a minimum of 10 minutes if not soiled and 15 minutes if soiled.
5. Tags for classification of categories of dead bodies should be attached to the dead body and the body bag or mortuary sheet for the purpose of identification and communication.
6. All tubes, drains and catheters on the dead body should be removed.
7. Oral, nasal and rectal orifices of a category 2 or 3 dead body have to be plugged to prevent leakage of body fluids.
8. The outside of the body bag (if used) and casket (if present) should be wiped with 0.5-1% hypochlorite. Disinfection of the dead body itself is not required.
9. The mortuary must be kept clean and properly ventilated at all times. Lighting must be adequate. Surfaces and instruments should be made of materials which can be easily disinfected and maintained.
10. Make sure any wounds are covered with waterproof bandages or dressings.
11. For category 3 corpses, unzipping of the body bag is NOT allowed.
12. For category 2 and 3 bodies that have yet to be placed in a plastic bag, proper signage should be placed at the entrance of the room to indicate the type of additional precautions to be taken for people entering the room. Proper donning and doffing stations should be present as in any isolation room. All other isolation precautions like the presence of bins and sanitizers should also be taken – see chapter 4 and national SOPs for details.
13. The biohazard plastic bag should be leak-proof, robust and not less than 150µm thick. It should preferably be zipped closed instead of being pinned or stapled (to avoid leakage).
14. Care must be taken to ensure that run-off resulting from the natural decomposition of buried human remains is managed so as not to contaminate groundwater. The burial site:
    a. Should be at least 250 meters from any well, borehole or spring supplying water for human consumption or used in food production – for example at farms.
    b. Should be at least 30 meters from any spring or watercourse not used for human consumption or not used in food production.

c. Should be at least 10 meters from any field drain, including dry ditches.

d. Should have at least 1 meter clearance between the base of the grave and the top of the water table – they should not have any standing water in them when dug.

e. Should be deep enough so at least 1 meter of soil will cover the top of the coffin or body.

f. Should not be below the water table.

g. Should not be dug in areas susceptible to groundwater flooding.

h. These criteria may be different for specific organisms – consult individual protocols on different infections for details e.g., see chapter 24 in this document on cholera for its management of corpses.

15. Organisms that are known to remain infective for months or years after corpses are buried and hence, require transmission-based precautions during exhumation, include anthrax, tetanus and leptospirosis.

16. A Landing Permit of Mortal Remains/No Objection Certificate for Transportation of Ashes (whichever is applicable) should be obtained from MOHW of the Republic of Mauritius, prior to repatriation of a body/transportation of ashes to Mauritius.

    a. A non-infectious/non-contagious certificate should be submitted, failing which the relevant authorities should be contacted to decide about the precautions to be taken during repatriation.

17. Dedicated cemeteries and mass graves are generally not required for any hazard group of corpses. However, for practical purposes, designated graves may be used for certain infections in Mauritius – contact the relevant authorities at MOHW for more details.

22.5 DECISION FRAMEWORK

The following decision framework can help HCW to categorize corpses.

Category	Risk of spreading after direct contact with corpse*	Case fatality rate	Effective disease-specific treatment is available and treatment is not lifelong
3	> 10%	> 10%	N
2	> 10%	< 10%	N
2	> 10%	< 10%	Y
3	< 10%	> 10%	N
2	< 10%	< 10%	N
1	< 10%	< 10%	Y

*Table 56: If an effective treatment is available, it is expected that the case fatality rate will be less than 10%. * Without wearing PPE but when standard precautions are adhered to; can be estimated from the secondary attack rate after direct exposure to an infected human.*

22.6 EXAMPLES

Examples of categories of infected corpses are given below.

Category 1	Category 2	Category 3
Seasonal influenza	HIV¶¶	Anthrax (especially bioterrorist or pneumonic form)
Dengue	HCV*	Plague (especially bioterrorist or pneumonic form)
Salmonellosis	HBV*	Rabies
Malaria	SARS-CoV-2**	Ebola
Measles	Mpox	Marburg
Polio†	Cholera	Highly pathogenic avian influenza°°
Tuberculosis°	Creutzfeldt-Jacob Disease / prion disease¶	MERS
Tetanus††		Other HCIDs
Leptospirosis††		
Most multi-drug resistant organisms		
Pertussis		

*Table 57: * Treatment with direct acting antivirals for HCV is efficacious and a vaccine exists for HBV; hence, these diseases may now be categorized as 1 but they have been left as category 2 (similar to international recommendations) so that embalming by family members is avoided. ** The Omicron variant of COVID-19 behaves like seasonal influenza and can be classified as category 1 if the population is well-vaccinated but most authorities still consider it as category 2 in 2025. ¶ CJD is more contagious after necropsy, especially involving the brain; it can be considered category 3 if nervous tissue is exposed. † In a country where most of the population is vaccinated against polio, it can be categorized as 1; otherwise, it should be in category 2. ° However, multi-drug resistant tuberculosis, cutaneous tuberculosis or tuberculosis with scrofula are category 2; treatment of tuberculosis is complex, the disease can relapse and mortality rate can be > 10% especially if multi-drug resistant. †† Since these organisms can persist in the soil despite not being easily transmissible from the corpse to a human, the body should be placed inside an impermeable plastic bag. °° Avian influenza can be classified as category 2 if the case fatality rate goes down during an epidemic through mutations and if a large part of the population is vaccinated. ¶¶ To maintain confidentiality, family members should only be informed that the patient had a contagious illness.*

22.7 CONTROVERSIES

Due to a lack of evidence regarding mortuary practices, multiple controversies exists regarding the best IPC measures to take. Protocols vary according to each country.

For instance, controversies persist regarding the need to use double bags for category 2 corpses (like COVID-19). WHO considers the use of body bags to be necessary only:

- when there is excessive fluid leakage,
- for post-autopsy procedures, and
- to facilitate the transportation and storage of bodies outside of the mortuary area.[9]

Similarly, South African authorities no longer consider the use of any body bag necessary for COVID-19 bodies given the low risk of transmission.[10] Double bagging is recommended by the Red Cross only if the pouch/bag is thin and may leak.[11]

Hence, taking all the above into account, in Mauritius, single bag can be used for category 2 corpses provided the bag is leak-proof and non-biodegradable.

22.7 STEPS FOR SAFE BURIAL PRECAUTIONS AS ADAPTED FROM WHO RECOMMENDATIONS

- Category 3 corpses should be transported in a dedicated vehicle i.e., not in a relative's car or in a public transport vehicle. A funeral service's vehicle can be used.
- A minimum of two staff should help with the body bag process and with transport.
- An identification label should always be present.
- The body bag process:
    - Perform hand hygiene;
    - Wear PPE according to the category of the corpse;
    - Open the body bag;
    - Grab the body by the arms and legs;
    - Transfer the body in the body bag;
    - Perform hand hygiene;
    - Close the body bag;
    - Wipe the outer side of the body bag with an approved disinfectant;
    - If a category 3 corpse:
        - Place the body bag inside a second plastic bag.
        - Wipe the outer side of the body bag with an approved disinfectant;
        - Transport the body bag to the coffin (while wearing PPE);
        - Place the clothing and personal belongings of the deceased person in the coffin (if this is the will of the family);
        - Remove gloves and perform hand hygiene;

        - Wear a new set of gloves;
        - Close the coffin with gloved hands;
        - Disinfect the outer side of the coffin to be transported
        - Remove PPE
        - Perform hand hygiene
        - If proceeding with transport, put on new, clean full PPE
    - If a category 2 corpse:
        - Remove PPE
        - Perform hand hygiene
        - If proceeding with transport, put on gloves
- Transport process:
    - For category 3 corpses:
        - Transport the coffin with full PPE.
            - International organisations allow the transport of category 3 corpses while wearing only gloves.
            - The coffin, once disinfected, is generally considered non-contaminated.
            - However, for additional safety reasons, staff or family members who would like to touch the coffin should wear full PPE.
        - Family members can carry the coffin while wearing PPE.
    - For category 2 corpses:
        - Wear gloves while transporting the bag.
    - The body is placed at the rear of the vehicle.
    - Allow the necessary time to the family for prayers as needed;
    - Family members can be on the rear if appropriate PPE is worn.
- The burial process:
    - Those tasked with placing the body in the grave, on the funeral pyre, etc., should wear full PPE for category 3 corpses or only gloves for category 2 corpses.
    - They should also wash their hands with soap and water after removal of the gloves once the burial is complete.
    - Family and friends may view the body/coffin after it has been prepared for burial, in accordance with customs.
    - They should not touch or kiss the body and should wash their hands thoroughly with soap and water after the viewing.
    - A minimum number of people should be involved in preparing the body.

- Others may observe without touching the body at a minimum distance of 1 meter.
- Children, elderly people (>60 years), and anyone with underlying illnesses, should not be involved in preparing the body.

- Burial team for category 3 corpses:
  - Four members, in charge of dead body management (including transport and movement);
  - One hygienist (e.g., IPC team member) to supervise the hygienic process;
  - One technical supervisor to guide the preparation of the body according to the family's requests and to local religious practices;
  - One communicator to talk to relatives and other concerned parties.
    - This can be a religious representative to ensure good community engagement.
- If the body will not be handed over to the relatives immediately, it should be kept refrigerated at the mortuary in a designated body storage compartment. It is preferable to have a separate compartment for infectious corpses.

References

1. https://www.chp.gov.hk/files/pdf/grp-guideline-hp-ic-precautions_for_handling_and_disposal_of_dead_bodies_en.pdf
2. Department of Health (2023). NCEC National Clinical Guideline No. 30 Infection Prevention and Control Volume 2. Available at: http://health.gov.ie/national-patient-safety-office/ncec/
3. https://mauritius-riyadh.govmu.org/Documents/Consular%20Services/Repatriation%20Of%20Mortal%20Remains9.pdf
4. World Health Organization. Rapid Response Teams Essentials Online Course. Health Security Learning Platform. Accessed 16 November 2024.
5. International Committee of Red Cross. CEMETERY PLANNING, PREPARATION AND MANAGEMENT DURING COVID-19: A QUICK GUIDE TO PROPER DOCUMENTATION AND DISPOSITION OF THE DEAD. July 2020.
6. Health and Safety Executive, Ireland. Managing infection risks when handling the deceased: Guidance for the mortuary, post-mortem room and funeral premises, and during exhumation. 2018.
7. Environment Agency, UK. Cemeteries and burials: prevent groundwater pollution. 5 March 2020.
8. Ministry of Health and Wellness, Mauritius. Guidelines for the handling of dead bodies. 2020.
9. World Health Organization. Infection prevention and control for the safe management of a dead body in the context of COVID-19. 4 Sep 2020.
10. https://www.sanews.gov.za/south-africa/covid-19-plastic-wrapping-not-required-coffins 28 January 2021
11. ICRC Forensic Unit. COVID-19: GENERAL GUIDANCE FOR THE MANAGEMENT OF THE DEAD. May 2020.

Chapter 23: IPC for Specific Diseases

23.1 CLASSIFICATION OF INFECTIONS

Infectious diseases can be classified based on several criteria, including causative agents, modes of transmission, duration and severity, and geographic distribution. Although controversial, some experts divide microbes into communicable and non-communicable ones. An example of the latter is tetanus which is contracted directly from a contaminated environment. Communicable diseases are transmitted via vectors, fomites, transplacentally / congenitally, sexually, water, fecal-oral route, blood or directly from person-to-person. Communicable diseases are further divided into contagious illnesses and non-contagious illnesses. The former is transmitted from human-to-human via air, droplets or contact (direct or indirect). Non-contagious infections are not transmitted in this manner e.g., they can be vector-borne.

23.2 DISEASE SURVEILLANCE

Effective disease surveillance systems are crucial for monitoring, detecting, and responding to health threats. Different approaches to surveillance have been developed to address various public health needs, and they can be categorized as follows:

1. Indicator-Based Surveillance: This method relies on routine reporting of specific diseases, conditions, or health indicators from healthcare facilities, laboratories, or health programs. It involves the regular collection, analysis, and interpretation of data based on pre-defined criteria (e.g., weekly counts of influenza cases).

2. Event-Based Surveillance: This involves the rapid collection and analysis of unstructured information about health events that might pose a risk, from diverse sources like news reports, social media, community health workers, or hotline calls. It focuses on the early detection of unusual events or outbreaks that might not be captured by traditional surveillance systems.

3. Lab-Based Surveillance: This involves systematic collection and analysis of laboratory test results to identify pathogens responsible for infectious diseases.

4. Clinical-Based or Syndromic Surveillance: It relies on reports from healthcare providers about diagnosed cases based on clinical symptoms rather than laboratory confirmation.

5. Sentinel Surveillance: This approach involves selecting specific sites or healthcare facilities (referred to as sentinel sites) to collect high-quality data on particular diseases or health conditions. These sites act as “sentinels” to detect and monitor trends in diseases that may not be captured comprehensively through nationwide systems.

6. Active Surveillance: It involves actively seeking out cases through regular visits to healthcare facilities, calling healthcare providers, or conducting surveys to identify new cases. It is resource-intensive but provides more accurate and comprehensive data.

7. Passive Surveillance: This relies on routine reporting by healthcare providers or laboratories. It is less resource-intensive but may miss cases if providers do not report regularly.

Integrated Disease Surveillance and Response (IDSR) is a comprehensive public health strategy developed to improve the ability of countries. Instead of managing separate systems for each disease, IDSR combines the surveillance of priority diseases, conditions, and events, streamlining data collection, analysis, and response efforts. This integration reduces duplication, optimizes the use of resources, and strengthens the overall surveillance infrastructure. Countries using the IDSR framework identify and prioritize diseases based on their public health significance, such as their potential to cause outbreaks, mortality, or economic impact. A key objective of IDSR is to detect and

respond to diseases quickly. By integrating surveillance systems, health authorities can monitor disease trends, identify unusual patterns, and detect outbreaks in their early stages. The system also promotes the development of early warning systems, which are crucial for preparing and responding to emergencies, thereby minimizing the impact of outbreaks. IDSR promotes the use of standardized tools and procedures for data collection, analysis, and reporting.

23.3 CATEGORIES OF DISEASE FOR SURVEILLANCE

Diseases included in IDSR are those that require continuous, systematic collection, analysis, and dissemination of health data to guide public health decisions. This includes:

1. Outbreak-prone diseases:
    a. A risk assessment should be carried out by each respective country to check whether the risk of an outbreak of a specific infection is moderate to high and this assessment should be updated regularly,
2. Diseases with high mortality or morbidity in the country,
3. Diseases that have national intervention programs for control i.e., are of public health concern, and
4. Diseases that are targeted for eradication or elimination on the global or regional level.

Diseases under IDSR can be further sub-divided into moderate-to-high priority acute illnesses, low priority acute illnesses, moderate-to-high priority chronic illnesses and low priority chronic illnesses.

In many countries, moderate-to-high priority acute illnesses have been made notifiable, i.e., it is mandatory by law to report these diseases when they occur. On the other hand, moderate-to-high priority chronic illnesses (like cancer and chronic kidney disease) are often recorded into a national registry where epidemiological data are analyzed periodically (e.g., annually) for research or for policy-making purposes.

Internationally, although practices differ, notifiable diseases can be further categorized by the degree of urgency as follows:

1. High priority (class A or category 1): These diseases have a moderate to high mortality rate and have the potential of spreading rapidly but are currently rare or absent in the country e.g., viral haemorrhagic fevers. Suspected cases have to be notified by healthcare providers within 24 hours to the relevant authorities if case definitions are met – there is no need to wait for confirmation for notification.
2. Moderate priority for early detection (class B or category 2): These diseases have a low mortality rate and are rare or absent in the country but if they enter the country, they can spread rapidly e.g., chikungunya. Confirmed cases are notified, typically by the laboratory, within 24 hours of the results being ready. This can also include diseases targeted by vaccine programs e.g., measles. Depending on the needs of the national programme, public authorities may be informed of highly suspicious cases even before confirmation.
3. Moderate priority for intensified monitoring (class C or category 3): These diseases have a low to moderate mortality rate and are already well-established in the country but are epidemic-prone and have a program aimed at stopping the spread of the disease e.g., HCV. Confirmed cases are notified, typically by the laboratory. Weekly reporting is adequate. Leptospirosis can be another example if the country develops a disease control program.
4. Moderate priority for intensified control (class D or category 4): These diseases have a moderate to high mortality rate and are not rare in the country but are unlikely to spread rapidly in the community (i.e., low to moderate transmission rate) e.g., hospital-acquired

infections and multi-drug resistant organisms. These are generally reported by healthcare facilities or by the lab on a monthly basis.

Of note, even in cases where public authorities are not notified promptly, the treating doctor and the patient should always be informed of the diagnosis as soon as possible so that treatment can be started in a timely manner and isolation precautions can be initiated at the level of the healthcare facility if necessary.

23.4 DECISION FRAMEWORK

A decision framework to categorize notifiable diseases is displayed in the table below.

Category	Case fatality rate	Reproductive number	Endemic
1	> 10%	> 1.5	No
3	> 10%	> 1.5	Yes*
4	> 10%	< 1.5	No
4	> 10%	< 1.5	Yes*
2	< 10%	> 1.5	No
3	< 10%	> 1.5	Yes*
Not notifiable	< 10%	< 1.5	No
Not notifiable	< 10%	< 1.5	Yes

*Table 58: * these diseases are notifiable only if the country has a national programme to prevent or control the spread of the infection.*

It is highlighted that, even if a disease is not classified as notifiable by law, concerned stakeholders are allowed to report it to appropriate authorities for actions to be taken if needed.

Actions taken can vary according to the category of the notifiable disease – see the table below for details. Readers should consult SOPs written by the public health unit to understand algorithms to be followed during notification.

Category	Time to notify	Who typically notifies*	Other stakeholders to be rapidly informed¶	Maximum Time to respond ŧ	To wait for confirmation before notification
1	24h	Medical officer	Public health, Director Health Services	24h	No
2	24h	Medical officer / laboratory	Public health, Director Health Services, vaccination program	24h	No / Yes**
3	7d	Laboratory	Public health, head of program concerned with the disease	7d	Yes
4	28d	Medical officer / laboratory	Public health, IPC teams, AMS teams	28d	Yes

*Table 59: * Medical officers are expected to fill in case notification forms and send them to the RPHS. For categories 1 and 2, they should also call the RPHS. Laboratories are expected to fill in case line lists and send these to the CDCU. For categories 1 and 2, the lab should also call the CDCU. ¶ This is just a brief list; other stakeholders can be involved depending on the situation. ŧ Response can involve case investigation or confirmation, contact tracing, isolation, admission to a healthcare facility, etc. ** Public authorities can be informed of*

probable cases or highly suspicious cases before confirmation. This table should be used as a guide only – consult national plans and policies for more details.

23.5 HIGH-CONSEQUENCE INFECTIOUS DISEASES

While there is no standardized definition for high-consequence infectious diseases (HCIDs), expert consensus defines these as novel or reemerging infectious agents that are easily transmitted from person-to-person, have limited or no medical countermeasures (such as an effective vaccine or prophylaxis), have a high mortality, require prompt identification and implementation of infection control activities (for example, isolation, special personal protective equipment), and require rapid notification to public health authorities and special action. They are also termed highly pathogenic infectious diseases.

Utmost care has to be taken when dealing with patients infected with these organisms and as such, the IPC practices are correspondingly more drastic. In particular, maximum (enhanced) contact precautions together with airborne precautions are usually taken when caring for patients infected with HCIDs.

Characteristics that allow an infectious disease to be classified as an HCID are usually:

- A reproductive number > 1.5 (of note, in the presence of a vaccinated population, this number may drop and hence, the infection may no longer be classified as an HCID),
- A case fatality rate > 10% despite usual care, and
- Absence of an effective and widely available disease-specific treatment or prevention.

Disease X, which is an unknown infection of pandemic potential, may be considered an HCID until its reproductive number and case fatality rate is further elucidated.

The following table lists some of the HCIDs according to the UK.

Argentine haemorrhagic fever (Junin virus)
Bolivian haemorrhagic fever (Machupo virus)
Crimean Congo haemorrhagic fever (CCHF)
Ebola virus disease (EVD)
Lassa fever
Lujo virus disease
Marburg virus disease (MVD)
Severe fever with thrombocytopenia syndrome (SFTS)
Andes virus infection (hantavirus)
Avian influenza (highly pathogenic form)*
Middle East respiratory syndrome (MERS)
Nipah virus infection
Pneumonic plague (*Yersinia pestis*)

Table 60: Adapted from https://www.gov.uk/guidance/high-consequence-infectious-diseases-hcid#list-of-high-consequence-infectious-diseases. Of note, mpox has been removed from the list given that the mortality rate associated with this virus has been recently found to be less than 10% in most countries and a vaccine

*exists to protect the population. * Avian influenza may not be considered an HCID once the population is well-vaccinated and the risk of spread is low.*

23.6 IPC INFORMATION SHEET FOR SPECIFIC MICROORGANISMS

The following tables summarize the IPC precautions to take in hospitals when caring for patients with specific infections.

Of note, the tables are not meant to expound on the IPC measures needed to prevent the spread of the disease in the community – please consult the relevant national public health protocols and the different chapters in this document for details on each topic.

23.6.1 HIV

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	Some patients with AIDS may have tuberculosis – a risk-based assessment is necessary
Equipment cleaning	As per standard IPC practices	Routinely used disinfectants are effective against HIV
Injection safety	As per standard IPC practices	Many healthcare workers in Mauritius have been observed not to wear gloves when drawing blood from general patients
Environmental cleaning	As per standard IPC practices	Fumigation of rooms where HIV patients have been admitted is not a normal practice
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	Some consultants in Mauritius 'isolate' their AIDS patients in side wards – this is not required, especially when there is no space to isolate patients infected with multi-drug resistant organisms
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	
Vector control	Not relevant	
Prophylaxis	Use PEP and PrEP as indicated in the National HIV Guidelines	

23.6.2 Entamoeba histolytica

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	Ensure water in bathrooms and toilets are well chlorinated. Liquid waste can be treated with iodine or tetraglycine hydroperiodide with a minimum of 30 min contact time.	Chlorine alone does not kill cysts.
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact precautions with a separate toilet)	Gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	Wash all fruits and vegetables with potable water before consumption. Preferably, eat cooked food that is prepared hot.
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.3 Chikungunya

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Mosquito precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no mosquitoes in the patient's room, in the hospital and in the surrounding yard.	
Prophylaxis	A chikungunya vaccine is available	The vaccine is available in USA but is not yet approved for use in Mauritius

23.6.4 Dengue

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Mosquito precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no mosquitoes in the patient's room, in the hospital and in the surrounding yard.	
Prophylaxis	Several dengue vaccines are available	Risks and benefits should be carefully weighed before use of the vaccine

23.6.5 Salmonella typhi

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	The waste storage area should be well-covered to avoid the proliferation of flies
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact precautions with a separate toilet)	Gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	Ensure hospital water is well chlorinated. Preferably, eat cooked food that is prepared hot. If an outbreak occurs in the hospital, avoid giving salads to patients.
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no flies in the patient's room, in the hospital in general, in the hospital's kitchen, in the waste storage area and in the surrounding yard.	
Prophylaxis	If an outbreak occurs in the hospital, test kitchen staff to see if they are carriers – they should not return to the kitchen until they have eliminated the bacteria from their stools (in 3 consecutive specimens). Vaccination can be considered during an outbreak	

23.6.6 Highly pathogenic avian influenza

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	Avoid sorting laundry
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Airborne and maximum contact precautions (HCID precautions)	N95 / FFP3 respirators, hazmat suit with hood, boots, goggles / face shields & gloves. The isolation rooms should be well-ventilated and under negative pressure if available.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 3 corpse	
Vector control	Not relevant	
Prophylaxis	A vaccine against H5N1 is available internationally	

23.6.7 Seasonal influenza

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet precautions	Medical masks. Use N95 / FFP2 respirators during aerosol-generating procedures.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Vaccinate all healthcare workers against seasonal influenza. Vaccinate the public as per national protocol. Consider use of antivirals as prophylaxis during outbreaks in hospitals or nursing homes.	

23.6.8 Salmonella non-typhi

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact precautions with a separate toilet)	Gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	Avoid recontamination in the kitchen after food is cooked. Store uncooked food separate from cooked or ready-to-eat food.
Handling of corpses	As for category 1 corpse	
Vector control	Ensure the absence of pests in the patient's room	Pets such as lizards should not be brought into the patient's room
Prophylaxis	Nil	

23.6.9 Norovirus

Standard precautions	Practice	Remarks
Hand hygiene	Washing with soap and water is preferred over alcohol sanitizer	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact precautions with a separate toilet)	Gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.10 Cholera

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	Do not spray or fumigate households or patient rooms with hypochlorite
Linen management	As per standard IPC practices	In addition to washing in hot water, disinfect in 0.05% hypochlorite or soak in boiling water for 5 min
Waste management	As per standard IPC practices Large spills with high concentration of organic matter like vomit and feces should be treated with 2% chlorine instead of 0.5%. Cholera treatment centers should confirm with regulatory facilities that liquid waste including sewage is properly treated before disposal into rivers or sea	
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact precautions with a separate toilet)	Gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	Ensure the water supply is well chlorinated
Handling of corpses	As for category 2 corpse	Do not prepare food at burial; see cholera protocol in chapter 24 for details
Vector control	Ensure there are no flies in the kitchen, on hospital premises and in the patient's room	
Prophylaxis	Vaccination should be considered in case of an outbreak. Antibiotics as post-exposure prophylaxis have rarely been used during difficult-to-control outbreaks.	

23.6.11 Ebola Virus Disease

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	Use 0.5% chlorine instead of 0.1%	
Injection safety	As per standard IPC practices	
Environmental cleaning	Use 0.5% chlorine instead of 0.1%	
Linen management	Linen bags must be leakproof – use double bags if necessary Before removal from the isolation room, the linen bag should be disinfected with 0.5% hypochlorite	Incinerate all linen coming out of the room – if not possible, before washing at high temperature, disinfect in 0.05% hypochlorite and soak in boiling water for 15 minutes
Waste management	Waste bags must be leakproof – use double bags if necessary Before removal from the isolation room, the bag should be disinfected with 0.5% hypochlorite Liquid waste should be disinfected with chlorine before disposal	Incinerate all waste – if not possible, use an autoclave-shredder
Transmission-based precautions		
Isolation procedures	Airborne and maximum contact precautions (HCID precautions)	N95 / FFP3 respirators, hazmat suit with hood, boots, goggles / face shields, apron over the suit & double gloves. The isolation rooms should be well-ventilated and under negative pressure. Entry of non-essential staff should be restricted.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 3 corpse	Dead bodies should be sealed in leakproof material
Vector control	Not relevant	
Prophylaxis	A vaccine against Ebola is available internationally for some strains – it may be used as post-exposure prophylaxis	

23.6.12 Marburg Virus Disease

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	Use 0.5% chlorine instead of 0.1%	
Injection safety	As per standard IPC practices	
Environmental cleaning	Use 0.5% chlorine instead of 0.1%	
Linen management	Linen bags must be leakproof – use double bags if necessary Before removal from the isolation room, the linen bag should be disinfected with 0.5% hypochlorite	Incinerate all linen coming out of the room – if not possible, before washing at high temperature, disinfect in 0.05% hypochlorite and soak in boiling water for 15 minutes
Waste management	Waste bags must be leakproof – use double bags if necessary Before removal from the isolation room, the bag should be disinfected with 0.5% hypochlorite Liquid waste should be disinfected with chlorine before disposal	Incinerate all waste – if not possible, use an autoclave-shredder
Transmission-based precautions		
Isolation procedures	Airborne and maximum contact precautions (HCID precautions)	N95 / FFP2 respirators, hazmat suit with hood, boots, goggles / face shields, apron over the suit & double gloves. The isolation rooms should be well-ventilated and under negative pressure. Entry of non-essential staff should be restricted.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 3 corpse	Dead bodies should be sealed in leakproof material
Vector control	Not relevant	
Prophylaxis	No vaccine is currently approved against Marburg Virus Disease	

23.6.13 Leptospirosis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Rodent control within hospital premises	
Prophylaxis	Administration of a leptospirosis vaccine may be considered during an outbreak Doxycycline 200mg PO stat can be considered in high-risk groups post-exposure during an outbreak	

23.6.14 Middle East Respiratory Syndrome

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Airborne and maximum contact precautions (HCID precautions)	N95 / FFP2 respirators, hazmat suit with hood, boots, goggles / face shields & gloves. The isolation rooms should be well-ventilated and under negative pressure.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 3 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.15 Malaria

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	Nosocomial transmission through needlestick injuries and contaminated syringes and needles has been described
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Mosquito precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no mosquitoes in the patient's room, in the hospital and in the surrounding yard.	
Prophylaxis	Malaria vaccine may be considered during difficult-to-control outbreaks. Chemoprophylaxis when traveling to high-risk areas is standard of care.	

23.6.16 Measles

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Airborne and simple contact precautions	N95, FFP2 or FFP3 respirators, gowns and gloves
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. An additional dose of measles vaccine can be considered during outbreaks. Post-exposure vaccination within 72 hours of exposure, especially for children who are only partially immunized, can be considered.	

23.6.17 Neisseria meningitidis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet precautions for 24h after start of appropriate treatment	Medical masks
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. Contacts should be given rifampicin or ciprofloxacin.	

23.6.18 Respiratory diphtheria

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet precautions until 2 cultures from nose and throat are negative	Medical masks
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. Contacts and carriers should be given benzathine penicillin or erythromycin. A booster dose of diphtheria toxoid can be given to immunized contacts if the last dose was more than 5 years ago. Adult contacts should avoid being closely associated with children for 7 days.	During outbreaks, ensure herd immunity is reached through vaccination campaigns.

23.6.19 Tetanus

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. Contacts and carriers should be given benzathine penicillin or erythromycin. A booster dose of tetanus toxoid can be given to patients with contaminated wounds if the last dose was more than 5 years ago.	During outbreaks, ensure herd immunity is reached through vaccination campaigns. Clean deliveries of babies in hospitals are important. Clean and debride contaminated wounds.

23.6.20 SARS-CoV-2 (COVID-19)

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	Fumigation with hypochlorite solution is not recommended
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet and simple contact precautions	Medical masks and gowns. Gloves should be used when in contact with body fluids. Systematic use of gowns is controversial nowadays due to the low risk of transmission through contact. Use N95 / FFP2 respirators during aerosol-generating procedures or if poor ventilation. Double-gloving and double-masking are not recommended. Caps and boots are not needed in most cases. Use of contact precautions for SARS-CoV-2 can depend on the activities being performed i.e., a risk assessment is needed (see national SOPs for details)
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine.	

23.6.21 Tuberculosis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	Use 0.5% hypochlorite
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Airborne precautions Use simple contact precautions if cutaneous tuberculosis or scrofula is present	N95 respirators Gowns and gloves if contact
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	Category 2 if multi-drug resistant, cutaneous or if scrofulas are present
Vector control	Not relevant	
Prophylaxis	All contacts should have a BCG test and a chest x-ray	

23.6.22 Bordetella pertussis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet precautions	Medical masks
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. Contacts can be administered clarithromycin if they have children less than 1y old at home or if there are pregnant women in their 3rd trimester at home. Macrolides can also be given to contacts who are less than 1y old or to pregnant women in their 3rd trimester.	During outbreaks, ensure herd immunity is reached through vaccination campaigns. Infected children should not go to schools. Contacts who are teachers (working with kids) may be given prophylactic antibiotics too.

23.6.23 Gonorrhea

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	Place infected neonates or prepubertal children on contact precautions for 24h after start of treatment
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Refrain from sexual intercourse until 7 days after completion of therapy. Notify sex partners for treatment. All infants born to infected mothers should receive treatment.	Counsel on safe sex

23.6.24 Syphilis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Refrain from sexual intercourse until completion of therapy and until lesions heal. Notify sex partners for treatment.	Counsel on safe sex

23.6.25 Filariasis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Mosquito precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no mosquitoes in the patient's room	
Prophylaxis	Nil	

23.6.26 Mpox

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	Healthcare workers can often acquire the infection through needlestick injury
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	Ensure the linen staff wear appropriate PPE as mentioned below. Mixing infectious linen with non-infectious linen must not occur. Do not shake linen or laundry. If machine washing is not possible, the linens should be soaked in chlorine, rinsed with clean water and allowed to fully dry.
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Simple contact and airborne precautions	Gloves, gowns and N95 / FFP2 respirators. Transmission of mpox via airborne route is questionable; yet due to high lethality of clade 1b and because rapid sequencing is not possible in Mauritius, airborne precautions are preferred over droplet precautions. Droplet transmission may be possible but may be rare.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	
Vector control	Nil	
Prophylaxis	Vaccination should be considered during outbreaks. Vaccination should be offered to high-risk individuals or as post-exposure prophylaxis.	

23.6.27 Adenovirus-induced conjunctivitis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	Do not share towel.
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	Proper disinfection of all equipment in the eye clinic is mandatory in between patients
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Droplet precautions	Medical mask Place patient in a separate waiting area in hospital
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Nil	
Prophylaxis	Nil	Ensure proper chlorination of swimming pools. Restrict access to schools during outbreaks. Limit overcrowding.

23.6.28 Poliomyelitis

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	Ensure liquid waste is properly treated and disinfected before release into the environment
Transmission-based precautions		
Isolation procedures	Enteric precautions (i.e., contact with separate toilet)	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	Category 2 if people handling the corpse are not vaccinated; ideally, these people should not be handling the corpse
Vector control	Nil	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine	

23.6.29 Scabies

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	Launder all clothes and bed linen in contact with the patient for the past 48h. Use a hot cycle as well as a dryer.	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Contact precautions for 24h after start of treatment	Gloves and gowns. Longer duration of isolation may be required if lesions are crusted.
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Nil	
Prophylaxis	All household contact as well as those who had skin-to-skin contact with the patient should be treated prophylactically. Regular bathing of contacts with soap can help.	Infected individuals should avoid visiting the workplace or school for 24h after treatment. During hard-to-control outbreaks, 10 days of home isolation may be needed.

23.6.30 Plague

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	See transmission-based precautions below	
Respiratory hygiene	See transmission-based precautions below	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	Ensure liquid waste is properly treated and disinfected before release into the environment
Transmission-based precautions		
Isolation procedures	Airborne precautions for 48h till after appropriate antibiotics have been started for pneumonic plague	Some guidelines prefer droplet precautions for pneumonic plague but due to the mortality rate, airborne precautions are preferred in Mauritius; standard precautions are sufficient for bubonic plague
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 3 corpse if pneumonic or bioterrorist; category 2 otherwise	
Vector control	Rodent and flea control	In flea-infested areas, dust the clothes of workers with insecticide
Prophylaxis	Close contacts should receive chemoprophylaxis. They should be quarantined if they refuse chemoprophylaxis.	

23.6.31 Zika

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Mosquito precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Ensure there are no mosquitoes in the patient's room, in the hospital and in the surrounding yard.	
Prophylaxis	Nil	Sexual abstinence or use of condoms by high-risk men.

23.6.32 Hepatitis B virus

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	All syringes and needles should be single use.
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	
Vector control	Not relevant	
Prophylaxis	All healthcare workers should be up-to-date with their vaccine. Post-exposure prophylaxis should be given to all contacts in the form of vaccination (if not already immunized).	

23.6.33 Hepatitis C virus

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	Many healthcare workers in Mauritius have been observed not to wear gloves when drawing blood from general patients
Environmental cleaning	As per standard IPC practices	
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Nil	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.34 High-priority multi-drug resistant bacteria

These include meticillin-resistant *Staphylococcus aureus*, carbapenem resistant *Enterobacteriaceae*, carbapenem resistant *Pseudomonas spp.*, carbapenem resistant *Acinetobacter spp.*, carbapenem resistant *Serratia spp.* and vancomycin resistant *Enterococcus spp.*

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	More frequent cleaning and disinfection is needed Use 0.5% hypochlorite
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Simple contact precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.35 Candida auris

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	As per standard IPC practices	
Injection safety	As per standard IPC practices	
Environmental cleaning	As per standard IPC practices	More frequent cleaning and disinfection is needed Use 0.5% hypochlorite
Linen management	As per standard IPC practices	
Waste management	As per standard IPC practices	
Transmission-based precautions		
Isolation procedures	Simple contact precautions	
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 1 corpse	
Vector control	Not relevant	
Prophylaxis	Nil	

23.6.36 Prions

Standard precautions	Practice	Remarks
Hand hygiene	As per standard IPC practices	
Use of personal protective equipment	As per standard IPC practices – see below for more details	
Respiratory hygiene	As per standard IPC practices	
Equipment cleaning	Use prion-specific procedures	Destruction of equipment is preferred if possible if in contact with nervous tissue. Refer to steps outlined in the section on prions in this document (chapter 7).
Injection safety	As per standard IPC practices	
Environmental cleaning	Use prion-specific procedures	Refer to steps outlined in the section on prions in this document. High concentrations of sodium hydroxide and / or hypochlorite are required.
Linen management	As per standard IPC practices	Incinerate if contaminated with CSF or in contact with nervous tissue.
Waste management	As per standard IPC practices	High temperature incineration (≥ 1,000 °C) is needed for infectious waste.
Transmission-based precautions		
Isolation procedures	Nil in most circumstances	Use simple contact precautions if in contact with nervous tissue
Other precautions		
Food preparation and handling	As per standard IPC practices	
Handling of corpses	As for category 2 corpse	Use category 3 precautions if nervous tissue is exposed
Vector control	Not relevant	
Prophylaxis	Nil	

References

1. Zheng J, Zhang N, Shen G, Liang F, Zhao Y, He X, Wang Y, He R, Chen W, Xue H, Shen Y, Fu Y, Zhang WH, Zhang L, Bhatt S, Mao Y, Zhu B. Spatiotemporal and Seasonal Trends of Class A and B Notifiable Infectious Diseases in China: Retrospective Analysis. JMIR Public Health Surveill. 2023 Apr 27;9:e42820. doi: 10.2196/42820.
2. https://www.nicd.ac.za/wp-content/uploads/2022/09/SOP-Notifiable-Medical-Conditions_paper-based-reporting_v2Jan2018final....pdf
3. https://nphi.go.ke/sites/default/files/2024-02/IDSR%20Clinicians%20Handbook.pdf
4. Ministry of Health, National Public Health Institute of Liberia, Liberia, World Health Organization and US-Centers for Disease Control and Prevention (2021). National Technical Guidelines Integrated Disease Surveillance and Response Liberia., Monrovia, Republic of Liberia.
5. https://www.gov.uk/guidance/high-consequence-infectious-diseases-hcid#list-of-high-consequence-infectious-diseases
6. https://www.jointcommission.org/standards/standard-faqs/hospital-and-hospital-clinics/infection-prevention-and-control-ic/000002503/
7. https://www.chp.gov.hk/files/pdf/grp-guideline-hp-ic-precautions_for_handling_and_disposal_of_dead_bodies_en.pdf
8. Heymann DL. Control of Communicable Diseases Manual. American Public Health Association. 21st Edition. 2022.
9. Kuehn R, Fox T, Guyatt G, Lutje V, Gould S (2024) Infection prevention and control measures to reduce the transmission of mpox: A systematic review. PLOS Glob Public Health 4(1): e0002731. https://doi.org/10.1371/journal.pgph.0002731
10. CD Surveillance and Outbreak Response – Guidelines. Ministry of Health of Fiji. Oct 2010.
11. Public Health Disease Notification Manual for Health Care Professionals. Auckland Regional Public Health Service. March 2019.

CHAPTER 24: Cholera

24.1 INTRODUCTION

Cholera is a highly infectious disease caused by the *Vibrio cholerae* bacterium, leading to severe diarrhea and dehydration. It spreads rapidly in areas with inadequate water, sanitation, and hygiene (WASH) systems, often resulting in outbreaks with high morbidity and mortality rates. Infection Prevention and Control (IPC) is critical in managing cholera outbreaks, minimizing transmission, and preventing further public health crises.

24.2 THE ROLE OF INFECTION PREVENTION AND CONTROL IN CHOLERA MANAGEMENT

1. **Containment of Outbreaks**: Effective IPC measures are essential to limit the spread of cholera in affected areas. Proper WASH practices, including access to clean water, adequate sanitation facilities, and hygiene education, reduce the potential for person-to-person transmission, as well as environmental contamination that can further spread the disease.
2. **Protection of Healthcare Workers and Communities**: Healthcare facilities treating cholera patients are at high risk for transmission due to frequent contact with infected bodily fluids. IPC protocols such as personal protective equipment (PPE) for healthcare workers, safe waste disposal, and disinfection of contaminated surfaces help protect healthcare workers and prevent transmission within healthcare settings and communities.
3. **Reducing the Economic Burden of Cholera**: Cholera outbreaks impose significant economic costs on affected regions, disrupting communities, diverting resources from other health priorities, and impacting workforce productivity. Implementing IPC measures can minimize these costs by controlling the spread of disease and allowing resources to be focused on patient care and recovery.
4. **Supporting Resilient Health Systems**: Consistent IPC practices contribute to stronger, more resilient health systems that are better equipped to manage cholera and other infectious diseases. By investing in WASH infrastructure and IPC capacity-building, health systems can improve overall healthcare quality and strengthen community health resilience, reducing the likelihood and impact of future outbreaks.

24.3 KEY PRINCIPLES

1. Clean water, appropriate sanitation, provision of sanitation facilities and frequent handwashing are the mainstay of cholera prevention.
    a. Health inspectors can check chlorination and send water samples to the lab regularly to test for water contamination with *Escherichia coli.*
2. Immunization can be undertaken to control outbreaks or prevent an epidemic in high-risk settings.
3. Standard precautions continue to apply as in any other circumstances – check the relevant chapters in this guideline for more details:
    a. Hand hygiene – follow the 5 moments of hand hygiene.

b. Use of personal protective equipment – wear face shields and boots as per risk assessment during waste disposal and environmental cleaning; for additional details, see “transmission-based precautions” below.

c. Respiratory hygiene – masks are not required to protect against cholera.

d. Cleaning of patient equipment – use dedicated equipment as far as possible; use 70% alcohol.

e. Injection safety – cholera is not a bloodborne pathogen; use gloves when in contact with body fluids.

f. Environmental cleaning – see the national protocol for basic information.

    i. Floors, buckets and other items should be disinfected with 0.2% chlorine instead of 0.1%.

    ii. Large spills with high concentrations of organic matter like vomit and feces should be treated with 2% chlorine instead of 0.5%.

g. Safe handling of linen – place all linen in yellow bags and treat as infectious; see the national standard operating procedure for details.

    i. Use 0.05% chlorine for laundry disinfection or place in boiling water for 5 minutes.

h. Waste management – dispose of infectious waste as per national protocol.

    i. Cholera treatment centers should confirm with regulatory facilities that liquid waste including sewage is properly treated before disposal into rivers or sea.

    ii. If adequate treatment is not available, dedicated pits should be used.

    iii. Landfills should not be used for infectious waste – incinerate or autoclave.

4. Transmission-based precautions:

    a. All patients with cholera should be isolated under contact (enteric) precautions.

        i. If single bedrooms are not available, infected cases can be placed 2 meters or more away from other patients.

        ii. Whenever patients are isolated, attention should be paid to special populations e.g., the critically ill, newborns / children, pregnant women, breastfeeding mothers and patients requiring urgent surgeries.

    b. Enteric precautions imply that all healthcare workers and visitors should wear disposable gloves and single-use impermeable gowns when in contact with the patient, especially for incontinent or diapered patients.

        i. Isolation precautions can stop when symptoms abate.

        ii. Hand hygiene and sanitation are the most important components of enteric precautions.

    c. The isolation facility should have its own attached toilet / bathroom, handwashing facility, bins, isolation signs, alcohol sanitizer, donning and doffing areas and appropriate posters – see the national protocol on the layout of isolation facilities for details.

d. If an attached toilet is not available, use a bedpan / commode.

5. Safe food preparation and handling:
    a. During outbreaks, ensure that kitchen workers follow basic sanitation procedures and do not have diarrhea.
    b. Handwashing before preparing food and serving meals is mandatory.
    c. Only kitchen staff should have access to kitchen and food stocks, handle food and distribute meals.
    d. No flies should be seen in the kitchen.
    e. All food should be heated to at least 70°C and kept hot until eating; avoid reheating.
    f. Perishable foods should not be left at room temperature for more than two hours.
    g. Fruits and vegetables should be washed with safe water.
    h. No left-over food should be taken home by patients, caregivers or staff.
    i. Wash dishes in hot water with domestic gloves.
6. Handling of cholera corpses:
    a. Cholera can survive in dead bodies and spread in the environment.
    b. Avoid ritual washing whenever possible; use 2% chlorine to disinfect the corpse.
    c. Those preparing corpses should wear gloves and impermeable gowns.
    d. Plug all orifices with cloth soaked in a 2% chlorine solution.
    e. Corpses should be wrapped or placed in a non-porous bag with two disposable underpads (one placed under the head, the other under the buttocks) to absorb possible leaks through the mouth and anus.
    f. Ensure adequate handwashing after manipulation of corpses.
    g. Avoid serving food during ceremonies.
    h. If buried:
        i. Burial should take place within 24h.
        ii. The body should be buried at least 50 meters from a water source and at least 1.5 meters deep.
7. Vector control:
    a. If flies are noted within the hospital premises, spray insecticides.
8. Post-exposure prophylaxis:
    a. Other than vaccination, chemoprophylaxis with ciprofloxacin 250mg single dose or doxycycline 300mg single dose is rarely, if at all, indicated but may be considered during outbreaks in institutions like prisons or orphanages.

References

1. Harris JB, LaRocque R and Qadri F. Cholera: Treatment and prevention. UpToDate. 18 Jan 2024.
2. WASH Working Group. Technical Note: Water, Sanitation and Hygiene and Infection Prevention and Control in Cholera Treatment Structures. Global Task Force on Cholera Control. Jan 2019.
3. Department of Health, South Africa. Guidelines for Cholera Preparedness and Response Infection Prevention and Control Interventions. Accessed on 13 Feb 2024: https://www.health.fs.gov.za/wp-content/uploads/2023/05/Final-IPC-guidelines-For-Cholera-management-1.pdf
4. Reveiz L, Chapman E, Ramon-Pardo P, Koehlmoos TP, Cuervo LG, Aldighieri S, Chambliss A. Chemoprophylaxis in contacts of patients with cholera: systematic review and meta-analysis. PLoS One. 2011;6(11):e27060. doi: 10.1371/journal.pone.0027060.
5. String GM, Gutiérrez EV, Lantagne DS. Laboratory efficacy of surface disinfection using chlorine against Vibrio cholerae. J Water Health. 2020 Dec;18(6):1009-1019. doi: 10.2166/wh.2020.199.
6. US CDC. Infection Control for Cholera in Health Care Settings. 14 November 2022.
7. Médecins Sans Frontières. Infection prevention and control in a CTC. Accessed on 13 Feb 2024: https://medicalguidelines.msf.org/en/viewport/CHOL/english/7-5-infection-prevention-and-control-in-a-ctc-25297026.html#Section%207.5.3
8. Médecins Sans Frontières. Management of a Cholera Epidemic: Management of deaths. Accessed on 13 Feb 2024: https://medicalguidelines.msf.org/en/viewport/CHOL/english/7-8-management-of-deaths-25297056.html#section-target-3
9. Heymann DL et al. Control of Communicable Diseases Manual. 21st Edition, 2022.

Chapter 25: Marburg Virus Disease and Ebola Virus Disease

25.1 BACKGROUND

Following the principles of IPC diligently ensures the safety of both staff and patients. The risk of cross-contamination when taking care of highly contagious patients can be reduced to less than 1% when the fundamentals of IPC are adhered to.

However, infection control deficiencies like a lack of personal protective equipment (PPE) and environmental or engineering controls, inefficient triage, failure to recognize patients with Marburg Virus Disease (MVD) or Ebola Virus Disease (EVD), a shortage of human resources, nonfunctional isolation wards for suspected MVD / EVD cases, a lack of water and electricity, no proper waste disposal system, and inconsistent hand hygiene practices have been linked to a higher risk of healthcare worker infection.[10]

25.2 TRANSMISSION ROUTE

Person-to-person spread of MVD / EVD occurs through direct contact with blood or bodily fluids of an infected individual or contact with contaminated fomites or surfaces. Transmission can also occur from exposure to semen of men who have recovered from MVD / EVD.[1]

Typical ways to spread MVD / EVD include:[5]

- Contact with blood and body fluids (such as urine, feces, saliva, sweat, vomit, breast milk, amniotic fluid, semen, and vaginal fluids) of MVD / EVD cases.
- Contact with items that may have come in contact with an infected person's blood or body fluids (such as clothes, bedding, needles, and medical equipment).
- Funeral or burial practices that involve touching the body of someone who died from suspected or confirmed MVD / EVD.

The top three healthcare occupations that are most often cross-contaminated with filoviruses are nurses, doctors and laboratory personnel. During small outbreaks that were linked to imported cases, 50% or more of the infected individuals were healthcare workers. Moreover, healthcare workers can be up to 32 times more likely to get infected with filoviruses than the general population.[10]

In one study of household contacts who reported directly touching a case, the attack rate was 32%. Risk of disease transmission between household members without direct contact was low at 1%.[24]

Ebolavirus has been shown to survive up to 365 hours (more than 15 days) on nonporous surfaces in a low-humidity, 22-degree Celsius setting. Ebolavirus survival is significant in dried blood and has been shown for up to 16 days in a dried, organic substance on a nonporous surface. Live viruses can be recovered for 8 days in wastewater.[24]

25.3 STANDARD PRECAUTIONS

All the key steps related to standard precautions should be closely complied with, especially frequent hand hygiene. Soap and alcohol hand gel can both disrupt the lipid membrane of filoviruses and

interrupt transmission, though hand hygiene is no substitute for the correct use of PPE in suspect patients.[8] The use of no-touch thermometers is preferred over those that need to be in contact with the surface of the skin or with mucous membranes.

See Chapter 4 of this document for further details.

25.4 ADDITIONAL PRECAUTIONS

The transmission-based precautions that should be followed are advanced / enhanced / maximum contact precautions together with airborne precautions. More information on the type of PPE that should be worn is given below.

There is no data to suggest that EVD or MVD can be spread via the airborne route; however, recurrent vomiting, coughing or diarrhea may theoretically lead to aerosolized particles being suspended in the air. Moreover, WHO mentions that, in some cases, due to the desirability of an off-the-face design, and not for protection from aerosols, respirators may be selected for use instead of medical masks. Hence, whenever practical and feasible, it is proposed that respirators be worn in Mauritius, especially since EVD and MVD are not endemic in the country, and because they are highly lethal.

See Section 4.7 and Annex B of this document for more details on additional precautions.

25.5 TRIAGE

Use the “Identify, Isolate, and Inform” strategy to ensure individuals at risk for MVD / EVD are identified and isolated appropriately, and communication is expedited:[1]

- Identify patients by assessing the potential for exposure and by checking whether they meet the given case definition.
- Isolate patients who meet the case definition in a private (single occupancy) room with a dedicated bathroom or a covered, bedside commode.
- Inform the facility’s IPC staff and other involved health care personnel about the suspected case to determine next steps, such as arranging for testing.

Restrict the number of visitors and keep a log of people who enter the patient’s room.

If triage and screening cannot be performed at a distance of more than 1 meter with a no-touch technique, then full PPE should be worn while carrying out these activities.

25.6 ISOLATION

Suspected cases should be admitted in a separate ward from confirmed cases. All staff working in isolation areas should wear hospital scrubs.

The patient should be placed in a single room with a private bathroom or a covered, bedside commode. The door should be kept closed. Avoid aerosol-generating procedures (AGPs), if possible. Any necessary AGPs should be performed in a well-ventilated room fitted with an air purifier and an ultraviolet light disinfector (since negative pressure ventilation is currently not available in the public sector). Only essential personnel should be in the room during the procedure. Use negative pressure ventilation whenever it is available (e.g., in private clinics in Mauritius).[1]

Dedicated medical equipment (preferably disposable if possible) should be used for the provision of patient care. Restrict the use of needles and other sharps as much as possible. Phlebotomy, procedures, and laboratory testing should be limited to the minimum necessary for essential diagnostic evaluation and medical care.[6]

Each patient bay should have its own bins, hand washing station, paper towels, liquid soap, elbow operated taps and alcohol sanitizer. The mattress must be covered by a disposable plastic sheet or an impermeable mattress cover.

The layout of the isolation room or ward should be well designed e.g., staff should be well versed with the entry and exit points. Isolation areas should follow a unidirectional flow to encourage movement of personnel and equipment from "clean" to "dirty" zones and not vice -versa. Restrict all non-essential staff from patient care areas to reduce potential exposure to HCWs

Consultants to whom the patient is referred to should evaluate the patient in a timely manner – that the patient is infected with MVD / EVD and is isolated should not be an excuse to provide suboptimal care.

IPC support should be enhanced at the treatment center during an outbreak of EVD or MVD in the country.

Whenever feasible, individuals must not be mixed (or cohorted) together while awaiting laboratory confirmation.

One study determined that health workers have a high chance of breaking the chain of transmission if they isolate 75% of individuals who are infected with Ebola virus and in critical condition within four days of symptom onset.[24]

See Annex B in this document for additional details.

25.7 PERSONAL PROTECTIVE EQUIPMENT

Data is inadequate on the effectiveness of various types of PPE to prevent the spread of MVD / EVD.[12] However, since MVD / EVD is a high-consequence infectious disease, when in the same room as the patient, all staff are expected to wear:[1, 2]

- A disposable impermeable coverall or Hazmat suit that covers the head and shoulders;
- An N95, N99, FFP-2 or FFP-3 respirator (a mask fitness test is vital; powered air purifying respirators are currently not available in the country);
    - Most international recommendations prefer the use of facemasks and leave the use of respirators only for aerosol generating procedures – for maximum efficacy, it is proposed that respirators be used preferentially in Mauritius.
- A full-face shield (goggles alone are no longer recommended);
- Fluid-resistant shoe covers that extend to at least the mid-calf (if the coverall does not already protect the feet);
- 2 pairs of gloves with the outer gloves having extended cuffs; and
- An apron donned over the coverall that covers the torso to mid-calf.

Use dedicated crocs or rubber boots when getting inside the patient's room. These should be cleaned and disinfected at least once a day before being reused the next day.

All health and care workers who work in areas with patients who are suspected of having or confirmed to have Ebola or Marburg disease should wear medical scrubs (as opposed to personal clothing) and closed-toe shoes during their shift. Waterproof rubber boots are preferred in patient-care areas with suspect/confirmed Ebola disease or Marburg disease.

Different sizes of rubber boots should be available for health and care workers. Boots need not be removed when the healthcare worker leaves the PPE doffing area, provided they have been cleaned and disinfected. The same pair of boots can be worn throughout the working day or shift.

Steps for donning and doffing should be carefully followed by the healthcare worker – details can be found in videos online and in annexed posters.[3] All staff involved in the care of MVD / EVD patients must ensure they have received adequate training on donning and doffing of PPE.

Among exposed healthcare workers, 1% – 10% will develop MVD / EVD. The most common exposure risk situations are inadequate use of or lack of PPE and exposure to patients with unrecognized MVD / EVD. Touching the face to adjust the mask or goggles or face shield can lead to exposure to virus particles. Errors in donning and doffing are common and can occur in up to 97% of instances.[10]

PPE should be stockpiled well in advance to avoid shortages during emergencies. The donning and doffing stations should be equipped with all the necessary PPE, with sanitizer and with bins. Staff can consider showering after doffing their PPE.

PPE is not required during screening activities in health-care settings where a distance of at least 1 meter can be guaranteed and a no-touch approach is strictly followed.

Cleaners/hygienists and mortuary/burial workers should wear the same PPE recommended for other healthcare workers, with the exception that 1) the outer pair of gloves should be heavy duty (utility) gloves, 2) aprons should be heavy duty, and 3) their shoes should be waterproof boots. If the outer utility glove is to be reused, then a process for decontamination must be put in place. The outer glove should be disinfected (using soap and water and 70% alcohol-based hand rub) in between environments and tasks. However, when using soap and water, splashing can occur, and the method requires time for the hands to dry.

Healthcare workers with direct contact and/or indirect contact with patients with Ebola disease or Marburg disease should wear eye protection (goggles or a face shield) under the head-and-neck covering instead of over the head-and-neck covering.

Instructions/SOPs for health workers who have an exposure, including those with percutaneous or muco-cutaneous exposure to blood, body fluids, secretions, or excretions from a patient with suspected or confirmed Ebola disease or Marburg disease should be available including:

- immediately and safely stop any current tasks;
- wash the affected skin surface immediately with soap and water (before leaving patient care area);
- leave the patient care area, and safely remove PPE, then repeat washing the affected skin surface once doffing has been completed and occurs in a safer environment; and
- report the exposure to their immediate supervisor.

25.8 CLEANING AND DISINFECTION

Ensure all cleaning staff wear recommended PPE. No clutter or decoration is allowed in the patient's room. Routine cleaning of the PPE doffing area should be performed at least once per day and after the doffing of grossly contaminated PPE.[4]

Single use items should not be reused. Thermometers, stethoscopes, otoscopes and sphygmomanometers should be separate for each patient. To avoid contamination, patient files should be kept at the nursing station.[14]

70% alcohol and 0.5% hypochlorite[15, 18] can be utilized to disinfect surfaces. Accidental spilling of potentially contaminated material should be covered immediately for at least 30 min with an absorbent pad (or towel) saturated with 0.5% sodium hypochlorite and then cleaned with absorbent material impregnated with 0.5% sodium hypochlorite.[20]

Spraying humans and the environment with chlorine is a practice implemented in haemorrhagic fever epidemics such as past Ebola epidemics, but for which there is no evidence as a recognized outbreak control measure. In fact, it is documented that in the West Africa Ebola Virus Disease outbreak, deliberate exposure of humans to chlorine resulted in detrimental health effects, such as skin, respiratory and eye conditions. Other negative effects include creating a false sense of security after spraying exercises. Therefore, spraying and fumigation with hypochlorite solution is not recommended.[7]

For additional details, please see the Standard Operating Procedure on the Routine Environmental Cleaning of Healthcare Facilities and the national guidelines on Antimicrobial Spectra of Some of the Disinfectants Available on the Mauritian Market.

25.9 WASTE MANAGEMENT

All healthcare waste should be disposed of in leakproof yellow bags and should be sent for incineration. Do not compress or overfill waste containers. Before removal from the isolation room, the bag should be disinfected with 0.5% hypochlorite. All such bags should be labelled 'MVD' or 'EVD' and must be handled with care.[1, 4]

The healthcare facility's administration should confirm with the Ministry of Energy and Public Utilities that the sewage handling processes for liquid waste originating from the isolation ward can inactivate viruses. Otherwise, a separate septic tank may be required.

Transportation of contaminated material should be carried out with caution – staff charged with this task should wear appropriate PPE and should have received training on donning and doffing. All such materials should be properly packaged to avoid accidental exposure to viral particles. Safe transportation vehicles should be used.

The designated area for treatment and final disposal of the waste should have controlled access to avoid the entry of animals, untrained personnel, or children. A biohazard sign must be affixed and plainly visible.

Whenever feasible, do not store contaminated waste with EVD or MVD for more than 24h on site.

For additional details, see the Standard Operating Procedure on Color Coding for the Disposal of Healthcare Waste.

25.10 CONTACT TRACING

Healthcare workers who are exposed to MVD / EVD or who develop symptoms after seeing MVD / EVD patients should inform their supervisors and relevant authorities. Regular monitoring of such staff is imperative. Staff who have examined MVD / EVD patients without breaching any IPC principles are not considered to have been exposed to the virus, but temperature monitoring is still required.

Specific instructions can be given to individuals, according to their risk contact group, so that they understand the steps to follow clearly. However, even then, non-compliance rate to such instructions can be as high as 20%.[13]

HCW who have had an exposure to Ebolavirus or Marburgvirus should be excluded from work for 21 days.

25.11 LINEN MANAGEMENT

Soiled linen should be discarded in leakproof red bags. Before removal from the isolation room, the bag should be disinfected with 0.5% hypochlorite. Do not carry bins, linen or waste against the body. All such bags should be labelled 'MVD' or 'EVD' and must be handled with care.

Contaminated linen should preferably be incinerated. If not, then the following steps should be followed:

- If there is any solid excrement such as faeces or vomit, scrap it off carefully using a flat firm object and flush it down the sluice before the linen is placed in its container.
- At the linen facility, wash with detergent and hot water, rinse and then soak in 0.05% chlorine for about 30 minutes.[18] Linen that cannot be laundered in this manner should be incinerated.
- Of note, use of hot water is mandatory since 0.05% chlorine may not be sufficient to kill Ebolavirus.[24]

Heavily soiled linens resulting from care of patients with Ebola disease or Marburg disease in health-care facilities, treatment centers or community settings should be incinerated rather than disinfected/decontaminated.

25.12 STAFFING

Adequate staffing is important since up to 80% of infected healthcare workers report being overworked. Fatigue, stress and burn-out can be associated with worse IPC practices and hence, with an increased risk of getting infected.[10] A reasonable staffing model should be determined by the healthcare facility. Healthcare workers should not stay in full PPE for longer than 4 consecutive hours.[23]

25.13 LABORATORY BIOSAFETY

Since a biosafety level (BSL) 4 facility does not exist in Mauritius, virus isolation (culture) is not possible. RT-PCR and ELISA testing of inactivated samples can be performed at BSL-2 laboratory facilities. Inactivation should be carried out in a BSL-3 environment. The samples should only be opened within biosafety cabinets (class II if inactivated or class III if the sample has yet to be inactivated). Do not store biological samples without inactivating, under BSL-2 conditions.[19, 20]

If a centrifugation process is required, it should be done in equipment with closed buckets. The holders of the centrifuge (buckets) and rotors should be sterilized in an autoclave or by immersion in 1% glutaraldehyde (in a sealed container) during 10 min.[20]

Blood samples are taken only if absolutely necessary (by means of a closed system ideally) and then preferably analysed at point-of-care. If this is impossible, samples must be transported to the microbiological laboratory by a dedicated courier where they are subsequently inactivated in a biosafety level 3 laboratory by heat (1h at 60°C) or chaotropic salt (guanidine isothiocyanate) and next distributed to the relevant areas for testing.[11, 15] Of note, such heating can modify the results of enzyme tests (e.g., transaminases) and antibody levels.[20] All blood samples should be transported in biohazard plastic bags and in triple packaging boxes.[16]

The slides for thick blood films should be fixed in 10% buffered formalin during 15 min and subsequently washed (at least 3 times) with distilled water (pH 7.0) before carrying out the staining.[20]

Serum samples for ELISA based determinations can be inactivated with final concentrations of 0.2% of sodium dodecyl sulphate / 0.1% Tween 20 and heat treatment at 60°C for 15 min.[20]

Lab technicians must be alerted beforehand to the nature of the specimens and should be supervised to ensure appropriate isolation measures are taken. Full PPE should be worn.[15]

Thorough terminal disinfection of surfaces with 0.5% hypochlorite solution is adequate; fumigation of the laboratory area with formaldehyde can be considered under certain circumstances.[15]

25.14 PREGNANCY[8, 9, 17]

Amniotic fluid, placenta, blood and aborted fetuses are highly infectious and likely remain high-risk for viral transmission even after the mother has recovered. Full PPE must be worn during obstetric procedures.

Filovirus can be found in semen for several weeks after convalescence, and for this reason abstinence from sex, including oral sex, is recommended for at least three months. Safe sex is recommended for male survivors of MVD / EVD from the 4th month till 12th month after the onset of symptoms. Condoms should be handled with gloves.

Convalescent mothers should avoid breast-feeding for a minimum of 30 days since the virus has been detected in breast milk up to 15 days after infection.

25.15 DISPOSAL OF HUMAN REMAINS

Human remains should be handled as little as possible, and autopsies should be avoided.[8] However, a skin or other superficial sample for postmortem confirmation of the case can be taken and immediately fixed in 10% buffered formalin (or 2.5% glutaraldehyde), with enough time that makes it possible to completely penetrate the sample. This sample can be later used for molecular detection at the laboratory.[20]

If the patient dies, the body should be sealed in a mortuary sack which is sprayed with 0.5-1% bleach. The body in the mortuary sack should be sealed in a second mortuary sack, also sprayed with 0.5-1% bleach and laid to rest in a sealed casket. All personnel who handle the corpse must wear full PPE.[11, 14, 15, 19, 21]

Natural orifices should be plugged. Cremation is preferred but if not possible, bury the corpse as soon as possible, in a dedicated graveyard (if available), and with the help of a trained burial team. Access to the graveyard should be restricted. The grave should be at least 2 meters deep.

Every family deserves a safe and dignified burial. Respect as much as possible religious or cultural beliefs to avoid unnecessary conflicts with affected families.[15] Even though family members should avoid contact with the body, to facilitate the grieving process, family members are allowed to get involved if they wish to. After proper counselling, the following is permitted:[21]

- Prayers, orations or reading of scriptures before closing the body bag from within a side room;
- Carrying the cleaned coffin;
- Witnessing burial activities;
- Taking pictures;
- Viewing the body from a different room through a window;
- Having a priest offer spiritual consolation;
- Throwing the first soil on the grave; and
- Placing religious symbols at or inside the grave.

While family members are not allowed in the same room as the deceased person, the burial team can help with sprinkling water over the body and with placing a written scripture verse on the body. While touching the coffin, relatives are required to wear PPE.[21]

Do not wash or clean the body and do not embalm the body.[22]

After the body leaves the room, the contaminated room should be cleaned and disinfected with 0.5% chlorine. Once the family grants permission, discard items that cannot be cleaned e.g., soiled mattresses.[21]

The vehicle should be disinfected after transporting the hearse by personnel in full PPE. The grave site should also be disinfected.

References

1. National Emerging Special Pathogens Training and Education Center. Infection Prevention and Control Measures for Marburg Virus Disease. March 3, 2023.
2. Medscape. WHO Guidance on PPE for Ebola Stresses Individual Choice. Nov 03, 2014.
3. LTH Blended Learning. Ebola PPE Doffing. April 20, 2015. Accessed on 29 April 2023. https://www.youtube.com/watch?v=S6XtQK5TCl8
4. USA Centers for Disease Control and Prevention. Interim Guidance for Environmental Infection Control in Hospitals for Ebola Virus. October 20, 2022.
5. USA Centers for Disease Control and Prevention. Marburg (Marburg Virus Disease): Prevention. April 19, 2023.
6. USA Centers for Disease Control and Prevention. Infection Prevention and Control Recommendations for Hospitalized Patients Under Investigation (PUIs) for Ebola Virus Disease (EVD) in U.S. Hospitals. January 12, 2023.
7. International Federation of Red Cross and Red Crescent Societies. Marburg Virus Disease (MVD). 14 June 2022.

8. Bebell LM, Riley LE. Ebola virus disease and Marburg disease in pregnancy: a review and management considerations for filovirus infection. Obstet Gynecol. 2015 Jun;125(6):1293-1298.
9. Mohapatra RK, Sarangi AK, Kandi V et al. Recent re-emergence of Marburg virus disease in an African country Ghana after Guinea amid the ongoing COVID-19 pandemic: Another global threat? Current knowledge and strategies to tackle this highly deadly disease having feasible pandemic potential. Int J Surg. 2022 Oct;106:106863.
10. Selvaraj SA, Lee KE, Harrell M, Ivanov I, Allegranzi B. Infection Rates and Risk Factors for Infection Among Health Workers During Ebola and Marburg Virus Outbreaks: A Systematic Review. J Infect Dis. 2018 Nov 22;218(suppl_5):S679-S689.
11. Bauer MP, Timen A, Vossen ACTM, van Dissel JT. Marburg haemorrhagic fever in returning travellers: an overview aimed at clinicians. Clin Microbiol Infect. 2019 Apr;21S:e28-e31.
12. Hersi M, Stevens A, Quach P et al. Effectiveness of Personal Protective Equipment for Healthcare Workers Caring for Patients with Filovirus Disease: A Rapid Review. PLoS One. 2015 Oct 9;10(10):e0140290.
13. Timen A, Isken LD, Willemse P et al. Retrospective evaluation of control measures for contacts of patient with Marburg hemorrhagic fever. Emerg Infect Dis. 2012 Jul;18(7):1107-14.
14. Colebunders R, Sleurs H, Pirard P et al. Organisation of health care during an outbreak of Marburg haemorrhagic fever in the Democratic Republic of Congo, 1999. J Infect. 2004 May;48(4):347-53.
15. Heymann DL. Control of Communicable Diseases Manual. American Public Health Association. 21st edition, 2022.
16. World Health Organization. Marburg Virus Disease: Operational Support & Logistics Disease Commodity Packages. 21 Sep 2018.
17. World Health Organization. Marburg Virus Disease: Factsheet. 20 October 2017.
18. United Nations. Marburg Virus Disease (MVD) Risk Mitigation Plan for UN Personnel. August 2021.
19. European Centre for Disease Prevention and Control. Factsheet about Marburg virus disease. 3 April 2023.
20. World Health Organization. General procedures for inactivation of potentially infectious samples with Ebola virus and other highly pathogenic viral agents.
21. World Health Organization. How to conduct safe and dignified burial of a patient who has died from suspected or confirmed Ebola or Marburg virus disease. Oct 2017.
22. USA Centers for Disease Control and Prevention. Guidance for Safe Handling of Human Remains of Ebola Patients in U. S. Hospitals and Mortuaries. 20 Oct 2022.
23. Tuchmayer R. Hospital Ebola and Other Emerging Infectious Disease Preparations: Perspectives from the Region IX Ebola Treatment Center.
24. Infection prevention and control guideline for Ebola and Marburg disease, August 2023. Geneva: World Health Organization; 2023 (WHO/WPE/CRS/HCR/2023.1). L

Chapter 26: Bundles of Care for Specific HAI

26.1 INTRODUCTION

Care bundles in infection prevention and safety are simple sets of evidence-based practices that, when implemented collectively, improve the reliability of their delivery and improve patient outcomes. A number of specific bundles are available that can be implemented at healthcare facilities. These packages of care contribute to infection prevention, reduce unnecessary antibiotic prescribing, limit the development of antibiotic resistance and have been shown to decrease the incidence of HAI.

26.2 HOSPITAL-ACQUIRED PNEUMONIA (HAP)

HAP occurs when pneumonia is diagnosed 48 hours or more after admission but is not believed to have been incubating at the point of admission. HAP can include ventilator-associated pneumonia, which is discussed in the next section, and aspiration pneumonia, but it can also be due to other pathogens acquired in the hospital from co-workers or patients (e.g., influenza, SARS-CoV-2, etc.).

Risk factors for HAP include severe underlying illness, old age, chronic obstructive pulmonary disease, multiple traumas, diabetes mellitus, malignancy, immunosuppression, stroke, smoking, colonization of the oropharynx with pathogenic organisms, mechanical ventilation, admission to an ICU and long duration of hospital stay.

26.2.1 Bundle of care for the prevention of HAP

1. Address modifiable risk factors if any.
2. All HCW should follow hand hygiene before interacting with patients.
3. Administer appropriate vaccines for prevention (but not in acute phase of illness) where indicated e.g., influenza, pneumococcal and COVID-19 vaccines.
4. Patients who are at risk of developing aspiration pneumonia (e.g., after a stroke), should be assessed by a swallow therapist and requested to eat food with the right consistency (e.g., pureed food).
5. Patients should be held upright while they are eating to reduce the risk of aspiration.
6. If swallowing capacity is severely dysfunctional, non-oral feeding should be encouraged.
7. A swallowing program may help reduce the risk of aspiration among patients with dysphagia.
8. Regular chest physiotherapy can help to remove excess secretions in the airway.
9. Good dental and oral care (especially with brushing) is important.
10. Prompt mobilization of in-patients reduce the risk of HAP.
11. Excessive use of acid-suppressive therapy may be associated with HAP and should be avoided if possible.

26.2.2 International recommendations

The following two tables describe simple strategies to prevent HAP.

Coughing and deep breathing exercises with incentive spirometer every 4 hours while awake
Twice or thrice daily oral hygiene by brushing with toothpaste (evidence for use of chlorhexidine is weaker)
Early progressive ambulation with good pain control
Head-of-bed elevation to at least 30o and sitting up for all meals (‘up to eat’)
Up in chair 3 times daily; out of bed to chair early after surgery; walk at least once a day if possible (or else use assistance to walk)
Proper PEG tube care

Table 61: Strategies to prevent non-ventilator associated pneumonia. Adapted from “Livesey A, Quarton S, Pittaway H et al. Practices to prevent non-ventilator hospital-acquired pneumonia: a narrative review. J Hosp Infect. 2024 Sep;151:201-212. doi: 10.1016/j.jhin.2024.03.019”

Recommended in the appropriate clinical setting	Antibiotic therapy for 24h in comatose patients after emergency intubation
	No food for at least 8h and no clear liquids for at least 2h before elective surgery with general anesthesia
To be considered in the appropriate clinical setting	Swallowing evaluation after stroke and after extubation from mechanical ventilation
	Preference for angiotensin-converting–enzyme inhibitors for blood-pressure control after stroke
	Oral care with brushing and removal of poorly maintained teeth
	Feeding in a semi-recumbent position for patients with stroke
Not yet recommended; more data needed	Swallowing exercises for patients with dysphagia after stroke
	Oral chlorhexidine in patients at risk for aspiration

Table 62: Strategies to prevent aspiration pneumonia. ACEI may reduce cough by promoting cough. Taken from “Mandell LA, Niederman MS. Aspiration Pneumonia. N Engl J Med. 2019 Feb 14;380(7):651-663. doi: 10.1056/NEJMra1714562.”

26.3 VENTILATOR-ASSOCIATED PNEUMONIA (VAP)

VAP is a subset of HAP that can occur 48 hours after intubation. The risk factors are similar to those for HAP but also include airway respiratory distress syndrome, head trauma and the use of acid-suppressing medications.

26.3.1 Bundle of care for the prevention of VAP

1. Minimize the use of proton pump inhibitors due to their association with pneumonia.
2. Avoid mechanical ventilation if not essential for the patient. Non-invasive ventilation or high-flow oxygen therapy are preferred.
3. Intubation and tracheostomy tube insertion should only be undertaken by persons trained and competent in the technique.
4. Strict hand hygiene and wearing of appropriate PPE prior to endotracheal or tracheostomy tube insertion or manipulation should be observed.

5. Keep the duration of mechanical ventilation as short as possible – assess the patient daily for sedation, weaning and extubation. Sedation vacations and spontaneous breathing trials should be used regularly to evaluate intubated patients.
6. Use a new ventilator circuit tubing for each patient and change it if it appears contaminated.
7. Elevate the head of the bed, preferably to 45°, where possible.
8. Suction the patient when changing position (especially before lying flat).
9. Minimize sedation to attain a target RASS (Richmond Agitation Sedation Scale) score of 0 to -1 (alert and calm to drowsy).
10. Maintain good oral hygiene. Use of chlorhexidine is no longer recommended in ventilated patients but toothbrushing, mouth moisturization, and lip moisturization two to six times a day are important.

26.3.2 International recommendations

The following three tables summarize international recommendations on the bundle of care to prevent VAP in adults, neonates and pediatric patients.

Category	Rationale	Intervention	Quality of Evidence
Essential practices	Good evidence that the intervention decreases the average duration of mechanical ventilation, length of stay, mortality, and/or costs. Benefits likely outweigh risks.	Avoid intubation and prevent reintubation Use high-flow nasal oxygen or noninvasive positive pressure ventilation (NIPPV) as appropriate whenever safe and feasible	HIGH
		Minimize sedation Avoid benzodiazepines in favor of other agents Use a protocol to minimize sedation Implement a ventilator liberation protocol	MODERATE
		Maintain and improve physical conditioning	MODERATE
		Elevate the head of the bed to 30–45°	LOW
		Provide oral care with toothbrushing but without chlorhexidine	MODERATE
		Provide early enteral vs. parenteral nutrition	HIGH
		Change the ventilator circuit only if visibly soiled or malfunctioning (or per manufacturers' instructions)	HIGH
Additional approaches	Good evidence that the intervention improves outcomes in some populations, but may confer some risk in others.	Use selective oral or digestive decontamination in countries and ICUs with low prevalence of antibiotic-resistant organisms	HIGH

	May lower VAP rates but insufficient data to determine impact on duration of mechanical ventilation, length of stay, or mortality.	Utilize endotracheal tubes with subglottic secretion drainage ports for patients expected to require >48–72 hours of mechanical ventilation	MODERATE
		Consider early tracheostomy	MODERATE
		Consider post-pyloric rather than gastric feeding for patients with gastric intolerance or at high risk for aspiration	MODERATE
Generally not recommended	Inconsistently associated with lower VAP rates and no impact or negative impact on duration of mechanical ventilation, length of stay, or mortality.	Oral care with chlorhexidine	MODERATE
		Probiotics	MODERATE
		Ultrathin polyurethane endotracheal tube cuffs	MODERATE
		Tapered endotracheal tube cuffs	MODERATE
		Automated control of endotracheal tube cuff pressure	MODERATE
		Frequent cuff-pressure monitoring	MODERATE
		Silver-coated endotracheal tubes	MODERATE
		Kinetic beds	MODERATE
		Prone positioning	MODERATE
		Chlorhexidine bathing	MODERATE
	No impact on VAP rates, average duration of mechanical ventilation, length of stay, or mortality.	Stress-ulcer prophylaxis	MODERATE
		Monitoring residual gastric volumes	MODERATE
		Early parenteral nutrition	MODERATE
No recommendation	No impact on VAP rates or other patient outcomes, unclear impact on costs.	Closed endotracheal suctioning systems	MODERATE

Table 63: Summary of Recommendations to Prevent VAP in Adult Patients. Taken from "Klompas M, Branson R, Cawcutt K, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infection Control & Hospital Epidemiology. 2022;43(6):687-713. doi:10.1017/ice.2022.88".

Category	Rationale	Intervention	Quality of Evidence
Essential practices	May lower VAP and/or PedVAE rates and have minimal risks of harm. Benefits likely outweigh potential risks.	Use non-invasive positive pressure ventilation in selected populations	HIGH
		Minimize the duration of mechanical ventilation	HIGH
		Use caffeine therapy to facilitate extubation	HIGH
		Assess readiness to extubate daily	LOW
		Manage patients without sedation whenever possible	LOW
		Avoid unplanned extubations and reintubations	LOW

		Avoid reintubation by using nasal CPAP, non-invasive positive pressure ventilation (NIPPV), or high flow nasal cannula in the post-extubation period	HIGH
		Provide regular oral care with sterile water	LOW
		Change the ventilator circuit only if visibly soiled or malfunctioning (or per manufacturer's instructions)	LOW
Additional approaches	Unknown impact on VAP and VAE rates but risk of harm likely minimal. Reasonable to consider implementing if rates remain elevated despite essential practices.	Lateral recumbent positioning	LOW
		Reverse Trendelenberg positioning	LOW
		Closed/in-line suctioning systems	LOW
		Oral care with maternal colostrum	MODERATE
Generally not recommended	Unknown impact on VAP rates and inadequate data on risks.	Regular oral care with an antiseptic or Biotene	LOW
	May be harmful. Risk-benefit balance does not favor intervention, unless specifically indicated for reasons other than VAP prevention.	Histamine-2 receptor antagonists	MODERATE
		Prophylactic broad-spectrum antibiotics	MODERATE
		Daily spontaneous breathing trials	LOW
		Daily sedative interruptions	LOW
		Prophylactic probiotics or synbiotics	LOW
	Not recommended because appropriate products are not available or approved for use in this population.	Endotracheal tubes with subglottic secretion drainage ports	NA
		Silver-coated endotracheal tubes	NA

Table 64: Summary of Recommendations to Prevent VAP in Preterm Neonates. Taken from "Klompas M, Branson R, Cawcutt K, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infection Control & Hospital Epidemiology. 2022;43(6):687-713. doi:10.1017/ice.2022.88".

Category	Rationale	Intervention	Quality of Evidence
Essential practices	Interventions with minimal risk of harm and some data that they may lower VAP rates, PedVAE rates, and/or duration of mechanical ventilation.	Avoid intubation if possible. Use non-invasive positive pressure ventilation for selected populations	MODERATE
		Assess readiness to extubate daily in patients without contraindications	MODERATE
		Take steps to minimize unplanned extubations and reintubations	LOW
		Avoid fluid overload	MODERATE
		Provide regular oral care (i.e., toothbrushing or gauze if no teeth)	LOW
		Elevate the head of the bed unless medically contraindicated	LOW
		Change ventilator circuits only if visibly soiled or malfunctioning (or per manufacturer's instructions)	MODERATE

		Prevent condensate from reaching the patient	LOW
		Use cuffed endotracheal tubes	LOW
		Maintain cuff pressure and volume at the minimal exclusive settings	LOW
		Suction oral secretions before each position change	LOW
Additional approaches	Risk of harm likely minimal with some evidence of benefit in adult patients, but data in pediatric populations are limited. Reasonable to consider implementing if rates remain elevated despite essential practices.	Interrupt sedation daily	MODERATE
		Utilize endotracheal tubes with subglottic secretion drainage ports for older pediatric patients expected to require >48 or 72 hours of mechanical ventilation	LOW
		Consider early tracheostomy	LOW
Generally not recommended	Unknown impact on VAP rates and inadequate data on risks.	Prolonged systemic antimicrobial therapy for ventilator-associated tracheitis	LOW
		Selective oropharyngeal or digestive decontamination	LOW
		Prophylactic probiotics	LOW
	No impact on VAP rates	Oral care with antiseptics such as chlorhexidine	MODERATE
		Stress-ulcer prophylaxis	LOW
	Lowers VAP rates in adults but no impact on duration of mechanical ventilation, length of stay, or mortality.	Silver-coated endotracheal tubes	LOW
No recommendation	Limited data on pediatric patients, no impact on VAP rates or outcomes in adults, unclear impact on costs	Closed or in-line suctioning	LOW

Table 65: Summary of Recommendations to Prevent VAP in Pediatric Patients. Taken from "Klompas M, Branson R, Cawcutt K, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infection Control & Hospital Epidemiology. 2022;43(6):687-713. doi:10.1017/ice.2022.88".

26.4 CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

Catheter-Associated Urinary Tract Infections (CAUTIs) are urinary tract infections resulting from indwelling urinary catheters and are among the most common types of hospital-acquired infections.

Risk factors include the unnecessary catheterization of patients, a longer duration of catheterization, female gender, old age, immunosuppression and the presence of diabetes mellitus.

Common organisms causing CAUTI are *Escherichia coli, Klebsiella* spp., *Proteus* spp. and *Enterococci* spp.

26.4.1 Bundle of care for the prevention of CAUTI

1. Insert catheters only for clinically appropriate indications e.g., intubated patients and patients undergoing anesthesia. Routine insertion for "comfort" is not recommended. Clearly document the indication (e.g., urinary retention) for the catheter insertion. Consider intermittent catheterization for patients who are unwilling to cooperate with urine collection.
2. Insert catheters using aseptic technique – gloves should be worn and hand hygiene must be practiced before catheter insertion.
3. Lubricate the catheter with a sterile lubricant before insertion.
4. Ensure the catheter is secured to the patient.
5. Always keep the urine drainage bag below the level of the bladder.
6. Do not allow the urine drainage bag to contact the floor.
7. Catheters and the drainage system should only be handled using aseptic technique.
8. Maintain a closed drainage system and unobstructed urine flow i.e., no kinking, no backflow, and the drainage bag should not be left more than ¾ full at any time.
9. Sampling ports should be used to collect urine samples if needed.
10. Ensure that the insertion site and peri-urethral region is checked and washed daily.
11. Leave the catheters in place only for as long as needed, reviewing at least daily the need to keep the catheter.

26.4.2 Indications for use of urinary catheters

Indications are as follows:

1. Inability to void e.g., from enlarged prostate, urethral strictures, pelvic organ prolapse, post-operative procedures, spinal cord injury or induced coma (e.g., when intubated in the ICU).
2. For palliative care in some instances, i.e., in end-stage disease.
3. Presence of stage III or IV pressure ulcers that are not healing because of continual urine leakage.
4. Instances where a caregiver is not present (usually in the home-care setting) to provide incontinence care.

The following are not considered good reasons to insert a urinary catheter but may be observed in Mauritius:

1. Being bed-ridden
2. Being admitted to the ICU but not in induced coma
3. For monitoring urine output or when the patient is on diuretics
4. Requests from patients or caregivers

Alternatives like diapers, condom catheters and intermittent catheterization may be safer in the above instances since CAUTIs carry a risk of death. Weighing patients regularly can give an accurate idea of the volume status of the patient but unfortunately beds in the public sector are often not accompanied by weighing scales.

26.4.3 International recommendations

Category	Details	Quality of Evidence
Infrastructure and resources	Perform a CAUTI risk assessment and implement an organization-wide program to identify and remove unnecessary catheters.	MODERATE
	Develop and implement institutional policy requiring periodic review of catheter necessity.	MODERATE
	Consider utilizing electronic or other types of reminders for catheter presence.	MODERATE
	Conduct daily review during rounds of all patients with urinary catheters.	MODERATE
	Provide appropriate infrastructure for preventing CAUTI.	LOW
	Ensure supplies for managing urinary issues are readily available.	LOW
	Provide and implement evidence-based protocols for the urinary catheter life cycle.	LOW
	Ensure only trained HCP insert urinary catheters and assess competency regularly.	LOW
	Ensure supplies for aseptic technique for catheter insertion are available.	LOW
	Implement a system for documenting catheter placement and removal.	LOW
	Perform surveillance for CAUTI if indicated.	LOW
	Standardize urine culturing by adapting an institutional protocol.	LOW
Education and Training	Educate HCP about CAUTI prevention, catheter insertion, management, and removal.	LOW
	Assess healthcare professional competency in catheter use and care.	LOW
	Educate HCP about urine-culture stewardship and provide indications for urine cultures.	LOW
	Provide training on appropriate collection of urine specimens.	LOW
	Train clinicians to consider other methods for bladder management.	LOW
	Share data in a timely fashion and report results to stakeholders.	LOW
Insertion of Indwelling Catheters	Insert urinary catheters only when necessary and leave in place only as long as needed.	MODERATE
	Consider other methods for bladder management when appropriate.	LOW
	Use appropriate technique for catheter insertion.	MODERATE
	Consider working in pairs to help perform patient positioning.	LOW
	Practice hand hygiene before and after catheter manipulation.	LOW
	Insert catheters following aseptic technique and using sterile equipment.	LOW
	Use sterile gloves, drape, and antiseptic solution for cleaning the urethral meatus.	LOW
	Use a catheter with the smallest feasible diameter to minimize urethral trauma.	LOW
Management of Indwelling Catheters	Properly secure indwelling catheters after insertion to prevent movement and urethral traction.	LOW
	Maintain a sterile, continuously closed drainage system.	LOW

	Replace the catheter and collecting system using aseptic technique when breaks in aseptic technique, disconnection, or leakage occur.	LOW
	For fresh urine examination, collect a small sample from the needleless sampling port with a sterile syringe/cannula adaptor after disinfecting with antiseptic.	LOW
	Facilitate timely transport of urine samples to the laboratory. If not feasible, refrigerate urine samples or use collection cups with preservatives. Obtain larger volumes for special analyses (e.g., 24-hour urine) aseptically from the drainage bag.	LOW
	Maintain unobstructed urine flow.	LOW
Approaches That Should Not Be Used	Routine use of antimicrobial/antiseptic impregnated catheters.	HIGH
	Breaking a closed system.	LOW
	Screening for asymptomatic bacteriuria in catheterized patients except in select populations (e.g., pregnant women, patients undergoing endoscopic urologic procedures with mucosal trauma).	HIGH
	Treatment of asymptomatic bacteriuria is ineffective (in most patients) for preventing CAUTI and increases antibiotic resistance.	MODERATE
	Catheter irrigation as a strategy to prevent infection.	LOW
	Do not perform continuous irrigation of the bladder with antimicrobials as a routine infection prevention measure.	LOW
	If continuous irrigation is used to prevent obstruction, maintain a closed system.	LOW

Table 66: Taken from "Patel PK, Advani SD, Kofman AD, Lo E, Maragakis LL, Pegues DA, Pettis AM, Saint S, Trautner B, Yokoe DS, Meddings J. Strategies to prevent catheter-associated urinary tract infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2023 Aug;44(8):1209-1231. doi: 10.1017/ice.2023.137."

26.5 CENTRAL LINE-ASSOCIATED BLOOD STREAM INFECTIONS

Central Line-Associated Blood Stream Infections (CLABSI) refers to a bloodstream infection caused by the introduction of pathogens into the bloodstream via a central line/hemodialysis line. Patients can experience tenderness, redness, swelling and purulent discharge at the insertion site.

Risk factors are extended hospitalization, prolonged placement of the line, heavy microbial colonization at the insertion site and microbial colonization of the cannula / catheter hub, usually secondary to contamination from hands during care interventions such as injections.

Common organisms causing CLABSI are *Staphylococcus aureus* and coagulase-negative Staphylococcus but sometimes, *Escherichia coli, Enterococcus* spp., *Klebsiella* spp., *Candida* spp., *Pseudomonas* spp. and *Acinetobacter* spp. may be the causative organism.

26.5.1 Bundle of care for the prevention of CLABSI

1. Insert lines only for appropriate indications e.g., if the patient is on inotropes or peripheral venous access is not available or if urgent hemodialysis is required.
2. Clearly document the details of the insertion i.e., the person inserting the catheter, indication for insertion, location in the hospital, site of insertion and date and time of insertion.
3. Where available, ultrasound guidance should be used for insertion.
4. Femoral sites should be avoided as far as possible for central line insertion.

5. Strictly apply infection control precautions including hand hygiene and aseptic technique when inserting and maintaining lines.
6. Use appropriate skin preparation. Prefer chlorhexidine to iodine.
7. Use full barrier precautions during central line insertion including sterile drapes, gowns and gloves.
8. Ensure the catheter is secured before ending the procedure.
9. Change dressings every 48 hours, or if soiled.
10. Leave lines in place only for as long as needed, inspecting the site of insertion and reviewing the necessity of the line, at least daily. To facilitate inspection, transparent dressings are preferred. A nursing checklist helps to ensure that daily review of the line site has been performed.
11. Cleaning of the patient and environment should occur at least daily.
12. Central lines inserted during an emergency should be changed within 48 hours.
13. Information about central line insertion and care should be shared on transfer to another unit or ward.
14. When CLABSI is suspected, take blood cultures through the central line and seriously consider removing the central line and sending tip for culture if clinical situation allows. Thereafter, start empirical antibiotic therapy with adjustments as dictated by culture results.
15. Avoid inserting a central line as far as possible when blood cultures are positive for microorganisms.

26.5.2 Indications for inserting central lines

The following are adequate indications for the use of central venous lines:

1. Patients on certain medications like vasopressors, hyperosmolar agents, total parenteral nutrition, chemotherapy and thrombolytic therapy.
2. Need for hemodynamic monitoring, including central venous pressure.
3. Inadequate peripheral IV access
4. For specific procedures like dialysis, extracorporeal membranous oxygenation, inferior vena cava filter placement, transvenous cardiac pacing, and intra-venous stenting.
5. Mass transfusion of blood products.

To avoid CLABSIs, peripheral IVs should be used in most patients. Just because a patient is admitted to the ICU does not mean a central venous catheter should be inserted.

26.5.3 International recommendations

Category	Intervention	Quality of Evidence
Before insertion	Provide easy access to an evidence-based list of indications for CVC use to minimize unnecessary CVC placement.	LOW
	Require education and competency assessment of HCP involved in insertion,	MODERATE

	care, and maintenance of CVCs about CLABSI prevention.	
	Bathe ICU patients aged >2 months with a chlorhexidine preparation on a daily basis.	HIGH
At insertion	A facility should have a process in place (e.g., checklist) to ensure adherence to infection prevention practices at the time of CVC insertion in ICU and non-ICU settings.	MODERATE
	Perform hand hygiene prior to catheter insertion or manipulation.	MODERATE
	The subclavian site is preferred to reduce infectious complications when the catheter is placed in the ICU setting.	HIGH
	Use an all-inclusive catheter cart or kit.	MODERATE
	Use ultrasound guidance for catheter insertion.	HIGH
	Use maximum sterile barrier precautions during CVC insertion.	MODERATE
	Use an alcoholic chlorhexidine antiseptic for skin preparation.	HIGH
After insertion	Ensure appropriate nurse-to-patient ratio and limit use of float nurses in ICUs.	HIGH
	Use chlorhexidine-containing dressings for CVCs in patients over 2 months of age.	HIGH
	For non-tunneled CVCs in adults and children, change transparent dressings and perform site care with a chlorhexidine-based antiseptic at least every 7 days or immediately if the dressing is soiled, loose, or damp. Change gauze dressings every 2 days.	MODERATE
	Disinfect catheter hubs, needleless connectors, and injection ports before accessing the catheter.	MODERATE
	Remove nonessential catheters.	MODERATE
	Routine replacement of administration sets not used for blood, blood products, or lipid formulations can be performed at intervals up to 7 days.	HIGH
	Perform surveillance for CLABSI in ICU and non-ICU settings.	HIGH
Additional Approaches	Use antiseptic- or antimicrobial-impregnated CVCs	HIGH in adult patients and MODERATE in pediatric patients
	Use antimicrobial lock therapy for long-term CVCs	HIGH
	Use recombinant tissue plasminogen activating factor (rt-PA) once weekly after hemodialysis in patients undergoing hemodialysis through a CVC	HIGH
	Utilize infusion or vascular access teams for reducing CLABSI rates	LOW
	Use antimicrobial ointments for hemodialysis catheter insertion sites	HIGH
	Use an antiseptic-containing hub/connector cap/port protector to cover connectors	MODERATE
Approaches that Should Not Be Considered a Routine Part of CLABSI Prevention	Do not use antimicrobial prophylaxis for short-term or tunneled catheter insertion or while catheters are in situ	HIGH
	Do not routinely replace CVCs or arterial catheters	HIGH

Table 67: Taken from "Buetti N, Marschall J, Drees M, Fakih MG, Hadaway L, Maragakis LL, Monsees E, Novosad S, O'Grady NP, Rupp ME, Wolf J, Yokoe D, Mermel LA. Strategies to prevent central line-associated bloodstream infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2022 May;43(5):553-569. doi: 10.1017/ice.2022.87."

26.6 SURGICAL SITE INFECTIONS

Surgical Site Infections (SSI) refers to an infection that occurs in the region of the body where prior surgery has been performed. Patients may experience drainage of pus or unpleasant-smelling fluid from the wound; as well as localized swelling, redness, pain and tenderness to touch.

Risk factors include existing infection at the time of surgery, low serum albumin, old age, obesity, malnutrition, smoking, immunosuppression, diabetes mellitus, especially with poor glucose control, excessive alcohol consumption, intravenous drug use, chronic liver disease, chronic renal failure, ischemia secondary to vascular disease or radiation, large wounds, the presence of drains, prolonged surgery and incorrect post-operative wound care.

Of note, the main risk factor is the extent of contamination during the procedure i.e., clean, clean contaminated, contaminated or dirty surgeries.

SSI usually occurs within 30 days of the operative procedure. In some types of surgery, infection can appear even after 30 days of the operation. Since infection may occur late, all deep infections related to the operative site and to the implant within 1 year of an operation should be considered postoperative infections. SSI can be superficial, incisional, deep incisional or organ/space related.

The characteristics of a superficial SSI are drainage of pus from the superficial incision and pain, tenderness, localized swelling, redness or heat at the site of surgery.

On the other hand, diagnosis of a deep / organ space SSI may be made if there is spontaneous dehiscence of the wound, the patient has a fever greater than 38°C or there is evidence of abscess formation on radio-imaging.

Specimens for culture include pus, wound swabs, drainage fluid and exudate. Common organisms causing SSIs include *Staphylococcus aureus, Escherichia coli, Klebsiella* spp., *Enterococcus faecalis* and *Pseudomonas* spp.

26.6.1 Bundle of care for the prevention of SSI

1. Pre-operative:
    a. Diabetic patients should have good glucose control.
    b. Surgery should be delayed in malnourished patients.
    c. Obese patients should be advised to lose weight.
    d. Patients should stop smoking.
    e. Reduce intake of immunosuppressive drugs where possible.
    f. Shorten pre-operative hospital stay e.g., admit the patient on the day of surgery.
    g. Pre-operative antibiotic prophylaxis should be given in the correct manner i.e., a single dose of antibiotic 30 minutes to 60 minutes before incision (120 min is allowed for some antibiotics).
    h. Patients should shower before surgery.

i. Under some circumstances, *Staphylococcus aureus* nasal swab should be done on patients pre-operatively and if positive, they should be treated with mupirocin later.

j. Hair should not be removed but if removal is mandatory, hair should be clipped instead of shaved.

k. Mechanical bowel preparation should be used pre-operatively for colorectal surgeries.

2. Intra-operative:

a. Strict sterile technique should be observed. Details are provided in the relevant section of chapter 8.

b. Skin should be disinfected and allowed to dry before incision.

c. Patients should not be hypothermic nor hyperthermic during surgery.

- National Institute for Clinical Excellence (NICE) guidelines recommend temperature measurement at 1h before induction, every 30 min intraoperatively (for surgeries lasting more than 30 min), every 15 min in the post-anesthesia care unit, and every 4 h in the ward or every 30 min, if active warming is required in the ward.

d. Use triclosan-coated sutures when they are available.

e. SpO_2 must be kept above 94% intra-operatively.

3. Post-operative:

a. Ensure wound dressings are not interfered with in the first 24 to 48 hours after surgery unless there are signs of bleeding or early infection.

b. Blood glucose level should be well controlled during the postoperative period.

c. Dressing changes should be performed using the aseptic non-touch technique in a clean area. The four safeguards of this technique are: standard precautions, identification of key areas that must not be contaminated, not touching these areas during the procedure and not contaminating the field around the patient.

d. Post-op antibiotics for most surgeries should not be continued for more than 24 to 48 hours.

e. Negative pressure dressings should be used on high-risk surgical wounds.

The use of checklists e.g., the WHO Surgical Checklist, is highly recommended – they have been shown to help reduce SSI by reminding healthcare professionals, who are often busy, to follow the bundle of care stringently.

26.6.2 International recommendations

Category	Intervention	Quality of Evidence
Essential Practices	Administer antimicrobial prophylaxis according to evidence-based standards and guidelines.	HIGH
	Use a combination of parenteral and oral antimicrobial prophylaxis prior to elective colorectal surgery to reduce the risk of SSI.	HIGH
	Decolonize surgical patients with an anti-staphylococcal agent in the	HIGH

	preoperative setting for orthopedic and cardiothoracic procedures.	
	Decolonize surgical patients in other procedures at high risk of staphylococcal SSI, such as those involving prosthetic material.	LOW
	Use antiseptic-containing preoperative vaginal preparation agents for patients undergoing cesarean delivery or hysterectomy.	MODERATE
	Do not remove hair at the operative site unless the presence of hair will interfere with the surgical procedure.	MODERATE
	Use alcohol-containing preoperative skin preparatory agents in combination with an antiseptic.	HIGH
	For procedures not requiring hypothermia, maintain normothermia (temperature > 35.5°C) during the perioperative period.	HIGH
	Use impervious plastic wound protectors for gastrointestinal and biliary tract surgery.	HIGH
	Perform intraoperative antiseptic wound lavage.	MODERATE
	Control blood-glucose level during the immediate postoperative period for all patients.	HIGH
	Use a checklist and/or bundle to ensure compliance with best practices to improve surgical patient safety.	HIGH
	Perform surveillance for SSI.	MODERATE
	Increase the efficiency of surveillance by utilizing automated data.	MODERATE
	Provide ongoing SSI rate feedback to surgical and perioperative personnel and leadership.	MODERATE
	Measure and provide feedback to HCP regarding rates of compliance with process measures.	LOW
	Educate surgeons and perioperative personnel about SSI prevention measures.	LOW
	Educate patients and their families about SSI prevention as appropriate.	LOW
	Implement policies and practices to reduce the risk of SSI for patients that align with applicable evidence-based standards, rules and regulations, and medical device manufacturer instructions for use.	MODERATE
	Observe and review operating room personnel and the environment of care in the operating room and in central sterile reprocessing.	LOW
Additional Approaches	Perform an SSI risk assessment.	LOW
	Consider use of negative pressure dressings in patients who may benefit.	MODERATE
	Observe and review practices in the preoperative clinic, post-anesthesia care unit, surgical intensive care unit and/or surgical ward.	MODERATE
	Use antiseptic-impregnated sutures as a strategy to prevent SSI.	MODERATE
Approaches that Should Not Be Considered a Routine Part of SSI Prevention	Do not routinely use vancomycin for antimicrobial prophylaxis.	MODERATE
	Do not routinely delay surgery to provide parenteral nutrition.	HIGH
	Do not routinely use antiseptic drapes as a strategy to prevent SSI.	HIGH

Table 68: Taken from "Calderwood MS, Anderson DJ, Bratzler DW, Dellinger EP, Garcia-Houchins S, Maragakis LL, Nyquist AC, Perkins KM, Preas MA, Saiman L, Schaffzin JK, Schweizer M, Yokoe DS, Kaye KS. Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2023 May;44(5):695-720. doi: 10.1017/ice.2023.67."

26.7 BACTEREMIA ASSOCIATED WITH PRESSURE ULCERS (BAPU)

Decubitus ulcers occur when patients suffer from breakage of skin integrity in one or more locations, as a result of prolonged pressure on their skin in a context of relative immobilization, either during their hospitalization, or outside of a hospital setting, or both. Sites most commonly affected include the sacrum, heels, greater trochanters, elbows and neck. Such wounds often become infected and if left unaddressed, may cause deterioration with sepsis, osteomyelitis, septicemia and death, even after attempted chemical or surgical debridement and antimicrobial therapy.

Risk factors are as follows: long duration of stay, immobilization due to pathology (e.g., fractured neck of femur), treatment (e.g., intravenous lines connected to drip pole) or physical restraints, elderly age, urinary and fecal incontinence, poor hydration, poor nutrition, especially with low albumin level, peripheral neuropathy of any cause, diabetes mellitus with poor control of glucose level, low Glasgow Coma Score, inability to call for nursing attention, arterial or venous insufficiency, smoking and alcohol consumption.

26.7.1 Bundle of care for the prevention of BAPU

1. Conduct a survey of the patient's skin at the point of hospitalization and at least every day (usually done during showers / bed baths).
2. Document any pre-existing wound.
3. Grade any pressure ulcers found:
    a. Grade 1: Skin reddened but not broken;
    b. Grade 2: Epidermis broken;
    c. Grade 3: Dermis and/or soft tissues exposed; and
    d. Grade 4: Bone exposed.
4. Document key aspects of the wound like location, appearance, size, depth and any discharge from wound.
5. Arrange for swab for culture if wound discharge is observed.
6. Refer early to the appropriate team (e.g., orthopedics) for expert management on chemical / surgical debridement, wound and dressings care, pressure area care and choice and duration of antibiotic treatment needed if any.
7. Start empirical antibiotics if indicated and rationalize after swab results obtained.
8. Assess hydration and nutrition status and treat, correcting hypoproteinemia in particular.
9. Ensure good control of blood glucose level in diabetic patients.
10. Remove unnecessary lines to reduce restrictions of movement.
11. Avoid unnecessary limb restraints.
12. Refer early to physiotherapist to promote bed exercises and mobilization.

13. Ensure nursing staff is aware to change soiled incontinence pads as soon as possible after episodes of urinary or fecal incontinence.
14. Use pillows/ cushions/water gloves to elevate heels/affected areas/high-risk areas off bed.
15. Use anti-bedsore mattress (e.g., ripple mattress with alternating pressure mechanism).
16. Regularly reposition the patient (ideally every 30 min but at least every 2 hours).
17. Advise and support in quitting smoking and alcohol abuse.

26.7.2 International recommendations

Figure 46: Taken from "Yilmazer and Tuzer. Pressure Ulcer Prevention Care Bundle: A Cross-sectional, Content Validation Study. Wound Management and Prevention. April 2019. Accessible at: https://www.hmpgloballearningnetwork.com/site/wmp/article/pressure-ulcer-prevention-care-bundle-cross-sectional-content-validation-study"

26.8 PERIPHERAL LINE-ASSOCIATED BLOOD STREAM INFECTIONS (PLABSI)

Peripheral Line-Associated Blood Stream Infections (PLABSI) refers to a bloodstream infection caused by the introduction of pathogens into the bloodstream via a peripheral line. Patients can experience tenderness, redness, swelling and purulent discharge at the insertion site.

Risk factors include being elderly, poor catheter placement, catheter maintenance cycle, wrong insertion technique, immunosuppressed state, and sepsis prior to insertion.

26.8.1 Bundle of care for the prevention of PLABSI

1. Clearly document the details of the insertion (e.g., on the dressing) i.e., the person inserting the line, indication for insertion, location in the hospital, site of insertion and date and time of insertion.
2. Strictly apply infection control precautions including hand hygiene and aseptic technique when inserting and maintaining lines.
3. Use appropriate skin preparation e.g., chlorhexidine (2%) or alcohol (70%).
4. Wear gloves and aprons when inserting a cannula.
5. Leave lines in place only for as long as needed, inspecting the site of insertion and reviewing the necessity of the line, at least daily. To facilitate inspection, transparent dressings may be used whenever available – irrespective, dressings should remain clean. A nursing checklist helps to ensure that daily review of the line site has been performed.
6. Cleaning of the site of insertion, and of the patient and environment, should occur at least daily.
7. Cannula should be re-sited at 72 hours or before if high risk insertion or if clinically indicated.
8. When PLABSI is suspected, remove the line, and send blood cultures before starting empirical antibiotic therapy, rationalizing same after culture results.

26.8.2 Recommendations from the World Health Organization

It is noted that:

- WHO recommends that clinicians inserting a peripherally-inserted central catheter (PICC) or peripheral arterial catheter (PAC) use single-use sterile gloves compared to non-sterile gloves in adults, adolescents, children and neonates.
- WHO suggests the use of the distal arm veins over the proximal section of the upper limb (cubital fossa or above) for peripheral intravenous catheter (PIVC) insertion in adults, adolescents, children and neonates.

Recommendations and good practice statements	Type of catheter	Population	Type of statement	Certainty of evidence
General statements				
Education and training				
WHO recommends that all clinicians should be appropriately educated in the indications for intravascular catheter (PIVC, PICC, PAC) use, the proper procedures for their use, and the appropriate infection control measures to prevent catheter-related infections in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
WHO recommends that clinicians should be regularly assessed for their knowledge and adherence to guidelines related to appropriately managing intravascular catheters in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
Hand hygiene and aseptic no-touch technique				
WHO recommends that all clinicians should be appropriately trained in hand hygiene procedures in the context of the WHO multimodal improvement strategy for hand hygiene to prevent catheter-related infections in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
WHO recommends that hand hygiene should be performed at any time indicated according to the "Five moments" during catheter insertion, maintenance, access and removal practices, preferably using the WHO hand rub technique with alcohol-based hand rub products (allow hands to dry) or by hand washing with soap and water and using single-use or clean towels to dry hands.	PIVC, PICC, PAC	All	Good practice statement	NA
WHO recommends that all clinicians should be appropriately trained in the *aseptic no-touch* technique to prevent catheter-related infections in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
Insertion				
Sterile and aseptic no-touch insertion technique				
WHO recommends using a sterile technique for the insertion of a PICC and PAC in adults, adolescents, children and neonates.	PICC, PAC	All	Good practice statement	NA
WHO suggests using either a chlorhexidine-containing or a non-chlorhexidine-containing skin disinfectant before PIVC and PICC insertion in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Very low certainty evidence

Recommendations and good practice statements	Type of catheter	Population	Type of statement	Certainty of evidence
Skin disinfection preparations				
WHO recommends that adequate skin disinfection should always be used prior to the insertion of a PIVC, PICC and PAC in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
WHO suggests using either a chlorhexidine-containing or a non-chlorhexidine-containing skin disinfectant before PIVC and PICC insertion in adults, adolescents, children and neonates.	PIVC, PICC	All	Conditional recommendation	Very low certainty evidence
Formal training on catheter insertion				
WHO suggests that clinicians who insert intravascular catheters (PIVCs, PICCs, PACs) in adults, adolescents, children and neonates should undergo a formal training programme on catheter insertion.	PIVC, PICC, PAC	All	Conditional recommendation	Very low certainty evidence
Catheter insertion by a clinician wearing single-use gloves				
WHO recommends that clinicians inserting a PIVC or PICC in adults, adolescents or children, wear single-use gloves at the time of catheter insertion.	PIVC, PICC	Adults, adolescents, children	Good practice statement	NA
WHO suggests that clinicians who insert a PIVC or PICC in neonates either use single-use gloves or no gloves at the time of catheter insertion.	PIVC, PICC	Neonates	Conditional recommendation	Very low certainty evidence
Catheter insertion by a clinician wearing single-use sterile gloves				
WHO recommends that clinicians inserting a PICC or PAC use single-use sterile gloves compared to non-sterile gloves in adults, adolescents, children and neonates.	PICC, PAC	All	Good practice statement	NA
WHO suggests not using sterile gloves when inserting a PIVC in adults, adolescents, children and neonates, provided that the steps of the *aseptic no-touch* technique are carefully adhered to.	PIVC	All	Conditional recommendation	Very low certainty evidence
Catheter insertion using a standardized insertion pack/kit				
WHO recommends that clinicians use a standardized insertion pack/kit when inserting a PICC or PAC in adults, adolescents, children and neonates.	PICC, PAC	All	Good practice statement	NA
WHO suggests that clinicians who insert a PIVC use a standardized insertion pack/kit for catheter insertion in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Very low certainty evidence
Catheter insertion using ultrasound-guided assistance				
WHO suggests the use of ultrasound-guided assistance when inserting a PICC in adults, adolescents, children and neonates.	PICC	All	Conditional recommendation	Very low certainty evidence
WHO suggests not routinely using ultrasound-guided assistance when inserting a PIVC in adults, children, adolescents or neonates.	PIVC	All	Conditional recommendation	Very low certainty evidence

Recommendations and good practice statements	Type of catheter	Population	Type of statement	Certainty of evidence
Catheter insertion in the distal section of the upper limb (below the cubital fossa) compared to insertion in the proximal section of the upper limb (cubital fossa or above)				
WHO suggests the use of the distal arm veins over the proximal section of the upper limb (cubital fossa or above) for PIVC insertion in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Very low certainty evidence
Catheter insertion in the upper limb compared to insertion in the lower limb				
WHO suggests use of the upper limb over the lower limb for PIVC insertion in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Very low certainty evidence
WHO suggests use of the upper limb over the lower limb for PICC insertion in neonates.	PICC	Neonates	Conditional recommendation	Very low certainty evidence
Use of occlusive catheter dressings				
WHO suggests the use of either an occlusive dressing or a non-occlusive dressing for PIVCs in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Low certainty evidence
WHO suggests the use of an occlusive dressing for PICCs in adults, adolescents, children and neonates.	PICC	All	Conditional recommendation	Very low certainty evidence
PIVC insertion by an insertion team				
WHO suggests that PIVC insertion in adults, adolescents, children and neonates is performed by a clinician who is appropriately trained in PIVC insertion, but may not necessarily be part of a formal insertion team, compared to insertion by a formal insertion team.	PIVC	All	Conditional recommendation	Low certainty evidence
Use of local anaesthetic for insertion of a PIVC and PICC				
WHO suggests either using or not using local anaesthetic when inserting a PIVC or PICC in adolescents, children and neonates.	PIVC, PICC	Adolescents children and neonates	Conditional recommendation	Low certainty evidence
PIVC insertion in the scalp compared to catheter insertion in other sites in neonates				
WHO suggests that sites other than the scalp veins should generally be prioritized over scalp veins for insertion of a PIVC and PICC in neonates.	PIVC, PICC	Neonates	Conditional recommendation	Low certainty evidence
Maintenance				
Catheter maintenance using formal sterile dressing protocols				
WHO recommends that for all PIVCs, PICCs and PACS the insertion site should be maintained using a formal sterile dressing protocol in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
Catheter management with continuous intravenous (IV) fluid infusion				
WHO suggests that catheter management of PICCs and PIVCs be with either a schedule of continuous IV fluid infusion or no schedule of continuous IV fluid infusion (intermittent or no infusion) in adults, adolescents, children, and neonates	PICC, PIVC	All	Conditional recommendation	Low certainty of evidence

Recommendations and good practice statements	Type of catheter	Population	Type of statement	Certainty of evidence
Systematic sterile flushing after product administration				
WHO recommends that after product administration via a PIVC or PICC, the catheter should be flushed with a compatible sterile fluid (saline or other) in adults, adolescents, children and neonates.	PIVC, PICC	All	Good practice statement	NA
Saline compared to anticoagulant solutions in "lock-off" flushing of PIVCs and PICCs				
WHO suggests "lock-off" flushing using sterile saline over "lock-off" flushing using heparinized saline for PIVCs and PICCs in adults, adolescents, children, and neonates.	PIVC, PICC	All	Conditional recommendation	Very low certainty evidence
Catheter management with a schedule of regular changing of the administration (tubing/giving) set				
WHO suggests having a regular schedule of changing of administration (tubing/giving) sets for PIVC and PICC maintenance in adults, adolescents, children and neonates.	PICC, PIVC	All	Conditional recommendation	Low certainty of evidence
Access				
Catheter access using a formal sterile or aseptic protocol				
WHO recommends using a formal sterile or aseptic protocol to access PIVCs, PICCs and PACs in adults, adolescents, children and neonates.	PIVC, PICC, PAC	All	Good practice statement	NA
Catheter access using a closed-access hub system				
WHO suggests using either a closed-access hub system (for example, luer lock) or an open-access hub system to access PIVCs and PICCs in adults, adolescents, children and neonates.	PIVC, PICC	All	Conditional recommendation	Low certainty of evidence
Removal				
Catheter removal based on defined schedules				
WHO recommends inspecting PIVCs in adults, adolescents, children and neonates at least daily to assess for signs of inflammation and infection at the insertion site and vein to guide whether the catheter should be removed.	PIVC	All	Good practice statement	NA
WHO suggests either scheduled removal or clinically indicated removal of PIVCs in adults, adolescents, children, and neonates.	PIVC	All	Conditional recommendation	Moderate certainty evidence
Catheter removal/replacement within 24 hours if inserted under uncontrolled/emergency conditions				
WHO suggests the removal/replacement of PIVCs inserted in uncontrolled/emergency conditions as soon as possible in adults, adolescents, children and neonates.	PIVC	All	Conditional recommendation	Low certainty evidence
Catheter selection				
Use of single lumen PICCS compared to multi-lumen PICCS				
WHO suggests using single-lumen PICCs over using multi-lumen PICCs (unless there is a specific reason that requires multiple lumens) in adults, adolescents, children and neonates.	PICC	All	Conditional recommendation	Low certainty of evidence

Recommendations and good practice statements	Type of catheter	Population	Type of statement	Certainty of evidence
PICC versus midline vascular catheters				
WHO suggests the use of either a PICC or MVC in adults, adolescents and children requiring longer term intravenous access.	PICC, MVC	Adults, adolescents, children	Conditional recommendation	Very low certainty evidence

Table 69: Taken from "Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part I: peripheral catheters. Geneva: World Health Organization; 2024."

References

1. Australian Commission on Safety and Quality in Health Care. Selected best practices and suggestions for improvement for clinicians and health system managers; March 2018. Available from: https://www.safetyandquality.gov.au
2. SA Health. Your official portal to public health services, hospitals, health information and health careers in South Australia; Jan 2021. Available from: https://www.sahealth.sa.gov.au
3. Centres for Disease Control and Prevention, US; March 2016. Available from: https://www.cdc.gov/hai
4. Bindu, Barkha; Bindra, Ashish; Rath, Girija. Temperature management under general anesthesia: Compulsion or option. Journal of Anaesthesiology Clinical Pharmacology 33(3):p 306-316, Jul–Sep 2017. | DOI: 10.4103/joacp.JOACP_334_16
5. Livesey A, Quarton S, Pittaway H et al. Practices to prevent non-ventilator hospital-acquired pneumonia: a narrative review. J Hosp Infect. 2024 Sep;151:201-212. doi: 10.1016/j.jhin.2024.03.019
6. Mandell LA, Niederman MS. Aspiration Pneumonia. N Engl J Med. 2019 Feb 14;380(7):651-663. doi: 10.1056/NEJMra1714562.
7. Klompas M, Branson R, Cawcutt K, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infection Control & Hospital Epidemiology. 2022;43(6):687-713. doi:10.1017/ice.2022.88
8. Patel PK, Advani SD, Kofman AD, Lo E, Maragakis LL, Pegues DA, Pettis AM, Saint S, Trautner B, Yokoe DS, Meddings J. Strategies to prevent catheter-associated urinary tract infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2023 Aug;44(8):1209-1231. doi: 10.1017/ice.2023.137
9. Buetti N, Marschall J, Drees M, Fakih MG, Hadaway L, Maragakis LL, Monsees E, Novosad S, O'Grady NP, Rupp ME, Wolf J, Yokoe D, Mermel LA. Strategies to prevent central line-associated bloodstream infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2022 May;43(5):553-569. doi: 10.1017/ice.2022.87.
10. Calderwood MS, Anderson DJ, Bratzler DW, Dellinger EP, Garcia-Houchins S, Maragakis LL, Nyquist AC, Perkins KM, Preas MA, Saiman L, Schaffzin JK, Schweizer M, Yokoe DS, Kaye KS. Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2023 May;44(5):695-720. doi: 10.1017/ice.2023.67
11. Yilmazer and Tuzer. Pressure Ulcer Prevention Care Bundle: A Cross-sectional, Content Validation Study. Wound Management and Prevention. April 2019. Accessible at: https://www.hmpgloballearningnetwork.com/site/wmp/article/pressure-ulcer-prevention-care-bundle-cross-sectional-content-validation-study
12. Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part I: peripheral catheters. Geneva: World Health Organization; 2024.
13. Wei Li, Jing Cao, Yu-luo Du, Yan-di Wen, Wei-xiang Luo, Xue-yan Liu. Risk factors and prediction model construction for peripherally inserted central catheter-related infections, Heliyon, Volume 10, Issue 8, 2024, e29158, ISSN 2405-8440. https://doi.org/10.1016/j.heliyon.2024.e29158.

Annex A: Antibiogram for the Public Hospitals of Mauritius in 2022

Percentages represent susceptibility rates

For in-patients

	Ampicillin	Tetracycline	Oxacillin	Erythromycin	Vancomycin	Ciprofloxacin	Gentamicin	Amikacin	Piperacillin-tazobactam	Meropenem	Ceftriaxone
Escherichia coli	*20%*	*35%*				*41%*	*78%*	*95%*	*81%*	*91%*	*26%*
Klebsiella pneumoniae		*41%*				*33%*	*55%*	*72%*	*43%*	*63%*	*15%*
Acinetobacter spp.						*12%*	*22%*	*34%*	*18%*	*22%*	*3%*
Staphylococcus aureus	*4%*	*94%*	*60%*	*90%*	*100%*	*73%*					

For outpatients and emergency departments

	Tetracycline	Co-trimoxazole	Oxacillin	Co-amoxiclav	Ceftriaxone	Meropenem
Escherichia coli	*32%*	*56%*		*37%*	*29%*	*95%*
Klebsiella pneumoniae	*40%*	*56%*		*29%*	*28%*	*84%*
Staphylococcus aureus	*97%*	*97%*	*58%*			

For patients in ICUs

	Co-trimoxazole	Cefotaxime	Co-amoxiclav	Ciprofloxacin	Gentamicin	Amikacin	Piperacillin-tazobactam	Meropenem
Escherichia coli	*54%*	*44%*	*28%*	*45%*	*78%*	*94%*	*75%*	*84%*
Klebsiella pneumoniae	*26%*	*12%*	*10%*	*22%*	*36%*	*49%*	*23%*	*40%*
Acinetobacter spp.	*17%*	*2%*	*2%*	*11%*	*13%*	*20%*	*12%*	*13%*

All Escherichia coli, Klebsiella pneumoniae *and* Acinetobacter spp. *are considered non-susceptible to colistin since 2021. Caution should be exercised when interpreting antibiograms due to selection bias when ordering cultures and when testing for susceptibility to antibiotics.*

Reference: Dr. M. Issack. Samples were collected and analyzed at the Central Health Laboratory, Victoria Hospital, and at Dr. A. G. Jeetoo Hospital

Annex B: Guidelines on cases that need isolation

Pathogens or conditions	Type of isolation	Duration of isolation
Disseminated herpes zoster or chickenpox	Airborne + Simple Contact Precautions	Duration of illness
Extra-pulmonary tuberculosis with draining site	Airborne + Simple Contact Precautions	Discontinue precautions only when patient is improving clinically, and drainage has ceased or there are 3 consecutive negative cultures of continued drainage
Mpox	Airborne + Simple Contact Precautions	Discontinue precautions when the patient is afebrile and skin lesions have healed
Avian or swine influenza	Airborne Precautions; Enhanced Contact Precautions required for highly pathogenic forms	For the 7 days after illness onset or until 24 hours after the resolution of fever and respiratory symptoms, whichever is longer
Measles	Airborne Precautions	For 4 days after onset of rash
Pulmonary tuberculosis	Airborne Precautions	Discontinue precautions when 3 consecutive sputum smears are negative for acid-fast bacilli; in children, smears of gastric lavage are acceptable; patients who do not cough and who have received at least two weeks of appropriate treatment are also considered non-infectious and do not require isolation
Clostridium difficile infection	Contact Plus Precautions	Duration of illness
Major draining abscess or infected decubitus ulcer that is draining	Simple Contact Precautions	Until drainage stops or can be contained by dressing
Acute viral conjunctivitis or parainfluenza infection in children	Simple Contact Precautions	Duration of illness
Impetigo, lice or scabies	Simple Contact Precautions; patients to wear caps if head is affected	For 24h after initiation of effective therapy
High-priority multidrug resistant organisms: meticillin-resistant *Staphylococcus aureus*, *Candida auris*, carbapenem / colistin resistant *Enterobacteriaceae*[†] */ Pseudomonas spp. / Acinetobacter spp.*, vancomycin-resistant *Enterococcus spp.*	Simple Contact Precautions	Varies (until no longer colonized based on 2 consecutive swabs) – for duration of hospitalization or at least 6 months since last positive culture
Gastroenteritis including norovirus, giardiasis, salmonellosis, rotavirus and shigellosis	Simple Contact Precautions for diapered or incontinent patients or if an outbreak is occurring in the ward or if the patient recently travelled outside the country or if there is an ongoing epidemic of a non-endemic organism	Duration of illness
Cholera and typhoid fever	Simple Contact Precautions	Duration of illness

	(Enteric Precautions)	
Group A Streptococcus infection (pneumonia or draining skin lesions)	Droplet (+ Simple Contact Precautions if skin lesions present)	For 24h after initiation of effective therapy; household contacts may be alerted regarding symptoms; chemoprophylaxis can be considered for high-risk contacts; if outbreaks occur in hospitals, screen and treat healthcare workers
MERS; viral haemorrhagic fever including Ebola and Marburg; SARS	Airborne + Enhanced Contact Precautions	Duration of illness; may require negative viral PCR before removal from isolation (check policy of MOHW)
RSV, adenovirus pneumonia, SARS-CoV-2 and human metapneumovirus	Droplet + Simple Contact Precautions (+ Airborne Precautions during aerosol generating procedures)	Duration of illness; use of contact precautions for SARS-CoV-2 can depend on the activities being performed i.e., risk assessment is needed (see national SOPs for details)
Meningitis from *Haemophilus influenzae* B or *Neisseria meningitidis*, and epiglottitis or pneumonia due to *Haemophilus influenzae* B in children	Droplet Precautions	For 24h after initiation of effective therapy
Mumps	Droplet Precautions	Until 5 days after the onset of swelling
Mycoplasma pneumoniae	Droplet Precautions	Duration of illness
Parvovirus B19	Droplet Precautions	Varies (until PCR negative) – minimum of 7 days
Pertussis	Droplet Precautions	For 5 days after initiation of effective therapy
Rubella	Droplet Precautions	Until 7 days after onset of rash
Pneumonic plague	Airborne Precautions	For 2 days after initiation of effective therapy
Pandemic or seasonal influenza	Droplet Precautions (+ Airborne Precautions during aerosol generating procedures)	For the 7 days after illness onset or until 24 hours after the resolution of fever and respiratory symptoms, whichever is longer
Malaria, chikungunya, zika or dengue*	Mosquito control	Discontinue when aparasitemic or aviremic

*Table 70: Evidence for the types of isolation precautions can be found on the website for the Centers of Disease Control (CDC) of USA: Adapted from Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings; updated May 2019. Some recommendations are from the Society for Healthcare Epidemiology of America and the World Health Organization (WHO). † - Patients infected with organisms that are inherently resistant to colistin like Proteus sp., Serratia sp., Brucella sp., Burkholderia sp., Chryseobacterium sp., Elizabethkingia sp., Providencia sp., Moraxella sp. and Morganella sp., do not need to be isolated unless these organisms are also multi-drug resistant. * - Follow recommendations of the Ministry of Health and Wellness (MOHW) of Mauritius.*

Summary on the types of isolation precautions

Type of transmission-based precautions	Description
Contact Precautions	Place patient in a single room, wear gloves and fluid-resistant gowns within 1 meter of patient, limit transport of patient, use disposable equipment whenever possible and prioritize cleaning of frequently touched surfaces
Airborne Precautions	Place patient in a single room, negative pressure ventilation if available, close doors, use N95 / FFP2 respirator prior to entry, restrict entry of susceptible staff and limit transport of patient
Droplet Precautions	Place patient in a single room, wear mask upon entry and limit transport of patient

Protective Environment	Use an N95 / FFP2 respirator if he/she is leaving the room, air in the room must be HEPA filtered, ventilation rate needs to be ≥ 12 air exchanges per hour, positive pressure ventilation of > 2.5 kPa if available, self-closing doors should be installed and no fresh flowers, fresh fruits/vegetables, nor potted plants are allowed in the room
Mosquito Precautions	Patient should be under an insecticide-sprayed mosquito net, windows should have mosquito screens, doors should be closed, breeding sites on hospital grounds should be eliminated, use insect repellents in the room, patients, staff and visitors should wear protective clothing (e.g., long sleeves), nurses should verify daily that mosquitoes are absent and if present, insecticides should be applied; rooms should be well-screened or air conditioned to prevent mosquitoes from biting

Note:

1. MERS – Middle Eastern Respiratory Syndrome; SARS - Severe Acute Respiratory Syndrome; SARS-CoV-2 - Severe Acute Respiratory Syndrome Coronavirus 2; PCR – Polymerase Chain Reaction.
2. In all cases of isolation, standard precautions continue to apply. Use goggles or face shields when splashes affecting the eyes may occur.
3. For transmissible pathogens that are not mentioned in table 1, contact the Regional Public Health Superintendent for details of isolation if necessary. For most common infections that are not cited in the table, standard precaution is adequate.
4. For HIV positive patients, only standard precautions are necessary usually. Postexposure chemoprophylaxis may be needed for some blood exposures.
5. For *Clostridium difficile* infections, wash hands with soap and water instead of using alcohol (Contact Plus Precautions). Some authorities suggest using Contact Plus Precautions for norovirus infection also.
6. Advanced Contact Precautions include the use of caps, face shields / goggles and overshoes together with the usual Contact Precautions; a hazmat suit or powered air-purifying respirator may be worn. Check WHO guidelines regarding the need for boots and double gloving, and concerning how to don and doff these Personal Protective Equipment.
7. Negative pressure rooms should ideally be airlocked and have an anteroom (class Q isolation) e.g. for Ebola cases or for patients with multi-drug resistant tuberculosis.
8. Patients who are suspected to be infected with a transmissible pathogen e.g. tuberculosis, and who are undergoing confirmatory tests, should be isolated appropriately at least until the test result is received.
9. For severely immunosuppressed patients (data are mostly available for bone marrow transplant patients), Protection Environments are needed.
10. If single rooms are not available for isolation, cohort patients with similar illnesses together in groups of 2 or more.
11. If isolation rooms and cohort bays are not available, mention this in the patient's chart and let administration know.
12. On all isolation rooms, place a sign that describes the type of transmission-based precaution to be utilized. Additional items should be provided as needed e.g., sanitizer, bins and donning and doffing stations. See the national SOP on infrastructure for isolation rooms for details.
13. With regards to mosquito control, usual procedures to prevent infestation with mosquitoes should be continued in the hospital (removing stagnant water, spraying insecticide, etc.). Bed nets and insect repellents are to be used as per policy from the MOHW.
14. Droplet Precautions should be added to standard precautions when providing care to all patients with symptoms of acute respiratory infection as per guidelines from the WHO.

15. Airborne Precautions should generally be applied when performing aerosol-generating procedures on patients with suspected or confirmed communicable pulmonary infections (e.g. MERS, tuberculosis, viral pulmonary infections including influenza and SARS-CoV-2, measles and varicella) – such procedures include intubation, doing bronchoscopies, doing cardio-pulmonary resuscitation, carrying out autopsies, etc.

Annex C: Cleaning Protocol for Specific Infectious Organisms

Infecting organisms	Cleaning protocol of the surrounding environment
Multi-drug resistant organisms e.g., methicillin resistant *Staphylococcus aureus*, vancomycin resistant enterococci, carbapenem resistant *Enterobacteriaceae*, colistin resistant *Enterobacteriaceae*, *Candida auris,* carbapenem resistant *Acinetobacter baumannii* and multi-drug resistant *Pseudomonas sp.*	– Standard cleaning procedures apply – These organisms are susceptible to 0.5% chlorine, 70% ethanol and most quaternary ammonium compounds (except for fungi for which QAC have variable efficacy) – Clean the rooms of these patients last – Pay particular attention to high-touch surfaces and to surrounding areas close to the patient – Use disposable cleaning wipes whenever possible
Clostridioides difficile	– Standard cleaning procedures apply – This organism is susceptible to 0.5% chlorine – Contact time should be 10 minutes or more – Avoid ethanol and quaternary ammonium compounds since they are not sporicidal – Clean the rooms of these patients last – Pay particular attention to high-touch surfaces and to surrounding areas close to the patient
Clostridium perfringens (causing gas gangrene)	– Standard cleaning procedures apply; do not fumigate – Usual disinfectants can be utilized since patient to patient or environment to patient transmission is rare. However, ethanol and quaternary ammonium compounds are not sporicidal – hypochlorite is preferred
HIV	– Standard cleaning procedures apply; do not fumigate – This organism is susceptible to most disinfectants
Mycobacterium tuberculosis	– Standard cleaning procedures apply – Tuberculosis is very rarely transmitted via contact with the environment. Hence, usual disinfectants can be utilized – The following agents are tuberculocidal with a contact time ≤ 10 min provided no organic material surrounds the mycobacteria: 70% ethanol, 2% glutaraldehyde (undiluted), 1% povidone iodine and 1% hypochlorite – *M. tuberculosis* suspended in organic material (like sputum) requires a longer contact time (several hours) and/or greater disinfectant concentration to be effective – Alcohol may not provide the proper contact time due to its rapid rate of evaporation. Most quaternary ammonium compounds are not tuberculocidal – Close the room and ventilate the room till 99.9% of airborne pathogens are removed: this will take 24h, 12h, 3.5h, 2h, 1h or 0.5h if the air changes per hour (ACH) is 0.25, 0.5, 2, 4, 6 or 12 respectively – Extracted air should not recirculate throughout the hospital
SARS-CoV-2	– Standard cleaning procedures apply – This organism is susceptible to 0.1-0.5% chlorine – In case an aerosol-producing procedure was performed on the patient, close the room and ventilate the room till 99.9% of airborne pathogens

	are removed: this will take 24h, 12h, 3.5h, 2h, 1h or 0.5h if the air changes per hour (ACH) is 0.25, 0.5, 2, 4, 6 or 12 respectively. – Extracted air should not recirculate throughout the hospital

Fumigation is not indicated as part of the cleaning process. Resistance to antimicrobials is not a marker of resistance to disinfectants. Cleaning personnel should wear proper attire before entering the patient's room as specified by the hospital's isolation protocol. See national protocols on the disinfection of the environment contaminated with specific infections for more details.

Annex D: Cleaning Schedule

Ward / Location: _____

CLEANING SCHEDULE FOR WARDS

Tasks	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time	Date / Time
Daily Cleaning Tasks														
Floors including patient bays, kitchen, sluice, treatment room and store*														
High touch surfaces e.g., tray tables, bedside tables, bed rails, bed frames (contact points), door handles, light switches, chair arms, hand washing stations / sinks, desk phones, countertops, arm rests. Including at nursing station and treatment room.§														
Toilets, bathrooms and sluice including the sinks, taps and mirrors (for both patients and staff)†														
High-touch equipment e.g., bedside monitors, IV poles and flowmeters§														
Daily and after each use: ECG probes, BP cuffs, infusion pumps, pulse oximeters, nebulizers, urinary catheter stands, washbowls, medicine trolleys, dressing trolleys, resuscitation trolleys, wheelchairs, patient trolleys, commodes, bed pans, mops, buckets and dustpans														
After patient discharge: patients' beds, mattress covers, pillowcases, headboards, tray tables, bedside tables, chairs, cupboards, drawers and bed curtains (made of plastic)														
Scheduled Cleaning Tasks														
Weekly or if soiled: refrigerators, fans, wall-mounted oxygen and suction equipment														
Monthly or if soiled: cupboards, air conditioners, bed curtains (made of cloth)‡, curtain rails, under patient beds, mattresses and pillows														
Annually or if soiled: windows and exterior of air vents														
Signature and initials of Charge Nurse														

*Table 1: Check the "Standard Operating Procedure for the Routine Environmental Cleaning of Healthcare Facilities" and the National IPC Guidelines for details. * - at least once daily for areas with non-infectious patients; at least twice daily for areas with infectious patients or in ICUs. § - at least twice daily. † - at least twice daily for areas with en-suite bathrooms; at least three times daily for areas with shared bathrooms. ‡ - around infectious patients, bed curtains (even if made of cloth) should be cleaned after patient discharge; for non-infectious patients, cleaning can be monthly.*

Annex E: Core Components of IPC

Core components	Key principles
1. IPC programmes	• A functional IPC programme should be in place, including at least one full-time focal point trained in IPC and a dedicated budget for implementing IPC strategies/plans. • Trained IPC focal point (one full-time trained IPC Officer [nurse or doctor]) as per the recommended ratio of 1:250 beds with dedicated time to carry out IPC activities in all facilities.
2. IPC guidelines	• Evidence-based, ministry-approved guidelines adapted to the local context and reviewed at least every five years. • Evidence-based facility-adapted SOPs based on the national IPC guidelines. • Routine monitoring of the implementation of at least some of the IPC guidelines / SOPs.
3. IPC education and training	• National policy that all HCWs are trained in IPC (in-service training). • An approved IPC national curriculum aligned with national guidelines and endorsed by the appropriate body. • National system and schedule of monitoring and evaluation to check on the effectiveness of IPC training and education (at least annually).
4. HAI surveillance	• Establishment by the national IPC focal point of a technical group for HAI surveillance and IPC monitoring that is multidisciplinary. • Development of a national strategic plan for HAI surveillance (with a focus on priority infections based on the local context) and IPC monitoring.
5. Multimodal strategies	• Use of multimodal strategies to implement IPC interventions according to national guidelines / SOPs under the coordination of the national IPC focal point (or team, if existing).
6. Monitoring, auditing and feedback	• Develops recommendations for minimum indicators (for example, hand hygiene). • Develops an integrated system for the collection and analysis of data (for example, protocols, tools). • Provides training at the facility level to collect and analyze these data.
7. Workload, staffing and bed occupancy	• Bed occupancy should not exceed the standard capacity of the facility. • HCW staffing levels should be adequately assigned according to patient workload.
8. Built environment, materials and equipment for IPC	• Functional hand hygiene facilities should always be available at points of care / toilets and include soap, water and single-use towels (or if unavailable, clean reusable towels) or alcohol-based hand rub at points of care and soap, water and single-use towels (or if unavailable, clean reusable towels) within 5 meters of toilets. • Sufficient and appropriately labelled bins to allow for health care waste segregation should be available and used (less than 5 meters from point of generation); waste should be treated and disposed of safely via autoclaving, high temperature incineration, and / or buried in a lined, protected pit. • The facility layout should allow adequate natural or mechanical ventilation, decontamination of reusable medical devices, triage and space for temporary cohorting / isolation / physical separation if necessary. • Sufficient and appropriate IPC supplies and equipment (for example, mops, detergent, disinfectant, personal protective equipment and sterilization) should be available for performing all basic IPC measures. • The facility should have adequate single isolation rooms or at least one room for cohorting patients with similar pathogens or syndromes.

Adapted from "WHO. MINIMUM REQUIREMENTS for infection prevention and control programmes. 2019." IPC = Infection Prevention and Control; SOP = Standard Operating Procedure; HCW = Healthcare Worker; HAI = hospital-acquired infections.

Annex F: Min. IPC Requirements for Mauritius

S. No.	WHO Core Component	National Level	Facility Level
1	IPC PROGRAMME	One National Focal Point on IPC. Budgetary support for implementation of IPC measures	Regional / Tertiary hospital: At least one fulltime trained IPC focal point (nurse / doctor) across each regional / tertiary hospital PHC: Trained IPC link person, with dedicated (part-) time in each primary health care facility supported by RPHS
		Set up a national multidisciplinary IPC committee	Revive the regional multidisciplinary IPC committee
2	IPC GUIDELINES	Evidence-based, ministry-approved guidelines adapted to the local context and reviewed at least every five years.	SOPs based on the national IPC guidelines
3	IPC EDUCATIONS AND TRAINING	Set up a policy that all HCW should be trained in IPC. Monitor it.	Training and refresher courses for all front line clinical staff and cleaners on IPC guidelines and SOPs. Staff to receive additional training, regular CME on IPC and more training materials (videos, documents) through setting up of a network/platform.
4	HEALTHCARE ASSOCIATED INFECTION SURVEILLANCE	To be one of the agenda of the National IPC Committee to decide on priorities regarding HAI issues	Conduct active HAI and AMR surveillance based on national priorities and feedback to hospital authorities for action.
5	USE OF MULTIMODAL STRATEGIES	Use of multimodal strategies / action plan to implement IPC interventions according to national guidelines / SOPs	Use of multimodal strategies / action plan to implement IPC interventions according to national guidelines / SOPs
6	MONITORING, AUDITING AND FEEDBACK	To be one of the agenda of the National IPC Committee to decide on plan of action and monitoring indicators. This may include WHO IPC scorecard system (rapid) which may then be scaled up to the IPCAF tool (advanced).	National focal point to lead and co-ordinate with regional and PHC link person To implement the WHO IPC scorecard tool across all healthcare facilities
7	WORKLOAD, STAFFING AND BED OCCUPANCY	To undertake assessment of appropriate staffing levels, depending on the categories identified when using the WHO / national tools (national norms on patient / staff ratio), and development of an appropriate plan.	Set up a triage system and patient flow systems at PHC
8	BUILT ENVIRONMENT, MATERIALS AND EQUIPMENT FOR IPC		Functional hand hygiene facilities should always be available at points of care / toilets with single use / clean reusable towels Ensure sufficient and appropriate IPC supplies and equipment's as per SOPs requirement Ensure cohorting at all regional hospital through appropriate measures (COVID-19 Testing Centers)

Table 71: Adapted by WHO Technical Officer from WHO recommendations.

Annex G: Tasks and Responsibilities of IPC Committees and IPC Teams in Mauritius as Approved by MOHW

National IPC committee

- To ensure compliance at national and sub-national level on the prevention and control infections and related guidance by having appropriate monitoring and management systems in place to identify risk of infection.
- To review, elaborate and approve recommendations regarding infection prevention and control policies and procedures, regionally and to specific programs or services as required.
- To review and make recommendations on the focus of epidemiological surveillance, continuing education and research activities related to infection prevention and control.
- To approve/elaborate acute & continuing care infection prevention and control protocols and guidelines.
- To support the Infection Prevention & Control program by encouraging compliance with approved policies and procedures.
- Ascertain that a pre-approved plan of action is devised and followed. The latter is to be adapted as per available resources.
- Introduction, review and monitor compliance to infection prevention policies and procedures.
- Receive regular reports on the incidence and location of healthcare associated infections and take actions, when required.
- Monitoring of trends in cleanliness standards.
- Regularly review available resources for optimal infection prevention control practice.
- Advise on appropriate equipment for prevention of infection.
- Regularly monitor education and training on good Infection Prevention and Control practice.
- Identify and address gaps and barriers to implementation of infection control.
- Demonstrate a year-on-year reduction in avoidable infections.
- Be innovative in infection prevention and control practices.

Regional IPC committee

- To support the Ministry of Health and Wellness in the development and implementation of its strategic framework, action plan and policies on IPC.
- To develop a regional IPC programme for its region and update it on a regular basis.
- To plan, evaluate and implement evidence-based practice on all matters related to IPC.
- To prioritize and allocate resources for IPC.
- To develop and disseminate manuals and protocols regarding the practice of IPC.
- To address food processing, laundry handling, cleaning procedures, visitation policies and direct patient care practices in relation to IPC.
- To ensure that an adequate supply of standardized essential equipment for IPC is available in all departments.

- To inform and educate all staff about proper IPC measures.
- To support campaigns on media or social platforms with regards to IPC.
- To ensure that standard precautions are being undertaken by all hospital staff.
- To make recommendations regarding the implementation of IPC measures in the hospital.
- To obtain and manage critical bacteriological data and information, including surveillance data.
- To recognize and investigate outbreaks of infections in the hospital.
- To assess and identify risks within the IPC portfolio.
- To monitor compliance and support surveillance of IPC-related issues on an on-going basis.
- To regularly audit IPC practice.
- To conduct visits on a regular basis at various locations within healthcare premises and report to the Regional Health Director.
- To provide advice to all staff on IPC.
- To provide advice about IPC on projects related to renovations and new constructions.

IPC team

- Be responsible for the day-to-day running of the IPC programme.
- Be available for advice regarding IPC.
- Meet regularly to discuss relevant issues pertaining to IPC.
- Be involved in continuous education and training on IPC.
- Monitor daily IPC practices.
- Evaluate the performance of healthcare facilities on IPC using checklists and scorecard.
- Identify problems in the implementation of IPC activities which need to be addressed to the RIC.
- Organize epidemiological surveillance of hospital-acquired infections and multi-drug resistant organisms.
- Investigate outbreaks.
- Participate in audit activities.
- Submit reports on IPC activities to the RIC.

Annex H: Terms of Reference of Antimicrobial Stewardship Teams

PURPOSE

Antimicrobial resistance (AMR) is a growing global health concern, necessitating the establishment of an Antimicrobial Stewardship Team (AST) at each major hospital. Mauritius has not been spared and resistance to antibiotics in the country is worrisome.

The AST is tasked with promoting the optimal use of antimicrobials to ensure patient safety, improve clinical outcomes, and minimize the emergence of antimicrobial resistance.

ACCOUNTABILITY

The AST will be answerable to the Regional IPC Committee which is chaired by the Regional Health Director (RHD).

RESPONSIBILITIES

1. Help in the development of and periodic update of antimicrobial stewardship (AMS) guidelines.
2. Implement educational programs to promote awareness and understanding of AMS principles among healthcare providers and patients.
3. Establish mechanisms for regular review and evaluation of antimicrobial utilization data.
4. Provide feedback to prescribers on their antimicrobial prescribing patterns, promoting rational use.
5. Monitor and respond to trends in antimicrobial resistance within the hospital.
6. Collaborate with the pharmacists to develop and update formularies, taking into account resistance patterns and new antimicrobial agents.
7. Implement AMS activities as guided by the policies of the Ministry of Health and Wellness.
8. Be available for advice regarding AMS.
9. Meet regularly to discuss relevant issues pertaining to AMS.
10. Submit reports on AMS activities to the Ministry of Health and Wellness.

MEMBERSHIP

1. Antimicrobial Stewardship Team Leader – he / she can be a Specialist in General Medicine; if such a person is not available, the RHD can choose another Specialist; this Specialist may be someone who forms part of the hospital's Infection Prevention and Control (IPC) team.
2. Antimicrobial Stewardship Registered Medical Officer – he / she may be someone who forms part of the hospital's IPC team.
3. IPC Nursing Officer
4. Pharmacist
5. Other members can form part of the team depending on the needs and availability in the region e.g., Microbiologist, Infectious Disease Specialist, epidemiologist, representatives of nursing and medical staff, etc.

The RHD shall ensure that all members of the AST have dedicated time to carry out their tasks. The members are responsible for the smooth running of AMS activities throughout their entire region and not just in their own wards or in their own departments.

The AMR Focal Point for Human Health will coordinate the activities of the AST.

FREQUENCY OF MEETINGS

The AST will meet at least twice per month or as and when deemed necessary by the team leader.

DURATION

The establishment and operation of the AST shall be an ongoing commitment reflecting the hospital's dedication to antimicrobial stewardship.

AMENDMENTS

These terms of reference may be amended as needed, with changes subject to approval by the Ministry of Health and Wellness.

Annex I: WHO's Surgical Safety Checklist

Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Date: **Time:** **Patient name:** **Age:** **Gender:** **Procedure:**

Ward:

Before induction of anaesthesia

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

Before skin incision

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

Before patient leaves operating room

(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

Annex J: List of Notifiable Diseases in Mauritius

As per the "Public Health (Testing of Infectious or Communicable Diseases) Regulations 2024", people who suspect the following infectious or communicable diseases should alert the Sanitary Authority in the Republic of Mauritius:

1. Amoebiasis
2. Anthrax (Human)
3. Brucellosis
4. Chikungunya
5. Cholera
6. Dengue fever
7. Diphtheria
8. Food poisoning (bacterial and others)
9. Gonorrhoea
10. Haemorrhagic fever
11. Infective hepatitis
12. Influenza like diseases
13. Leprosy
14. Leptospirosis
15. Malaria
16. Measles
17. Meningitis (cerebrospinal)
18. Plague
19. Poliomyelitis, acute
20. Puerperal pyrexia
21. Rabies (Human)
22. Relapsing fever
23. Schistosomiasis (bilharsiasis)
24. Soft chancre
25. Syphilis
26. Tetanus (neonatorum and adult)
27. Tuberculosis (respiratory, skeletal, central nervous system)
28. Typhoid fever (with paratyphoid)
29. Typhus
30. Whooping cough (Pertussis)
31. Smallpox

32. Rubella
33. Yellow fever
34. COVID-19
35. Mpox
36. Nipah
37. Legionella
38. Listeriosis
39. Zika

According to the Occupational Safety and Health (Amendment) Bill (No. XVII of 2022), the following infections are Notifiable Occupational Diseases in the Republic of Mauritius:

1. Brucellosis
2. Hepatitis viruses
3. Human immunodeficiency virus (HIV)
4. Tetanus
5. Tuberculosis
6. Toxic or inflammatory syndromes associated with bacterial or fungal contaminants
7. Anthrax
8. Leptospirosis

Annex K: Posters on Donning and Doffing PPE

Steps to put on personal protective equipment (PPE) including coverall

1 Remove all personal items (jewelry, watches, cell phones, pens, etc.)

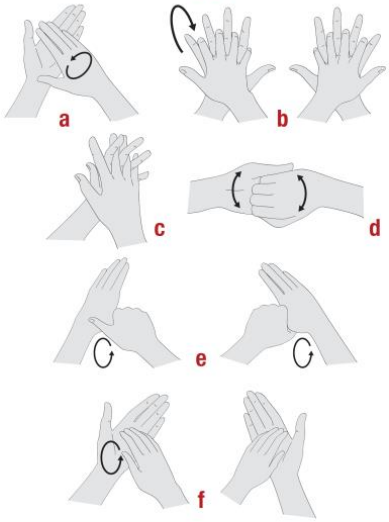
2 Put on scrub suit and rubber boots[1] in the changing room.

3 Move to the clean area at the entrance of the isolation unit.

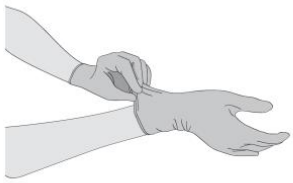
4 By visual inspection, ensure that all sizes of the PPE set are correct and the quality is appropriate.

5 Undertake the procedure of putting on PPE under the guidance and supervision of a trained observer (colleague).

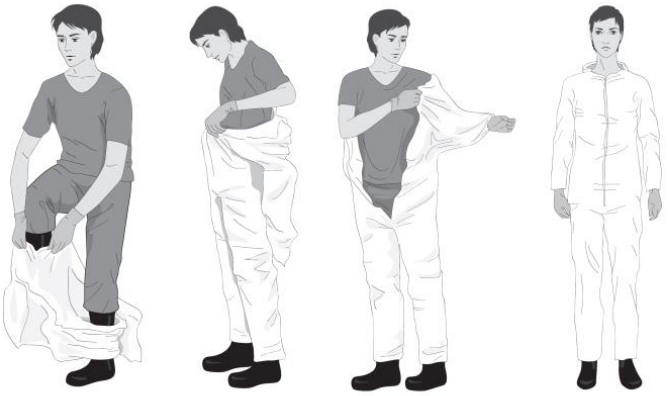
6 Perform hand hygiene.



7 Put on gloves (examination, nitrile gloves).

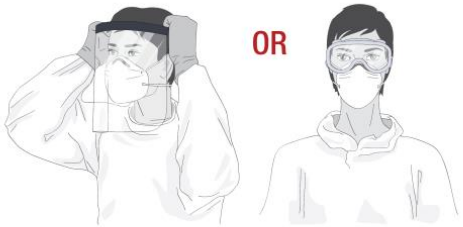


8 Put on coverall.[2]



9 Put on face mask.

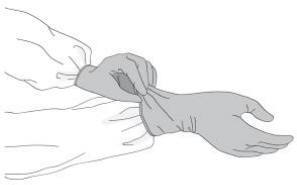
10 Put on face shield OR goggles.



11 Put on head and neck covering surgical bonnet covering neck and sides of the head (preferable with face shield) OR hood.

12 Put on disposable waterproof apron (if not available, use heavy duty, reusable waterproof apron).

13 Put on second pair of (preferably long cuff)[2] gloves over the cuff.



1 If boots are not available, use closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and shoe covers (nonslip and preferably impermeable)

2 Do not use adhesive tape to attach the gloves. If the gloves or the coverall sleeves are not long enough, make a thumb (or middle finger) hole in the coverall sleeve to ensure that your forearm is not exposed when making wide movements. Some coverall models have finger loops attached to sleeves.

World Health Organization

Steps to put on personal protective equipment (PPE) including gown

1 Remove all personal items (jewelry, watches, cell phones, pens, etc.)

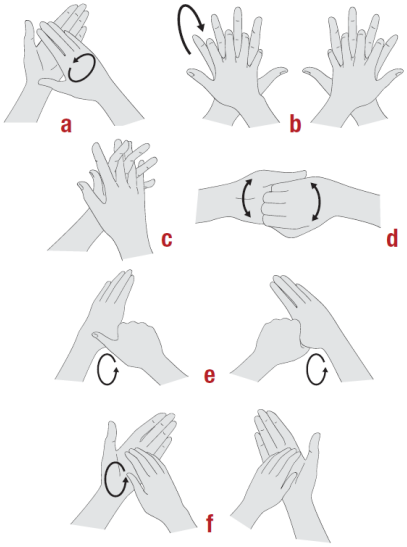
2 Put on scrub suit and rubber boots[1] in the changing room.

3 Move to the clean area at the entrance of the isolation unit.

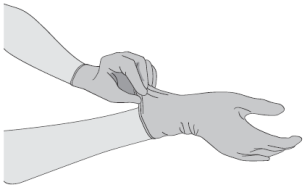
4 By visual inspection, ensure that all sizes of the PPE set are correct and the quality is appropriate.

5 Undertake the procedure of putting on PPE under the guidance and supervision of a trained observer (colleague).

6 Perform hand hygiene.



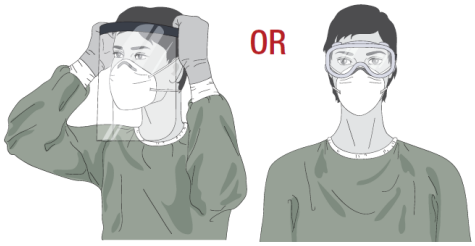
7 Put on gloves (examination, nitrile gloves).



8 Put on disposable gown made of fabric that is tested for resistance to penetration by blood or body fluids OR to blood-borne pathogens.

9 Put on face mask.

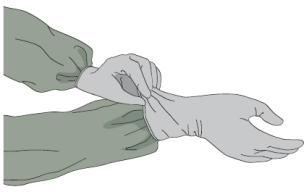
10 Put on face shield OR goggles.



11 Put on head and neck covering surgical bonnet covering neck and sides of the head (preferable with face shield) OR hood.

12 Put on disposable waterproof apron (if not available, use heavy duty, reusable waterproof apron).

13 Put on second pair of (preferably long cuff) gloves over the cuff.



[1] If boots are not available, use closed shoes (slip-ons without shoelaces and fully covering the dorsum of the foot and ankles) and shoe covers (nonslip and preferably impermeable)

World Health Organization

WHO/HIS/SDS/2015.1

Steps to **take off** personal protective equipment (PPE) including **gown**

1 Always remove PPE under the guidance and supervision of a trained observer (colleague). Ensure that infectious waste containers are available in the doffing area for safe disposal of PPE. Separate containers should be available for reusable items.

2 Perform hand hygiene on gloved hands.[1]

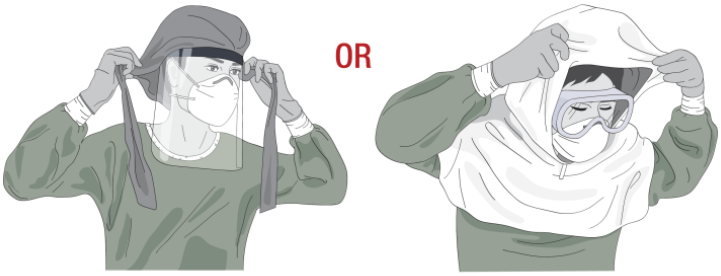
3 Remove apron leaning forward and taking care to avoid contaminating your hands. When removing disposable apron, tear it off at the neck and roll it down without touching the front area. Then untie the back and roll the apron forward.

4 Perform hand hygiene on gloved hands.

5 Remove outer pair of gloves and dispose of them safely.
Use the technique shown in Step 17

6 Perform hand hygiene on gloved hands.

7 Remove head and neck covering taking care to avoid contaminating your face by starting from the bottom of the hood in the back and rolling from back to front and from inside to outside, and dispose of it safely.

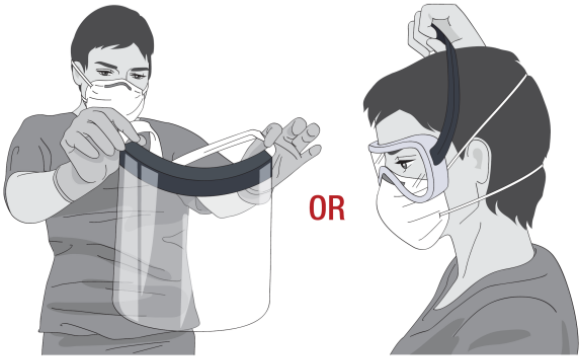


8 Perform hand hygiene on gloved hands.

9 Remove the gown by untying the knot first, then pulling from back to front rolling it from inside to outside and dispose of it safely.

10 Perform hand hygiene on gloved hands.

11 Remove eye protection by pulling the string from behind the head and dispose of it safely.



12 Perform hand hygiene on gloved hands.

13 Remove the mask from behind the head by first untying the bottom string above the head and leaving it hanging in front; and then the top string next from behind head and dispose of it safely.

14 Perform hand hygiene on gloved hands.

15 Remove rubber boots without touching them (or overshoes if wearing shoes). If the same boots are to be used outside of the high-risk zone, keep them on but clean and decontaminate appropriately before leaving the doffing area.[2]

16 Perform hand hygiene on gloved hands.

17 Remove gloves carefully with appropriate technique and dispose of them safely.

18 Perform hand hygiene.

1 While working in the patient care area, outer gloves should be changed between patients and prior to exiting (change after seeing the last patient)

2 Appropriate decontamination of boots includes stepping into a footbath with 0.5% chlorine solution (and removing dirt with toilet brush if heavily soiled with mud and/or organic materials) and then wiping all sides with 0.5% chlorine solution. At least once a day boots should be disinfected by soaking in a 0.5% chlorine solution for 30 min, then rinsed and dried.

World Health Organization

WHO/HIS/SDS/2015.3

Steps to **take off** personal protective equipment (PPE) including **coverall**

1 Always remove PPE under the guidance and supervision of a trained observer (colleague). Ensure that infectious waste containers are available in the doffing area for safe disposal of PPE. Separate containers should be available for reusable items.

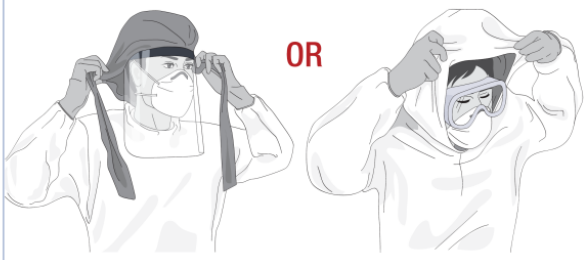
2 Perform hand hygiene on gloved hands.[1]

3 Remove apron leaning forward and taking care to avoid contaminating your hands.

When removing disposable apron, tear it off at the neck and roll it down without touching the front area. Then untie the back and roll the apron forward.

4 Perform hand hygiene on gloved hands.

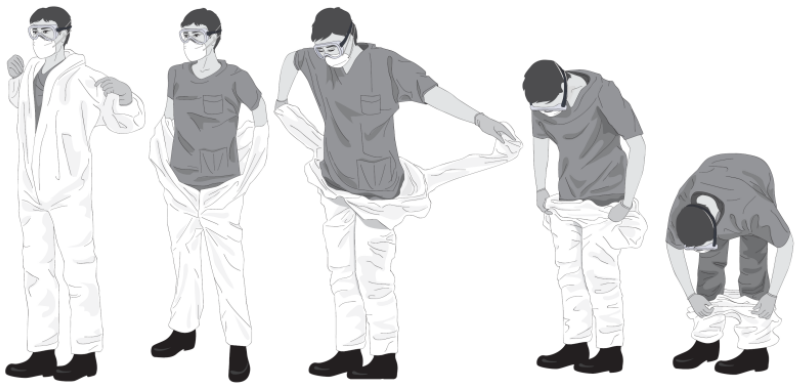
5 Remove head and neck covering taking care to avoid contaminating your face by starting from the bottom of the hood in the back and rolling from back to front and from inside to outside, and dispose of it safely.



6 Perform hand hygiene on gloved hands.

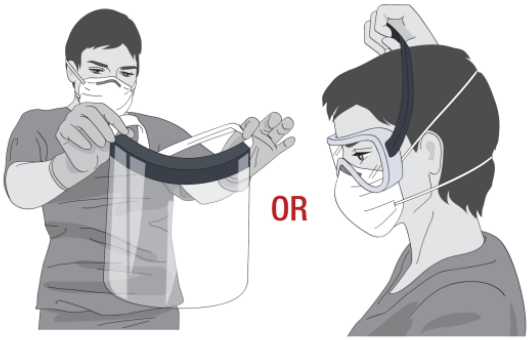
7 Remove coverall and outer pair of gloves:

Ideally, in front of a mirror, tilt head back to reach zipper, unzip completely without touching any skin or scrubs, and start removing coverall from top to bottom. After freeing shoulders, remove the outer gloves[2] while pulling the arms out of the sleeves. With inner gloves roll the coverall, from the waist down and from the inside of the coverall, down to the top of the boots. Use one boot to pull off coverall from other boot and vice versa, then step away from the coverall and dispose of it safely.



8 Perform hand hygiene on gloved hands.

9 Remove eye protection by pulling the string from behind the head and dispose of it safely.



10 Perform hand hygiene on gloved hands.

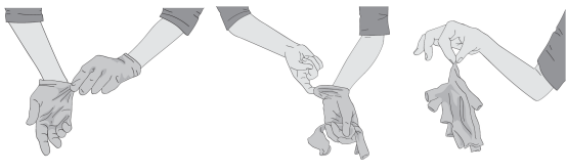
11 Remove the mask from behind the head by first untying the bottom string above the head and leaving it hanging in front; and then the top string next from behind head and dispose of it safely.

12 Perform hand hygiene on gloved hands.

13 Remove rubber boots without touching them (or overshoes if wearing shoes). If the same boots are to be used outside of the high-risk zone, keep them on but clean and decontaminate appropriately before leaving the doffing area.[3]

14 Perform hand hygiene on gloved hands.

15 Remove gloves carefully with appropriate technique and dispose of them safely.



16 Perform hand hygiene.

1 While working in the patient care area, outer gloves should be changed between patients and prior to exiting (change after seeing the last patient)

2 This technique requires properly fitted gloves. When outer gloves are too tight or inner gloves are too loose and/or hands are sweaty, the outer gloves may need to be removed separately, after removing the apron.

3 Appropriate decontamination of boots includes stepping into a footbath with 0.5% chlorine solution (and removing dirt with toilet brush if heavily soiled with mud and/or organic materials) and then wiping all sides with 0.5% chlorine solution. At least once a day boots should be disinfected by soaking in a 0.5% chlorine solution for 30 min, then rinsed and dried.

World Health Organization

WHO/HIS/SDS/2015.4

Annex L: Checklist for Donning and Doffing of PPE When in Coverall

Ebola – Doffing PPE – N95 and Coverall Checklist

HCW leaving the patient room
☐ Signal to enter doffing area
☐ HC worker inspects PPE for obvious signs of contamination (if so wipe with EPA-designated wipe)
☐ Disinfect gloves with EPA wipe or Alcohol based hand rub - Allow hands to dry
☐ Enter doffing area
Trained Observer (required to be in CDC recommended PPE)
☐ Use a checklist
☐ Remind that you will be reviewing the steps aloud and to repeat back
☐ Remind steps should be done slowly and methodically
Disinfect outer gloves
☐ Alcohol based hand rub – Allow hands to dry
Remove outer apron (if used)
☐ Gently pull from neck or have trained observer or assistant untie
☐ Roll from inside out away from body and discard
☐ Inspect for contamination, cuts or tears and use EPA disinfectant wipe if necessary
☐ If assistant has helped use Alcohol based hand rub and allow to dry
Disinfect outer gloves
☐ Alcohol based hand rub – Allow hands to dry
Remove boot/shoe covers * ONLY IF ON OUTSIDE OF COVERALL
☐ Sit on chair designated and marked for "dirty"
☐ Remove boot /shoe covers and discard (remove based on manufacturer's instructions)
☐ Disinfect Outer Gloves with alcohol based hand rub – Allow hands to dry
***Remove outer gloves – Do not snap gloves and cause spray**
☐ Pinch glove and lift at the wrist
☐ Rolled down until the glove is completely off hand in a ball in the palm of the other hand
☐ Slide finger down and inside outer glove on other hand and pull it off until it's balled around the first glove.
☐ Dispose of outer gloves
Inspect Inner gloves
☐ If no signs of tears, holes or contamination perform hand hygiene with ABHR – Allow hands to dry
☐ Inspect both sides of gloves (if tear, hole or contamination – see next step)
☐ Compromised gloves ☐ Perform hand hygiene with ABHR or EPA wipe ☐ Remove gloves ☐ Perform hand hygiene with ABHR ☐ Don new pair of gloves
Remove Face Shield
☐ Tilt head forward slightly, grab the strap at the temples and pull it forward and over your head, which will let the face shield fall from face.
☐ Dispose of face shield
Disinfect Inner gloves
☐ Alcohol based hand rub – allow to dry
Remove Hood
☐ Tilt head slightly, grasp at the crown of the head and use one hand to pull the hood forward and away from body and off head
☐ Dispose Hood
Disinfect Inner gloves
☐ Alcohol based hand rub – Allow hands to dry
Remove Coverall – Always avoid touching of scrubs and skin during the process
☐ Tilt head back and reach for the zipper at the top of the suit
☐ Grasp zipper with two fingers (without using the other hand on the front of the suit) and pull down unzipping completely
☐ Assistant will stand behind HC worker and grasp the outside of the coverall at the shoulders and pull it off of the body in a downward motion until the coverall is off the shoulders completely

Doffing N95 and Coverall V1: 15 November 2014
http://www.cdc.gov/vhf/ebola/hcp/ppe-training/n95Respirator_Coveralls/doffing_08.html

Ebola – Doffing PPE – N95 and Coverall Checklist

☐ Assistant will then reposition his or her hands and roll the suit outward and down the back in a controlled fashion, removing hc workers arms and slowly pulling it down until it's at the waist
☐ To get the coverall off the rest of the way, the hc worker may need to sit down in the clearly marked clean chair Grab the coverall, and pull it away from your body, one leg at a time.
☐ Dispose of coverall
Disinfect Inner gloves
☐ Assistant - Use Alcohol based hand rub – Allow hands to dry ☐ HC worker - Use Alcohol based hand rub – Allow hands to dry
Remove boot/shoe covers
☐ Sit on chair designated and marked for "clean" to remove your boot covers ONLY
☐ Remove boot/shoe covers and discard (remove based on manufacturer's instructions)
Change Inner gloves
☐ Remove gloves and discard gloves ☐ Perform hand hygiene with Alcohol based hand rub – allow hands to dry ☐ Don new pair of gloves
Remove N95 Respirator
☐ Tilt head forward. Then, use two hands to grab the bottom strap, pull to the sides, then over head. Next, use both hands to grab the upper strap, pull to the sides, then over head. Keep tension on the upper strap as you remove it, which will let the mask fall forward
☐ Discard N95 respirator
Disinfect Inner gloves
☐ Use Alcohol based hand rub – Allow hands to dry
Disinfect Shoes
☐ Sit in chair marked "clean" ☐ Use EPA-registered disinfectant wipes to thoroughly disinfect all the surfaces of shoes, moving from top to bottom and including the soles
Disinfect Inner gloves
☐ Use Alcohol based hand rub - Allow hands to dry
Remove Inner Gloves
☐ * Remove Inner gloves
☐ Discard Inner gloves
Perform Hand Hygiene
☐ Use Alcohol based hand rub – allow hands to dry
☐ **Review Body for Contamination**
Exit Doffing Area ☐ Remove scrubs and shower

Healthcare personnel name: _____

Assistant name: _____

Date: _____ Time: _____ Room # _____

Signature of Trained Observer: _____

SOUTH DAKOTA DEPARTMENT OF HEALTH

Doffing N95 and Coverall V1: 15 November 2014
http://www.cdc.gov/vhf/ebola/hcp/ppe-training/n95Respirator_Coveralls/doffing_08.html

Table 72: Taken from the Department of Health of South Dakota

Annex M: Legislation in Mauritius Relevant to IPC in Healthcare Facilities

1. THE PUBLIC HEALTH ACT 1925

42 Notification by medical practitioner

(1) Every medical practitioner attending on or called in to visit the patient shall, on being aware that the patient is suffering from an infectious or communicable disease, give notice to the Sanitary Authority or health inspector of the district, of the existence of the disease, the name of the patient, the situation of the premises, and the name of the occupier.

48 Removal of patient to hospital

Where, in the opinion of the Sanitary Authority, any person certified by a medical practitioner to be a patient is not accommodated or is not being treated or nursed in such manner as adequately to guard against the spread of the disease, that patient may, on the order of the Sanitary Authority, be removed to and detained in a hospital or temporary place which, in the opinion of the Sanitary Authority is suitable for his reception until the Sanitary Authority or any medical practitioner authorised by the Permanent Secretary is satisfied that he is free from infection or can be discharged without danger to the public health.

49 Unlawful exposure to infectious disease

(1) Any person who —

(a) knowing that he is a patient wilfully or negligently exposes himself in such manner as to be likely or liable to spread the disease in any street, public place, public building, shop, inn, hotel, church, or other place used, frequented or occupied in common by persons, other than the members of the family or household to which the patient belongs;

(b) being in charge of a patient, exposes the patient in the manner mentioned in paragraph (a)

2. PUBLIC HEALTH (TESTING OF INFECTIOUS OR COMMUNICABLE DISEASES) REGULATIONS 2024

3.(1) Any person, including any incoming passenger, who is suspected to be infected with, or suffering from, an infectious or communicable disease shall undergo a medical examination or medical investigation, or both, as may be requested by the Sanitary Authority.

3. THE ENVIRONMENT PROTECTION ACT 1991

Drinking Water Standards

- *E. coli:* must not be detectable in any 100ml sample
- Coliform Organisms: 0 in 95% of samples examined throughout the year. In the case of quantities of water needed for distribution throughout the year, when not less than 50 samples are examined for each period of 30 days, 3 in an occasional sample , but not in consecutive samples.

Labels for infectious substances

The bottom half of the label should bear:

- INFECTIOUS SUBSTANCES (Optional) And the Inscription
- "In case of damage or leakage immediately notify Public Health Authority" (optional)

Symbol (three crescents superimposed on a circle) and

- Inscription: Black
- Background: White

4. THE FOOD ACT 2022

4. Storage of garbage

The food business operator of any food premises shall ensure that –

(a) there are on the premises adequate impervious garbage receptacles with close fitting lid;
(b) where appropriate, foot operated pedal refuse receptacles are provided;
(c) all food refuse and garbage are placed in garbage receptacles which are removed from the premises as often as necessary and at least daily;
(d) all garbage receptacles are cleaned and disinfected regularly;
(e) as directed by an authorised officer, a garbage room at low temperature is provided for the storage of garbage before its collection and disposal.

7(b) Floors are–

(i) made of such materials, without crevices, for effective cleaning and disinfection;(ii)unable to absorb grease, food particles or water; and
(iii) adequately sloped for liquids to drain to trapped outlets.

36. Food not to be exposed to contamination

2) A food business operator shall ensure that –

(a) food is produced or processed and packaged in such manner and within such lapse of time as to avoid contamination and deterioration;
(b) chopping boards and food preparation surfaces are cleaned and disinfected on a daily basis or after such regular interval as may be necessary, whichever earlier;
(c) light bulbs or fixtures suspended over food or food processing areas are properly secured and protected to prevent contamination of food in case of breakage;
(d) flies, birds, rodents, and anyother pests and domestic animals, including pets do not enter into the premises where food is produced or processed and packaged.

39. Cleanliness

Every food business operator shall ensure that –

(a) the premises where food is produced, processed or packaged are kept clean and disinfected on such regular intervals as may be necessary;
(b) bags, containers, crates or boxes are kept on racks at least 300 millimetres above floor level or where forklifts or other mechanical lifting devices are used, on pallets;
(c) no food is kept on the floor level.

50. Prohibition of food handling by infected person

Any person who is the carrier of an infectious or communicable disease, or is in contact with a person who is suffering from any infectious or communicable disease, diarrhoea, venereal disease, open infected wound, or any inflammatory or communicable infection of the skin shall not –

(a) engage himself in the sale, preparation, manufacture, storing, serving, packing, cooking, transport, handling or delivery of any food; and
(b) handle, whether for cleansing, washing or other purposes, any vessel, receptacle, utensil, package or any instrument used in the preparation, manufacture, serving, packing, cooking, storing, transport, handling or delivery of any such food.

"temperature control" means maintaining perishable food at such temperature as may be required to minimise

the growth of infectious or toxigenic microorganisms so that the microbiological safety of the food is not adversely affected during the time the food is at –

(a) a temperature not exceeding 4 degrees celsius;

(b) a temperature of not less than 60 degrees celsius; or

(c) such other temperature at which, according to the food business operator, the food will not get adversely affected if kept for a period of time.

Guideline Values for Packaged Water

Total coliforms / E-coli / Faecal streptococcus / Salmonella / Pseudomonas aeruginosa / Sulphite reducing clostridia / Pathogenic protozoa: Shall not be detectable in any sample of 100 ml - absent.

5. THE OCCUPATIONAL SAFETY AND HEALTH ACT 2005

"substance hazardous to health" means – (c) a biological agent;

"bodily injury" includes any disease or any impairment of a person's physical or mental condition;

5. General duties of employers

(1) Every employer shall, so far as is reasonably practicable, ensure the safety, health and welfare at work of all his employees.

35. Cleanliness

(1) Every employer shall keep every place of work in a clean state and free from effluvia arising from any drain or sanitary convenience or any other nuisance.

37. Ventilation and temperature

(1) Effective and suitable provision shall be made for securing and maintaining the adequate ventilation of every workroom by the circulation of fresh or artificially purified air of suitable temperature and relative humidity and for rendering harmless, so far as is practicable, all impurities generated in the course of any process or work carried on in the workroom as may be injurious to health.

39. Sanitary conveniences

(1) In any building where work is carried on, sufficient and suitable sanitary conveniences for the employees shall be provided.

41. Washing facilities

There shall be provided and maintained for the use of the employees adequate and suitable facilities for washing which shall include a supply of clean water, soap, clean towels or other suitable means of cleaning and drying, and the facilities shall be conveniently accessible and shall be kept in a clean and orderly condition.

67. Substances hazardous to health

(4) The prevention or adequate control of exposure to a substance hazardous to health, except a biological agent, shall as far as possible be secured by measures other than the provision of personal protective equipment.

(5) Where the measures taken in accordance with subsection (4), do not prevent or provide adequate control of exposure to substances hazardous to health of employees, the employer shall in addition to taking those measures, provide the employees with suitable and appropriate personal protective equipment and clothing that shall adequately prevent their exposure to substances hazardous to health.

(6) Every employer who provides any control measure, personal protective equipment and clothing shall take all reasonable steps to ensure that it is effectively used or applied, as the case may be, and is properly maintained.

(7) Where engineering controls are provided to prevent the exposure of employees to substances hazardous to health, the employer shall ensure that thorough examinations and tests of the engineering controls are carried out by a competent person -

77. Health surveillance

(1) Every employer shall ensure that an employee who is exposed, or liable to be exposed, to a substance hazardous to health be placed under suitable health surveillance, including medical surveillance, where –

82. Personal protective equipment and clothing

(1) Where any process carried out at a place of work is likely to cause bodily injury and such bodily injury cannot be prevented by other means, every person employed in that process and liable to such bodily injury, shall be provided with such suitable and appropriate personal protective equipment and clothing as will protect him from risk of injury.

86. Notification of occupational diseases

(1) Where a medical practitioner suspects or finds that any person is suffering from any occupational disease specified in the Fourteenth Schedule, he shall notify in writing the employer of that person and the Director, Occupational Safety and Health.

6. THE MEDICAL COUNCIL ACT 1999

"professional misconduct or negligence", in relation to a registered person, includes –

(a) a breach of the Code of Practice or Clinical Guidelines;

(b) a failure to exercise due professional skill or care which results in injury to, or loss of life of, a person;

6. Vacation of office of member

(1) The Council may require a member to vacate his office if he – (a) commits a professional misconduct or negligence, or breach of trust in the discharge of his duties, as a member or otherwise, which in the opinion of the Council renders him unfit to be a member;

Annex N: Schemes of Service Relevant to IPC in the Public Sector

1. **Regional Public Health Superintendent:**
    a. "To be responsible to the Regional Health Director for-
        i. …basic sanitation and safe water supply,…, immunization, prevention and control of local endemic diseases…,
        ii. enforcing all sanitary regulations…,
        iii. organising training programmes…,
        iv. co-ordinating … prevention and control programmes, assisting the CDCU during outbreak of communicable diseases…"
2. **Medical Superintendent:**
    a. "…ensuring that the hospital and its annexed institutions are properly equipped and staffed…,
    b. To ensure all operations in the hospital and its annexed institutions adhere to the relevant health acts…"
3. **Community Physician:**
    a. "…promotion of sanitation and safe water supply,…, immunization, prevention and control of local endemic diseases…,
    b. ensuring the implementation of all sanitary regulations…,
    c. the collection of statistics relevant to his work…"
4. **Nursing Administrator:**
    a. "…To plan the training of the nursing and ancillary staff and implement approved programmes of training…
    b. To organize post basic nursing courses for the staff…
    c. To maintain high nursing and hygienic norms…
    d. To propagate policy changes amongst the staff…"
5. **Nursing Supervisor:**
    a. "…To ensure that nursing procedures, activities or decisions do not contravene standing regulations and existing laws…
    b. To ensure that a high standard of hygiene is maintained in wards…
    c. To take all possible steps to safeguard the welfare and safety of patients and staff…"
6. **Ward Manager:**
    a. "…To advise staff on principles of infection control…,
    b. To participate in clinical teaching…,
    c. To control supplies, stock,… and be in charge of the inventory…,
    d. To be responsible for general cleanliness and upkeep of the ward…"
7. **Charge Nurse:**

a. "…To give training to qualified nursing staff…,

b. To maintain and keep an inventory of stores…,

c. To ensure the maintenance and cleanliness of ward…,

d. To ensure the safety of patients…,

e. To ensure the protection of staff against occupational hazards…"

8. Head of Occupational Health Unit (Ministry of Health and Wellness):

a. "…To supervise the biological monitoring among workers employed in hazardous trades…"

9. Senior Occupational Health Physician (Ministry of Health and Wellness):

a. "…To plan and monitor screening programmes for workers (carnet de santé)…"

b. To carry out clinical examinations including biological monitoring among workers, as and when required…"

10. Director of Occupational Health and Safety (Ministry of Labour and Industrial Relations):

a. "…Timely execution of occupational safety and health policies and projects…

b. Ensuring the implementation and enforcement of legislation relating to Occupational Safety and Health…"

11. Occupational Health and Safety Officer (Ministry of Labour and Industrial Relations):

a. "…Assessing workplace hazards and the suitability of protective measures taken and/or protective equipment provided to abate or eliminate the hazards and to take appropriate follow-up action…"

12. Health and Safety Officer (Ministry of Public Service and Administrative Reforms):

a. "…Assessment of risks are duly carried out and control/remedial measures are implemented in compliance with relevant legislation…

b. To conduct, monitor and review risk assessment exercises in Ministries/Departments in compliance with relevant legislation…"

Glossary

Acinetobacter sp.: An aerobic Gram-negative bacillus commonly isolated from the hospital environment (especially intensive care units) and hospitalized patients; can cause healthcare associated infections, especially wound infections and pneumonia.

Acute respiratory infection: Any new onset acute respiratory infection that could potentially be spread by respiratory droplets (either upper or lower respiratory tract), which presents with symptoms of a fever greater than 38°C and a new or worsening cough or shortness of breath (previously referred to as febrile respiratory illness). It should be noted that elderly people and people who are immunocompromised may not have a febrile response to a respiratory infection.

Additional precautions: See Transmission based precautions

Adverse event: An unexpected and undesired incident directly associated with the care or services provided to the client/patient/resident.

Aerosol-generating medical procedures: Aerosol-generating medical procedures are medical procedures that can generate aerosols as a result of artificial manipulation of a person's airway, e.g., intubation and related procedures (e.g., manual ventilation, open endotracheal suctioning); cardiopulmonary resuscitation; bronchoscopy; sputum induction; nebulized therapy; non-invasive positive pressure ventilation (continuous or bi-level positive airway pressure).

Airborne transmission: Transmission of microorganisms via inhalation of aerosols that results in an infection in a susceptible host.

Alcohol-based hand rub: Alcohol based preparation designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth.

Antimicrobial: A chemical substance that kills or inhibits or destroys bacteria, viruses, protozoa or fungi and can be safely administered to humans and animals.

Antimicrobial resistance: Loss of effectiveness of any anti-infective agent, including antiviral, antifungal, antibacterial and anti-parasitic medicines

Antimicrobial stewardship: An ongoing effort in a health service organization to reduce the risks associated with increasing antimicrobial resistance and to extend the effectiveness of antimicrobial treatments. It may incorporate several strategies, including monitoring and review of antimicrobial use.

Audit: In the context of this document, an audit is a tool used to examine a process for errors or omissions. An audit tool usually consists of a checklist of items which must be completed or be in place in order for a process to be considered to be correct.

Biomedical waste: Waste generated within a healthcare facility that warrants special handling and disposal because it presents a particular risk of disease transmission. Materials shall be considered biomedical waste if they are contaminated with blood or body fluids containing visible blood or when compressed, they release liquid.

Bundle: An implementation tool aiming to improve the care process and patient outcomes in a structured manner. It comprises a small, straightforward set of evidence-based practices that have been proven to improve patient outcomes when performed collectively and reliably.

Cleaning: The physical removal of foreign material (e.g., dust, soil, organic material such as blood, secretions, excretions and microorganisms). Cleaning physically removes rather than kills microorganisms. It is accomplished using water and detergents in conjunction with mechanical action.

Cluster: A grouping of cases of a disease within a specific time frame and geographic location, suggesting a possible association between the cases with respect to transmission.

Critical items: Instruments and devices that enter sterile tissues, including the vascular system.

Decontamination: The removal of microorganisms to leave an item safe for further handling.

Disinfectant: Product used on inanimate objects to reduce the quantity of microorganisms to an acceptable level.

Disinfection: The inactivation of disease-producing microorganisms with the exception of bacterial spores.

Hand hygiene: A general term referring to any action of hand cleaning. Hand hygiene relates to the removal of visible soil and removal or killing of transient microorganisms from the hands. Hand hygiene may be accomplished using soap and running water or an alcohol-based hand rub. Hand hygiene also includes surgical hand antisepsis.

Healthcare-associated infection: A term relating to an infection that is acquired during the delivery of healthcare (also known as 'nosocomial infection').

Healthcare facility: A set of physical infrastructure elements supporting the delivery of health-related services. A healthcare facility does not include a patient's home where healthcare may be provided.

Healthcare setting: Any location where healthcare is provided, including settings where emergency care is provided, hospitals, complex continuing care, rehabilitation hospitals, long-term care homes, mental health facilities, outpatient clinics, community health centres and clinics, physician offices, dental offices, offices of allied health professionals and home healthcare.

Healthcare workers: Individuals who provide healthcare or support services, such as nurses, doctors, dentists, healthcare assistants, physiotherapists, students, housekeeping staff, etc.

Hierarchy of controls: There are three levels or tiers of IPC and occupational health controls to prevent illness and injury in the workplace: engineering controls, administrative controls and PPE.

High-level disinfection: It is the level of disinfection needed when processing semi-critical items. High-level disinfection processes destroy vegetative bacteria, mycobacteria, fungi and enveloped (lipid) and non-enveloped (non-lipid) viruses, but not necessarily bacterial spores.

Infection: The entry and multiplication of an infectious agent in the tissues of the host. Asymptomatic or subclinical infection is an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms. Symptomatic or clinical infection is one resulting in clinical signs and symptoms (disease).

Infection prevention and control: Evidence-based practices and procedures that, when applied consistently in healthcare settings, can prevent or reduce the risk of transmission of microorganisms to healthcare providers, clients, patients, residents and visitors.

Infection prevention and control committee: The infection prevention and control committee is a multidisciplinary committee that serves the healthcare facility and is responsible for verifying that the infection prevention and control recommendations and standards are being followed in the healthcare facility.

Infection prevention and control program: A healthcare facility or organization (e.g., hospital, long-term care, continuing complex care, home care) program responsible for meeting the recommended mandate to decrease infections in the patient, healthcare providers and visitors. The program is coordinated by healthcare providers with expertise in infection prevention and control and epidemiology.

Infection control professional(s): Trained individual(s) responsible for a healthcare setting's infection prevention and control activities.

Infectious waste: Refer to biomedical waste.

Long-term care: A broad range of personal care, support and health services provided to people who have limitations that prevent them from full participation in the activities of daily living. The people who use long-term care services are usually the elderly, people with disabilities and people who have a chronic or prolonged illness.

Low-level disinfection: It is the level of disinfection needed when processing non-critical items or some

environmental surfaces. Low-level disinfectants kill most vegetative bacteria and some fungi, as well as enveloped (lipid) viruses (e.g., influenza, hepatitis B and C and HIV). Low-level disinfectants do not kill mycobacteria or bacterial spores.

Multi-drug resistant organisms: In general, bacteria that are resistant to several classes of antimicrobial agents.

Methicillin-resistant *Staphylococcus aureus*: A strain of *S. aureus* that has a minimal inhibitory concentration to oxacillin of ≥ 4 mcg/ml and contains the *mecA* gene coding for penicillin-binding protein 2a (PBP 2a). MRSA is resistant to all of the beta-lactam classes of antibiotics, such as penicillins, penicillinase- resistant penicillins (e.g., cloxacillin) and cephalosporins.

Multimodal strategy: A multimodal strategy comprises several elements or components implemented in an integrated way with the aim of improving an outcome and changing behavior. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that consider local conditions.

Non-critical items: Items that touch only intact skin but not mucous membranes.

Occupational safety and health: Preventive and therapeutic health services in the workplace provided by trained occupational health professionals, e.g., nurses, hygienists, physicians and occupational safety and health specialists.

Outbreak: An outbreak is an increase in the number of cases above the number normally occurring in a particular health care setting over a defined period of time.

Outcome surveillance: Surveillance used to measure patient outcomes (changes in the patient's health status that can be attributed to preceding care and service). An example of outcome surveillance related to infection prevention and control is surveillance of infection rates. Outcome surveillance reflects the effectiveness of the infection prevention and control program in protecting patients, healthcare providers and visitors from healthcare-associated infections while decreasing costs from infections.

Patient zone: Concept related to the "geographical" area containing the patient and his/her immediate surroundings.

Personal protective equipment: Clothing or equipment worn for protection against hazards.

Point-of-care: The place where three elements occur together: the patient, the health care provider and care or treatment involving patient contact. The concept usually refers to a hand hygiene product which is easily accessible to staff by being as close as possible, i.e., within arm's reach, to where patient contact is taking place. Point-of-care products should be accessible to the care provider without the provider leaving the zone of care, so they can be used at the required moment.

Precautions: Interventions to reduce the risk of transmission of microorganisms (e.g., patient-to-patient, patient-to-staff, staff-to-patient, contact with the environment, contact with contaminated equipment).

Process surveillance: Surveillance used to assess or measure patient processes (things done to or for a patient during their encounter with the healthcare system). An example of process surveillance related to infection prevention and control is planned audits to verify that procedures and / or standards of practice are being followed.

Risk assessment: Assessment, analysis and management of risks. It involves recognizing which events may lead to harm in the future and minimizing their likelihood and consequences.

Routine: Performed as part of usual practice (as opposed to the use of additional measures in specific circumstances e.g., where invasive procedures are conducted or in the event of an outbreak)

Semi-critical items: Items that come in contact with non-intact skin or mucous membranes but ordinarily do not penetrate them.

Sharps: Instruments used in delivering healthcare that can inflict a penetrating injury, e.g., needles, lancets, scalpels.

Staff: Anyone conducting activities in settings where healthcare is provided, including healthcare providers.

Standard precautions: Work practices that constitute the first-line approach to infection prevention and control in

the healthcare environment. These are recommended for the care and treatment of all patients.

Sterile: Free from all living microorganisms; usually described as probability (e.g., the probability of a surviving microorganism being 1 in 1 million).

Surgical antibiotic prophylaxis: Prevention of infectious complications by administering an effective antimicrobial agent prior to exposure to contamination during surgery.

Surveillance: The systematic ongoing collection, collation and analysis of data with timely dissemination of information to those who require it in order to take action.

Transmission based precautions: Precautions (i.e., contact precautions, droplet precautions and airborne precautions) that are necessary in addition to routine practices for certain pathogens or clinical presentations. These precautions are based on the method of transmission (e.g., contact, droplet, airborne) and was formerly called additional precautions.

Vancomycin-resistant enterococci: Strains of *Enterococcus faecium* or *Enterococcus faecalis* that have a minimal inhibitory concentration to vancomycin of ≥ 32 mcg/ml and / or contain the resistance genes *vanA* or *vanB*.

Bibliography

1. ANTT | PHA Infection Control. Accessed June 6, 2021. https://www.niinfectioncontrolmanual.net/antt.
2. Association of Occupational Health Professionals in Healthcare. Recommended work restrictions for communicable diseases in health care workers. 24 October 2014.
3. Australian Commission on Safety and Quality in Health Care March 2018. Selected best practices and suggestions for improvement for clinicians and health system managers.
4. Australian Guidelines for the Prevention and Control of Infection in Healthcare, Canberra: National Health and Medical Research Council. May 2019.
5. Barrera-Cancedda, Amy Elizabeth, Kathryn A. Riman, Julianna E. Shinnick, and Alison M. Buttenheim. "Implementation Strategies for Infection Prevention and Control Promotion for Nurses in Sub-Saharan Africa: A Systematic Review." *Implementation Science* 14, no. 1 (December 30, 2019): 111. https://doi.org/10.1186/s13012-019-0958-3.
6. Birgand, G., A. Johansson, E. Szilagyi, and J. -C. Lucet. "Overcoming the Obstacles of Implementing Infection Prevention and Control Guidelines." *Clinical Microbiology and Infection* 21, no. 12 (December 1, 2015): 1067–71. https://doi.org/10.1016/j.cmi.2015.09.005.
7. CDC NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, 2020. Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings. Available from: https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
8. CDC, 2012. NIOSH Fast Facts: How to prevent latex allergies. Available from: https://www.cdc.gov/niosh/docs/2012-119/pdfs/2012-119.pdf
9. CDC, 2016. Infection Control: Transmission-Based Precautions. Available from: https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html
10. CDC, 2018. Standard Precautions. Available from: https://www.cdc.gov/oralhealth/infectioncontrol/summary-infection-prevention-practices/standard-precautions.html
11. CDC. "Handwashing: Clean Hands Save Lives". Centers for Disease Control and Prevention. Accessed May 1, 2021. https://www.cdc.gov/handwashing/posters.html
12. CDC. "Infection Control". Centers for Disease Control and Prevention, September 25, 2020. https://www.cdc.gov/infectioncontrol/index.html
13. Centre for Communicable Diseases and Infection Control, Canada. (2013). Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Healthcare Settings. Ontario: Public Health Agency of Canada. Available online: https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/routine-practices-precautions-healthcare-associated-infections-2016-FINAL-eng.pdf (Last accessed on 03.05.2021).
14. Curless, Forrester and Trexler. Reference Manual for Health Care Facilities with Limited Resources; Infection Prevention and Control: Module 1 - Introduction to Infection Prevention and Control. Jhpiego Corporation; Johns Hopkins Medicine. 2018.
15. Danasekaran R, Mani G, Annadurai K. Prevention of healthcare-associated infections: protecting patients, saving lives. Int J Community Med Public Health. 2014;1(1):67–68.
16. Dr. C. Gaud, 2018. Protocole National de prise en charge des personnes vivant avec le VIH a Maurice.
17. Environmental Cleaning Procedures | Environmental Cleaning in RLS | HAI | CDC. February 11, 2021. https://www.cdc.gov/hai/prevent/resource-limited/cleaning-procedures.html.
18. European Centre for Disease Prevention and Control. Surveillance of healthcare-associated infections and prevention indicators in European intensive care units. Stockholm: ECDC; 2017.
19. Gay N, Belmonte O, Collard JM, et al. Review of Antibiotic Resistance in the Indian Ocean Commission: A Human and Animal Health Issue. Front Public Health. 2017;5:162. Published 2017 Jul 6. doi:10.3389/fpubh.2017.00162
20. George Freedman, Samaranayake Lakshman P., 2012. Contemporary Esthetic Dentistry. Available from: https://www.sciencedirect.com/topics/nursing-and-health- professions/transmission-based-precautions.html
21. Global Alliance for Infections in Surgery. "7 Strategies to Prevent Healthcare-Associated Infections". February 2, 2019. https://infectionsinsurgery.org/7-strategies-to-prevent-healthcare-associated-infections/
22. Aboobakar S. Guidelines for Infection Prevention and control, Dr. A. G. Jeetoo Hospital. Ministry of Health and Wellness, Mauritius. 2014.
23. Ideal Clinic Monitoring System. Accessed May 1, 2021. https://www.idealhealthfacility.org.za/.
24. Infection Prevention and Control – Physiopedia. Accessed May 1, 2021. https://www.physio-pedia.com/Infection_Prevention_and_Control.
25. Infection prevention and control [Internet]. World Health Organization. 2020 [cited 27 March 2020]. Available from: https://www.who.int/infection-prevention/about/ipc/en/
26. Interagency Coordination Group on Antimicrobial Resistance. NO TIME TO WAIT: SECURING THE FUTURE FROM DRUG-RESISTANT INFECTIONS - REPORT TO THE SECRETARY-GENERAL OF THE UNITED NATIONS. April, 2019.
27. ISID. "Bundles in Infection Prevention and Safety." Accessed June 6, 2021. https://isid.org/guide/infectionprevention/bundles/.
28. Issack MI, Manraj SS. Antibiotic susceptibility of bacteria isolated from hospitalised patients in Mauritius. Center for disease dynamics economics and policy editor. 1st Global Forum on Bacterial Infections: Balancing Treatment Access and Antibiotic Resistance 2011 New Delhi, India; 2011.
29. Issack MI. Antibiotic resistance among hospitalized patients in Mauritius in 2014. Int J Infect Dis. 2016;45S:1–477. DOI:10.1016/j.ijid.2016.02.250
30. Issack MI, Yee Kin Tet HY, Morlat P. Antimicrobial resistance among *Enterobacteriaceae* causing uncomplicated urinary tract infections in Mauritius: Consequences of past misuse of antibiotics. J Chemother. 2007;19(2):222-5.
31. Jepsen OB, Jensen LP, Zimakoff J, Friis H, Bissoonauthsing CN, Kasenally AT, et al. Prevalence of infections and use of antibiotics among hospitalized patients in Mauritius. A nationwide survey for the planning of a national infection control programme. J Hosp Infect. 1993 Dec;25[4]:271–8.
32. Key Infection Control Practices in Inpatient and Outpatient Medical Care Settings. Accessed May 1, 2021. https://www.health.ny.gov/professionals/diseases/reporting/communicable/infection/key_infection_control_practices.htm.
33. Kobedi, Puseletso. "Hospital Infection Outbreaks." *NICD* (blog), October 4, 2019. https://www.nicd.ac.za/diseases-a-z-index/hospital-infection-outbreaks/.
34. Kuhar, D.T., Carrico, R.M., Cox, K., de Perio, M.A., Irwin, K.L., Lundstrom, T., Overholt, A.D., Roberts, K.T., Russi, M., Steed, C. and Sen, S. (2019). Infection Control in Healthcare Personnel: Infrastructure and Routine Practices for Occupational Infection Prevention and

Control Services. Atlanta, Geaorgia: Centre for Disease Control, USA. Available on: https://www.cdc.gov/infectioncontrol/pdf/guidelines/infection-control-HCP-H.pdf (Last accessed on 03.05.2021).
35. Licker, Monica, Luminița Bădițoiu, Diana Lungeanu, Rossitza Dobrevska, Emese Szilagy, Lul Raka, Ljiljana Denic, and Silvio Brusaferro. "Infection Control Capacity Building in European Countries with Limited Resources: Issues and Priorities." *Journal of Hospital Infection* 96 (January 5, 2017). https://doi.org/10.1016/j.jhin.2016.12.024.
36. Mehmood, Rashid. "Risk Based Internal Audit Plan - A Practical Approach." CAclubindia. Accessed May 1, 2021. https://www.caclubindia.com/articles/risk-based-internal-audit-plan-a-practical-approach-16707.asp.
37. National Guidelines for Infection Prevention and Control in Healthcare Facilities. Ministry of Health and Family Welfare, Government of India. January 2020.
38. National institute for clinical excellence. Antimicrobial stewardship-systems and processes for effective antimicrobial medicine use NG15. NICE guideline. Published: 18 August 2015.
39. NHS FOUNDATION TRUST, 2021, COVID 19 staff FAQS: wearing face masks in our hospitals. Available from: https://www.ouh.nhs.uk/working-for-us/staff/covid-staff-faqs- masks.aspx
40. NHS, 2018. What should I do if I injure myself with a used needle? Available from: https://www.nhs.uk/common-health-questions/accidents-first-aid-and-treatments/what- should-i-do-if-i-injure-myself-with-a-used-needle/
41. NHS, 2020, Respiratory and Cough Hygiene, UK, Harrogate and District NHS Foundation Trust. Available from: DC-09-Respiratory-and-cough-hygiene-2020-Version-1.00.pdf
42. Nuckchady DC. Incidence, Risk Factors, and Mortality From Hospital-Acquired Infections at a Hospital in Mauritius. Cureus. 2021 Nov 28;13(11):e19962. doi: 10.7759/cureus.19962.
43. Nuckchady DC. Isolation Guidelines, 2020. Regional Infection Prevention and Control Committee of Region 1, Mauritius.
44. Nuckchady D C. Impact of a Multimodal Improvement Strategy to Promote Hand Hygiene at a Hospital in Mauritius. Cureus 13(6): e15812. 21 June 2021. doi:10.7759/cureus.15812
45. Nuckchady DC. Situational analysis: Infection Prevention and Control at Dr. A. G. Jeetoo Hospital, 2019-2020. Ministry of Health and Wellness. 18 November 2020.
46. Nuckchady DC, Boolaky SH. The Prevalence of Multi-Drug Resistant Organisms and Their Outcomes in an ICU in Mauritius: An Observational Study. Asian J Med Health. 2020 Dec 21;71–8.
47. Ogbonnaya Oji, Haile, Mesfin, April Baller, Nathalie Tremblay, Nuha Mahmoud, Alex Gasasira, Victor Ladele, Catherine Cooper, Francis Kateh, Tolbert Nyenswah, and Peter Nsubuga. "Implementing Infection Prevention and Control Capacity Building Strategies within the Context of Ebola Outbreak in a 'Hard-to-Reach' Area of Liberia." *Pan African Medical Journal* 31 (October 12, 2018). https://doi.org/10.11604/pamj.2018.31.107.15517.
48. Ossama Rasslan. IFIC Basic Concepts of Infection Control; Chapter 2: Organisational Structure. International Federation of Infection Control. 3rd edition, 2016.
49. Outbreak Management | PHA Infection Control. Accessed May 1, 2021. https://www.niinfectioncontrolmanual.net/outbreak-management.
50. Outline For Healthcare-Associated Infections Surveillance. CDC. April 2006.
51. Pan American Health Organization, "Epidemiological Surveillance of Healthcare Associated Infections". Washington, D. C.: PAHO, © 2011. ISBN 978-92-75-13147-3.
52. Pássaro L, Harbarth S, Landelle C. Prevention of hospital-acquired pneumonia in non-ventilated adult patients: a narrative review. Antimicrob Resist Infect Control. 2016;5:43. Published 2016 Nov 14.
53. Practical Manual for Implementation of the National Infection Prevention and Control Strategic Framework. Department of Health, Republic of South Africa. March 2020.
54. Prevention of hospital-acquired infections: A practical guide 2nd edition. WHO.
55. Quick and Dirty of Cleaning and Disinfection Designated Officer Training. Simcoe Muskoka District Health Unit. 17 January 2013.
56. Republic of Mauritius. National Action Plan on Antimicrobial Resistance 2017-2021. Ministry of Health and quality of life. April 2017.
57. SA Health: "Your official portal to public health services, hospitals, health information and health careers in South Australia". Jan 2021. www.sahealth.sa.gov.au
58. SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH, 2021. How to put on and remove a face mask. Available from: https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
59. Siegel D Jane, 2012. Principle and Practice of Paediatric infectious diseases. Available from: https://www.sciencedirect.com/topics/nursing-and-health-professions/transmission- based-precautions.html
60. Soeters, Heidi M., Lamine Koivogui, Lindsey de Beer, Candice Y. Johnson, Dianka Diaby, Abdoulaye Ouedraogo, Fatoumata Touré, et al. "Infection Prevention and Control Training and Capacity Building during the Ebola Epidemic in Guinea." *PLOS ONE* 13, no. 2 (February 28, 2018): e0193291. https://doi.org/10.1371/journal.pone.0193291.
61. Storr, Jules, Anthony Twyman, Walter Zingg, Nizam Damani, Claire Kilpatrick, Jacqui Reilly, Lesley Price, et al. "Core Components for Effective Infection Prevention and Control Programmes: New WHO Evidence-Based Recommendations." *Antimicrobial Resistance & Infection Control* 6 (January 10, 2017): 1–18. https://doi.org/10.1186/s13756-016-0149-9.
62. Thomas A., Hooven, R. A. (2014). Healthcare-associated infections in the hospitalized neonate: a review.
63. Vincent, P. J. (2003). Nosocomial infections in adult intensive-care units. The Lancet.
64. WHO Department of Service Delivery and Safety (SDS). Antibiotics of choice for surgical antibiotic prophylaxis. EML GUIDANCE ON SAP, FINAL VERSION 1 Application for the 21st Model List of Essential Medicines.
65. WHO, 2009. WHO Guidelines on hand hygiene in healthcare: a summary, Switzerland, WHO Press. Available from: https://www.who.int/gpsc/5may/tools/who_guidelines- handhygiene_summary.pdf
66. WHO, 2020. Coronavirus disease (COVID-19) advice for the public: When and how to use mask. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus- 2019/advice-for-public/when-and-how-to-use-masks.html
67. WHO, 2021. Handbook on Infection Prevention and Control for Primary Health Care Workers.
68. WHO. "WHO | Capacity Building." World Health Organization. Accessed May 1, 2021. http://www.who.int/violence_injury_prevention/capacitybuilding/en/.
69. WHO. "WHO | Evidence, Guidelines and Publications." World Health Organization. Accessed May 1, 2021. http://www.who.int/infection-prevention/publications/en/.
70. World Health Organisation. Health care-associated infections, Fact Sheet. Retrieved from https://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf
71. World Health Organisation. WHO Africa. Antimicrobial consumption Monitoring in Mauritius. 23 Jan 2018. https://www.afro.who.int/news/antimicrobial-consumption-monitoring-mauritius.

72. World Health Organization and International Labour Organization. (2021). COVID-19: Occupational Health and Safety for Health Workers. Geneva: World Health Organization Headquarters. Available on: https://www.who.int/publications/i/item/WHO-2019-nCoV-HCW_advice-2021.1 (Last accessed on 03.05.2021).
73. World Health Organization. Observation form. August 2009.
74. World Health Organization. Prevention of hospital acquired infections. A practical guide. 2nd edition. WHO/CDS/CSR/EPH/2002.12
75. World Health Organization. WHO Guidelines for Safe Surgery 2009: safe surgery saves lives. 2009.