KINGDOM OF CAMBODIA

NATION RELIGION KING

Ministry of Health

National Guidelines For Infection Prevention and Control for Healthcare Facilities

2017

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ACKNOWLEDGEMENTS

In the past decade globalization has enabled rapid economic, social, cultural, health development around the world. Despite this progress countries around the world have been faced with diseases once under control such as TB and other communicable diseases including Severe Acute Respiratory Syndrome (SARS), ZIKA, avian influenza (AI) and so on. Some pathogens that are not treatable such as HIV, and HBV have caused high morbidity and mortality. There is some evidence of poor compliance to infection prevention and control (IPC) practices especially infection prevention in healthcare facilities. Improving knowledge and practice of proper IPC among healthcare workers will ensure high quality and safe healthcare services and prevent infection to other staff, clients and their families, students and interns, as well as reduce infection from healthcare facilities to the community. In addition, antimicrobial resistance and the cost of unnecessary treatment will also be reduced.

Given the importance and need of medical technology and with the technical support of WHO and Global Fund, the IPC Guideline for healthcare facilities has been updated with a view to providing healthcare managers and workers in the Kingdom of Cambodia with knowledge and practice of IPC in healthcare settings in a transparent and effective manner.

The IPC Guideline that contains an IPC assessment tool will be introduced in all health facilities at both national and sub-national level and may be used in all aspects of the IPC program including healthcare waste management in both public and private healthcare facilities in the Kingdom of Cambodia. The Ministry of Health (MoH) calls on all health workers to strictly follow these guidelines and to use them as the basis for developing various educational policies in their respective healthcare facilities. MoH encourages health development partners to support the successful implementation of this Guideline.

28 August

For Minister of Health

Prof. ENG HUOT
SECRETARY OF STATE

PREFACE

The Ministry of Health wishes to acknowledge the following contributors and development partners for their invaluable support, both technical and financial contribution, in the development and finalization of this National Guideline for Infection Prevention and Control at Healthcare Facilities.

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ACRONYMS

ACH	Air Changes per Hour
AI	Avian Influenza
AIDS	Acquired Immuno-Deficiency Syndrome
AHR	Alcohol-based Hand Rub
AMR	Anti-Microbial Resistance
APSED	Asia Pacific Strategy for Emerging Diseases
ARI	Acute Respiratory Infection
BCG	Bacillus Calmette-Guérin
BI	Biological Indicator
BSI	Blood Stream Infection
BSL	Bio-Safety Level
CABSI	Catheter Associated Blood Stream Infection
CDC	Centers for Disease Control and Prevention
CI	Chemical Indicator
CSSD	Central Sterilization and Supply Department
ECG	Electrocardiogram
E.Coli	Escherichia Coli
EID	Emerging Infectious Diseases
ER	Emergency Room
EVD	Ebola Virus Disease
HAI	Hospital Acquired Infection
HAI	Health Care Associated Infection
HBV	Hepatitis B Virus
HCF	Health Care Facility
HCV	Hepatitis C Virus
HCW	Health Care Worker
HEPA	High Efficiency Particulate Air (filters)
HH	Hand Hygiene
HIV	Human Immunodeficiency Virus
HCWM	Health Care Waste Management
HLD	High-Level Disinfection
ICU	Intensive Care Unit

ID	Infectious Disease
IFIC	International Federation of Infection Control
IHR	International Health Regulation
IPC	Infection Prevention and Control
IU	Isolation unit
IV	Intravenous
LAI	Laboratory-Acquired Infectious
MCH	Maternal and Child Health
MD	Medical Doctor
MDR-TB	Multi-Drug Resistant Tuberculosis
MERS	Middle East Respiratory Syndrome
M&E	Monitoring and Evaluation
MoH	Ministry of Health
MRSA	Methicillin Resistant Staphylococcus Aureus
NI	Nosocomial Infection
NICU	Neonatal Intensive Care Unit
NIOSH	The National Institute for Occupational Safety and Health
OHS	Occupational Health and Safety
OPD	Out-Patient Department
OR	Operating Room
PNEU	Pneumonia
PPE	Personal Protective Equipment
SARS	Severe Acute Respiratory Syndrome
SSI	Surgical Site Infection
TB	Tuberculosis
UP	Universal Precautions
USA	United States of America
UTI	Urinary Tract Infection
VRE	Vancomycin Resistant Enterococcus
WHO	World Health Organization
WPRO	Western Pacific Regional Office
XDR-TB	Extensively Drug-Resistant TB

CHARTER I INTRODUCTION

1.1 Background

Infection Prevention and Control (IPC) has an integral role in the provision of a safe healthcare environment for patients, their family and visitors, and Health Care Workers[1] (HCWs) across the continuum of care. Lack of adherence to safe practices or inadvertent exposure to pathogens in the healthcare environment can lead to significant morbidity (including disability) and mortality in patients and healthcare workers alike.

In the mid-19th century, Viennese obstetrician Dr Ignaz Semmelweis demonstrated that the routine washing of hands could prevent spread of puerperal fever. In 1860, English nurse Florence Nightingale began implementing hospital hygiene and sanitation measures in her care of wounded soldiers, thereby pioneering what is now considered modern nursing.

IPC measures were at first known as hospital hygiene, then Universal Precautions (UP), barrier nursing, and Infection Control (IC). Due to the current practice, not only to control but also to prevent patient and staff from any infection, the current terminology used by the World Health Organization (WHO) and the United States – Centers for Disease Control and Prevention (US-CDC) is "Infection Prevention and Control (IPC) measures".

Without appropriate precautions, people receiving medical care or those working in a Health Care Facilities (HCFs), are at risk of infection. Those infections contracted by a patient or HCW in a HCF are identified as healthcare-acquired infections (HCAI), healthcare-associated infections (HAI) or nosocomial infections (NI). In this Guideline, the term "nosocomial infection" will be used and defined (by WHO) as those infections that affect patients in a hospital or other healthcare facility and are not present or incubating at the time of admission. The term also includes infections acquired by patients in the hospital or facility but appearing after discharge, and occupational infections among staff.

Worldwide, it has been reported (2002) that around 1.4 million people are suffering from NI. However, this figure may be underestimated as some countries are under-reporting or not reporting at all, especially developing countries. The higher frequency of NI was reported in Mediterranean and South East Asian regions, with prevalence greater than 10% [2].

[1] HCWs include medical doctors (MD), surgeons, dentists, nurses, midwives, cleaner, housekeeping staff, technical staff such as laboratory, radio-technician, and pharmacist etc. .

[2] Translated from "Prevention des infections nosocomiales", 2nd Edition, WHO - 2008

The strict application of IPC measures contributes to the reduction of NIs such as Methicillin Resistant Staphylococcus Aureus (MRSA) whilst decreasing the risk of Anti-Microbial Resistance (AMR).

IPC measures are crucial in any response to an outbreak of emerging or re-emerging infectious disease (EID), such as Ebola Virus Disease (EVD), Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and various Influenza subtypes. Moreover, IPC is identified as a key component of the Asia Pacific Strategy for Emerging Diseases and Public Health Emergencies (APSED III), and the International Health Regulation (IHR [2005]).

To address local, regional and global contexts, the Ministry of Health (MoH) in Cambodia – guided by the National IPC Policy and Strategy – has developed these General Guidelines for Infection Prevention and Control for Healthcare Facilities, which will serve as guidance for HCWs to understand the principles of IPC, as well as recommended procedural best practice.

To prevent and control any infectious disease, for patients and staff safety, the Ministry of Health (MoH) aims to strengthen the IPC measures in all HCFs by implementing IPC programme.

CHARTER II

INFECTION PREVENTION AND CONTROL (IPC) PROGRAMME

An IPC programme incorporates all aspects of IPC at all levels of the healthcare system. It puts together various practices which, when used appropriately, restrict the spread of infection.

2.1 The objectives of the IPC Programme

To reduce the incidence and risk of preventable Nosocomial Infection (NI), and to for mulate an organisational framework that guides the effective use of resources to deliver safe, cost-effective and evidence-based healthcare.

2.2 Components of IPC Programmes

The core components of IPC programmes include:

1. Organization of IPC Programmes
2. Technical idelines,
3. Humanesources,
4. Surveillance of Infections and Assessment of Compliance with IPCractices,
5. Microbiology boratory,
6. Enabling Environment (equipment and infrastructure)
7. Monitor and evaluation (M&E) of Programmes, and
8. Links with Public Health or other Services

These eight core components are explained further in Table 1.

Table 1 Summary of core components of IPC programmes[3]

	Description
1. Organization of IPC programmes	• A structure responsible for policies, goals, strategies, legal and technical framework, and monitoring. • Existence of qualified and dedicated technical staff with clearly defined responsibilities, scope and functions. • A budget adequate to meet program-med activities.

[3] Infection Prevention and Control in Health Care Informal Network Report of the Second Meeting, 26-27 June 2008, Geneva, Switzerland.

2. Technical guidelines	• Development, dissemination and implementation of evidence-based guidelines for prevention of the relevant risks and/or infections, adapted to local conditions.
3. Human resources	• Training for all HCWs, and health science students on IPC. Caregivers such as family members should be trained on basic IPC. • Advanced training to IPC professionals. • Adequate staff responsible for IPC activities. • Implement prevention measures in line with the Occupational Health and Safety (OHS) policy (e.g. prevention of biological risk, chemical risk ….)
4. Surveillance of infections and assessment of compliance with IPC practices	• Established priorities for surveillance of infections and pathogens, standardized case definitions and active methods of surveillance. • Systematic assessment of compliance with IPC practices. Detection of outbreaks and prompt response. • Documentation of NI and IPC practices.
5. Microbiology laboratory	• Standardization 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.
6. Enabling Environment (Equipment and infrastructure)	• Minimum requirements for IPC: clean water, ventilation, hand-washing facilities, patient placement and isolation facilities, storage of sterile supply, conditions for building and/ or renovation, constant availability of IPC equipment.

7. Monitor and evaluation (M&E) of programmes	• Regular monitoring, evaluation and reporting of IPC outcomes
8. 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.

2.3 Training in IPC

An IPC programme can be successful only when everyone is involved. People are usually willing to change bad habits to good ones when they understand the reasons and the importance of each procedure. Therefore, it is recom-mended that each health-care facility should plan frequent in-service training programmes for staff, patients and visitors. In-service training is an ongoing activity. It should be used to teach good practices, change bad habits, and demonstrate new equipment or procedures.

All HCWs and people who work in the hospital setting (such as cleaning and kitchen staff) must be adequately trained in infection prevention and control. All HCWs are integral in preventing NI.

All HCWs should be trained to:

- Understand how infection spreads in the healthcare facility;
- Know the important role of each staff member plays in preventing infection;
- Know early signs and symptoms of common NI; and
- Be able to describe or demonstrate various methods of preventing the spread of micro-organisms.

Additionally, health science students should be trained on IPC based on National IPC pre-service training curriculum.

Please refer to ***"National IPC pre-service training curriculum"*** for more detail.

Train caregiver or family member in IPC

Whilst thorough training of all HCWs is key, in Cambodia, families are often very

involved in the personal care of the patient, as seen in Figure 1. As such, it is important for HCWs to also provide education to the caregivers on IPC measures so that they are best able to protect the patient and themselves, other patients and HCWs from infection.

| Figure 1
Patient and family members/caregivers

2.4 HCWs personal hygiene and self-protection (component of IPC programme under human resources)

HCWs must also be aware of the impact that their own personal IPC measures can have on HCF IPC implementation. HCWs must be vigilant with their own personal hygiene, compliance with food safety principles and responsible health behaviours, such as timely informing of manager when sick.

Uniforms should be cleaned in HCFs in order to contain any infectious agents on the uniforms with the HCF and not out in the community.

Appropriate (closed) footwear (as seen in Figure 2) must be worn to protect feet from contamination with potentially-infectious liquid agents (such as blood) and needle-stick injuries.

Finger nails should be kept tidy and short. False nails (as seen in Figure 3) are not permitted as they can harbour unseen microorganisms that cannot be removed with regular handwashing. No jewellery should be worn on the hands or arms as this can also inhibit optimal hand hygiene.

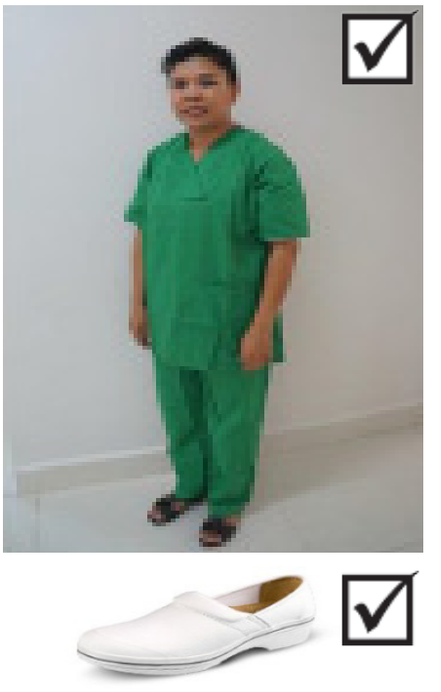


Figure 2 **|**
HCW with working uni-form and closed footwear

Working uniform should be worn as soon as at the beginning of each shift work.

Closed footwear, should also be worn to protect feet from splashes and injury by sharps or heavy items that may accidentally fall on them.

For this reason, sandals, or shoes made of soft materials should not be worn.

Figure 3 **|**
HCW with long nails and jewellery

It is also important that the staff

- keep tidy and short nails;
- remove fake nails and jewellery.

CHARTER III BASICS OF INFECTION

Infection is the invasion and multiplication of a microorganism, such as a virus, a parasite, a fungus or a bacterium, within or on the human body. This can cause the person to become sick.

Spread of infection in hospitals and health facilities is a serious problem, which affects the wellbeing of patients and healthcare workers alike. A breach in infection control practices facilitates transmission of infection between patients, HCWs, family, visitors, all at people in HCF. An infected healthcare worker can transmit a large number of microorganisms to a new host. An infected patient can contaminate an object, an instrument, or a surface, or another patient or staff via contaminated hands.

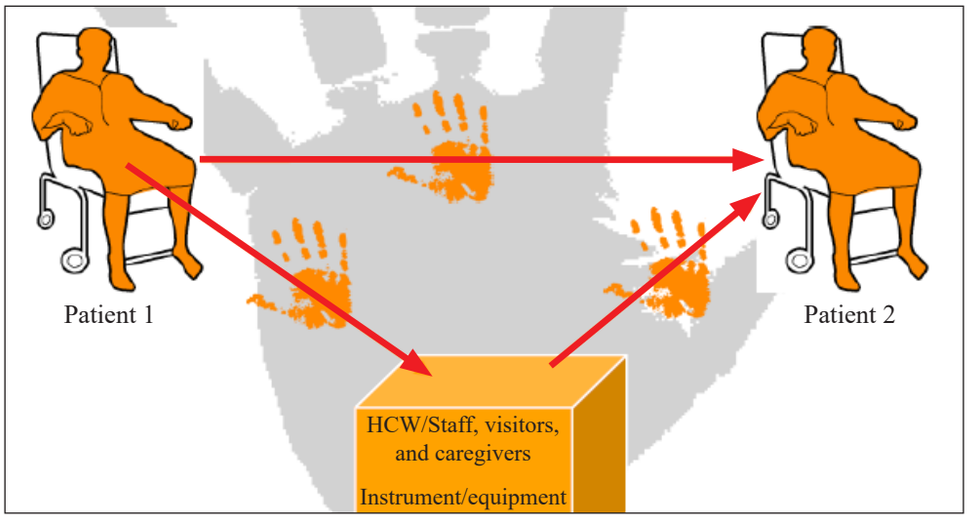
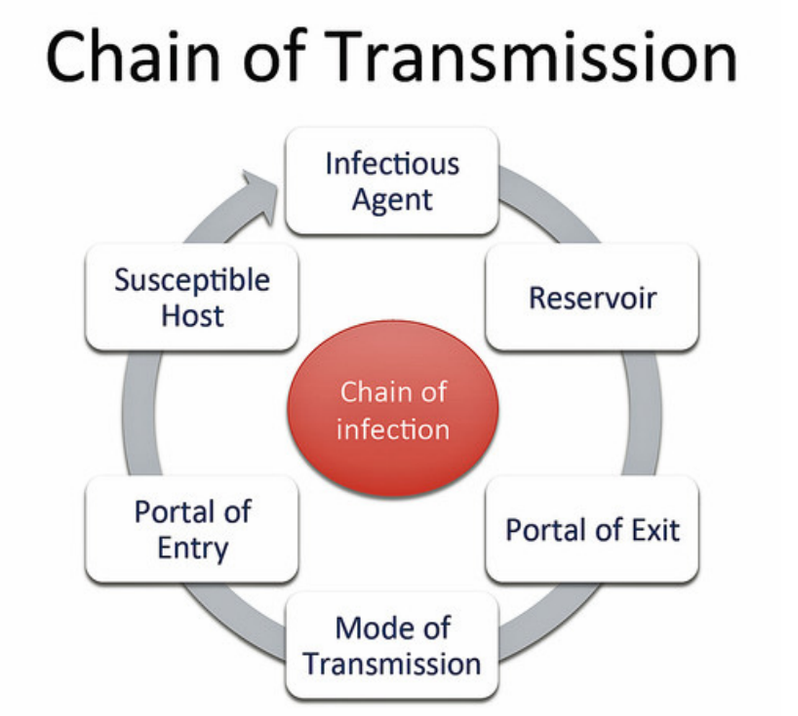


Figure 4 *| Examples of how infection spreads within a HCF*

3.1 Cycle of Infection

3.1.1 Transmission of Infection

To carry out IPC, it is important to understand the components of infection and the methods to control them. For an infection to spread certain conditions must be present. The cycle of infection is like a chain consisting of six links. For an infection to occur, each link of the infectious processes must be present:



| Figure 5
Cycle of Infection

(1) Infectious agent/ pathogen

They are the microorganisms, sometimes called germs that cause the infection. There are many types: bacteria, viruses, fungi, and parasites.

(2) Reservoir

It is where the microorganisms live, survive and multiply (equipment, humans, animals, plants, water, soil, and where waste collects). Often in the case of humans, they can live happily on one part of the body but can cause disease if they move to another part. For example E. coli is in the gut of all humans however it can cause a urinary tract infection if it finds its way to the bladder.

(3) Portal of exit

It is how the microorganism leaves the reservoir. The infectious agent can leave the reservoir through the bloodstream, broken skin (e.g. puncture, cut, surgical site, skin lesion or rash), mucous membranes (e.g. eyes, nose, and mouth), the respiratory tract (e.g. lungs), the genitourinary tract (e.g. vagina, penis), the gastrointestinal tract (e.g. mouth, anus), or the placenta by means of blood, excretions, secretions, or droplets that come from these sites. For environmental reservoirs, for example, exit may be accomplished by contamination of patient care equipment by microorganisms in tap water used to rinse the equipment.

(4) Mode or route of transmission:

It is how the microorganism enters the host, and it can happen through:

a. Contact transmission:

- Direct contact: (e.g. contaminated blood or secretion via open skin or contaminated hands touching directly mucus (e.g. eyes, nose…)

- Indirect contact: via a contaminated hands, object/ surface and environment. For instance, contaminated hands touching the hob of the door or light switch, this object/surface get contaminated and could transmit germs via indirect contact to patient or another HCW.

b. Droplets transmission: via large droplet, > 5 micrometers or micron µm, which areproduced when coughing, sneezing, and talking. Droplet transmission occurs when contagious droplets produced by the infected host propelling a short distance (<1 meter) and come into contact with another person's conjunctiva, mouth or nasal mucosa.

c. Airborne transmission: via droplet nuclei (< 5 µm), which can suspend in the air for a long time and travel a long distance.

d. Vector-borne transmission: Vectors are animals that are capable of transmitting diseases. Examples of vectors are flies, mosquitoes, mites, fleas, ticks, rats, and dogs. For instance, female Aedes aegypti mosquitoes vector for dengue fever, female anopheles mosquitoes vector for Malaria. In Operating Room (OR) particular attention to flies, as microorganisms could be outside surface of a vector (such as a fly) and spread through physical contact with aseptic instruments.

e. Fecal-oral transmission: usually associated with organisms that infect the digestive system. Infection such as Escherichia coli (E.Coli), giardiasis, cholera etc. are transmitted due to poor sanitation system and hygiene. Currently, E.coli is a serious threat in HCFs, worldwide.

(5) Portal of entry:

It is where the microorganism can enter the body through any opening. For example eyes, nose, moth, broken skin, any mucous membranes, any catheters inside the body, etc.).

(6) A susceptible host:

It is a person who has little or no resistance against the disease-producing organism and is likely to become infected if it enters his or her body. The host can be HCWs, patients, attendants or visitors.

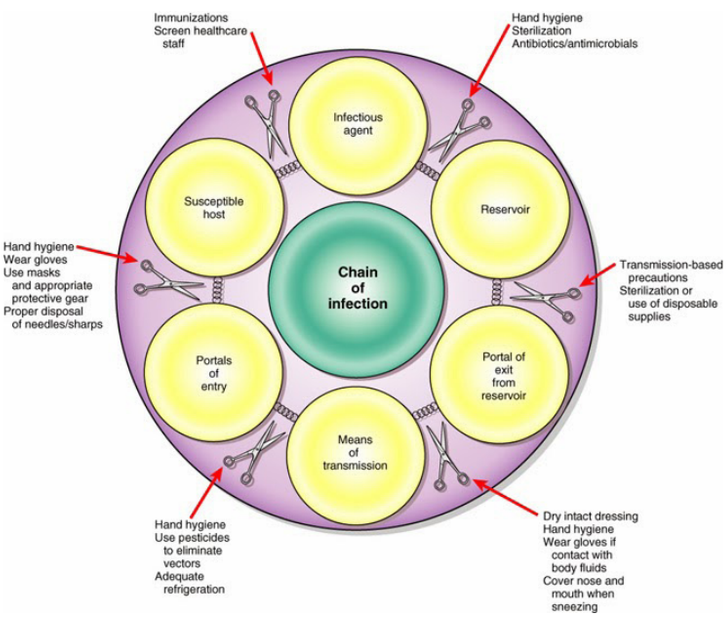
Important patient factors influencing acquisition of infection include age, immune status, underlying disease, and diagnostic and therapeutic interventions. The extremes of life - infancy and old age - are associated with an increased susceptibility to infection. Malnutrition also carries a high risk.

Patients with a chronic disease such as cancer, diabetes mellitus, leukaemia, renal failure, or Acquired immunodeficiency syndrome (AIDS) have an in creased susceptibility to infections with opportunistic pathogens.[4]

3.1.2 Breaking the Cycle of Infection

IPC measures will decrease the risk of spreading and getting infection by "breaking" the cycle of infection, at different levels depending on the type of precautions. IPC measures include standard and additional (transmission-based) precautions.

IPC precautions will break the chain of infection by decreasing the quantity and the virulence of pathogen by mechanical and chemical action (e.g. hand hygiene, cleaning, disinfecting, sterilising…), and by putting a barrier between the pathogen and the host, by wearing Personal Protective Equipment (PPE) and by eliminating the reservoir in a safe manner (e.g. proper management of medical waste).



| *Figure 6*
IPC measures and the chain of infection

(1) **Decreasing or eliminating the infectious agent** will break the cycle of infection. For instance by cleaning, disinfecting/ sterilising the soiled equipment or linen.

(2) **Control the reservoir** by screening and isolation

Isolation of infectious patient is an example of a method of controlling the person with the disease. In this way, the likelihood of them becoming in contact with susceptible hosts is diminished and so the transmission cycle is broken.

[4] These are organisms that are normally harmless, e.g. they may be part of the normal bacterial flora, but may cause disease when the body's immunological defenses are weakened.

(3) **Port of exit** can be closed by the use of proper attire- an example is covering seeping pustules so that the pus cannot escape and infect others; wearing surgical mask or covering mouth when sneezing or coughing.

(4) **Modes or means of transmission:**

a. Contact prevention

a.1 Diseases that are spread by direct contact can be controlled by washing hands or wearing surgical gloves when examining a patient's wounds.

a.2 Transmission through indirect contact can be controlled by decontaminating, cleaning, sterilizing patient' equipment/ instruments or soiled linen, and surfaces and by properly taking care of hazardous material.

b. Droplet spread prevention includes having a distance of > 1 metre from the source, wearing mask, and hand washing

c. Airborne spread can be stopped by having an adequate ventilation (negative pressure) and avoiding contamination of the HCFs air.

d. Vector-borne diseases can be prevented by reducing breeding sites and by using mosquito nets and insect repellents.

e. Fecal-oral prevention can be done by applying proper hygienic (hand hygiene) and sanitation practices, and having adequate sewage treatment and water filtration (potable water).

(5) **Block route/portal of entry by**

- adding barriers, such as additional PPE; for example, use of surgical mask for big droplet, or particulate respirator (e.g. N95) to stop entry of small particulate (< 5 micro) into the nasal mucus,
- using aseptic technique,
- avoiding sharp injuries and
- disinfection and sterilization of equipment.

(6) **Targeting the susceptible host:** A host can defend itself against some infectious agent if it develops immunity to it. Immunity can be acquired naturally, or by artificial immunity i.e. by injecting a vaccine (e.g. flu vaccine, Hepatitis B vaccine…). While a host/ patient who is immune-compromised (e.g. neo-natal child, Human Immunodeficiency Virus (HIV)- AIDS patient, elderly patient…) should be hospitalised away from infectious patient (e.g. infectious ward or infectious disease isolation room/ unit) to avoid cross-contaminated.

3.2 Basics of Nosocomial Infection

To prevent nosocomial infection, strict applications of IPC measures are crucial.

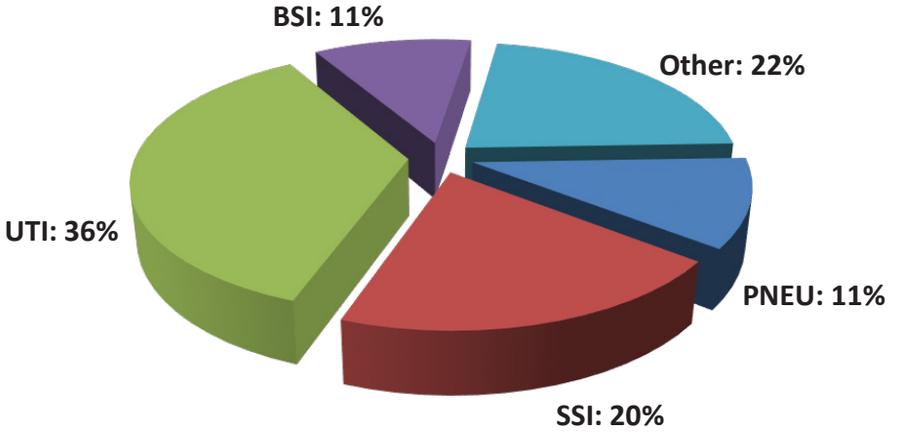
Nosocomial Infection (NI) also called "Hospital Acquired Infection" (HAI) or "Healthcare Associated Infection" (HAI) is defined as infection acquired during hospital care which is not present or incubating at admission. Infections occurring more than 48 hours after admission are usually considered nosocomial[5]. It also includes occupational infection contracted by HCWs.

The "Healthcare Associated Infection (HAI)" includes not only infection acquired in the hospital but in any health care setting, including long-term care facilities, ambulatory settings, and home/community care.

All NI are a burden for patient, family and healthcare facilities. It can be life threatening for the patient, it prolongs the length of stay, increase the healthcare cost for HCF, and more for the patient and family and society.

The most common NIs are Urinary Tract Infection (UTI), Surgical Site Infection (SSI), Blood Stream Infection (BSI) or Catheter Associated blood stream infection (CABSI), and nosocomial pneumonia (PNEU). Other risk of infection for staff and patient are blood-borne infection.

The distribution of NIs is different for each HCF, depending on application of IPC measures, their activities/ specialty and the type of patients.



| *Figure 7*
Example of NI Distribution

BSI: Blood Stream Infection
UTI: Urinary Tract Infection
SSI: Surgical Site Infection
PNEU: Nosocomial Pneumonia

(Source: Hong Kong, Margaret Hospital, IPC training, 2010)

[5] "Prevention of hospital-acquired infections", A practical guide, 2nd edition World Health Organization (WHO/CDS/CSR/EPH/2002.12)

3.2.1 Urinary tract Infection (UTI)

Urinary tract infection is one of the most common NI. It is associated with the use of an indwelling bladder catheter. Urinary infections cause less morbidity than other nosocomial infections, but can occasionally lead to bacteraemia (bacterial presence in the blood).

To avoid UTI, catheters should only be inserted if absolutely necessary and be removed them as soon as possible, strict asepsis at insertion, and maintain a closed drainage system.

3.2.2 Surgical site infections (SSI)

The incidence of SSI is also one of the most common NI, and incidence varies and depends on pre op preparation of the site of the incision, use of sterile equipment/ instruments the type and length of operation, technique and experience of the surgical team, use of antibiotic prophylaxis, and the presence of foreign bodies including drains.

Although sterilisation of instruments, aseptic techniques, etc. reduces the incidence of surgical site infections, it remains an important cause of morbidity and mortality worldwide. Risk factors involve the patient, the operation itself, and the environment.

3.2.3 Nosocomial pneumonia

Nosocomial pneumonia occurs in several different patient groups, and remains an important cause of morbidity and mortality. Patients who do not get mobilised post operatively, or patient with mechanical ventilation are the most at risk.

Prevention measures include hand hygiene, use of gloves when handling respiratory secretions, early mobilisation, daily assessment of readiness to wean from a ventilator, elevation of the bed head (unless contraindicated), use of oro-tracheal intubation, regular oral care with an antiseptic solution, and proper use of filter and disinfection of respiratory equipment.

Persons or patients who are close to or in contact with those with droplet (e.g. H1N1 influenza) or airborne disease (e.g. tuberculosis), and are not wearing appropriate personal protection are also at risk to develop nosocomial respiratory infection.

3.2.4 Catheter Associated blood stream infection (CABSI)

Insertion of intravenous (IV) catheters without adequate preparation of skin can lead to bacteraemia. Staff must consider the necessity of IV fluids/medications –i.e. does the patient really need an IV. Inappropriate use of IV catheters can lead to morbidity.

Strict aseptic technique and thorough hand disinfection by operator and skin site before insertion of catheter and during maintenance procedures will prevent CABSI.

As well as maintaining a closed system, protect the insertion site with a sterile dressing, inspect insertion site daily, remove the catheter as early as possible and immediately if any signs of infection are present, and do not reuse catheters which are intended for single use.

3.2.5 Blood-borne infection

Blood-borne infection is a recognised risk to both healthcare workers and the patients in their care. In health care setting, transmission of blood-borne infection may occur by injection, infusion, transplantation, unsterile equipment, or other accidental injury/penetration.

The risk of transmission of infections can be reduced and prevented by eliminating hazards, using personal protective equipment, immunisation, and post-exposure prophylaxis.

3.2.6 Skin infection

Skin infections are less common. However burns or other skin lesions can get infected when not using aseptic technique. Infection can also spread from the site of the pressure ulcer to a deeper layer of skin. This type of infection is called cellulitis. Regular mobilisation of patient (at least every 2 hours for patient immobilised in bed) will prevent from developing pressure ulcer (called “escarre” in French).

3.3 IPC Measures and Antimicrobial Resistance

The overuse and misuse of antimicrobials or antibiotics, and a lack of compliance with IPC measures have resulted in the development of antimicrobial resistance (AMR) in many parts of the world, including Cambodia.

In healthcare settings, the spread of resistant organisms is facilitated when IPC precautions are not systematically applied, for instance when hand hygiene and reprocessing of equipment practices (cleaning, disinfecting, sterilising) are suboptimal.

Due to the AMR some infectious diseases are more difficult or cannot be treated, with the results of prolonging number of days, and increasing the cost of hospitalization, at the expense of the HCFs and patient.

3.3.1 Antimicrobial Resistance

Antibiotic or antimicrobial resistance is the ability of microbes, such as bacteria, viruses, parasites, or fungi, to grow in the presence of a chemical (drug) that would normally kill it or limit its growth.

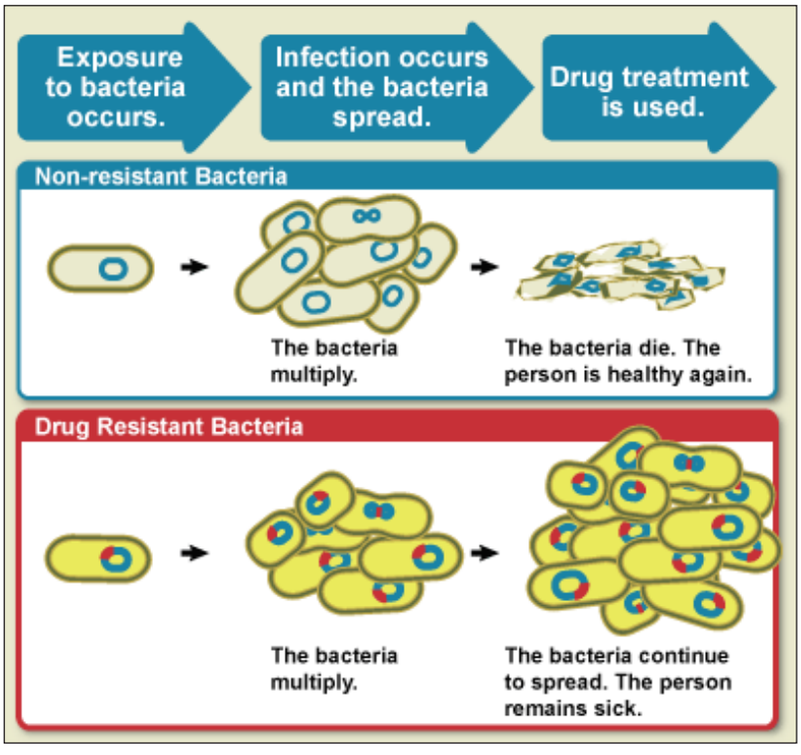


Figure 8 | *Antimicrobial Resistance and Infection*

3.3.2 Measures to combat antimicrobial resistance

To preserve susceptibility, or at least postpone development of resistance, antibiotics should be used rationally. This is of prime interest to everyone – government, clinicians and the public. Resistance can be delayed by better prescribing, this includes: 1) education, 2) antibiotic policies, and 3) surveillance of antibiotic usage and bacterial resistance with regular feedback to physicians. Effective IPC activities are also required.

Another vital aspect of the development of antibiotic resistance is related to ***treatment of infections***. Both patients and doctors have a responsibility when they begin an antibiotic regimen to combat an infectious disease.

- Unnecessary antibiotic prescriptions are the most common cause of resistance development.
- Often physicians use incomplete or imperfect information to diagnose an infection and thus prescribe an antimicrobial just-in-case or prescribe a broad-spectrum antimicrobial when a specific antibiotic might be better. These situations contribute to the acceleration of antimicrobial resistance.
- Unfinished antibiotic prescriptions may leave some bacteria alive or may expose them to low concentrations of antibiotics for a prolonged period of time, and thus contribute to the development of resistant strains of bacteria.

Avoid routine use of prophylactic antibiotics.

In general, routine use of prophylactic antibiotic is not recommended anymore,

but only for specific surgery; for instance, for orthopaedic surgery. When prophylactic antibiotics are essential, surveillance of NI need to be carried out, assessing the resistance of the antibiotic, and revising the protocol when necessary.

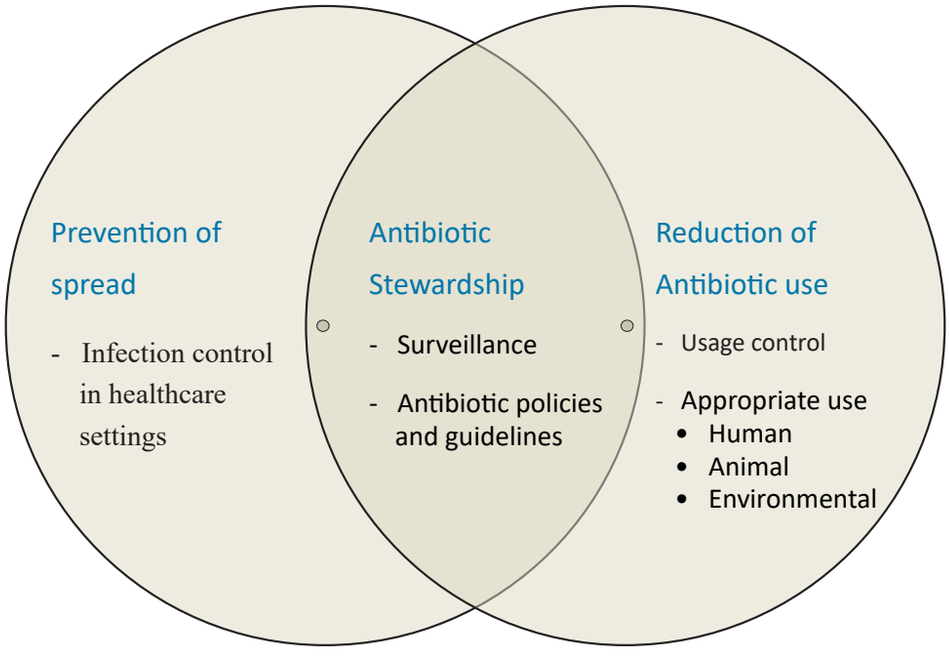
3.3.3 Infections with multi-drug resistant organisms

Increase in antimicrobial resistance creates a big problem and a heavy burden for healthcare facilities.

The most common examples of multi-drug resistant organisms are: Multi-Drug-Resistant Tuberculosis (MDR-TB), Extensively Drug-Resistant TB (XDR TB), Methicillin-Resistant Staphylococcus Aureus (MRSA), and Vancomycin Resistant Enterococcus (VRE).

As soon a patient is diagnosed with antimicrobial resistant pathogen, the patient should be immediately isolated. The type of isolation depends on the route of transmission. For instance, use contact precautions for MRSA and VRE, airborne precautions for MDR-TB (refer chapter 5 "Management of patient with infectious disease of public health concern).

Therefore strict compliance with IPC measures is essential to prevent and control the spread of AMR.



| ***Figure 9***
Methods to Manage AMR

Refer to "**National Policy to Combat Antimicrobial Resistance – 2014**" and "**National Strategy to Combat Antimicrobial Resistance – 2015-2017**", and the "**National Centre for Tuberculosis and Leprosy Control (CENAT) Guidelines for MDR-TB**" for more details.

4.1 STANDARD PRECAUTIONS

Infection Prevention and Control measures are:

- Standard precautions; and
- Transmission-based or additional precautions.

Standard precautions must be applied to all patients at all times, regardless of the diagnosis or infectious status as any patient can carry or have infectious disease without having symptoms.

Transmission-based or additional precautions are specific to the mode(s) of transmission of the pathogens (airborne, droplet and/or contact).

Transmission-based MUST be ALWAYS applied in addition to standard precautions to be effective.

Assessing the risk of exposure Level

Each HCW need to assess the risk of being in contact with body fluid before performing their task(s), such as:

- "which procedure will I perform?",
- "will I have a risk or not to have a contact with body fluid/blood, or with infected equipment?" Based on the answer, the HCW will apply standard precautions.

Furthermore, if the patient present specific symptoms or has been already diagnosed, HCFs staff need to select the additional precautions on top of the standards one.

For example, when a HCW takes blood sample, they have to wear disposable gloves for standard precautions. If the patient present some respiratory symptoms like flu, the HCW will wear in addition to the gloves (standard precaution), a surgical mask for additional precaution.

Selection of standard precautions is based on procedures and level of risk of contact with body fluid (example full blood, serum, sputum, urine…).

Standard precautions include:

1. Hand Hygiene (HH);
2. Use of personal protective equipment (PPE) when handling body fluid;
3. Appropriate handling of patient care equipment, and soiled linen;
4. Environmental cleaning management;
5. Prevention of needle-stick/sharp injuries;

6. Appropriate Health Care Waste Management (HCWM); and
7. Respiratory hygiene/cough etiquette.

4.1.1 Hand Hygiene

4.1.1.1 Role of hands in disease transmission

Hand hygiene (HH) is the single most important technique to prevent and minimize the spread of infection within health facility environments. Throughout the day micro-organisms accumulate on the hands from a variety of sources, such as direct contact with people, contaminated surfaces, foods, even animals and animal waste. If people don not wash their hands frequently and properly enough, they can infect themselves with these organisms by touching their eyes, nose or mouth. And they can spread these organisms to others by touching them or by touching surfaces that others also touch, such as doorknobs.

Most of infectious diseases are commonly spread through hand-to-hand contact such as ***common cold*** and more serious illnesses such as ***meningitis, influenza, Hepatitis A*** and most types of infectious ***diarrhoea.***

There are two types of microorganisms on the skin that can lead to infections:

1. Resident microorganisms live on the skin and are difficult to remove.
2. Transient microorganisms acquired during daily living can be easily removed by hand hygiene.

Hand hygiene includes hand washing or using Alcohol-based Hand Rub (AHR). By regularly washing hands or performing hand hygiene, HCFs staff and care givers/visitors are decreasing the risk to get infected and/or carried pathogen to others (patient, visitors or member of community/ their own family). Note that jewelleries and watch should be removed before hand hygiene.

4.1.1.2 When to perform hand hygiene in a health facility

HCFs staff and care givers should perform hand hygiene, when arriving at work/ HCFs and before leaving work/HCFs, as well as before eating and after using the toilet/ latrine.

Additionally, for anyone who is providing care to patients, the "Five moments for hand hygiene" must be respected.

Five moments for Hand Hygiene:

1). Before patient contact
2). Before aseptic task
3). After body fluid exposure risk

4). After patient contact

5). After contact with patient surroundings, and immediately after taking off PPE

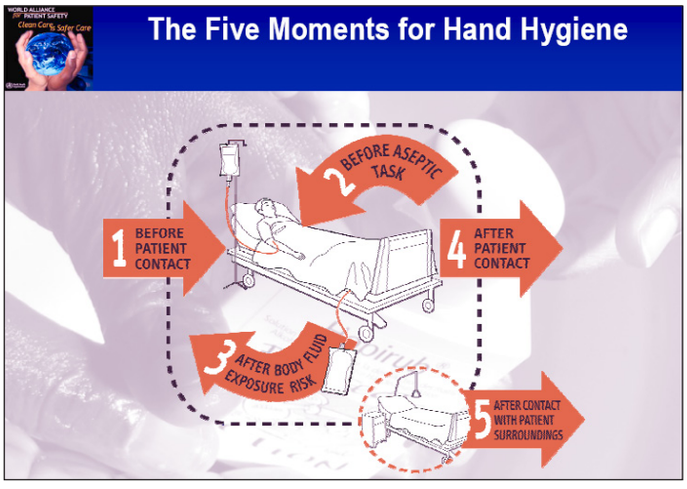


Figure 10 | *Five Moments for Hand Hygiene*

Recommendation

Routine Hand Hygiene

Hand hygiene must be performed before and after every episode of patient contact.

- Before touching a patient
- Before a procedure
- After a procedure or body substance exposure risk
- After touching a patient
- After touching patient's surroundings

Note: Hand hygiene MUST also be performed after taking off PPE.

4.1.1.3 How to perform Hand Hygiene

Figure 11 | *Hand washing vs Alcohol Hand Rub (AHR)*

(Photo: IPC training Hong Kong WHO collaborating centre, 2010)

Special attention should be made between and top of fingers, parts that are often missed when performing hand hygiene (see "red" areas in the picture), leading to risk of infection.

If hands are not washed according to the recommendation above, some parts of the hands are missed and can carry pathogen, transmitting infection.

| ***Figure 12***
Areas Frequently Missed during Hand Washing

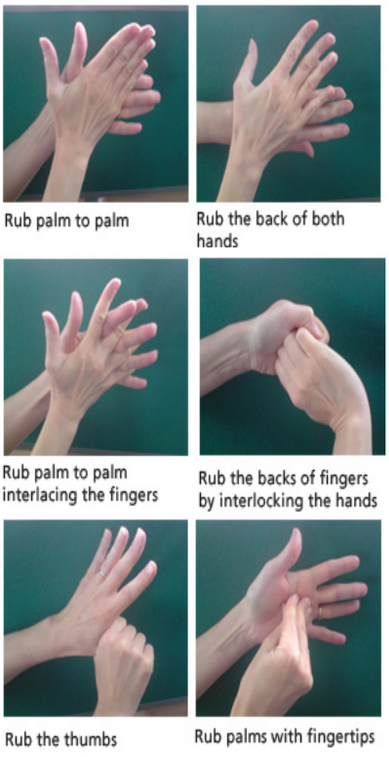
4.1.1.4 Principles and Steps for Hand Hygiene, using soap and water or AHR

Hand Washing

- **40 – 60 seconds**
- wash hands an wrists with soap and clean water following the 6 steps,
- dry hands with clean and single use or disposable towel

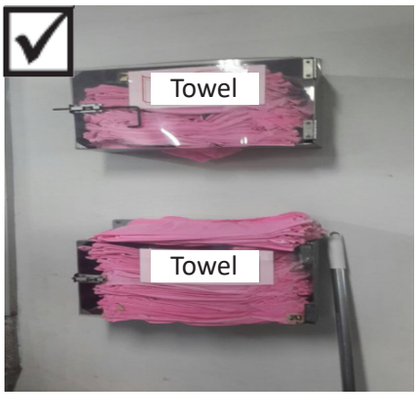
Hand Hygiene using AHR:

- only when hands are not visibly soiled
- **20 – 30 seconds**
- apply enough AHR to cover all areas of the hands, and rub hands following the 6 steps



| ***Figure 13***
Steps to Perform Hand Hygiene

4.1.1.5 Why drying hands after washing hands with soap and water?



(cotton towel has to be reprocessed after each use)

After hand washing, it is essential to dry hands properly because micro-organisms develop better, in humid/ wet surfaces.

- It is crucial to use a clean and single use paper or material towel.

Figure 14 **|** *Example of single-used Cotton Towel*

Dirty towel must NOT be re-used as they are potential sources of infection.

Figure 15 **|** *Example of dirty reusable cotton towel*

See Annex 1 for "Hand Washing Procedure", and Annex 2 for "Hand Hygiene with Alcohol Hand Rub (AHR) Procedure".

4.1.1.6 How to choose AHR or Hand Sanitizer?

Select AHR containing 60% to 80% of alcohol, to be effective[6], or HCF can produce it. The WHO formula 1 final product, contain ethanol 80%, and the formula 2 final product contain Isopropyl alcohol 75%.

See Annex 3 for "Production of Alcohol Hand Rub, WHO Formula".

|Figure 16 *Example of Alcohol Hand Rub (AHR)*

[6] Public Health Agency of Canada

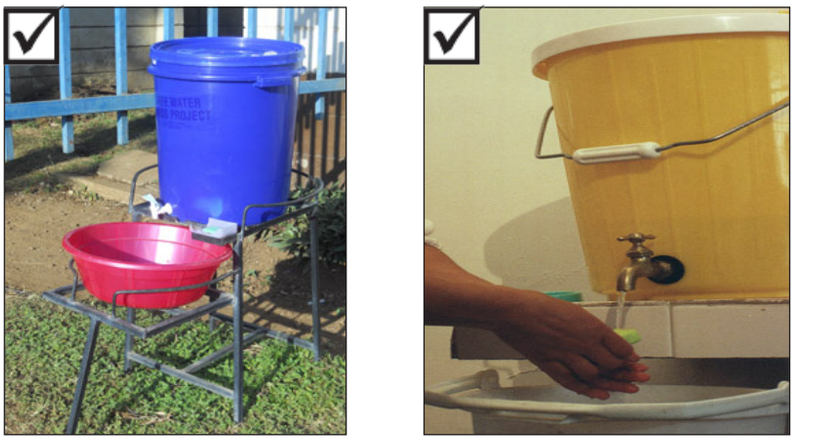
Hand Hygiene Recommendations

- To ensure that health workers follow hand hygiene procedure, it is necessary that all equipment is provided, such as, sink or washing basin, clean water, soap and single-used towels and/ or AHR.
- Because micro-organisms grow and multiply in moisture and in standing water, liquid soap is preferred to bar soap, which often soaks into the water.
- When using bar soap, use a rack to drain extra water.
- When using liquid soap do not top up the dispensers. This may lead to bacterial contamination of the soap.
  - If reuse the liquid soap container, ENSURE that
    - the container is empty;
    - the empty container is rinsed, cleaned, and dried before being refilled.
- Avoid using powder detergent. It often contains abrasive chemical that can lead to small skin abrasions, and be a portal of entry for infection.
- DO not dip hands into basins containing standing water, or any disinfectant solution
- Alcohol solution to replace AHR must be avoided, as the disinfectant solution is aggressive to the natural flora of the skin, abrasion. It can be portal of entry of infection for HCF Staff.

When running water is not available, use as following:

A bucket with a tap that can be turned on/off. Collect used water in a basin and discard in a latrine if a drain is not available.

A bucket and scoop. Using the scoop, one person pours clear water over the hands of the person who is washing. To avoid contamination of bucket water, hands and scoop handle should never be placed directly in the water in the bucket. Scoops should be cleaned daily with soap and water. The water should be poured over another bucket or basin which collects the waste water.



| ***Figure 17***
Buckets with Tap

4.1.2 Personal Protective Equipment

Using personal protective equipment (PPE) reduces the risk of acquiring or transmitting an infection, by putting a barrier between pathogen and Port of entry and port of exit of the host.

It is important that the equipment is used effectively, correctly, and at all times where contact with blood and body fluids of patients may occur. Continuous availability of PPE and adequate training for its proper use are essential.

To provide a proper protection, PPE should be worn on top of working clothes/ uniform. PPE protect HCFs staff, only if the item is not damaged or broken, and if it is appropriately selected (e.g. right size, right item). The HCFs staff is responsible to check the integrity of the PPE and properly select based on the risk level and its own size.

PPE for standard precautions includes:

- Gloves
- Surgical mask
- Eyewear (face shield, goggles or glasses)
- Gown
- Impermeable apron
- Hair cover
- Shoe covers
- Rubber boots

Figure 18 **|** *Essential PPE for Standard Precautions*

4.1.2.1 General Information for PPE Standard Precautions

Guiding principles for selection of PPE

PPE should be chosen **according to the risk of exposure**; thus not all PPE should be worn for every exposure.

Any HCWs and care giver with assistance from HCWs should perform a risk assessment before selecting appropriate PPE for standard precautions.

Choose your PPE according to:

- The nature of the procedure
- The risk of exposure to blood or body fluids
- The risk of exposure to pathogenic microorganisms
- The risk of contamination

Table 2 When to Perform Hand Hygiene and Use PPE

SCENARIO	HAND HYGIENE 	GLOVES 	GOWN 	MEDICAL/ surgical MASK 	EYE-WEAR 
Always before & after patient contact, & after contaminated environment	YES				
If direct contact with blood and body fluids, secretions, excretions, mucous membranes, non-intact skin	YES	YES			
If there is risk of splashes onto the health care worker's body	YES	YES	YES		
If there is a risk of splashes onto the body and face	YES	YES	YES	YES	YES

Remember:

- It is the procedure that carries the risk rather than the patient.
- PPE reduces risk of infection but does not completely eliminate the risk of acquiring an infection.
- Use of PPE does NOT replace hand hygiene.

General recommendations for PPE and PPE Procedure

- Do not share PPE.
- Disposable (single-use) PPE should NEVER be reused.
- When available, disposable PPE item is preferred to avoid risk of contamination if the item is not properly reprocessed.
- Change PPE completely and thoroughly wash hands each time you leave a patient to attend another patient.
- PPE procedure
  - Take off PPE from the most contaminated item (highest risk) to the least contaminated item (lowest risk).
  - Avoid any contact between contaminated (used) PPE and surfaces, clothing, people outside the patient care area, and HCWs uniform, and body part (e.g. eyes, mucous of nose, mouth, open-skin …), especially when taking off PPE.
  - Dispose used PPE directly after use (e.g. do not keep mask around the neck), according to the local health care facility protocol.

(Refer to Section 4.3 for "Appropriate handling of patient care equipment" and 4.6 for "HCWM").

During health care procedure or taking off PPE, for instance when taking off gown with blood/body fluid, HCW may be contacted with blood/body fluid through skin or mucous membranes, and there is a risk of contaminating themselves.

In that case, staffs need to stop their activity, calmly take off PPE, wash or rinse thoroughly the area that was contaminated, directly inform their supervisor (chief of unit) and/ or the IPC team

Refer to "Chapter 6: Occupational Health for post-exposure procedure" and "Injection Safety Guideline 2014".

Refer to Annex 3 for "Example of PPE Procedure for Standard Precautions"

4.1.2.2 PPE in Detail

Gloves

The roles of gloves **are:**

- to protect the wearer when touching blood, body fluids, secretions, excretions or mucous membranes.

- to reduce the risk of transmission of infectious microorganisms to patients during aseptic procedures generally using sterile gloves.

Gloves should be used according to the level of risk for the HCW and for the patient. There are three types of gloves used in HCF.

Disposable (non-sterile) gloves provide protection to HCFs staff when having contact with patient's blood, body fluids, excretions and secretions.

See Annex 3 for "*Example of PPE Procedure for Standard Precautions*".

| *Figure 19*
Disposable (non-sterile) gloves

Rubber (heavy-duty) gloves should be worn for handling, cleaning and disinfecting potentially contaminated objects or surface.

| *Figure 20*
Rubber (heavy-duty) gloves

Surgical (sterile) gloves MUST be worn when performing aseptic procedure (invasive medical or surgical procedures).

For example: insertion of urinary catheter, any surgical procedures, C-section …

Refer to *Annex 22* for procedure of wearing sterile gloves

| *Figure 21*
Surgical (sterile) gloves

The following principles are recommended when wearing gloves:

- Take off gloves immediately after use and perform hand hygiene before attending to another patient.
- Change gloves between tasks/ procedures on the same patient to prevent cross contamination between different body sites (from septic to aseptic site).
- Wash hands with soap and water or AHR immediately after removing gloves.
- Disposable gloves should not be reused but should be disposed of according to the policy of the healthcare facility.
- Pull gloves up over cuffs of gown (if worn) to protect the wrists.

Surgical Mask

The roles of surgical mask are:

- Masks protect mucous membranes of nose and mouth of HCWs when contact with blood and body fluids are likely.
- Masks also provide protection to patient, from microorganisms of HCF staff, when performing care.

- Masks should be worn when performing any task with a risk of splash into the face. Surgical masks have been designed to resist fluids and large droplet to varying degrees depending on the design of the material in the mask.
- Protect from large droplet
- Wear surgical masks rather than cotton material or gauze masks. Do not reuse disposable masks.

See Annex 3 for "Example of PPE Procedure for Standard Precautions".

Figure 22 **|** *Surgical Mask*

HCF stuff, when performing care.

Eyewear

Eyewear includes clear plastic goggles, safety glasses, face shields and visors.

The roles of eyewear are:

- to protect the eyes of HCFs staff when conducting procedures that are likely to generate splashes of blood, body fluids, secretions or excretions in the eyes.
- To protect the eyes of patient during specific procedures (e.g. dental care) when risk of splashes in the eyes.

Figure 23 **|** *Goggles*
Face Shield
Safety Glasses

> ***Note:*** If disposable, discard appropriately. If they are reusable, decontaminate them according to the manufacturers' instructions.

See Annex 4 for "Example of PPE Procedure for Standard Precautions".

Gowns

The roles of gown are:

- to prevent soiling of clothing during procedures that may involve contact with blood or body fluids, excretions or secretion, and avoid spreading infection.

They can be disposable or reusable.

- Impermeable gowns are preferable.
- Take off soiled or wet gown as soon as possible.

| *Figure 24*
Disposable and Fluid-Resistant Gown

| *Figure 25*
Reusable Gown

Disposable gowns can be fluid resistant or not. When the gown is not fluid resistant, impermeable apron is necessary when having contact with infected fluid.

See Annex 3 for "Example of PPE Procedure for Standard Precautions"

Reusable gown should be clean/ disinfected before being reuse

(see 3.3.2. Appropriate hand-ling of soiled linen).

Impermeable apron

The role of apron:

- Impermeable aprons are made of rubber or plastic, to provide a waterproof barrier along the front of the health worker's body.
- Wear impermeable apron on top of the gown to provide a better protec-

tion when exposure to blood, body fluids, secretions and excretions. Example when cleaning or during a procedure in which blood or body fluid spills are anticipated (e.g. delivery of women having haemorrhage).

Apron can be disposable or reusable.

disposable apron

reusable apron

Figure 26 |
Waterproof Disposable Apron

Figure 27 |
Waterproof Reusable Apron

Hair cover

Figure 28 |
Disposable Hair Cover

The roles of hair cover:

Hair cover are used to protect patient, by keeping the hair and scalp covered so that flakes of skin and hair are not shed into the wound during surgery.

Their other purpose is to protect the wearer from blood or body fluid splashes and sprays.

Shoe covers

Figure 29 |
Disposable Shoe Covers

The roles of shoe covers:

Provide protection of the shoes in case patient's blood, body fluids, secretions or excretions may splash, spill or leak onto the shoes (e.g. in isolation room, OR).

Keep clean a specific area such as operating room.

Rubber Boots

The role of rubber boots:

- to provide a better protection of feet than shoe covers when exposure to blood, body fluids, secretions and ex-cretions and sharp injuries.

For example, when cleaning or during a pro-cedure in which blood or body fluid spills are anticipated (e.g. delivery of women having hemorrhage).

| ***Figure 30***
Rubber Boots

4.1.3 Appropriate Handling of Patient Care Equipment and Soiled Linen

4.1.3.1 Patient-Care Equipment

All medical devices are either single-use or reusable ones. Single-use equipment must be discarded, while all reusable equipment must be properly processed between use and between patients, to prevent NI. Used instruments and equipment can easily become a reservoir for microorganisms, and therefore can spread infection to patients and staff.

For proper reprocessing of equipment, all items need to be cleaned with detergent (liquid soap) and water before disinfection and sterilization, to get rid of the organic matter e.g. blood and mucus that may neutralize chemical disinfectant and affecting the efficiency of the disinfectant.

Instruments and other items may be classified based on the risk of transmitting infection into critical, semi-critical or non-critical, depending on the sites[7].

Critical: These items and practices affect normally sterile tissues or the blood system and represent the highest level of infection risk.

Semi-critical: These items and practices are second in importance and affect mucous membranes and small areas of non-intact skin; and represent an intermediate level of infection risk.

Non-critical: Items and practices that involve intact skin and represent the lowest level of infection risk.

7 The classification of risk of transmission of infection by instruments and equipment has been called the "Spaulding Classification."

Table 3 Classification of Reusable Equipment

Category	Application	Type of processing	Example of items
Critical	Sterile tissues or the blood system	Sterilization (by heat or chemicals)	Dressing and suture instruments, surgical instruments, delivery sets, diagnostic catheters, dental instruments, bronchoscopes, cystoscopes, etc.
Semi-critical	Mucous membranes or non-intact skin	High-level disinfection (HLD) & intermediate level disinfection	Laryngoscope blades, vaginal specula, instruments for MVA, respiratory therapy and anaesthesia equipment. dental impressions, endoscopes, gastroscopes, etc.
Non-critical	Intact skin	Cleaning, low level Disinfection (depending on contact with the type of patient)	bedpans, toilets, urinals, blood pressure cuffs, ECG leads, thermometers, stethoscopes, beds, bedside tables

Protection of cleaning staff

Cleaning staff must wear PPE for standard precautions, at least rubber gloves and boots, impermeable apron. When there is a risk of splash in the face, staff must wear eyes protection and surgical mask.

Figure 31 **|** *PPE for Cleaning Staff*

Principle to effectively reprocess equipment and instruments

(1) **Cleaning** (soak when necessary, clean, rinse and dry)

(2) **Disinfecting** (low, middle or high level disinfection)

or

(3) **Sterilizing**, and

(4) **Storing**

(1) Cleaning

Cleaning is a process that removes organic matter and chemical.

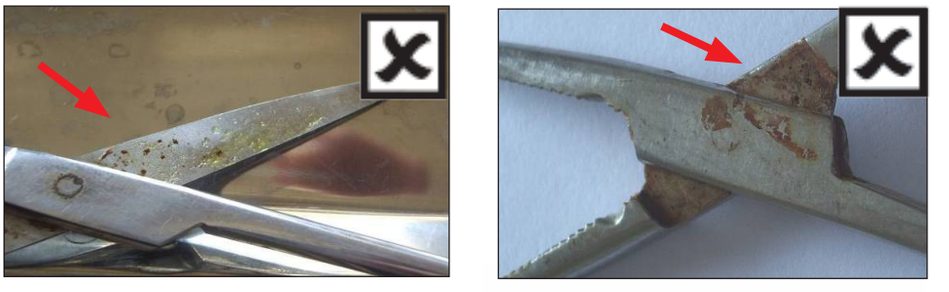
If the instrument/ equipment is not cleaned properly, organic matter may inactivate disinfectant or sterilization process.

Note that if an instrument/equipment is unable to be cleaned then it is unable to be sterilized or disinfected, and cannot be reused. Example of cleaning product: soap, detergent…

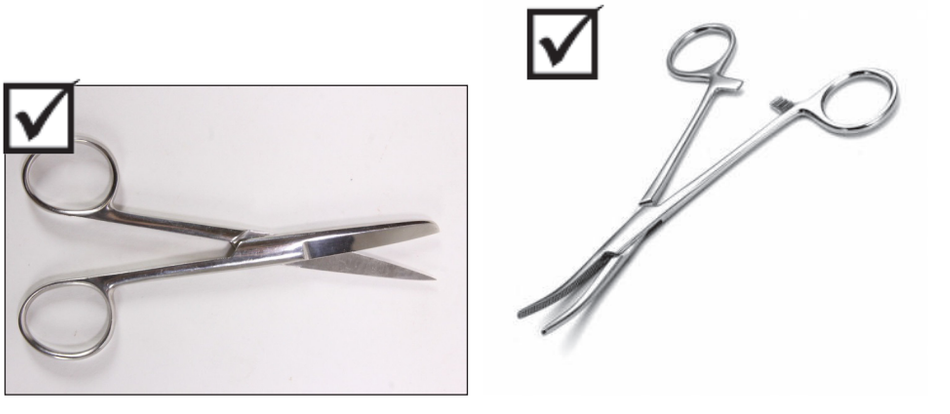
Cleaning process can be done by cleaning instrument such as enzymatic cleaner, ultrasonic cleaners, auto mated washers or by manual cleaning.

After cleaning, rinse with clean water and let it dry.

Always ensure that items are cleaned properly, are not damaged, and are dry, in order for sterilisation and high-level disinfectant to be correctly performed.



| ***Figure 32***
Insufficient Cleaning and damaged equipment



| ***Figure 33***
Adequately cleaned equipment

Refer to Annex 4 for "Patient Equipment Cleaning and Disinfection Procedures".

(2) Disinfection

Disinfection is a process that kill most of the micro-organisms (except some pathogens, and spores), without complete sterilization.

Disinfection is not a sterilizing process and must not be used as a convenient substitute for sterilization.

Level of disinfection

Certain products, disinfection solution and processes will provide different levels of disinfection.

These levels are classified as:

(a) High-level disinfection (HLD): Destroys almost all pathogens (almost all bacteria, fungi, viruses, and protozoa), with the exception of bacterial spores.

There are three methods of HLD:

- Boiling
- Steaming
- Chemical HLD

Boiling (thermal) HLD

Boiling is a simple method of HLD that can be performed in any location that has access to clean water and a heat source. Using this method, instruments and other items are placed in a pot or boiler and the water is heated to boiling for 20 minutes.

Steaming HLD

For this method, items are steamed in a steamer containing one to three tiers. It has similar steps to boiling HLD except the instruments are not immersed in water but are placed in a steamer pan (that has boiling water in the bottom) on a circular tray with holes in it.

Chemical HLD

They are used for processing instruments and other items (semi-critical items or critical items) when thermal autoclaving will damage the items or boiling/steaming is not available e.g. cannula, endoscope, etc.

Chemical HLD is done by using high level disinfectants. In Cambodia 0.5% chlorine solution made from household bleach is recommended. Chlorine is fast acting and inexpensive. It is effective against a broad range of microorganisms, including tuberculosis-causing microorganisms.

However metal instrument/equipment cannot handle high concentration of chlorine, as it is corrosive. Therefore, other chemical HLD needs to be used. The two recommended chemicals for HLD are 2% Gluraldehyde and Peracetic Acid.

(b) Intermediate disinfection: inactive Mycobacterium tuberculosis, vegetative bacteria, most viruses and most fungi, but does not always kill bacterial spores (e.g. Sodium hypochlorite 0.05%).

(c) Low-level disinfection: Can kill most bacteria, some viruses and some fungi, but cannot be relied on to kill more resistant bacteria such as M. tuberculosis or bacterial spores (e.g. ethyl and isopropyl alcohols 70%).

For more information, refer to Annex 5 for "Spectrum of Disinfectant Activity" and Annex 6 "High Level Disinfection Procedures"[8].

Flaming

Wiping items and then burning the alcohol is not a suitable form of disinfection and should be discouraged.

| Figure 34
flaming is an incorrect disinfection technique

Important facts about chemicals used for disinfectants

- When manipulating/ preparing any disinfectant solution, it is essential to protect the HCF support staff as all these chemicals are health hazard. Adequate PPE should be available and worn, at least:

  rubber gloves;

  eyes protection (from splash);

  surgical mask (toxic gas, e.g. bleach solution); and

  water-proof apron.

- Chlorine, bleach and other chemical disinfectants should be stored in a cool, dark area never in direct sunlight or in excessive heat (e.g. upper shelves in a tin-roofed building) and be out of reach for children.

[8] "Prevention of Hospital-acquired Infection" WHO – 2002, page 43

- *"Do not spray"* (i.e. fog) equipment or surface with disinfectant. This may spread infectious particle, and it is a potentially dangerous practice that has no proven disease control benefit.

Type of disinfectant solution

1) Sodium hypochlorite (Chlorine/ bleach/ eau de javel)

- Bleach solutions must be prepared daily because they lose their strength after 24 hours
- Routine disinfecting solution is 0.05% (denatured most of bacteria and virus. In some circumstances, other dilution may be needed, depending on the pathogen. For example 0.05% for SARS/MERS and AI; 0.5% for organic material contaminated of cholera patient.
- Sodium Hypochlorite is corrosive for metal. Another disinfectant should be use for metal instrument/ equipment, for instance chlorhexidine solution. If chlorhexidine is not available, a low concentration solution (0.05%), still can be used, if well rinse with non-contaminated water.

Refer to Annex 8 for "Preparation of Sodium Hypochlorite Solution Procedure".

2) Chlorhexidine

Chlorhexidine is an antiseptic and antimicrobial disinfectant which provides fast acting activity against a wide range of pathogens, especially against those commonly present on the skin. To prepare disinfectant solution follow instruction on the package.

3) Alcohol 70 %

Alcohol 70% inactivate several pathogens (bacteria, lipid-virus such as AI, EVD… virus). It is recommended to use for small surfaces, e.g. thermometer, stethoscope, etc. as alcohol is inflammable and may also damage rubber, plastics of equipment.

Use Alcohol 70 % solution, instead of the 90%, as 70% it is more efficient. It is the water that denature the proteins (inactivate germs), and alcohol 70% solution has more water than those with alcohol 90%. Additionally, alcohol 90% evaporate quickly, and may not inactive all germs, due to the short time of contact.

Refer to Annex 9 for the "Procedure to Prepare Alcohol 70% Solution" and Annex 4 for the "Patient Equipment Cleaning and Disinfection Procedures".

4) Sterilization

Sterilization is a process to completely eliminate all forms of living organisms (bacteria, viruses, fungi, and parasites), including spores.

Sterilisation must be used for any items that will come in contact with the bloodstream or tissues under the skin.

When sterilization is not possible or feasible (e.g. endoscope), High level disinfection (HLD) is the only acceptable alternative for these items.

To ensure that equipment is properly sterilised and will not cause any harm, such as NI, to patient, monitoring of the sterilization process is crucial.

Monitors

There are two types of test to monitor sterilization. Biological and chemical indicators are available and must be used for routine monitoring of autoclaves.

Biological Indicators (BI)

BI contains the spores of the bacterium Geobacillus stearothermophilus. Commercially-available spore strips or vials containing the spores are strategically placed in the load to be sterilised. After a cycle, the BI are cultured or evaluated for growth and they must all indicate no growth to declare the sterilisation process a success.

Figure 35
Biological indicators

Chemical indicators (CI)

CI is used to assess if the required time and temperature were attained during the sterilisation process. One type of CI is an autoclave tape that can be fixed to the outside and inside of a package; it shows a colour change if the package was exposed to heat.

Though CIs are not meant to indicate that a product has been sterilised, they can help to detect equipment malfunctions and identify procedural errors.

Figure 36
Chemical Indicators

Wrapping/ Packaging

All instrument/ equipment and drapes must be cleaned and wrapped/ packed before sterilization.

Only wrapped/packed sterilized materials should be described as sterile. A sterilization test (e.g. strip test, tape test for autoclave) is essential to ensure that the complete process has been done and that instruments/ equipment are sterilized.

Before any instrument/equipment goes under the process of sterilization, the following should be checked:

- Ensure that the instrument/equipment can resist the process (e.g. steam under pressure, high temperature), and does not require any special treatment.
- Ensure that the all part of instrument/equipment has been adequately cleaned, and are not damaged.
- Must be packed, with drapes or individual packaging
- Put indicator sterilization strip test (inside and outside the pack) before putting in the autoclave.

When preparing package for sterilization, sterilization unit staff should wear PPE (at least hair cover, disposable gloves, and clean uniform or where available gown) to avoid re-contamination of cleaned instrument/ equipment when packing.

Figure 37 | *Packaging and central sterilization*

| *Figure 38*
Packaging with drapes and individual packaging

Refer to Annex 10 for "Sterilization Procedures and Apparatus Specific Information".

Sterilization Methods

Sterilization can be done either by:

1) Steam under pressure (moist heat), or

2) Dry heat (poupinel), or

3) Chemical sterilants

- Ethylene oxide
- Hydrogen peroxide gas plasma

1) Steam under pressure (moist heat) sterilization: autoclaving

This is the most efficient and reliable method to achieve sterility of instruments/equipment. Steam is an effective method for two reasons. First, saturated steam is an extremely effective "carrier" of thermal energy.

Second, steaming is an effective method because any resistant, protective outer layer of the microorganisms can be softened by the steam, allowing coagulation of the sensitive inner portions of the microorganism (similar to cooking a white egg). Certain types of contaminants, however, especially greasy or oily materials, can protect microorganisms against the effects of steam, thus hindering the process of sterilization. This reemphasizes the need for thorough cleaning of objects before sterilization.

Steam sterilization requires moist heat under pressure, so there must be sources of both water and heat. Heat can be provided by electricity or by another fuel source (e.g. gas, kerosene burner, wood, charcoal), depending on the type of autoclave being used. This method sterilizes and dries the sterile package as part of the cycle.

Figure 39 |
High Vacuum Autoclave
(for Central Sterilization Unit)

Figure 40 |
Bench Type Autoclave
(for unit)

Remember:

Always sterilize instruments and other items for the correct amount of time at the correct pressure and temperature.

Be sure items are completely dry both before sterilizing and before removing them from the autoclave.

Make sure the sterilizer is packed correctly.

Refer to Annex 11 for "Sterilization Procedures and Apparatus Specific Information".

2) Dry heat sterilization

Remember:

Healthcare facilities (HCFs) are encouraged NOT to use dry heat sterilization unless other recommended sterilization methods are not available at their facilities.

Ministry of Health no longer procures and supplies the equipment to HCFs.

Dry heat sterilization is achieved by hot air that destroys pathogens and spores, by oxidation. Dry heat sterilizers have had limited value because it is difficult to maintain the same temperature and it takes a long time to achieve sterility.

It is used for materials that might be damaged by moist heat or that are impenetrable to moist heat. It is commonly used for glass and metal objects, powders, which do not support steam under pressure sterilization method.

Advantages

- It is nontoxic and does not harm the environment;
- Dry heat cabinet is easy to install and has relatively low operating costs;
- It penetrates materials; and it is noncorrosive for metal and sharp instruments.

Disadvantages

- time-consuming (long) method, due to slow rate of heat penetration and microbial killing,
- High temperatures are not suitable for most materials (e.g. gauze, cotton….).

| *Figure 41*
Examples of Poupinel

The manufacturers' instructions must be followed, and the door to the apparatus must not be opened while in sterilizing cycle.

When using dry-heat sterilizer, it is essential to use an industrial dry heat sterilizer. The apparatus must have a reliable temperature gauge and where possible a timer.

The following apparatus are not sterilizer, and MUST NOT be used to sterilize instrument/ equipment:

- Ultraviolet light,
- Incubators,
- Microwave ovens
- Domestic ovens

Domestic oven and microwave do not have constant high heat, and therefore cannot be used as steriliser apparatus.

They **MUST NOT** be used.

Figure 42 | *Domestic small oven*

Figure 43 | *Domestic microwave*

For more details, refer to Annex 10 for "Sterilization Procedures and Apparatus Specific Information".

3) Chemical sterilants

Several liquid chemical sterilants, such as ethylene oxide and hydrogen peroxide gas plasma, include indications for sterilization of medical devices. The indicated contact times range from 3 hours to 12 hours.

One limitation to sterilization of devices with liquid chemical germicides is the post-processing environment of the device. Devices cannot be wrapped or adequately contained during processing in a liquid chemical sterilant to maintain sterility following processing and during storage. Furthermore, devices may require rinsing following exposure to the liquid chemical sterilant with water that typically is not sterile; and sterilization testing cannot be performed.

Therefore, due to the inherent limitations of using liquid chemical sterilants, their use should be restricted to reprocessing critical devices that are heat-sensitive and incompatible with other sterilization methods.

4) Storage

When instrument/ equipment/ linen are disinfected or sterilized is also essential to maintain the level of sterilization, disinfection. Item should be stored in a clean (separate from dirty item), dry environment and protected from any damage.

For sterile item:

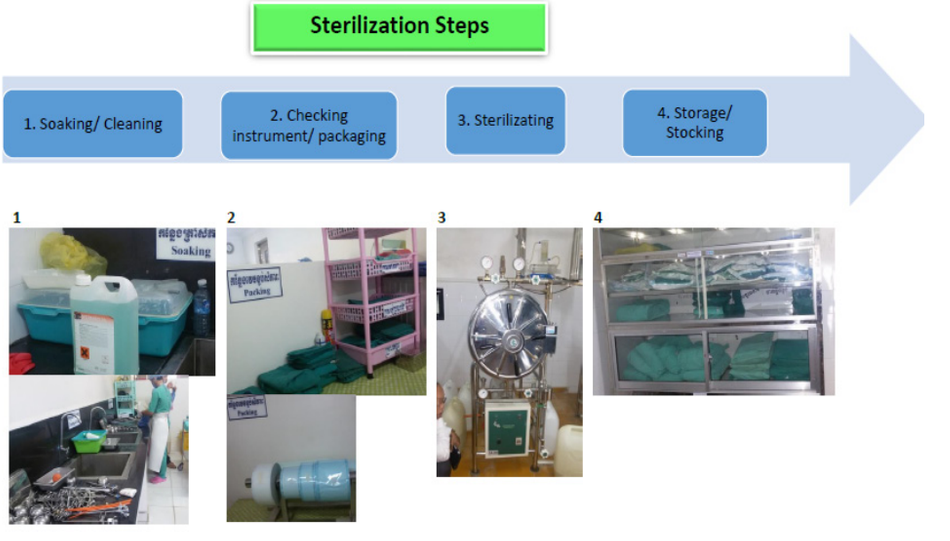
- Record the sterilization process in log book of the sterilization unit
- The sterilisation date must be recorded on the pack.
  - all packs[9] must be used within one week of sterilisation.
  - All boxed instruments must be used within 24 hours of sterilization.
- If sterilization expiration date passes, item must be re-sterilized.
- Unwrapped sterile or HLD items should be re-processed.

Stock Management:

One important rule: first in, first out, i.e. items due to expire first should be used first.

During the weekly inspection, packages should be checked to ensure that items expiring sooner are at the front and those with later expiry dates are at the back.

| *Figure 44*
Example of storage of sterile equipment



| *Figure 45*
Example of sterilization steps at Cambodian provincial hospitals - Complementary Package of Activities 3 (CPA3)

[9] Double-layered package

Remember:

If an item comes in contact with dust particles, insects, or any non-sterile item, person, or surface, the item must be considered to be contaminated.

When in doubt about the sterility of a pack, consider it to be contaminated and re-sterilize the item before use.

Central Sterilising and Supply Department

The Central Sterilization and Supply Department (CSSD) is a place for sterilizing and supplying sterilized materials in hospitals. CSSD is responsible for cleaning, drying and packing items before the sterilization process. They are also responsible of storage and stock management.

CSSD must be set up with appropriate clean and dirty areas i.e. decontamination and cleaning areas must be separated from drying and packing areas.

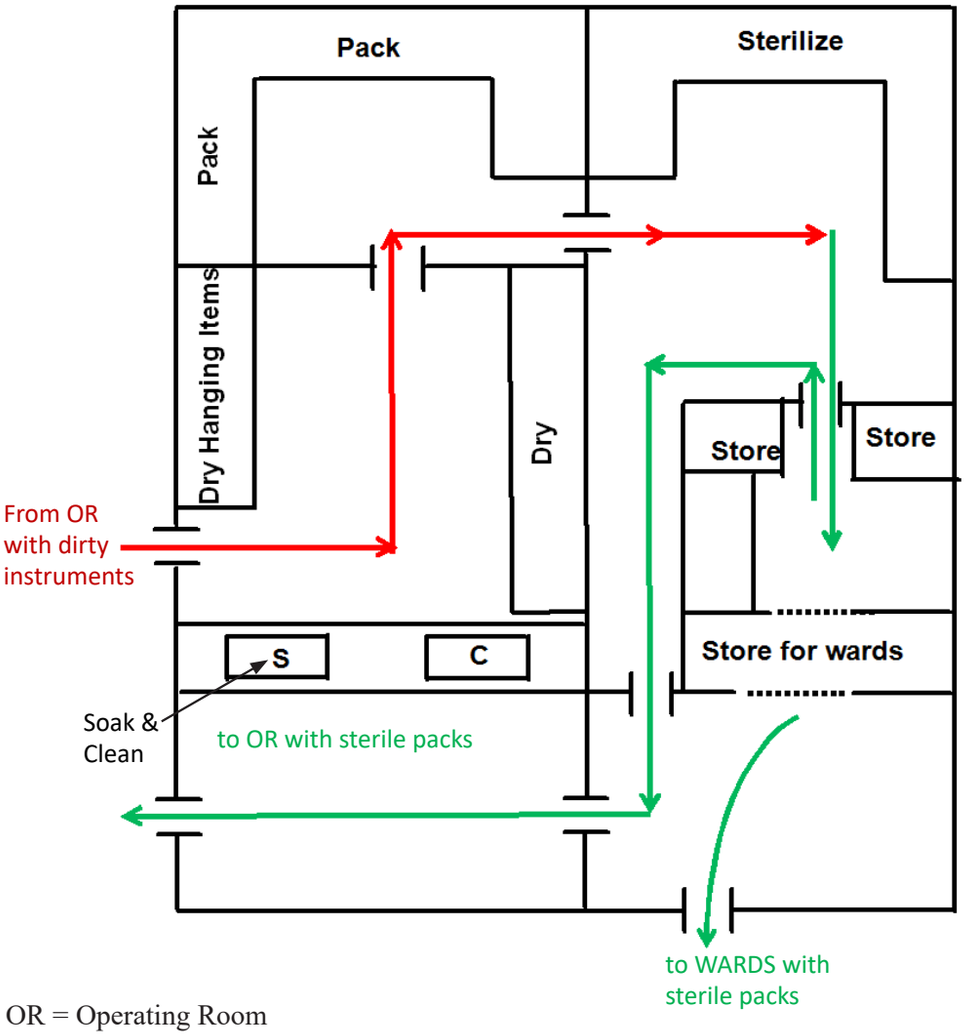


Figure 46 **|** *CSSD flow of clean and dirty items*

OR = Operating Room
S = Soak
C = Clean

KEY POINTS of cleaning, disinfection and sterilisation

- Cleaning, disinfection, and sterilisation are the backbone of infection prevention and control.
- Proper cleaning is essential before any disinfection or sterilisation process.
- Failure to sterilise or disinfect reusable medical devices properly may spread infections.
- The type and level of device decontamination depends upon the nature of the item and its intended use.
- Thermal decontamination is safer and more effective than chemical decontamination.
- Steam sterilisation is effective only when preceded by thorough pre-cleaning, proper packaging/loading, and careful monitoring of autoclaves.Chemical disinfectants must be properly selected, used, and discarded so as to minimise harm to humans and the environment.
- Equipment used must be continuously maintained and regularly monitored for their function.
- All staff responsible for processing contaminated items must be fully trained and wears protective clothing.
- Written policies and procedures must be available on-site for training personnel and for monitoring their performance.

4.1.3.2 Soiled Linen

General Information

Soiled linen, from patients and HCWs should be cleaned, and disinfected/ sterilised when necessary in HCF laundry.

To ensure a safe and sanitary environment for laundry staff, PPE should be available, as well as the supply of clean water, and hygienic laundry place.

The basic principles of linen management are as follows:

- In laundry room, the staff should be protected and wear at least: gloves, surgical mask, and impermeable apron, and close shoes or rubber boots.
    - where there is no laundry machine, and staff is washing by hands, the staff need to wear eyes protection (e.g. safety glasses)
- Place used linen in bag for linen at the point of generation. Do not rinse in patient care area.

- Any linens soiled with blood/bodily fluid are considered infectious.
- Separate infected linen from non-infected linen, and put it in a bag for infectious linen (e.g. yellow impermeable bag). Keep it separated during transport.
- Handle all linen with minimum agitation to avoid aerosolization of pathogenic microorganisms.
- Mattresses and pillows should be covered with plastic and be wiped over with a neutral detergent (refer to environment cleaning).

If there is no plastic cover, wash them by hands.

Figure 47 **|** *Laundry room to reprocess soiled linen*

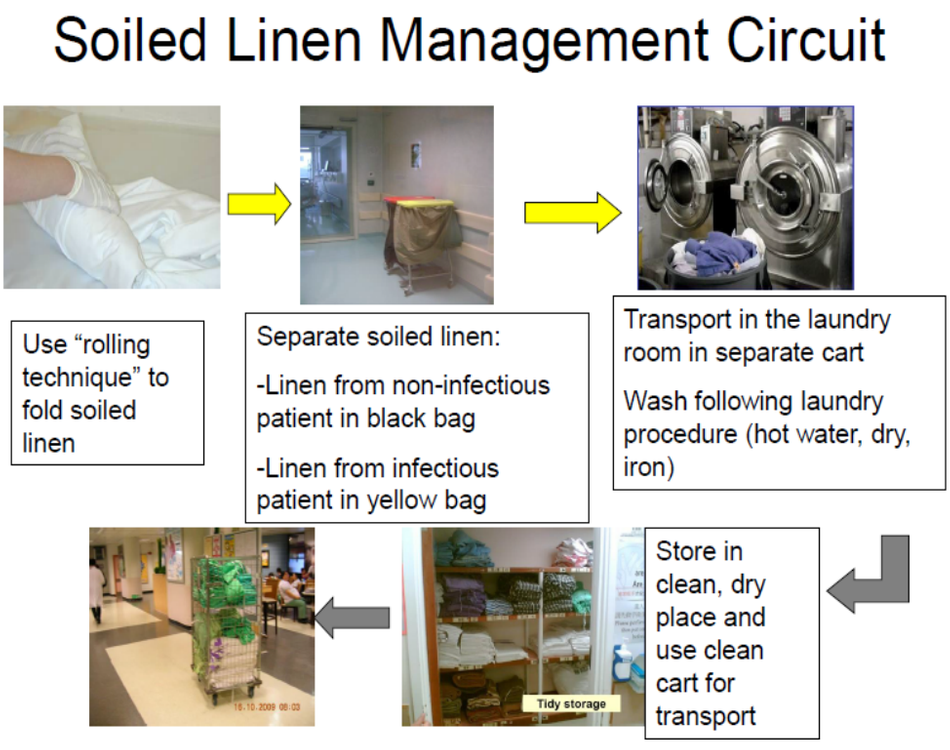
Table 4 Principles for reprocessing soiled linen

	Non-infectious linen	Infectious linen	Infectious Drapes from operating room
Overview	Linen from non-infectious patient and without blood/ body fluid	All linens from infectious patients and/ or with blood/ body fluid	All drapes from operating room are infectious.
PPE Required when Handling Linens	Disposable gloves	Disposable gloves (Other PPE may be required depending on route of transmission. See IPC Practices: Additional Precautions)	Rubber gloves (Other PPE may be required depending on route of transmission. See IPC Practices: Additional Precautions)

Sorting used linens	Place in bag for linens. Separate linens soiled with bodily fluid and put in infectious linens bag.	Place all used linen in bag for infectious linen (e.g. yellow impermeable bag) at the point of gene-ration	Place all drapes in bag for infectious linen (e.g. yellow impermeable bag) at the point of gen-eration
PPE required in laundry room, when using laundry machine	Gloves Surgical mask Impermeable apron Close shoes or rubber boots	Rubber gloves Surgical mask Eye protection Impermeable gown or non-impermeable gown with imper-meable apron Rub-ber boots	Rubber gloves Surgical mask Eye protection Impermeable gown or non-imperme-able gown with imper-meable apron Rub-ber boots
PPE required in laundry room, for hand washing	Rubber gloves, eyes protection, surgical mask, impermeable apron rubber boots,	**MUST NOT** be hand washed. If not laundry ma-chine available, wash by hands with caution Always wear eyes protection as using disinfectant	**MUST NOT** be hand washed If not laundry machine available, wash by hands with caution Always wear eyes protection as using disinfectant
Washing process with hot water (at least 70oC)	Detergent (Laun-dry liquid or powder) Rinse Dry (dryer or sun & iron)	Detergent (Laun-dry liquid or powder) Rinse Dry (dryer or sun & iron)	Detergent (Laun-dry liquid or powder) Rinse Dry (dryer or sun & iron) Bring clean and dried drapes to the central of sterilization

Washing process with warm or cold water (less than 70oC)	Wash with detergent (Laundry liquid or powder), Rinse Dry (dryer or sun & iron)	Detergent (Laundry liquid or powder) Rinse Soak in clean water with sodium hypo-chlorite 0.5% for 30 minutes[10] Wash again with detergent and water, and dry (dryer or sun & iron)	Detergent (Laundry liquid or powder) Rinse Soak in clean water with sodium hypo-chlorite 0.5% for 30minutes Wash again with detergent and water, and dry (dryer or sun & iron) Bring dried drapes for packaging and sterilization.
NOTE		If there is no other option (no laundry machine), for infec-tious linen/ surgical drape, before being wash by hand, they need to be decontaminated at first (soak in disinfectant solution e.g. bleach 0.05% or autoclaved), then they MUST be cleaned rinsed and disinfecting, and sterilisation for ste-rile drapes, to avoid contamination of patient	

[10] WHO - Practical Guidelines for Infection Control in Health Care Facilities 2004



| ***Figure 48***
Management of soiled linen

4.1.4 Environmental Cleaning

Housekeeping

Housekeeping refers to the general cleaning of HCFs, including the floors, walls, and certain types of equipment, such as tables and other surfaces. The purpose of general housekeeping is to reduce the number of micro-organisms that may come in contact with patients, visitors, staff and the community; and provide a clean and pleasant atmosphere for patients and staff. Cleaners have the responsibility of helping to keep the environment clean and safe, not just for patients but for their colleagues as well. Cleaners are an integral part of the healthcare system.

Most areas of HCFs, are low risk zone (non-infectious zone), these area should be cleaned daily, with detergent solution (soapy water) to remove dirt and organic material and dissolve or suspend grease, oil, and other matter so it can easily be removed by scrubbing.

In high-risk areas where heavy contamination is expected and risk of cross-contamination by the staff and other patients, surfaces need to be cleaned with soapy water, rinsed, and let it dry, before being disinfected (e.g. sodium hypochlorite (chlorine) solution 0.05%). High risk are areas are for instance, operating rooms, pre- and postoperative recovery areas, intensive care units (ICUs), isolation room, laboratory, toilets and latrines; or area with blood/ body fluid spills.

When cleaning, cleaners are at risk and need to be properly trained. They also must wear appropriate PPE, at least rubber gloves, rubber boots, uniform or apron. When there is risk of splash in the face, wear surgical mask and eyes protection.

Figure 49 |
Personal protective equipment for cleaning staff

Principles of Environmental Cleaning

- Apply hand washing / hygiene and wear appropriate PPE (at least rubber gloves, rubber boots, uniform or apron. When risk of splash in the face, wear surgical mask and eyes protection).
- Prepare fresh cleaning and household solution once a day; and change solution whenever they appear to be dirty.
- Perform cleaning and disinfecting patient environment at least once a day.
- Clean first with detergent (soapy water), rinse with water, let it dry in non-patient area (e.g. including corridor, laundry room etc.)
- In high risk area (patient care area), following cleaning procedure, disinfect surface by using household disinfectant (e.g. bleach 0.05% solution, alcohol 70% for small object, or follow manufacture recommendations).
- Every day clean all patients' rooms, units, cleaner's rooms
- Cleaning with a moistened cloth helps to avoid contaminating the air and other surfaces (do not a "feather duster/ chicken feather")
- Clean from the less contaminated to the most contaminated area (e.g. start from corridor, then patient' room, and last finish to clean bathroom and toilet)
- After patient discharge, clean and disinfect patient room very well, including all equipment that has been in contact with patient (e.g. bed, bed table…) as soon as possible
- After use, all cleaning equipment (e.g. mop, brush, bucket, cloth…) must be cleaned, disinfected and dried before storage, and be reused.
- In general, Do not spray (i.e. fog) occupied or unoccupied clinical areas with disinfec-tant. This is a potentially dangerous practice that has no proven disease control benefit.

Cleaning up Spills

Clean up spills of potentially infectious fluids immediately, to preventing the spread of the infection and also prevents accidents.

Small spills of blood of other body fluids should be wiped with paper towel (staff using disposable gloves), then clean with soapy water, rinse and disinfect.

> ***Note:*** In many settings, housekeeping staff may not understand their risks of getting infected. It is particularly important for supervisors to ensure that this staffs are trained, know their risks, and follow the appropriate procedures.

Appropriate handling of bedding

- Mattresses and pillows with plastic covers should be cleaned with detergent, after departure of each patient.
- In isolation unit and intensive care unit, as well as infectious wards (e.g. TB..) disinfecting should follow cleaning procedure.
- Clean (and disinfect in infectious unit) mattresses and pillow with plastic covers.
    - If not, they should be manually washed with detergent (Refer to "Management of soiled linen 5.3.2")

| ***Figure 50***
Handling of bedding

See Annex 8 for "Preparation of Sodium Hypochlorite Solution Procedure".

4.1.5 Prevention of Needle-stick/Sharp Injuries

In healthcare settings, injuries from needles or other sharp instruments are the number-one cause of occupational exposure to blood-borne infections. All staff that come in contact with sharps - from doctors and nurses to those who dispose of the trash - are at risk of infections.

Improper disposal of sharps also poses a great threat to members of the community.

The term *sharps* refers to any sharp instrument or object used in the delivery of healthcare services - including hypodermic needles, suture needles, scalpel blades, sharp instruments, intravenous (IV) catheters, and razor blades.

A needle stick/sharp injury means the skin is accidentally punctured by a used needle/sharp (e.g. scalpel). The injury is a port of entry for blood-borne diseases, such as hepatitis B (HBV) and hepatitis C (HCV), HIV etc.

Exposure to patient's body fluid also put HCWs at risk of infection. Therefore, they are encouraged to strictly comply with IPC precautions related to body fluid.

4.1.5.1 Main causes of needle stick/sharp injury

The main causes of needle stick/sharp injury include:

- Recapping of needles (identified as the most common cause)
- Unsafe handling of sharp waste (identified as the second most common cause)
- Reuse of safety box
- Manipulation of used sharps (bending, breaking, or cutting needles).
- Unnecessary injections
- Lack of supplies: disposable syringes, sharps-disposal container/safety box
- Failure to place needles in sharps containers immediately after injection
- Passing sharps from hand to hand (e.g. during surgery)
- Lack of management of sharp wastes
- Lack of awareness of the problem
- Lack of training for staff

"Hands-free" technique is an example of good practice when passing sharps from hand to hand, for instance during operation.

Figure 51 | *"Hands-free" technique used when passing instrument*

- The assistant places the instrument in a sterile kidney basin or in a designated "safe zone" in the sterile field.
- The service provider picks up the instruments, uses it, and returns it to the basin of safe zone.
- Risk of sharp injuries: Failure to place needles in sharps containers immediately after injection

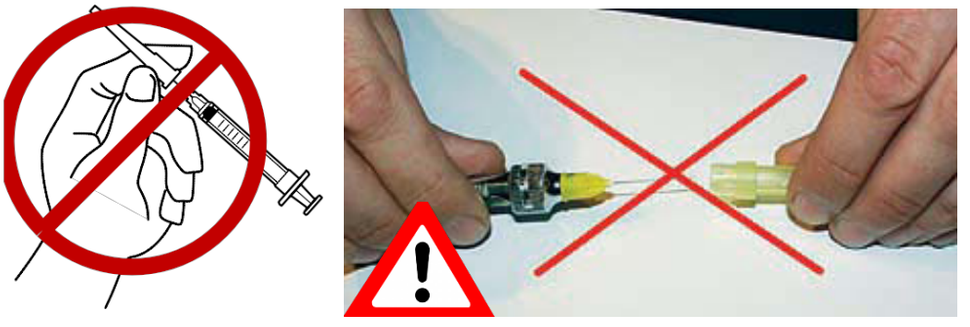
| *Figure 52*
Disposal of needles: ***incorrect*** *(left) and* ***correct*** *(right) disposal of needles*

4.1.5.2 Principle of the disposal of used needles/sharps

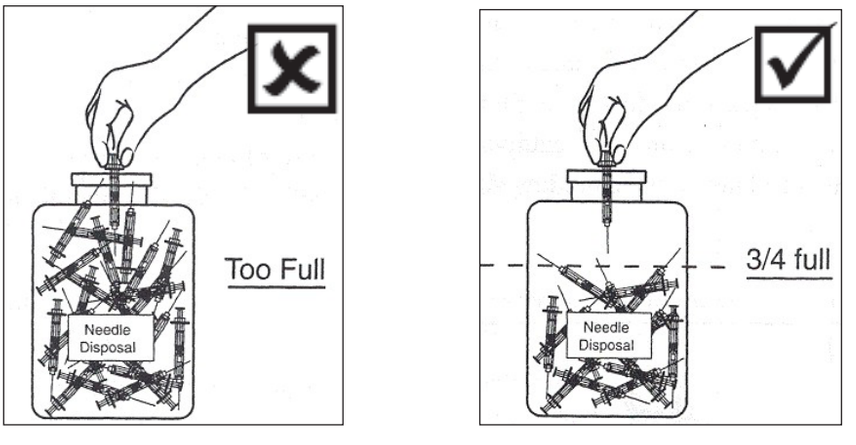
Never recap needle/sharp

- Dispose of needles and syringes immediately after use in the safety box.
- Close the safety box, whenever the containers become ¾ full.
- Safely dispose the safety box (e.g. via incinerator with temperature at least of 800o Celsius)
- When it is not immediately disposed, keep safety boxes in appropriate storage, for infectious waste.

Refer to "Healthcare Waste Management Guidelines 2011" and "National Injection Safety Guidelines 2014", for more information.



| *Figure 53*
NEVER *recap a needle*



| *Figure 54*
Overfilled sharps container
Correctly filled- 3/4 Full Container

Safety Box or Sharp disposal container

Safety boxes MUST be puncture and leak resistant. They should be conveniently located in any area where sharp objects are frequently used (such as injection rooms, treatment rooms, operating theatres, labour and delivery rooms, and laboratories).

Sharp Any object that can penetrate the skin; sharps include needles, scalpels, broken glass, broken capillary tubes and exposed ends of dental wires.

Safety box A puncture-resistant, rigid, leak-resistant container designed to hold used sharps safely during collection, disposal and destruction.

Sharps container: Reusable

Sharps injury An exposure event occurring when any sharp penetrates the skin.

Figure 55 | *Plastic bottles (eg. Water bottle) are not puncture-proof, and should not be used as sharp containers.*

Figure 56 | *Unsafety practice of safety box*

Safety box is for SINGLE use.
Do NOT reuse safety box!

(photo credit: Cambodia Healthcare facilities)

To practice SAFE injections:
"One needle, One syringe, only One time!"

For more details on safe injection practices, refer to the MoH "National Injection Safety Guidelines 2014".

4.1.6 Appropriate Health Care Waste Management

While approximately 80% of the wastes generated in a HCF are general waste, the remaining 20% comprise wastes that contain harmful microorganisms which can infect hospital patients, HCFs staff and the general public, as well as sharp objects and hazardous substances that can result in injuries, poisoning and pollution.

Type of Wastes

Healthcare waste is broadly categorized into two main groups, namely medical wastes and general wastes.

1. General wastes or household waste

- Any waste that are solid or semi-solids generated from HCFs that are non-toxic and non-hazardous and are not contaminated with medical wastes. These are the food wastes, paper, plastics, textiles, non-toxic metals, glass and garden wastes.
- In the event that general wastes are contaminated or mixed with any medical wastes, the general wastes shall be classified as medical wastes and managed accordingly.

2. Medical wastes

- Any waste which consists completely or partly of human or animal tissue, blood or other body fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, syringes, needles or other sharps instruments, … all

wastes that are hazardous or can cause infection to any person coming into contact with it.

- Any other wastes generated from healthcare activities which may be hazardous or toxic.
- The categories of medical wastes are:

    1) Infectious wastes

    2) Pathological wastes

    3) Sharps wastes

    4) Pharmaceutical wastes

    5) Genotoxic wastes

    6) Chemical wastes

    7) Wastes with high content of heavy metals

    8) Pressurized containers

    9) Radioactive wastes

In order to protect HCF staff, patient and population, it is essential that HCF' wastes are properly managed.

Proper HCWM includes (1) waste segregation, (2) collection and handling, (3) stock in a safe temporary storage, (4) safe waste treatment or decontamination, and (5) safe discard without any harm for the population.

Figure 57 | *Color code for general waste (green bin) and infectious waste (yellow bin*

(1) Organize waste segregation:

- green bin: general waste or household waste
- Yellow bin: infectious waste, main part of the medical waste

The Color Coding, Markings and Symbols[11]

All HCFs shall use the standard color coding and marking system for bags and containers for medical wastes and general wastes. These are:

[11] MOH- Healthcare Waste Management (HCWM) Guideline 2011

Waste Category	Colour of Container & Markings	Proposed Symbol
Infectious waste	Yellow, marked black	
Pathological wastes	Yellow, marked red	
Sharps “safety-box”	Yellow, marked “SHARPS”	
Chemical & pharmaceutical waste	Brown, marked “HAZARDOUS”	
Wastes with high content of heavy metals	Brown, marked with the specific heavy metal content and “HAZARDOUS”	Toxic
Genotoxic waste	Brown, marked “CYTOTOXIC”	
Radioactive waste	Red	
Pressurized containers	Black	
General waste	Black	

2) Handling

Staff should handle medical waste as little as possible before storage and disposal. The more waste is handled, the greater the chance for accidents.

Special care must be taken when handling used needles and other sharps, which pose the greatest risk of accidental injury and infection.

Emptying waste containers

Waste containers that are too full also present greater opportunities for accidents. Waste should be removed from operating theatres, procedure rooms, and sluice rooms before the containers become completely full. At the very least, these containers should be emptied once a day. Dispose of sharps containers when they are 3/4 full. (When sharps-disposal containers become too full, people may push sharps into the container, causing injury.)

Staff should wear utility gloves, heavy duty apron and boots when collecting waste.

Do not collect medical waste from patient-care areas by emptying it into open carts or wheelbarrows, as this may lead to spills and contamination of the surroundings, may encourage scavenging of waste, and may increase the risk of injury to staff, patients, and visitors.

Handle medical waste as little as possible.

Never put your hands into a container that holds medical waste.

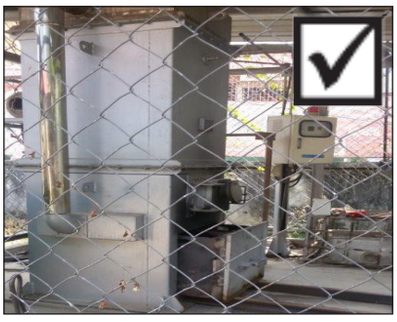
3) Stock in a safe temporary storage

Following segregation, medical wastes should be placed in a designated, safe (locked) and temporary storage at HCFs.

Three recommended procedures to safely disposed medical wastes:

1. Encapsulation (e.g. needle pit)
2. Secured landfill (e.g. fences and guard around landfill)
3. Incineration (e.g. temperature should be consistently above 800˚C for complete incineration and being environmental friendly)

General wastes can be removed to the regular community waste-disposal (land field). However, strict compliance with segregation should be monitored for the safety of the community, and people who are recycling the general wastes.



| Figure 58
Incinerator (>800˚C)

During HCWM, protection of healthcare workers (HCWs) needs to be ensured. PPE for standard precautions must to be provided and staffs need to be trained.

PPE for HCWM staff should be at least:

- Rubber
- Apron
- Rubber boots (or close shoes)
- Disposable surgical mask (if staff have to close the waste bags as part of their tasks)

When training HCWM staff, training material should be practical, for the staff to clearly understand their risks and the proper disposal practices.

Autoclave

Autoclave used to decontaminate infectious waste is required for laboratory (Level BS2+ and BSL3). They are available in some laboratories in Cambodia.

All laboratory equipment, materials and fluids must be decontaminated in the autoclave, before being discharged out of the laboratory.

| Figure 59
Autoclave used to decontaminate infectious wastes in laboratory

Disposal of Liquid Medical Waste

Always wear heavy utility gloves and shoes when handling or transporting liquid medical waste of any kind. When carrying or disposing of liquid medical waste, be careful to avoid splashing the waste on yourself, others, or on the floor and other surfaces.

Carefully pour liquid waste down a sink, drain, flushable toilet, or latrine. If this is not possible, bury it in a pit along with solid medical waste.

Remember:

If liquid waste is buried, large quantities (over 1 kg) should not be buried at the same time; burial should be spread over several days.

Moderate quantities of mild liquid or semi-liquid pharmaceuticals such as solutions containing vitamins, cough syrups, intravenous solutions, eye drops (but not antibiotics or cytotoxic drugs), may be diluted in a large flow of water and discharged into municipal sewers. Pharmaceutical wastes shall not be disposed of into slow-moving or stagnant water.

Note:

Before pouring liquid waste down a drain or toilet, consider where the drain empties. It is hazardous for liquid medical waste to run through open gutters that empty onto the grounds of the facility.

All facilities should have appropriate drainage. If the facility does not link to a treated municipal water drainage system, then all drainage should be treated locally. This includes appropriate septic and filtration systems.

Remember:

Highly infectious waste should be disinfected by proper disinfectants or autoclaved before they are disposed of either by incineration or non-incineration processes. Unless there is an adequate waste-water treatment plant, blood should be disinfected before discharged to a sewer.

For complete information, refer to the "Healthcare Waste Management (HCWM) Guideline 2011".

4.1.7 Respiratory Hygiene

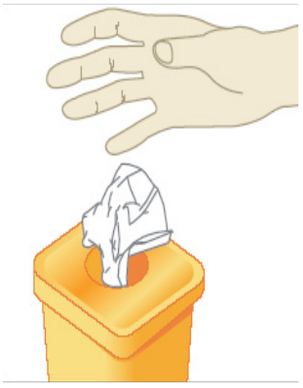
Respiratory hygiene and cough etiquette is a standard precaution that should be applied by all patients, visitors and HCWs to contain respiratory secretions (e.g. when coughing, sneezing…) to avoid spreading respiratory infections.

Cover nose and mouth when coughing, sneezing with tissue or mask.

If no tissues are available, cough or sneeze into the inner elbow rather than hand.

Do not "spit" in environment (use tissue instead).

Dispose used tissue and/or masks in the nearest bin after use.



Avoid shaking hands when sick. Use «traditional greeting» instead.

Perform hand hygiene after contact with respiratory secretions.

| *Figure 60*
Respiratory hygiene procedures

HCF should promote respiratory hygiene and cough etiquette by:

- Educating HCF staff, patients, family members, and visitors on the importance of containing respiratory droplet/ aerosol and secretions to prevent the transmission of infectious disease (e.g. influenza, tuberculosis, bacterial pneumonia …).
- Posting signs informing that patients and family members with acute febrile respiratory illness use respiratory hygiene/cough etiquette (e.g. poster).
- Prepare equipment in triage area for patient and family to apply respiratory hygiene. For instance, in Out-Patient- Department (OPD) and Emergency Room (ER), make mask, tissue, rubbish bin, and AHR available.

Remember:

If you have respiratory symptoms (e.g. coughing), consider using a mask, or seek permission to stay home from work, or performing office duties away from patients.

Remember:

Standard Precautions are the BASIC level of Infection Prevention and Control precautions which are to be used, as a minimum, in the care of all patients in every HCF.

4.2 Transmission-Based (Additional) Precautions

While standards precautions are applied for all patients, depending on the risks

assessment (e.g. splash of fluids on body, face…) and performed procedures (e.g. withdrawing blood…), transmission-based (additional) precautions are applied depending on the route of transmission of the pathogen, in addition to standard precautions.

Additional precautions are a set of procedures whose goal is to prevent communication of infectious disease transmitted in a certain manner.

There are three types of additional precautions:

1. Contact precautions
2. Droplet precautions
3. Airborne precautions

They may be combined for diseases that have multiple routes of transmission e.g. avian influenza (droplet and contact precautions are required).

For all type of isolation precautions:

- Implement all standard precautions.
- Place patient in a single room or in a room with another patient infected by the same pathogen - also called cohorting room.
    - In a cohort room, keep at least 1 meter distance between patient beds.
- Put a sign with the type of precautions (e.g. contact, droplet and/or airborne) and what PPE staff, visitors need to wear.
- Always limit the movement and transport of the patient from the room (e.g. use mobile X-Ray, where available, instead of transporting patient to X-Ray room)
    - If transportation is necessary, apply standard precautions to minimize the risk of transmission.
    - Avoid crowed area (with other patients, to avoid NI), when transporting patients.
- Use dedicated patient care equipment (one equipment for one isolated patient); if not possible clean and disinfect item between patients.

4.2.1 Contact Precautions

Contact route of transmission includes direct contact or indirect contact transmission.

- *Direct contact:* this involves direct physical transmission between people who

is infected to a susceptible host with open skin/ mucous, or via an injury with a contaminated sharp object (invasive contact) for instance (e.g. get injured with hepatitis B, C, HIV… contaminated needles).

- *Indirect contact:* this involves contact of susceptible person with a contaminated object or surface such as contaminated instruments (e.g. by touching patient table, thermometer…).

Diseases which are transmitted by this route include pathogens (e.g. virus, bacteria) present in blood and body fluids, which have contact with open skin or mucous of host. It includes enteric infections, skin infections etc. (e.g. cholera, varicella, Methicillin-resistant staphylococcus aureus (MRSA), etc.). In some case, when pathogen has high virulence, full PPE is needed to prevent having any contact between the pathogen and the host' skin (e.g. Ebola).

The following precautions need to be taken:

- Put a sign with "Contact Precautions Room" for restriction of movement and information for HCW/ staff and family, before entering to the isolation room.
- PPE:
  - Wear clean, non-sterile, disposable gloves when entering the room.
  - Wear a clean, non-sterile gown when entering the room if substantial contact with the patient, environmental surfaces or items in the patient's room is anticipated.
  - Removing PPE and wash hands when leaving the room, without touching potentially contaminated surfaces or items.

| ***Figure 61***
Disposable gloves

| ***Figure 62***
Disposable gown

| ***Figure 63***
Sign for Contact isolation room (example of MRSA isolation)

See Annex XXX for "Specific Recommendations for Contact Isolation"

4.2.2 Droplet Precautions

Droplet precautions must be applied in addition of standard precautions, for diseases that are transmitted via "droplet", which are large particles (> 5 microns), that can move ("drop") in about one meter.

Droplets are usually generated from the infected person during coughing, sneezing, talking or when health staffs undertake procedure such as throat swab collection sample.

Diseases that are transmitted by this mode include includes *pneumonia, pertussis* (whooping cough), *diphtheria, influenza (human and avian such as H1N1, H5N1…), mumps, and meningitis;* as well as recent emerging infectious diseases (EID) such as *Severe Acute Respiratory Syndrome (SARS), and Middle Est Respiratory Syndrome (MERS)*[12].

Droplets transmission occurs when there is adequate contact between mucous membranes (nose, mouth or conjunctivae) of a susceptible host and infected particle (> 5 microns).

The following precautions need to be taken:

Figure 64 **|** *Surgical mask*

- Put a sign with "droplet precautions room" for restriction of movement and information to HCW/ staff and family, before entering to the isolation room.
- PPE for health care workers, any one entering to the droplet isolation need to wear:
  - surgical mask when providing care to patient
  - eyes protection

Figure 65 **|** *Goggle*

  - when having contact with patient and surrounding, wear disposable gloves (risk of having indirect contact with infected droplets)
- PPE for patient, when transport is necessary:
  - surgical mask

See Annex YYYY for "Specific Recommendations for Droplet Isolation".

4.2.3 Airborne Precautions

Airborne precautions are designed to reduce the transmission of diseases spread by the

[12] IPC of epidemic-and pandemic-prone acute respiratory diseases in health care. WHO. 2014.

airborne particles in the air. These particles are tiny and are called “nuclei particles” (<5 micron size). They can remain suspended in the air for up to several hours and can be spread widely within a room or over long distances. Diseases which spread by this airborne route include pulmonary tuberculosis (TB), measles and chicken pox.

Airborne precaution has also to be followed during performance of procedure that may produce aerosol, such as intubation, bronchoscopy etc.

Particular attention, when taking care of patient with droplet ID (e.g. AI, H1N1, MERS, etc.), or EID, that need to be intubation, or have a bronchoscopy

The following precautions need to be taken:

- Place patient in an identified isolation single room with good ventilation; or when possible a negative pressure room.
- Put a sign with “Airborne precautions room” for restriction of movement and information to HCW/ staff and family, before entering to the solation room.

| *Figure 66*
Particulate respirator

- When transporting/transferring the patient, the patient must wear surgical mask.
- Anyone who enters the room must wear particulate respirator (e.g. N95).

See Annex 14 for “Specific Recommendations for Airborne Isolation”.

More specifically, regarding airborne precautions for tuberculosis patient with smear positive, refer to the “”Tuberculosis Infection Control Standard Operating Procedures, Cambodia, May 2010”.

Specification of Particulate Respirator

Particulate respirator, is a specific mask which filter small airborne particles (size of 1 to 5 micro), at least at 95% (e.g. N95) until 99.9%. This gave protection to HCWs when taking care of patient with airborne diseases, or when performing aerosol-producing procedure such as intubation, bronchoscopy etc.

There are several types of particulate respirators from disposable (or single-use) masks (N95) to reusable mask frame with disposable high-efficiency particulate air High Efficiency Particulate Air (HEPA) filter.

Note that not all particulate respirators are fluid resistant. When risk of splash in the face of HCW, the particulate respirators need to be fluid resistant. In that case, select a surgical particulate mask.

Please refer to “Standard Operating Procedures for TB Infection Control – CENAT

(2010)" for specific procedures of using particulate respirator (N-95) in TB setting.

Figure 67 | *Different types of NIOSH Certified particulate respirators*

Before entering in the room/ unit with patient with an airborne disease, particulate respirators must be worn and fit test (seal check) must be performed, to ensure the efficiency of the PPE.

It is also important before purchasing to check the certification of the N95 respirators to avoid the counterfeit or fake ones.

A NIOSH-certified respirator will have the following markings on the respirator's packaging, user instruction insert, and/or on the respirator itself (Figure XX):

- The NIOSH name or logo;
- The NIOSH filter classification - in this case "N95";
- The NIOSH test and certification - or TC - approval number;
- The Approval Holder's business name (usually the manufacturer), registered trademark, or an easily understood abbreviation;
- The model or part number; and
- The manufacturing lot number.

If in doubt, procurement officer could verify the list of certified manufacturers by consulting the following US-CDC website:

http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/N95list1.html#index

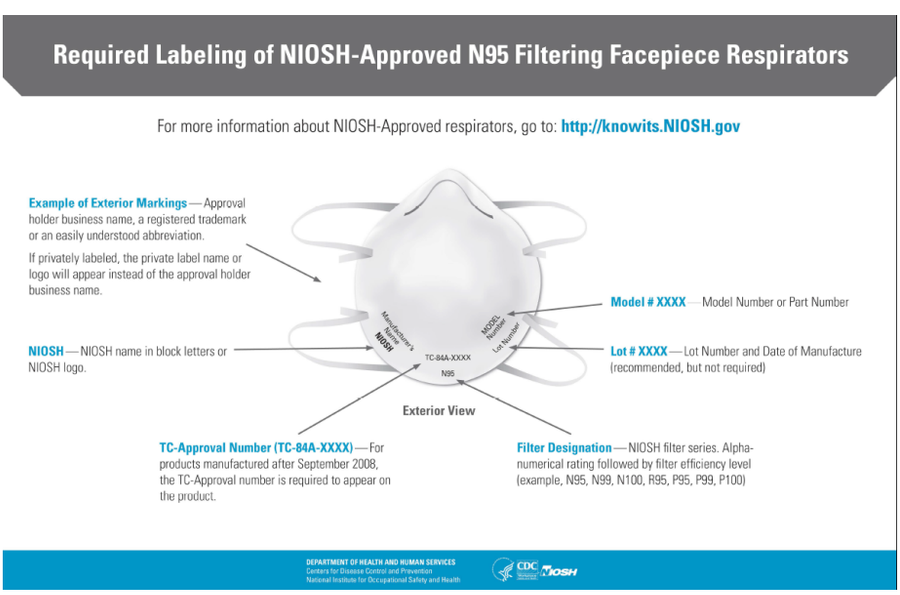


Figure 68 | *Example of required labeling of NIOSH-certified N95 Respirators*

NOTE:

There are some counterfeit N95 respirators, which are not certified or approved by National Institute for Occupational Safety and Health (NIOSH). Officers in charge of purchase and procurement of N95 respirators need to verify the respirators are of standard quality and genuinely certified by NIOSH.

| *Figure 69*
Example of counterfeit N95 Respirators

See Annex 15 for "Particulate Respirator Fitness Test Procedure and Specification".

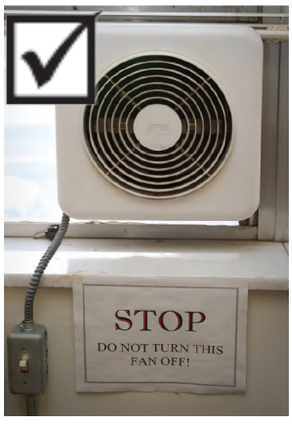
Negative Pressure

The purpose of having an airborne isolation room with negative pressure is to prevent the contaminated air from going inside HCFs, to the corridor and other patient' rooms, and the risk to contaminate other patients and staff.

This can be achieved by a

- Mechanical system (ventilation with HEPA Filter), with extraction fan(s) in the room, or
- by opening window(s) and keeping the doors closed.

By having a negative pressure in the isolation room, the air flow goes from clean corridor to infectious isolation room.



Negative pressure can be achieved by

- efficient installation of extraction fan, that requires blocking the opening around the fan to create a negative pressure, or
- open window and close the door of the room.

Figure 70 | *Extraction fan*

Ceiling and normal fan in an open space do not improve ventilation or control airflow, and do NOT create negative pressure.

Figure 71 | *Normal fan*

red arrow: contaminated air

green arrow: clean air (contaminated air is going through HEPA filter, filtering the infected nuclei)

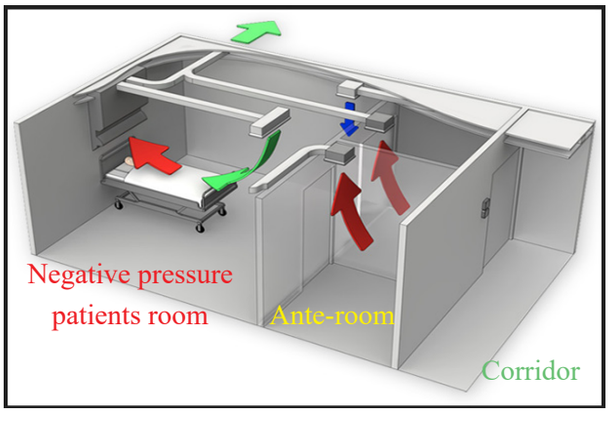


Figure 72 | *Example of design for airborne isolation room*

Normal air conditioner, do not have HEPA filter, and therefore do not filter airborne pathogen.

It is not to be used in airborne isolation room, as it creates a positive pressure, and push contaminated air outside the isolation room, into the HCF.

- Some disease has several route of transmission, in that case standard plus contact or/ and droplet, and/or airborne precautions need to be applied.
- In case of novel or emerging infectious disease(s), apply standard plus all additional precautions, until the route of transmission has been identified (this include wearing FULL PPE).

CHARTER V

MANAGEMENT OF PATIENT WITH INFECTIOUS DISEASE OF PUBLIC HEALTH CONCERN

To prevent any Infectious Disease (ID) spreading inside the HCF and in the community, it is important to early detect and properly manage any patient with contagious diseases of public health concern, to avoid having outbreak.

For instance, patient with TB especially MDR-TB, Extensively drug-resistant TB (XDR TB), MRSA, cholera, etc., as well as any Emerging Infectious Diseases (EID), as it was the case for MERS in Korea, Avian Influenza (AI) in Cambodia and Ebola in West Africa.

This is done by organizing triage of patients with specific symptoms before entering in the HCFs, and isolate them until they are no more contagious.

5.1 Triage

To organize triage, an area outside general OPD and/or Emergency room (ER) should be selected. The triage area should be away from a crowded area, and specifically from patients with low immunity such as pregnant women, young (under five), neo-natal unit, units with elderly patients, HIV/AIDS, Intensive Care Unit (ICU) …

Clear direction/sign should be given to patient with specific symptoms, for them to find directly the screening area; and avoiding spreading infection.

In the triage area, the patient zone should be clearly mark, and physically separated from the staff zone where the triage is done. The triage zone staff MUST apply standard precautions + the additional precautions (base on the route of transmission of the infectious disease.

If this is a novel agent, all routes of transmission should be considered or identified based on the current epidemiological knowledge.

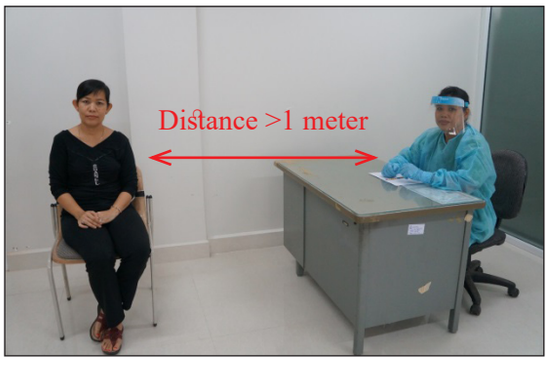


Figure 73 **|** *Example of triage for infectious disease (ID) patient*

Example of triage for patient that may have an infection transmitted by contact and droplet

➔ Change photo with triage outside HCF

See Annex 15 for "Example of Triage Procedures."

5.2 Isolation Room/Unit

When a patient is define as suspect infectious diseases case (refer to epidemiological of suspect case of the disease), it is important to isolate the patient for further investigation (sample collection, complete auscultation), to identify if the patient is probable, and later confirmed Infectious disease case.

If an isolation room or Isolation Unit (IU) is not yet available, select a room or unit which are naturally, well-ventilated and away from other patient unit, especially units with patient with low-immunity (e.g. Mother and Child unit, HIV/AIDS, oncology unit etc.),.

Anyone entering in the isolation room/unit, needs to wear appropriate PPE, depending on the route of transmission of the infectious disease. It is also essential that the selected isolation room/ unit is up-to-standards to prevent outbreak of nosocomial infection.

Main Principles of Isolation Room / IU

- Each single isolation room should have:
    - Individual hand washing for patient, toilet and bathroom.
    - Anteroom (changing room)- small room before isolation room (staff take off PPE)
    - Dispensers and alcohol hand-rub or equipped hand washing facilities are installed in anteroom and in the general access.
    - A place for contaminated equipment/ linen or bucket to dispose soiled equipment and linen, to be clean or before transfer to specific cleaning station.
    - Rubbish bin with pedal to activate the top (in each zone), with labelled biohazard bag for infectious wastes (yellow color).

For isolation of airborne pathogen, air flow should go from clean corridor to infectious isolation room to avoid contaminated of other patient and staff at the HCF.

Refer to Section 4.3 Airborne precautions.

    - A way to view the patient without entering in the room; for instance with a glass window on the room door.
    - A way to communicate with the patient without entering in the isolation room. It can be done with an intercom system.
    - Have dedicated equipment (e.g. infusion stand, thermometer, sphygmomanometer, stethoscope….)

- Remove all non-essential furniture, curtain and ensure that the remaining furniture is easy to clean, and does not retain dirt or moisture within or around it (e.g. keep plastic furniture easily to be cleaned and remove wooden furniture, or with material, curtain).
- One safety box per room

- Mark clearly the infectious and non-infectious zones with color code for instance:

  (1) clean zone = green (e.g. staff meeting room),
  (2) semi-infectious zone = yellow (e.g. ante-room),
  (3) infectious zone or high risk zone= red (e.g. isolated patient room)

- Running and clean water available 24 hours/7day per week;
- Limit contact between infected and uninfected persons
- restrict non-essential health staff and visitors (often, no more than one visitor is recommended)
- Anyone (including visitors) entering to the isolation unit/room, MUST be trained to wear (don) and take off PPE (doff).
- Registration book (logbook)
  - all visitors and Health staff need to record their name, date, contact details (e.g. mobile phone) each time they enter to IU, for transmission surveillance purpose.
- All wastes from IU/ isolation room should be appropriately managed (double bagging, incinerated).
- Where HCF does not have an isolation Unit (IU), select one unit (away from crowded area, away from unit with patient with low-immunity e.g. MCH, HIV/AIDS unit), and establish it as IU/isolation room. In this case, the entire unit is considered an infected zone and PPE has to be worn at all times.
- Keep adequate equipment required for cleaning and disinfecting per room, and inside the isolation room (in bathroom/ toilet).

Patient placement:

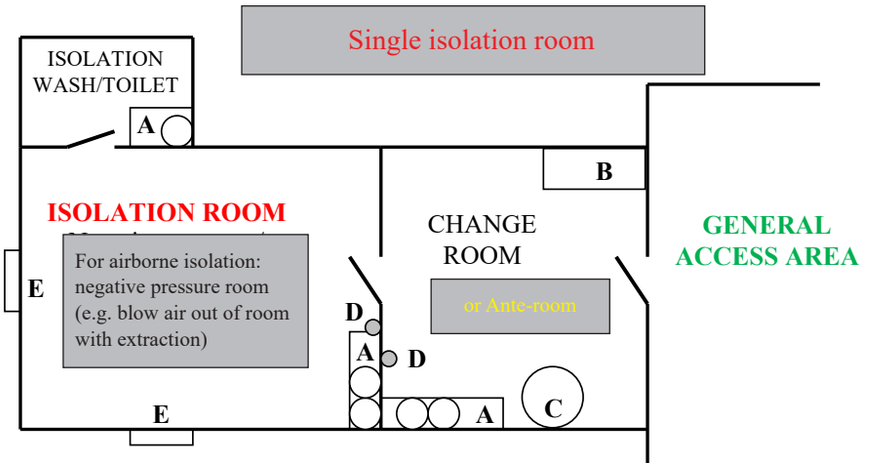
- Single rooms reduce the risk of transmission of infection from the source patient to others by reducing direct/indirect contact transmission, droplet, airborne or mix mode of transmission.
- Single isolation room is always preferred. When it is not feasible isolate confirmed cases in the same isolation room. It is refer as cohort isolation room. For example, confirmed smear positive tuberculosis cases can be placed together.

- Keep at least 1 meter distance between beds.
- Cohort room

- Post a sign on the door of room or unit, to indicate that the room/ unit is an isolation zone.

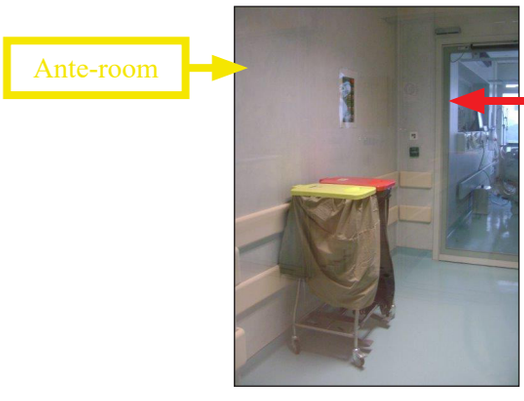
See Annex 11, 12, 13 for "Example of isolation room signs".

- Ensure security around the IU/ isolation room:
  - Put fence around the isolation unit, to ensure that people who are not aware of isolation precautions enter in the isolation zone, putting his/ her health at risk as well as the community one.
  - A security guard may be required in specific situation (e.g. in West Africa, during Ebola viral disease outbreak).



A. Disinfection station
B. Storage for general ward clothes, new PPE.
C. Biohazard bag for used PPE disposal.
D. Wall-mounted alcohol hand-wash dispensers.
E. Windows…external only. Keep clear of public.

| Figure 74
Schema of single isolation room



Single isolation room

with ante-room

(Hong Kong, Infectious Disease Centre, 2010)

| Figure 75
Anteroom of isolation room

ADD schema Cohort isolation room + schema

Figure …(still looking for a good schema of cohort room)

The use of cohort rooms is for IPC purposes. If single rooms are not available, or there is a shortage of single rooms, confirmed patients infected with the same pathogen can be put together; it is called a cohort room.

It is crucial to ensure that space between beds is at least 1 meter (more than 1meter)

| Figure 76
Example of cohort isolation room

(Photo: Battambang Provincial Hospital, 2015)

Refer to Annex 16 for "Specific IPC Procedures When Managing Patient in Isolation Room/Unit."

5.3 Identify Isolation Area before Transfer

Where it is not possible to isolate patient, transferring the patient to a referral HCF with up-to-standard isolation room/IU should be considered.

Before transferring, select a specific room, away from crowded area, well ventilated when possible, for the patient to wait before the transfer.

The following should be considered

- select a single room with window opening to outdoor
- having hand washing equipment or AHR
- having toilet and bathroom facilities
    - if more than one toilet, select one toilet to be used only by isolated patient.
    - If no toilet in the room, put dedicated portable toilet (pot).
        - NOTE: staff/ family need to wear proper PPE, for contact and prevent risk of splash, when cleaning the pot. Patient should not do it (restricted movement).

NOTE: this can be applied in border crossing when identified person correspondent to a specific case definition.

5.4 Transportation and Transfer of Infectious Patient

Limit the movement and transportation of patients inside HCF. Patient should be transported only for essential purposes (e.g. radiography exam when there is no a mobile X-Ray machine) to reduce the transmission of pathogen to other areas of the hospital.

Transfer patient to an identified hospital for infectious diseases case management with isolation room/ unit that is up to standard.

If transportation/transfer is necessary, proper precautions should be taken to reduce the risk of transmission of pathogen to other patients, health staff or the hospital environment (materials or equipment).

For instance, health staff and patient must wear appropriate PPE, depending on the route of transmission of the pathogen.

- Patients:
    - Wear surgical mask, for droplet (e.g. flu, Avian Influenza (AI) etc.) and airborne (e.g. tuberculosis, or new infectious disease).
    - Gown or sheet can cover patient, in some cases of contact transmission or unknown way of transmission.
- HCWs:
    - surgical mask for droplet transmission (e.g. flu, AI …),
    - particulate respirator (e.g.N-95), when airborne transmission (e.g. tuberculosis, or new EID).
    - disposable gloves when contact with blood/ body fluid, and indirect contact with infected equipment.
    - gown (and apron) for contact precautions and droplet when close contact (< 1 m.) with patient, and when risk of splash of body fluid/ blood on the body (standard precautions).
    - surgical mask and eyes protection, when a risk of splash in face (standard precautions).

After transporting/transferring the patient, push chair, vehicle/ ambulance must be cleaned and disinfected by the cleaner/ HCWs, who are wearing appropriate PPE, in accordance with the route of transmission. When transferring the infectious patient with ambulance/ vehicle, it must be cleaned by the HCWs and NOT in public carwash.

CHARTER VI CARE OF HEALTHCARE WORKERS (OCCUPATIONAL HEALTH)

Health care facilities around the world employ over 59 million workers who are exposed to many health hazards including:

(1) Biological: TB, Hepatitis B and C, HIV

(2) Chemical: disinfectants, ethylene oxide, antineoplastic agents, anesthetic gases, latex (in gloves causing allergies)

(3) Physical: noise, radiation, falls

(4) Ergonomic: heavy lifting, musculoskeletal disorders

(5) Psychosocial: shift work, violence, stress, and burn-out.

6.1 Biological Hazard

Each year, three million HCWs are exposed to blood-borne pathogen (HBV, HCV, HIV), as well as to respiratory pathogen such as tuberculosis, acute respiratory infection (ARI) including MERS, Avian Influenza (AI).

The risk of HBV, HCV and HIV transmission with an occupational exposure from a needle stick injury from an infected patient is estimated to be:

- HBV – 6-30%
- HCV – 1.8%
- HIV – 0.3%

However underreporting of injuries can reach 40-75%, especially in developing countries, where surveillance is not carry out; including in Cambodia.

Preventing exposure - through safer practices, applying the standard and additional precautions, such as safer needle devices, using adequate PPE, - remains the most effective strategy for reducing the risk of occupational exposure.

Prevention priorities

- All HCFs staff, including laboratory technician and support staff (e.g. cleaner, HCWM staff) should be trained and strictly follow IPC standard precautions (pre-service and in-service).
- Adequate equipment and supplies, such as disposable needles, safety boxes, PPE, etc. need to be available at all HCFs units/ wards.
- Additional structure for additional precautions, such as extraction fan (at the wall) should be available where additional precautions are crucial (e.g. TB and ART services).

- Educate healthcare workers about the risks of TB and other infectious diseases and provide them adequate equipment (PPE)
    - Staff wear particulate mask when being in room, unit with positive TB patient
    - Strict TB surveillance, clinical symptoms, for those working in TB-risk areas such as TB and medical wards, chest (pulmonology) clinics, bronchoscopy units, radiology units, TB laboratories, HIV wards and autopsy rooms are at the greatest risk of exposure.
    - When a health worker is diagnosed with active TB, s/he may be infectious to others, being in sick leave, and immediately being treated.
- All staff should receive a health check-up before recruitment, then once a year for all staff.
- All staffs need to be up to date for immunized preventable diseases. This includes: hepatitis A and hepatitis B (3 shots), influenza, measles, rubella, tetanus, and diphtheria. Immunization against varicella, rabies may be considered in specific cases. The Mantoux skin test will document a previous tuberculosis (TB) exposure.
- All HCFs have an OHS policy, including injection safety, and have a management of incident (accident and injuries) procedures.

These should include the following

- Immediate management/first aid

  For needle-stick/ sharp injuries

  ✓ Wash needle-sticks and cuts with soap and water
  ✓ Flush splashes to the nose, mouth, or skin with water
  ✓ Irrigate eyes with clean water, saline or sterile water
- Reporting of the incident
- Documentation
- Risk assessment, counseling and provision of post-exposure prophylaxis
- Monitoring and follow up of the exposed health worker
- Reporting and evaluation of the programme

Strictly follow HCFs post-incident procedure or post- exposure-procedures, or refer to the MOH- National Injection Safety Guidelines (2014), chapter 2.7, page 55.

Note that no scientific evidence shows that using antiseptics or squeezing the wound will reduce the risk of transmission of a blood-borne pathogen. Using a caustic agent such as bleach is not recommended.

- Report any incident, and also illnesses to Chief of the department, IPC link person or IPC team, for further evaluation and management.

6.2 Chemical Hazard

Chemical hazards in HCFs include chemical such as cytotoxic drugs, anaesthetic, mercury, disinfectant agent, etc. The main routes of entry are skin absorption, and inhalation, when breathing.

The adverse effects of chemical and waste anaesthetic gases have been well recognised on the health of HCWs, as well as the impact on pregnant HCW and on the foetus. The adverse effects may range from minor skin irritation (e.g. allergy) to possible mutagenic effects (e.g. cancer), chronic disease (e.g. occupational asthma) or adverse reproductive outcomes (e.g. miscarriage).

As occupational diseases are difficult to treat or cure, prevention is crucial, less costly for hospital and staff.

To prevent exposure from chemical hazard, OHS officer/IPC team need to ensure an effective safety environment (e.g. good ventilation, filter…) and PPE are available all the time; and that the staff are trained to use them properly.

If using respirators (e.g. N95) staff need also to be trained for the fit testing.

OHS team/ IPC team should conduct surveillance for occupational illness/ disease.

They also have to provide clear information on chemical hazards through labels, formal training, and a written communication, using Information Education and Communication (IEC) tools, or international sign to inform the type of hazard. Additionally, in case of exposure or accidents, standard emergency procedures must be in place and HCWs/ staff should be trained.

Employee training should include the following:

1) How to access and utilize available hazard information (read and interpret labels/ Education, Information and Communication (EIC) tools)

2) Identification and characteristics of hazards present at the work site

3) Employee protection plan detailing the use of personal protective equipment (PPE), safe work practices, and engineering controls.

Refer to Annex 18 – Occupational Health and Safety (OHS) for Specific Chemical Hazard

CHARTER VII HEALTHCARE FACILITY ENVIRONMENT

Many environmental factors, including the design of HCF for patient care areas, operating rooms and utility, as well as air quality, water and food quality and supply influence the transmission of infections in hospitals.

Health facility design and planning should have:

- adequate safe water supply;
- adequate toilet facilities, separated by gender, and people with disability.
- adequate changing room for staff in all wards, separated by gender;
- adequate floor space for beds; and inter-bed space (at least 1 meter);
- adequate hand washing facilities for staff, patients and visitors;
- adequate laundry facilities;
- suitable area for processing instruments and equipment;
- adequate ventilation in all units and waiting room, and more specifically at isolation rooms, and high-risk areas like operation theatres, transplant units, intensive care units, etc.;
- regulation of traffic flow for patients and items, to minimize exposure of high-risk patients and facilitate patient transport, and minimize risk between contaminated and clean or sterile items.
- precautions to control rodents, pests and other vectors
- appropriate waste management facilities and practices, including an appropriate sewage system;
- appropriate laboratory facilities and practices, including disposal of chemicals. (refer to MOH laboratory standard operating procedures or BioSafety Level guidelines - BSL);
- functional eye-washing station in laboratory and surgical ward
- sputum collection booth/area
- adequate isolation facilities for CPA3 HCF (For more details refer to the CPA and MPA Guidelines)

7.1 Ventilation

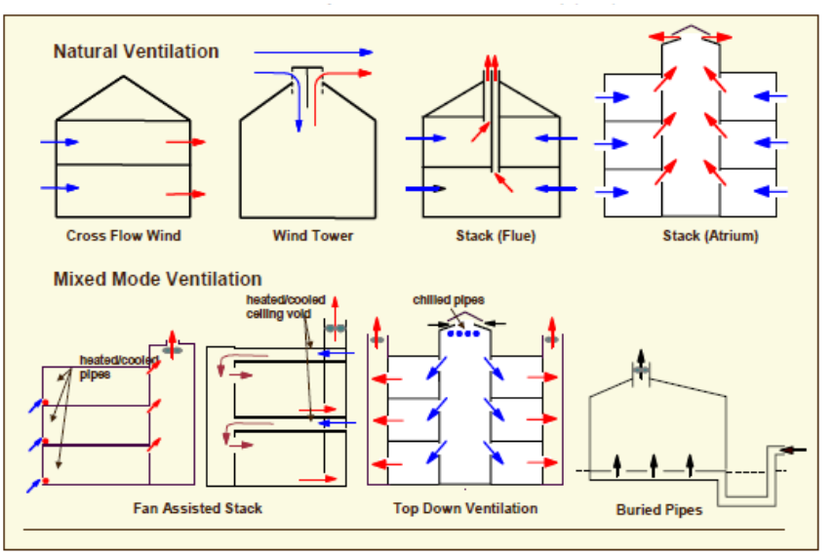
- Ventilation systems should be designed and maintained to reduce microbial contamination.
- Where air conditioners are available the filters should be cleaned regularly. Air should not be recirculated into rooms but directly to the outside. For normal air conditioner (without HEPA filter), do not use it in airborne isolation room or unit.
- Ceiling or normal fans (excluding the extraction fan) can spread further droplet and airborne pathogens. It should be avoided in high-risk areas such as triage area, OPD, infectious disease ward, isolation unit.

Refer to "*Standard Operating Procedure for TB Infection Control – 2010, CENAT*" for recommended use of fans in TB setting.

- Any room, including isolation rooms, should have windows which open directly to the outside.

It is recommended that windows should be screened to prevent insects from entering the room (to prevent patient being infected by Malaria, Dengue, etc.).

For specific ventilation (negative pressure) for airborne isolation room/ unit, refer to 5.3 Airborne precautions.



| *Figure 77*
Illustration of different natural and mixed mode ventilation systems

(Figure from "Respiratory Infection Prevention and Control in Healthcare facilities, Summary Guidance, WHO, 2008")

7.2 Safe Water

Each healthcare facility must have adequate quantity/ availability of safe water on site. Water can be piped from municipal or private source, rainwater stored in tanks, well water or surface water, like ponds.

If pond water is used, it must be fenced off from animals and humans and must be filtered prior to use. The quality of the water required depends on what the water is used for.

Two levels of water quality are necessary for the HCF:

- clean, and
- sterilized.

7.2.1 Clean Water

Clean water is described as being of a quality acceptable for drinking. It is free of microbiological and physical contamination, including arsenic.

Uses of clean water at the HCF include domestic health care activities use such as:

- Consumption (drinking and cooking)
- Hygiene (personal and domestic cleanliness, laundry, etc.)
- Handwashing
- Amenity use (car/ambulance washing, garden watering, etc.)
- Productive use (commercial activities)
- Healthcare activities

7.2.2 Sterilized Water

Water used for specific medical purposes should be sterilized on-site to prevent NI. Uses of sterilized water at the HCF include:

- during disinfection of medical devices, e.g., endoscopes;
- in dialysis units;
- SURGERY
- in dental units;
- in pharmacy;
- for respiratory devices (e.g. respirator, humidifier apparatus, oxygenotheray ….), etc.

Note that distilled (not sterilized) water is recommended for use to maintain autoclaves for sterilization.

Each HCF MUST have a safe, drinking, and adequate water supply, however ambient-temperature water treatment systems are susceptible to microbiological contamination. Treatment systems should be cleaned regularly to prevent colo-

nization of bacteria (e.g., Pseudomonas aeruginosa, Aeromonas hydrophila, non-tuberculosis mycobacteria and Legionella spp., Klebsiella pneumoniae etc.)

Due to the high consumption of water for domestic and HCF use, it is essential that each HCF has a reserve of water (water tank); being connected or not to the town/ city water supply scheme. See below how to estimate the quantity of water per day.

Table 5 "Minimum water quantities required in the HCF"

Outpatients	5 litres/consultation
Inpatients	40–60 litres/patient/day
Operating theatre or maternity unit	100 litres/intervention
Dry or supplementary feeding centre	0.5–5 litres/consultation (depending on waiting time)
Wet supplementary feeding centre	15 litres/consultation
Inpatient therapeutic feeding centre	30 litres/patient/day
Cholera treatment centre	60 litres/patient/day
Severe acute respiratory diseases isolation centre	100 litres/patient/day
Viral haemorrhagic fever isolation centre	300–400 litres/patient/day

In order to avoid NI I due to water-associated diseases, such as diarrheal illness or legionnaire's disease, the plumbing system and all equipment of water treat-ment should be assessed. Procedures of water treatment and quality of water should be regularly monitored and improved when necessary to be up-to-standard.

For more information, refer to the "Essential environmental health standards in Health Care", WHO 2008)

7.3 Food Safety and Quality

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

- preventing outbreaks of foodborne illness among patients,
- minimising microbiologic contamination of food by using appropriate food handling techniques during the preparation of food,
- Protecting food from contamination by insects, rodents and moisture.
- Providing good nutritional quality food to patient, in relation with their disease (e.g. diabetes) to increase their immune defence and prevent them from infection.

- Quality of food (following National Nutrition Guideline) require nutrition technician (a nutritionist speciliast/ dieteticienne should develop menu for specific patient).

Food services hygiene

If the health facility has a kitchen, all kitchen staff should wear appropriate protective clothing such as waterproof or fabric aprons, and hair cover during food preparation; mainly for food not being contaminated.

It is recommended that in health facilities where patients' food is prepared by relatives there is access to proper hygienic equipment (stoves, water, sinks, etc). Educate relatives in food safety.

Some food service hygiene practices are listed below:

- Wash hands before handling food or utensils and wear plastic gloves when appropriate.
- Wash hands and clean nails after:
    - Arrival to handling area
    - using the toilet
    - handling any foods
    - having contact with unclean equipment and work surfaces, soiled clothing and dishcloths
    - removing gloves
    - after having contact with patient care area, and patient, family member
- Hands and fingers should be kept away from hair and face where food contaminant organisms can be picked up and transmitted to food.
- Tongs, forks and spoons should be used when preparing foods to minimise hand contact. Cracked and chipped crockery should be discarded.
- Use different utensils between raw food and cooked food (e.g. take a new board and knife for cutting cooked chicken, do not reused those used for cutting the non-cooked chicken).
- Food should not be tasted with ladle or spoon used in food preparation. Utensils used for tasting should be thoroughly washed between tastes, or disposable utensils used
- Work areas, surfaces and utensils must be cleaned between different preparation tasks

- Do not cut or prepare food on the ground – use benches
- Food service staff must have clean fingernails. Wearing rings and nail polish should be discouraged.
- Staff suffering from diarrhoea should be immediately removed from handling food and contact with patients until all symptoms are fully over for 24–48 hours.
- Clean up benches and equipment properly before, during and after food preparation
- Serve food as soon as possible after cooking as bacteria are developing quickly in the hot and humid climate (not longer than two hours after preparation, store and serve food at the correct temperature.)
    - Store between 2 – 4 degree Celsius in the refrigerator.
    - If no refrigerator is available, serve the meal, and do not keep the left-over meal.
- Use correct handling and storage techniques for garbage containers and washing containers after emptying.
- Do not allow any animals (rats, mouse etc.) into the kitchen at any time
- Keep food away from flies and other insects.
- The kitchen should be far from dustbin storage and toilet

Washing cooking and eating utensils

Procedures for washing cooking and eating utensils:

- Wash pots, pans, utensils and trays thoroughly with detergent and water (hot water is best). Use a hard brush to remove difficult particles and stains. Rinse with fresh water.
- Wash all surfaces used for cutting or slicing food with a detergent for dishes and water (hot water is best). Use a hard brush to remove difficult particles and stains. Rinse with fresh water.
- Use correct handling and storage techniques for garbage containers and washing containers after emptying.

7.4 Healthcare Facilities (HCF) Design and Construction

There is some influence of design and construction and nosocomial infection, especially during renovation work, availability of sink, design of the operating room, infectious waste circuit etc. However it is difficult to evaluate the influ-ence of design

and construction on NI, as several factors influence transmission of infection, some of which are listed below:

- Numbers of patient and staff
- Numbers and types of procedures and examinations
- Available space
- Numbers and types of rooms
- Number of beds in a room
- Floors and surfaces
- Ventilation and air quality
- Handling of used and unused medical equipment
- Handling of food, laundry, and waste

Each country has different standards for HCFs design, construction and renovation, depending on their own building legal requirement. The International Federation of Infection Control (IFIC), founded in 2007 a Special Interest Group (SIG) to outline good practices for design, construction, and renovation, and to provide recommendations for low, medium, and high income countries.

- Basic: even with severely limited resources, "this is what you should do as a minimum".
- Standard: "this is what you should aim for in less wealthy countries".
- Ideal: "if you have the resources, this is what you could do".

General Recommendations

- Water, electricity, and sanitation:
  - clean water supply and electricity are available throughout 24 hours.
- Sink for hand washing
  - At least one in every patient room
  - One in each nursing and doctor room/ office
  - One in each support services facility (e.g. laundry, cleaning room, sluicing room…)
- Room or zone for clean/ sterile item separate from soiled/ infected item
  - Path and equipment for infected item separate from clean item

- Interior decoration and furnishings:
    - All surfaces should withstand cleaning with detergent and water and the use of disinfectants, when required.
- Wall finishes:
    - must be easy to maintain, particularly in areas such as corridors, waiting rooms.
- Floor finishes:
    - in public areas choose easy-to-clean durable materials that facilitate heavy pedestrian and wheeled traffic.
- Furniture and equipment:
    - Choose easy-to-clean, durable materials for furniture that can withstand cleaning with detergent and water and the use of disinfectants, when required.
- Toilet
- Waste storage and treatment of liquid waste/ liquid waste station (refer to **Chapter 3.6** on **Healthcare Waste Management (HCWM)**)
- Mortuary (refer to CPA book)
- Isolation room for CPA 3 (refer to CPA guideline for details).

See Annex 18 for some specific information on "International Federation of Infection Control (IFIC) Recommendations for Design of a General Hospital Ward, 2010", or refer to the IFIC website: www.theific.org for design of a surgery block, ICU and other hospital units.

CHARTER VIII

INFECTION PREVENTION AND CONTROL PRECAUTIONS IN SELECTED AREAS

8.1 Emergency Room (ER)

The emergency department provides urgent health care to a varied mix of patients (people suffering from physical trauma or infections, children, the elderly, and people suffering from psychiatric problems), 24 hours a day, seven days a week.

The emergency department should have easy vehicular access for cars and ambulances and to intensive care.

A triage zone should be established, for patients with symptoms of infection,such as cough, fever, diarrhoea/vomiting, suspicious haemorrhage or exanthema, should be separated from other patients to reduce the risk of transmission of infection.

All staff of ER MUST apply standard precautions, as health status and illness is unknown when patient arrive at the ER, and all equipment and infrastructure should be in place.

Special attention for hand hygiene, wearing disposable gloves (when contact with body fluid/gloves) and provide clean, disinfected equipment for each patient (e.g. change oxygen mask between patient, clean bed / stretcher between patient or change sheet, putting a clean one between patient if bed/ stretcher not visible dirty.

To apply hand hygiene as per standard, Alcoholic hand rub (AHR) must be available close to all patient beds and stretchers, and in all treatment rooms.

Regarding building, ER should have as a minimum[13]:

- Separate triage area, with hand hygiene equipment
- Reception and waiting area, with toilet and hand hygiene equipment
- Stretchers (brancards in French) area, with staff work area, and hand hygiene equipment
    - Distance between stretchers (or beds) is > 1 meter
- Shock treatment area resuscitation, with a separate room for infectious case

[13] IFIC Construction, Design and Renovation Interest Group (SIG), Emergency unit 2010. www.theIFIC.org

- Toilets
  - Sex-specific toilets.
  - No separation of toilets for patients and HCWs and visitors
  - Toilets should have ventilation/ aeration space or mechanical air supply (e.g. extraction fan)
  - hand hygiene equipment
- Nurses´ station
  - At least one, with hand hygiene equipment.
  - Organize a maximum distance between clean and dirty works.
- Doctors´ rooms
  - One room for doctor and examination, with hand hygiene equipment.
- Separate rooms for clean and dirty items
  - Dirty facilities for disposing of liquid and semi-solid waste (flushing sluice), bedpans and their contents. May be combined waste room.
  - Clean area or room to keep clean equipment, PPE, consumable.
- Ambulatory area, with hand hygiene equipment.
  - Separate ambulatory area from stretcher area.
  - Separate room for
  - severe care
  - infectious case
  - non-infectious case
- Family support area and one mourning room
- Procedure room / emergency operations room should be available

8.2 Operating Room

Although considerable progress has been made in understanding the cause and prevention of surgical site infections during the past 100 years, postoperative wound infections remain a leading cause of NIs. In many countries, SSIs account for up to 40% of Nis, it is estimated that 40% to 60% of SSIs are preventable. SSIs may prolong hospital stay from 6-30 days, increase antimi-crobial and costs for HCFs and patient.

Infections are acquired may be due to the flora of the patient, when preparation is not appropriate, or to lack of compliance when reprocessing equipment technique for instance. Despite sterilisation of instruments, aseptic technique, clean air, and antimicrobial prophylaxis have been shown to reduce the incidence of surgical site infections, it remains an important cause of morbidity and mortality worldwide.

Risk factors of SSI involve patient risk factors, types of surgical procedures, and the operating room environment. Subsequently, the appropriate pre-operative preparation of surgical patients and maintaining the sterile field during operation are essential in the prevention of surgical site infections.

8.2.1 General Recommendations

In the operating room/ theatre, a positive pressure ventilation should be maintain with respect to the corridors and adjacent areas. Twenty air changes per hour (20 ACH) are recommended. Filter all air and recirculate to keep air fresh and clean.

If the OR is not equipped with positive-pressure system, the focus should be on less expensive strategies, such as:

- Cleaning the operating room between each patient, and at the beginning and end of the day, every day (including during the weekend or holidays, in case of performing in emergency an operation) .
- Limit the duration of the procedure as much as possible.
- Restrict entrance to the operating room to necessary personnel only and restrict their movement as much as possible.
- Avoid excessive talking, sneezing, coughing…
- Do not eat and drink at all in the OR (before, during and after the operation)
- Keep doors and windows closed
- Keep entries into the OR to a minimum during a procedure
- Keep the temperature of the OR between 18˚C and 24˚C, with humidity of 50 to 55%.
- Remove all unwanted equipment from OR
- Do not clean any instruments in the OR post operation. They should be removed and taken to a suitable soaking and cleaning area.
- Sterilise all surgical instruments with validated methods.

8.2.2 Pre-Operative Recommendations

a. The patient

- Identify and treat all infections before elective operations.
- Maintain good control of diabetes.
- Keep preoperative hospital stay to a minimum.
- Do not remove hair preoperatively unless the hair at or around the incision site will interfere with the operation. If considered essential, remove hair immediately before the operation with a non-invasive procedure, e.g., clipper.
- Proper patient preparation ("patient prep") using antiseptics is critical before a procedure. Patient prep helps keep bacteria on the patient's skin from causing infections in the surgical/procedure site. For skin preparation use antiseptics (chlorhexidine or iodine), in gentle manner. DO NOT scrub or use a brush for the patient skin, as may create some skin abrasion and increase risk of infection.

Refer to Annex 19 for the "Pre-Operative Patient Preparation Procedure"

- Sterile drapes should be applied after proper asepsis of the surgical site.
- Exclude personnel who have signs and symptoms of a transmissible infection from surgical activities. Personnel with draining skin lesions must be excluded until the infection is fully resolved.
- Administer prophylactic antibiotics according to local policy (anti-microbial resistance policy). In general, routine prophylactic antibiotics are not recommended, only selective operation need prophylactic antibiotics (e.g. heaps replacement). Protocol must be adapted in accordance with antimicrobial resistance.

b. The surgical team

- Wear a mask, headgear (which fully covers hair), and proper attire in the OR. Do not wear theatre shoes or clothes outside the operating area.
- Shoe covers can be replaced by ordinary shoes dedicated exclusively to the operating theatre, as no differences exist in floor contamination whether personnel wear shoe covers or ordinary shoes
- Wear scrubs, which cover most bare skin, to decrease shedding of microorganisms from uncovered skin.
- Before the operation, OR staff (surgeon and nurses), perform an antiseptic hand surgical scrub for 2-4 minutes using an appropriate antiseptic, before

wearing sterile gown and gloves. It is discouraged the use of brushes for surgical hand scrub.

See Annex 20 for "Surgical Hand Scrub Procedure".

- A surgical scrub can be also performed using water-less products (e.g., alcohol-based hand rubs) in the absence of visibly dirty hands, during 3 minutes.
- PPE: wear sterile gloves. Put gloves on, after donning a sterile gown. Use water-resistant surgical gowns and drapes. Wear a surgical mask and a cap or hood to fully cover hair.
- Sterile gloves should be of good quality, as approximately 10% of gloves are inadvertently punctured during surgery.
- Ensure that all equipment and surgical instruments necessary for the procedure are in the OR before the operation begins, thus reducing traffic and the need to open doors.

Surgical asepsis

Aseptic technique refers to the practices performed immediately before and during a clinical procedure to reduce postoperative infection. These include:

- Hand washing/surgical hand scrub
- Using barriers (surgical attire)
- Patient prep (preparing a patient for clinical procedures)
- Maintaining a sterile field
- Using safe operative technique (making small incisions, avoiding trauma to tissue and surrounding structures, and controlling bleeding)
- Maintaining a safer environment in the surgical/procedure area

Figure 78 | *Surgical attire*

Importance of surgical scrub and surgical attire

During surgical procedures, both patients and providers are especially at risk of exposure to potentially infectious microorganisms.

Along with the other elements of aseptic technique, proper surgical attire helps reduce the risk of post-procedure infections in patients by decreasing the likelihood that microorganisms will enter areas of the patient's body during procedures. Some elements of surgical attire are also designed to reduce service providers' risk of exposure to potentially infectious blood and tissue during clinical procedures.

Refer to

- Annex 20 for "Surgical Hand Scrub Procedure",
- Annex 21 for "Wearing Surgical/ Sterile Gown Procedure", and
- Annex 22 for "Surgical Gloves Procedure".

8.2.3 Intra-Operative Recommendations

a. Patient

- Routinely, keep the body temperature of the patient between 36.5 and 37°C during the operation (normothermia).
- Place and keep the patient in an ergonomic position (avoiding compression of nerves or muscles) to avoid per-operatory injuries (patient safety).
- Keep the glycaemia level to <200 mg/dL during the operation (normoglycaemia).

b. Surgical team

- Use a surgical checklist (count instrument and compress before and after surgery, to ensure that none stay inside patient body).
- Adhere to principles of asepsis when performing interventions and invasive procedures in the operating room, e.g., when placing catheter (intra and central- venous, spinal, or epidural anaesthesia catheters), when injection (refer to injection safety, MOH 2013).
- Use a safe surgical technique.
- Create and maintain a sterile field.

Refer to Annex 23 for "Creating and Maintaining a Sterile Field".

- Handle tissue gently (to decrease risk of infection), maintain effective homeostasis, minimise devitalized tissue and foreign bodies (e.g., sutures, charred tissues, necrotic debris), and eliminate dead space at the surgical site.

- Use drains only if is necessary due to the patient's condition; then use closed suction drains. Place a drain through a separate incision distant from the operative incision. Remove it as soon as possible.
- Maintain good position, without exercising any pressure on the patient to avoid per-operatory injuries (patient safety).

8.2.4 Post-Operative Recommendations

a. Patient

- Don't touch the wound unless it is necessary.
- Review daily the necessity of continuing use of drains and take out when no longer necessary.
- Have an on-going surveillance system for SSI using standard definitions and risk classifications. Perform post-discharge surveillance for ambulatory surgery or short hospital stay patients.

b. Operating Room (OR)- Surgical Team

- Clean with detergent, rinse, and disinfect (0.05% chlorine solution) all surfaces, that could be contaminated during the previous operation (e.g. operating tables, counters, instrument carts, trolleys, and light handles), and the floor, before the next patient arrive into the room.

In Low-resource Countries

Surgical site infections are typically higher than in high-resource countries. Therefore, monitoring and decreasing SSI should be a priority.

Minimal requirements for the prevention of SSIs include:

- Do not remove hair preoperatively unless hair at or around the incision site will interfere with the operation.
- Perform glycaemia control in cardiac and vascular surgery.
- Use an antiseptic agent for skin preparation immediately prior to the operation.
- Perform a preoperative surgical scrub using an antiseptic product.
- Administer a prophylactic antimicrobial agent when indicated according to established criteria.
- Sterilize all surgical instruments with validated methods.
- Adhere to principles of asepsis when performing interventions or invasive procedures in the operating room.
- Have an on-going surveillance system for SSI using standard definitions and risk classifications.

8.3 Intensive care Unit and Neo-Natal Unit

Patients in the Intensive Care Unit (ICU) are severely ill and immunocompromised, as well as neo-natal patient are immunocompromised. They may have severe diseases, trauma, interruption of normal defence mechanisms (by mechanical ventilation, etc.), malnutrition due to the inability to eat and the inability to ambulate.

They also tend to have many invasive devices such as urinary catheter, intra-venous line (central or not), arterial line, endotracheal tubes etc. The presence of an invasive device automatically increases the risk of infection because it provides a ready means of entry by bacteria into a normally sterile space.

For these reasons patients in ICU and Neo-Natal units, are more susceptible to get infected, and strict application of standard and additional precautions are crucial. It is not uncommon that ICU-Neonatal patient passed away due to NI, and not due to their primary cause of hospitalisation.

To Prevent NI the following should be applied as a minimum:

- Dispensers with alcoholic hand rub (AHR) should be available in all rooms and bed spaces (e.g. patient rooms, changing rooms, break room, toilets, space for reprocessing of medical devices, waste room, laboratory, housekeeping room).
- Availability of PPE, and clean water 24h/day, 7days/week.
- Put sterile/pure water in humidifier of respirator, oxygen apparatus, and change tubule as per protocol.
- Remove invasive devices as quickly as possible.
- Individuals with a respiratory, cutaneous, muco-cutaneous or gastrointestinal infection should not have direct contact with patients in ICU or neonates.

Environmental controls

- Limit number of visitors, e.g. two at the bedside
- All visitors are instructed on IPC measures such as hand hygiene (provide gown to visitors and AHR, or soap, water and tissue). .
- Parents are advised not to visit when ill with febrile, upper respiratory, gas-trointestinal or flu-like illnesses.
- Discourage children to visit for preventing contagious diseases, but also for the psychological impact on the child.
- HCFs staff and visitors are not allowed in the unit, when being sick or having symptoms of infections

Bedside Equipment

- Each patient should have a designated non-shared stethoscope, thermometer, suction source and oxygen supply at the bedside. If not, clean and disinfect between patients.
- Upon discharge of a patient, all re-usable equipment must be terminally cleaned by designated support personnel before being used for another patient.
- Incubators will be cleaned daily with disinfectant and changed every two weeks.

The same procedures apply for immuno-compromised patients.

See Annex 24 for the "Information on Design of Intensive Care Units - IFIC 2011".

8.4 Laboratory

Any laboratory technician who handles blood or potentially infected body fluids, is at risk of accidental injury or exposure to pathogens.

Health facility managers must be made aware of the importance of laboratory safety. For each biosafety level, there are types of specialized equipment available to serve as primary barriers between the microorganism and the laboratory technician. These range from simple gloves and other PPE to simple (sealed centrifuge heads) or complex (biosafety cabinets) containment devices.

Ways of getting infected in a laboratory or Laboratory-Acquired Infectious (LAI)

The most common routes of infection are inhalation (particularly by aerosols), percutaneous inoculation (needle-stick injuries, broken glass injury, and/or animal bites or scratches), direct contact between contaminated surfaces (gloves, hands), and mucous membranes as well as through ingestion – for example by smoking, eating, or accidental aspiration through a pipette[14].

The risk assessment of the potential infection of laboratory staff must consider the route of transmission and also the minimal infective dose for humans, which varies according to the route of inoculation. The increased risk for microbiology laboratory staff that do research with zoonotical agents has long been recognized. Although LAIs caused by pathogenic bacteria have been described as the most common, LAIs caused by viruses have arisen nowadays, especially due to the emerging infectious diseases.

Refer to "National Medical Laboratory Biosafety Guidelines 2016" for more details.

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[14] Biological Risks and Laboratory-Acquired Infections: A Reality That Cannot be Ignored in Health Biotechnology. Ana Cláudia Coelho1,* and Juan García Díez1. Front Bioeng Biotechnol. 2015; 3: 56. Published online 2015 Apr 28. doi: 10.3389/fbioe.2015.00056

Infection Prevention and Control in the laboratory

Laboratory personnel need to know the bio-safety level (BSL) of their workplace, and be aware of potential hazards of infectious agents/materials. It is essential that laboratory technicians are trained in BSL protocol and IPC standard precautions and apply their procedures (e.g. dispose sharps in safety box without recapping, use of bio-safety cabinet, etc.).

Every laboratory should be supplied with a Laboratory Bio-Safety Manual which describes in detail the practices and procedures required to eliminate the risk of laboratory-acquired infections.

Refer to "National Medical Laboratory Biosafety Guidelines 2016" for more details.

8.5 Dental Department

- Strict IPC standard measures should be followed, especially sterilisation of dental apparatus (clean at first, then sterilised).
- Dentist need to wear PPE for standard precautions at least:
    - eyes protection,
    - surgical mask, and
    - disposable gloves.
- For IPC control in dental healthcare, refer to "Effective Cross Infection prevention and control in Dental Practice - MOH, 2009".

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ANNEX I

HAND HYGIENE PROCEDURE

1a – Hand Washing with Soap and Water

1b - Hand Hygiene with Alcohol-based Hand Rub (AHR)

[15] Guide to local production: WHO-recommended Handrub Formulations

ANNEX II

PRODUCTION OF ALCOHOL-BASED HAND RUB[15]

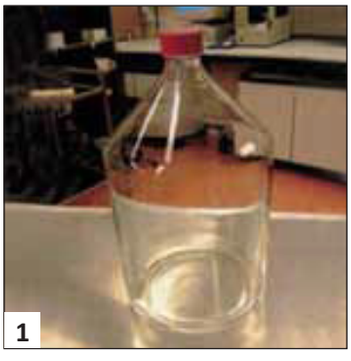
GUIDE TO LOCAL PRODUCTION

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

Materials required (small volume production)

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

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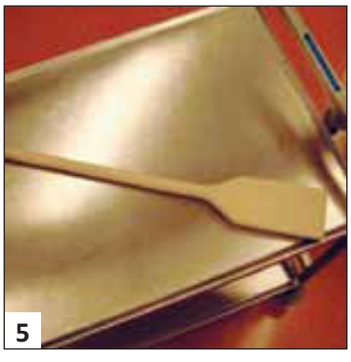
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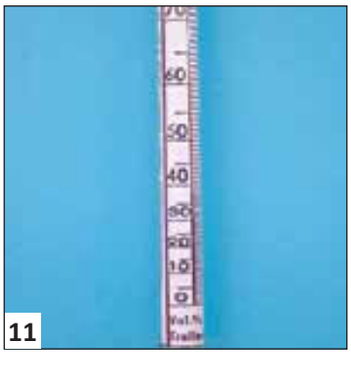
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NOTE

Glycerol: used as humectant, but other emollients may be used for skin care, provided that they are cheap, widely available and miscible in water and alcohol and do not add to toxicity, or promote allergy.

Hydrogen peroxide: used to inactivate contaminating bacterial spores in the solution and is not an active substance for hand antisepsis.

Any further additive to both formulations should be clearly labelled and be non-toxic in case of accidental ingestion.

A colorant may be added to allow differentiation from other fluids, but should not add to toxicity, promote allergy, or interfere with antimicrobial properties. The addition of perfumes or dyes is not recommended due to risk of allergic reactions.

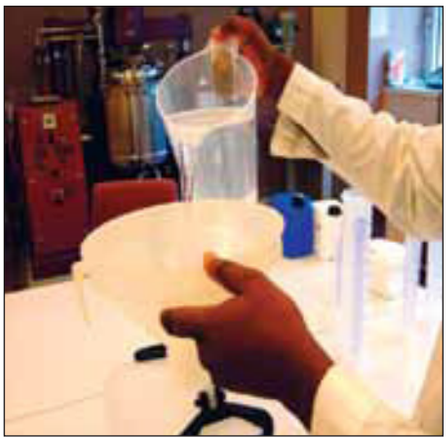
METHOD: 10-LITRE PREPARATIONS

These can be prepared in 10-litre glass or plastic bottles with screw-threaded stoppers.

Recommended amounts of products:

FORMULATION 1	FORMULATION 2
• Ethanol 96%: 8333 ml • Hydrogen peroxide 3%: 417 ml • Glycerol 98%: 145 ml	• sopropyl alcohol 99.8%: 7515 ml • Hydrogen peroxide 3%: 417 ml • Glycerol 98%: 145 ml

Step by step preparation:



1. The alcohol for the formula to be used is poured into the large bottle or tank up to the graduated mark.

2. Hydrogen peroxide is added using the measuring cylinder.

3. Glycerol is added using a measuring cylinder. As glycerol is very viscous and sticks to the wall of the measuring cylinder, it should be rinsed with some sterile distilled or cold boiled water and then emptied into the bottle/tank.

4. The bottle/tank is then topped up to the 10-litre mark with sterile distilled or cold boiled water.

5. The lid or the screw cap is placed on the tank/bottle as soon as possible after preparation, in order to prevent evaporation.

6. The solution is mixed by shaking gently where appropriate or by using a paddle.

7. Immediately divide up the solution into its final containers (e.g. 500 or 100 ml plastic bottles), and place the bottles in quarantine for 72 hours before use. This allows time for any spores present in the alcohol or the new/re-used bottles to be destroyed.

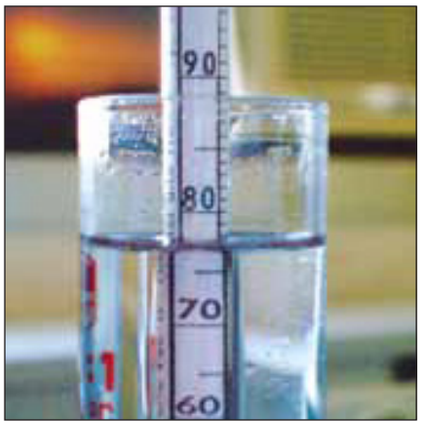
Final Products

FORMULATION 1	FORMULATION 2
Final concentrations: • Ethanol 80% (v/v), • Glycerol 1.45% (v/v), • Hydrogen peroxide 0.125% (v/v)	Final concentrations: • Isopropyl alcohol 75% (v/v), • Glycerol 1.45% (v/v), • Hydrogen peroxide 0.125% (v/v)

Quality control

1. Pre-production analysis should be made every time an analysis certificate is not available to guarantee the titration of alcohol (i.e. local production). Verify the alcohol concentration with the alcoholmeter and make the necessary adjustments in volume in the preparation formulation to obtain the final recommended concentration.

2. Post-production analysis is mandatory if either ethanol or an isopropanol solution is used. Use the alcoholmeter to control the alcohol concentration of the final use solution. The accepted limits should be fixed to ± 5% of the target concentration (75%–85% for ethanol).



3. The alcoholmeter shown in this information pamphlet is for use with ethanol; if used to control an isopropanol solution, a 75% solution will show 77% (± 1%) on the scale at 25°C.

General information

Labelling should be in accordance with national guidelines and should include the following:

- Name of institution
- WHO-recommended handrub formulation

- For external use only
- Avoid contact with eyes
- Keep out of the reach of children
- Date of production and batch number
- Use: Apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Rub hands until dry
- Composition: ethanol or isopropanol, glycerol and hydrogen peroxide
- Flammable: keep away from flame and heat

Production and storage facilities:

- Production and storage facilities should ideally be air conditioned or cool rooms. No naked flames or smoking should be permitted in these areas.
- WHO-recommended handrub formulations should not be produced in quantities exceeding 50-litres locally or in central pharmacies lacking specialized air conditioning and ventilation.
- Since undiluted ethanol is highly flammable and may ignite at temperatures as low as 10°C, production facilities should directly dilute it to the above-mentioned concentration. The flashpoints of ethanol 80% (v/v) and of isopropyl alcohol 75% (v/v) are 17.5°C and 19°C, respectively.
- National safety guidelines and local legal requirements must be adhered to the storage of ingredients and the final product.

ANNEX III

EXAMPLES OF PPE PROCEDURE FOR STANDARD PRECAUTIONS

HCWs must select the appropriate PPE after having assessed the risk of contact with body fluid.

The following is not a sequence of PPE. It is procedure for each PPE item.

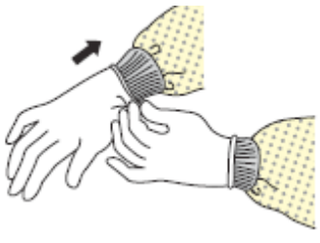
It is when the HCW remove the PPE that he/she may contaminate himself/ herself. Therefore wear PPE in a logical order, to be able to take off from the most contaminated item (higher risk) to the less contaminated item (lower risk).

Any PPE procedure must start by performing hand hygiene first.

When removing PPE, the last step is to thoroughly perform hand hygiene.

1. Gloves

Put On



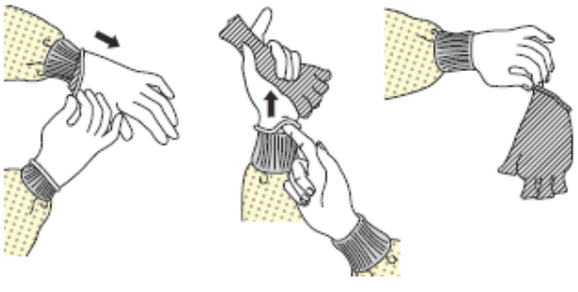
Putting on gloves

Put On

1. Carefully put on disposable gloves (to avoid breaking the gloves)

When wearing long sleeves gown, gloves cover the wrist of the gown

Take Off



Removing gloves

Take Off

! Outside part of gloves is con-taminated!

1. Grasp outside of glove with opposite gloved hand; peel off

2. Hold removed glove in gloved hand or discharge in waste container

3. Slide fingers of un-gloved hand under remaining glove at wrist

4. Peel glove off

5. Discard gloves in waste container

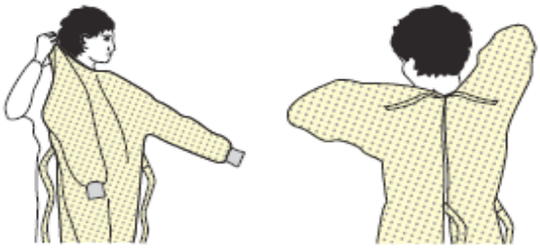
2. Gown

Put On

1. Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back

2. Fasten in back of neck and waist

Put On



Take Off

1. Unfasten ties

2. Gown front and sleeves are contaminated!

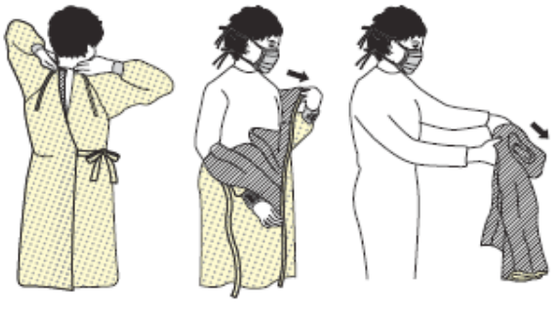
3. Pull away from neck and shoulders, touching inside of gown (only if not wearing gloves)

4. Turn gown inside out

5. Fold or roll into a bundle and discard

Note: Reusable gown should be clean/ disinfected before being reuse

Take Off



3. Surgical Mask

Put On

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

2. Fit flexible band to nose bridge

3. Fit snug to face and below chin

Put On

Take Off

Take Off

! DO NOT TOUCH with hands the front of mask, it is contaminated!

1. Grasp ties or elastics and take off

2. Discard in waste container

4. Eyes protection (safety glasses, goggles or face shield)

4.1 Procedure for goggle or face shield

Put On

Goggle face shield

Put On

Place goggle or face-shield over eyes and face, and adjust to fit

Take Off

Take Off

! DO NOT TOUCH, with hands front of the eyes protection, it is contaminated!

1. Take off, by handling the head band, elastics

2. Place in designated receptacle for reprocessing or in waste container for single use (e.g. face shield).

Goggle

4.2 Procedure for safety glasses

Put On

Put On

Place item over face and eyes and adjust to fit

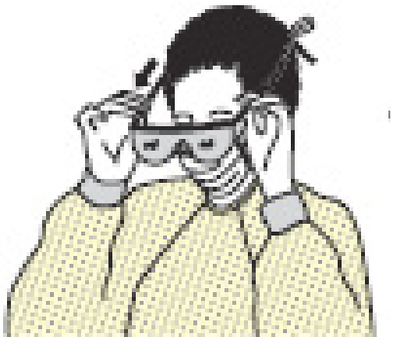
Take Off

! DO NOT TOUCH with hands front of the eyes protection, it is contaminated!

To take off, handle by ear pieces

Place in designated receptacle for reprocessing or in waste container for single use (e.g. face shield).

Take Off

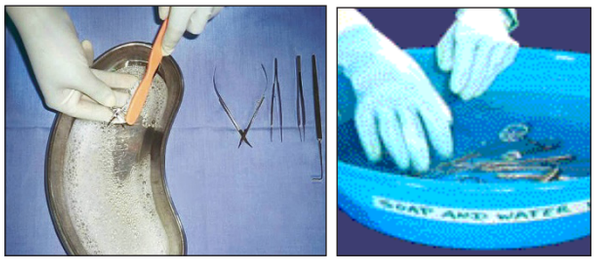


ANNEX IV

PATIENT EQUIPMENT CLEANING AND DISINFECTION PROCEDURES

- Prepare all cleaning and disinfecting equipment and solution
- Cleaner wear PPE:
    - rubber gloves and boots, impermeable apron.
    - when there is a risk of splash in the face, staff must wear eyes protection and surgical mask.
- Take off any gross soiling on the instrument by rinsing in clean water
- Take instrument apart – fully and immerse all parts in detergent solution, and clean all channels and bores of the instrument
- Ensure all visible soil is take off from the instrument – follow manufacturers' instructions,
- Rinse thoroughly with clean water
- Dry the instrument (let it dry to– on a clean rack or hang if tubing or items with lumens, away from other dirty items)
- Inspect to ensure the instrument is cleaned

Place items in soapy water. Use a soft brush or old toothbrush, to scrub and completely take off all blood, other body fluids, tissue and other foreign matter.



Soaking in detergent solution (soapy water) and gently brush

Note that scrubbing is the most effective way to take off dirt and microorganisms. Scrubbing should be a part of every cleaning procedure.

The brush should be the ***right size*** for the item to be cleaned. Carefully clean small spaces, teeth of clamps and ensure lumens are well cleaned. For long tubes, it will be necessary to flush the tube many times to ensure it is cleaned. Hold instruments and other items ***under the surface of the water*** while scrubbing and cleaning to avoid splashing. ***Disassemble instruments*** and other items with multiple parts, and be sure to brush in the grooves, teeth, and joints of items where organic material can collect and stick.

Rinse items thoroughly with clean water to remove all detergent. Any detergent left on the items can reduce the effectiveness of sterilization, or disinfection.

Then let it dry.

Rinsing equipment with clean water

Note:

Avoid using steel wool or abrasive cleansers. These products can scratch metal or stainless steel, resulting in grooves that can become a nesting place for microorganisms. This also increases the potential for corrosion.

Other Methods for Cleaning Equipment

Enzymatic cleaners

These can be used for fibre optic instruments, their accessories and other items that are difficult to clean. These products are hazardous and care should be taken when in contact with them. When used strictly follow company's recommendations.

Ultrasonic cleaners and automated washers

Ultrasonic cleaner's automated washers are recommended for cleaning basic instruments that can support this process.

Ultrasonic cleaner and automated washers

Patient Equipment Disinfecting procedure

- Prepare disinfectant solution according to the volume of medical instruments, following notice of disinfectant, cleaner wearing PPE.
- Immerse the cleaned equipment completely in the disinfectant solution. Soak in the solution, duration will depend on the disinfectant recommendations and dilutions. For example:

    - Sodium hypochlorite 0.05%: soak during 30 minutes[16]

- Rinse thoroughly with clear or sterile water (depending on the required level of disinfection and the use of the equipment)
    - Sterile water for semi-critical instrument (HLD)
    - Clean water for non-critical instrument (low level of disinfectant)
- Let it dry (on a rack)
- Pack the disinfected equipment and store in a clean area

[16] Guidelines on the Use of Disinfectants. CDC. 2011. www.cdc.gov.tw/english/downloadfile.aspx?fid=A0F06B0346016DAB

ANNEX V

SPECTRUM OF DISINFECTANT ACTIVITY[17]

Level of disinfection required	*Spectrum of activity of disinfectant*	*Active ingredients potentially capable of satisfying these spectra of activity*	*Factors affecting the efficacy of a disinfectant*
High	• Sporicidal • Mycobactericidal • Virucidal • Fungicidal • Bactericidal	• Peracetic acid • Chlorine dioxide • Formaldehyde • Glutaraldehyde • Sodium hypochlorite (0.5% or 1%) • Stabilized hydrogen peroxide • Succin-aldehyde (succinic aldehyde)	• Concentration • Contact time • Temperature • Presence of organic matter • pH • Presence of calcium or magnesium ions (for example, hardness of the water used for dilution) • Formulation of the disinfectant
Intermediate	• Tuberculocidal • Virucidal • Fungicidal • Bactericidal	• Phenol derivatives • Ethyl and isopropyl alcohols used (70 degree) • Sodium hypochlorite (0.05%)	
Low	• Bactericidal • some viruses • some fungi	• Quaternary ammonium • Amphiprotic • Amino acids	

[17] "Prevention of Hospital-acquired Infection" WHO – 2002, page 43

Boiling (thermal) HLD

Boiling is a simple method of HLD that can be performed in any location that has access to clean water and a heat source. Using this method, instruments and other items are placed in a pot or boiler and the water is heated to boiling for 20 minutes.

Procedure for boiling:

Step 1: Soak and clean all instruments and other items to be high-level disinfected.
Step 2: Completely immerse items in the water. Adjust the water level so that there is at least 2.5 cm of water above the instruments. In addition, make sure all bowls and containers are not face down and are boiled full of water.
Step 3: Close lid over pan and bring water to a gentle, rolling boil. (Boiling too vigorously wastes fuel, rapidly evaporates the water and may damage delicate instruments or other items.) Start timing when boiling starts. A timer should be used for this.
Step 4: After boiling for 20 minutes, remove objects with previously sterile or high-level disinfected forceps. Never leave boiled instruments in water that has stopped boiling. As the water cools and steam condenses, air and dust particles are drawn down into the container and may contaminate the instruments.

Remove the items with sterile transfer forceps and store in a HLD or sterile container for up to 24 hours only.

Clean the boiler and replace the water daily or more often if the water becomes dirty. Do not refill without cleaning.

Chemical HLD

High-level disinfectants
They are used for processing instruments and other items (semi-critical items when thermal autoclaving will damage the items or boiling is not available e.g. MVA cannula.)

Chemical HLD is done by using chemicals to kill any bacteria. It is effective against a broad range of micro organisms, including tuberculosis causing micro organisms.

The two recommended chemicals for HLD are Gluraldehyde & Peracetic Acid. Place items in 2% Glutaraldehyde solution for 45 minutes at 20 oC or a 0.2% Peracetic acid solution for 10 minutes then rinse with boiled water. Transfer with sterile forceps or HLD pick up forceps. Drain water and air dry before storing in HLD container. Use within 24 hours unless contaminated.

The following solutions should NOT BE USED for chemical HLD:

- **Chlorine solution is a low-medium level disinfectant and therefore can not be used to disinfect semi critical items.**

- **Formaldehyde** is a potential carcinogen and extremely irritating to the skin, eyes, and respiratory tract. Therefore, routine use of formaldehyde for processing instruments and other items or for disinfection of environmental surfaces is not recommended.
- **Alcohol (60-80% ethyl or isopropyl)** can be used to disinfect thermometers, goggles, ambu bag masks and stethoscopes. Although effective against a wide range of micro organisms, alcohol does not kill all organisms and, therefore, should not be used for HLD.
- **Iodine containing antiseptics**: Because of their low levels of iodine (which allow them to become contaminated with micro organisms), they are not recommended for use as disinfectants. Antiseptics are designed to be used for reducing or destroying micro organisms on the skin or mucous membranes without damaging these tissues. They usually do not have the same killing power as chemicals used for disinfection of inanimate objects. Therefore, antiseptic solutions should never be used to disinfect inanimate objects, such as instruments and reusable gloves. In addition, items such as pickup forceps, scissors, scalpel blades, and suture needles should never be left soaking in an antiseptic solution.

ANNEX VII

PREPARATION OF SODIUM HYPOCHLORITE SOLUTION PROCEDURE

HCW is wearing PPE (at least gloves, face protection (mask and eyes protection) and apron.

The following table shows the most common sources of chlorine in Cambodia, and the amount of water to add to obtain a 0.5% or 0.05% solution.

Table 6 Preparation of Chlorine Solution using % solution or tablets

Product	Available Chlorine	How to dilute 0.5%	How to dilute 0.05%
Sodium hypochlorite 5% (liquid bleach) If % is different to this, adjust recipe accordingly	5%	1 part bleach to 9 parts water	1 part bleach to 99 parts water
Sodium hypochlorite 6% (liquid bleach)	6%	1 part bleach to 11 parts water	1 part bleach to 119 parts water
Chloramine tablets (1 g liberates 250 mg chlorine) If amount of chlorine liberated is different to this, adjust % and hence recipe accordingly)	25%	20 grams to 1 liter water (20 tablets)	2 grams to 1 liter water (2 tablets)
Tablets that release 100 mg of chlorine	100 mg	50 tablets per 1 liter of water	5 tablets per 1 liter of water
Tablets that release 250 mg of chlorine	250 mg	20 tablets per 1 liter of water	2 tablets per 1 liter of water

ANNEX VIII

PROCEDURE TO PREPARE ALCOHOL 70% SOLUTION

Formula to produce Alcohol 70% solution from a 95% solution:

V1*M1 = V2*M2

V1 = volume of alcohol you want to get

M1 = the concentration of alcohol you want to get, in this case is 70 %

V2 = volume of your stock alcohol, in this case is 95%, which is needed to be dissolved

M2 = the concentration of your stock ethanol (95%)

Example	Procedure
1. To make 100 mL alcohol 70% from alcohol 95 % 100 x 70 = a x 95 a = 7000/95 = 73.684	• Take 74 ml (73.7 ml) of alcohol 95% • add 26 ml of distilled water Total volume = 100 ml of alcohol 70%
2. To make 1000 ml ethanol 70% from alcohol 95 % 1000 x 70 = a x 95 a = 70000/95 = 736.84	• Take 737 ml (736.8 ml) of alcohol 95% • add 263 ml of distilled water Total volume = 1000 ml of alcohol 70%

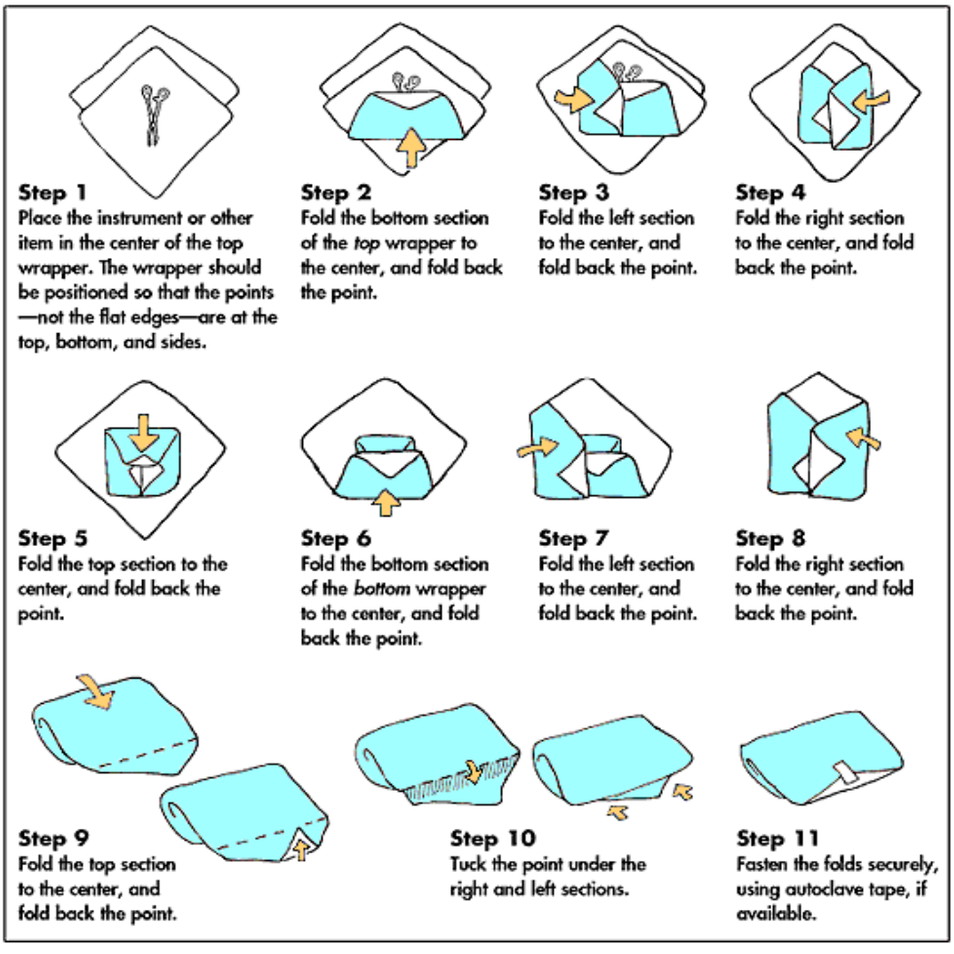
ANNEX IX

STERILIZATION PROCEDURES AND APPARATUS SPECIFIC INFORMATION

1. Packaging

Wrapping with Drape Procedure

- Check that equipment are not-damaged, properly cleaned and dry before packaging
- Wrap with two layers of clean drape, to reduce the possibility of contaminating the contents during unwrapping.
- Put indicator tape **inside** the pack and on the **outside** for outside tape.
    - To indicate that temperature reaches the instrument/ equipment inside the pack at constant temperature level.
    - The 2 indicators must show that total sterilisation process has been done, to use sterile equipment, without risk of contaminating the patient



2 Loading for steam sterilizer

When loading, leave sufficient space for steam to circulate freely. Do not overload. Place all packs (linen, gloves) on edge, and place canisters, utensils and treatment trays on their sides.

Place instrument sets in trays having mesh or perforated bottoms flat on the shelves. In combination loads of cloth (or paper) packs and instruments trays, place linens on top shelves and trays on lower shelves.

This prevents any condensation (moisture), which forms on cool metal when steam initially contacts the item, from dripping onto linen packs. Nested packs should be positioned in the same direction to help prevent air pockets, so condensation can drain and steam can circulate freely. Shelves (metal wire) or a loading cart must be used to ensure proper loading.

It is preferable to use the cart that comes with the sterilizer.

Recommendations for loading

- Items must not touch chamber walls. Never place items (wrapped or unwrapped) on the floor of the sterilizer. Items placed on the floor could block discharge of air from the sterilizer, or allow air and moisture to be trapped in pockets, resulting in sterilization failure and “wet packs”. Packs touching the chamber walls can be scorched or contents damaged due to excessive heat of the metal walls.
- Always allow 7-8 cm of space between top-most package and top of chamber. This allows displacement of air and free flow of steam.
- Place all fabric packs on the edge (folds perpendicular to shelf); and when loading two layers on one shelf, place the upper layer crosswise to the bottom layer. It is easier for steam to flow down through the folds to penetrate each fibre than through flat, compressed surfaces.
- Place all bottles, solid metal and glass containers of dry materials on their sides with lids held loosely in place. Air will drain out and steam will take its place.
- Place instrument trays (mesh or perforated bottom only) flat on shelves. If instruments have been placed in a solid tray or on a Mayo tray, the tray must be placed on the edge and tipped slightly forward. This facilitates drying
- Do not compress packages or overload the chamber.

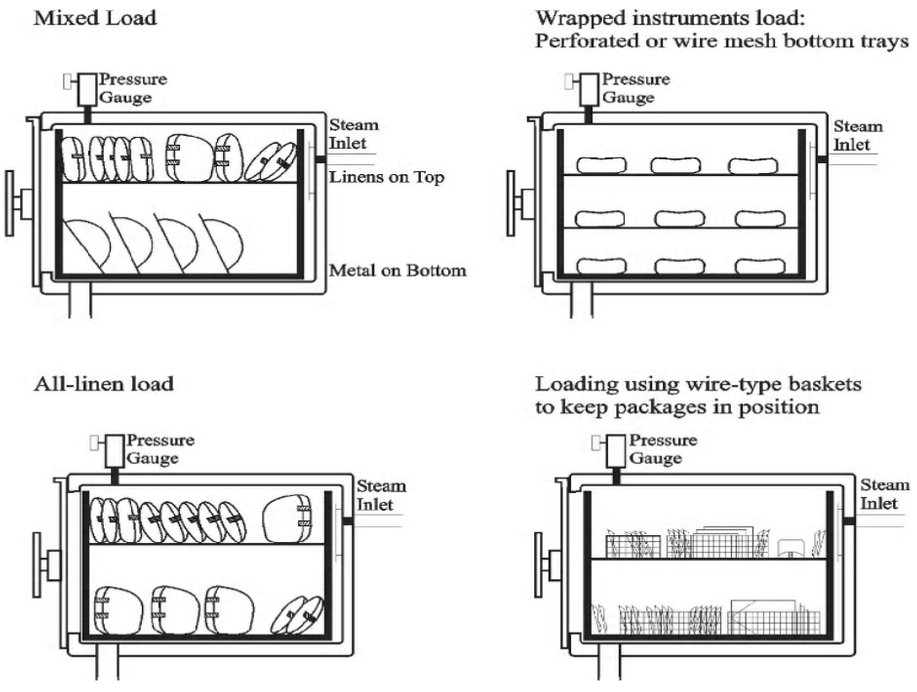


Figure 79 **|**
How to pack sterilizers

Remember:

Packs containing gowns, drapes, and other linens should not be more than 30 x 30 x 50 cm or 5 kg to allow steam to penetrate the items adequately. Place packs containing sheets, towels, and table covers on their sides to make it easier for the steam to penetrate. (It is easier for steam to go through folds than through flat, compressed surfaces.)

Problem solving

If steam escapes from the safety valve or under the lid, the autoclave is not working correctly and it is merely steaming items at low-pressure (HLD, not sterilization).

What to do?

- If steam escapes from the safety valve instead of the pressure valve, the pressure valve must be cleaned and inspected.
- If steam escapes from under the lid, the gasket (rubber ring) must be cleaned and dried or replaced.

3. Sterilization Apparatus Specific Information

3.1 Steam under pressure (moist heat) sterilization: autoclaving

STEAM STERILIZATION (AUTOCLAVING)

Steam sterilization in an autoclave is one of the most common forms of sterilization used in healthcare facilities. Steam sterilization requires moist heat under pressure, so there must be sources of both water and heat. Heat can be provided by electricity or by another fuel source (e.g. gas, kerosene burner,

wood, charcoal), depending on the type of autoclave being used.

Remember: an autoclave must have a pressure gauge and a source of water (either the machine is hooked up directly to a water source or water is put into the machine before the cycle begins).

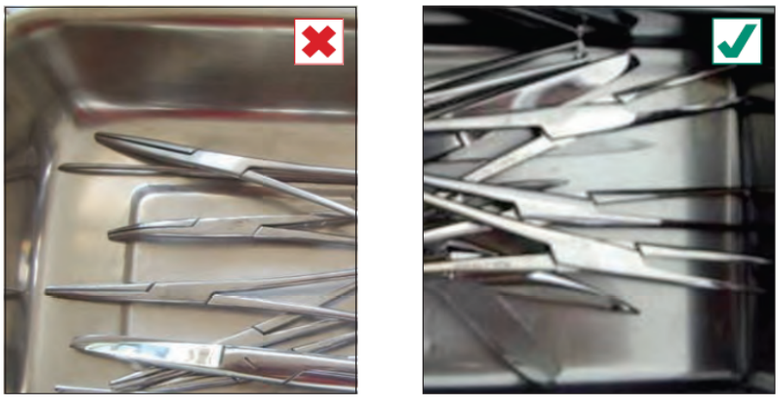
There are two types of steam sterilisers recommended for Cambodia – the small portable pressure cooker steriliser and the larger autoclave (electricity or gas).

| *Figure 80*
Pressure cooker sterilizer and autoclave

STEAM STERILIZATION (PRESSURE COOKER)

For sterilisation to be achieved, it is important to ensure the procedure is correct:

- Put water in the bottom of the autoclave - up to the ridge located on the inner wall.
- Make sure all equipment is double wrapped. Unwrapped items or single wrapping are not allowed See Annex IV for details.
- Place items in the autoclave and arrange them loosely, so steam can circulate around them.
- Steam must reach all surfaces to ensure sterilization is achieved. Instruments must be left open and/or disassembled. Gauze drums must have their vent holes left open to allow steam to pass into the drum; boxes must be left open so that steam can reach all surfaces (unless they have vented holes like gauze drums)



| *Figure 81*
Organization of instruments for sterilization

- Sterilization tape is required both inside the pack (to ensure sterilization of contents) and outside

- Sterilization tape is required both inside the pack (to ensure sterilization of contents) and outside
- Do not overload the steriliser otherwise the items will not be sterilized.
- Place the autoclave over the heat source (e.g. electric stove, gas, kerosene burner, wood or charcoal) and turn to high heat. Once steam is emitted from the pressure valve, begin timing the sterilization cycle. The heat can be reduced, but steam must continue to be emitted for the sterilization to be taking place. If it stops, the temperature and pressure must be reached and timing restarted.
- The pressure must reach 121 °C (250 °F) and 106 kP/15 lbs/inch2 (psi) and be maintained for 30 minutes.
- Once the time has been reached, turn off the heat or remove from the fire, open the pressure valve to release all steam and allow the autoclave to cool before opening it. The heat within the autoclave will allow items to completely dry.
- Leave instrument packs in the pressure cooker for about 30 minutes so they can dry completely
- Remove items, record sterilization date on the autoclave tape and store them in a cupboard with doors.

For larger autoclaves, the principles are the same i.e.

- Wrap all equipment
- Steam must reach all surfaces to ensure sterilization is achieved. Instruments must be left open and/or disassembled. Gauze drums must have their vent holes left open; boxes without holes must be left open
- Pack the steriliser so that items do not touch the walls of the sterilizer
- Do not overload the sterilizer
- Ensure the correct time, pressure and temperature are reached and maintained for the minimum time (121 °C (250 °F) and 106 kP/15 lbs /inch2 (psi) of 30 minutes).
- If the autoclave is automatic, the heat will shut off and the pressure will begin to fall once the sterilization cycle is complete. If the autoclave is not automatic, turn off the heat after steam has been escaping for the required time. Wait until the pressure gauge reads “zero” to open the autoclave. Open the lid or door to allow the remaining steam to escape. Leave instrument packs or items in the autoclave until they dry completely, which could take up to 30 minutes.
- Remove items, record sterilization date and store them in a cupboard with doors.

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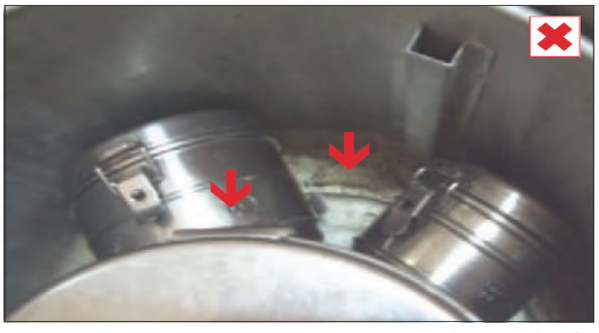
- Remove items, record sterilization date and store them in a cupboard with doors.

Note: Items must be removed dry. Once removed from the autoclave, damp packs draw micro organisms from the environment and should be considered contaminated.

This picture shows incorrect sterilization procedure as 1) items are not wrapped and 2) boxes have lids which prevent steam from coming into contact with all surfaces. Steam cannot penetrate these metal boxes therefore the lids must be left off during sterilization procedure. Boxes must be kept on their sides to allow steam to enter.



| *Figure 82*
Example 1 of incorrect packing of steam sterilizer

Example 2 of incorrect packing of steam sterilizer

The above pressure cooker steriliser shows the following problems:

- Unclean sterilizer
- Holes of the gauze drums are not left completely open to allow steam to penetrate

Gauze drum holes are open however they should be closed AFTER sterilization is complete. In addition, gauze must be wrapped in packs of 5 or 10. Paper or material can be used. Gauze can not be used for wrapping gauze packs.

In the photo on the left, the gauze drum holes were correctly open during sterilization but they were not closed after sterilization leaving all items to be recontaminated.

The gauze is considered unsterile and needs to be resterilized.

| *Figure 83*
Incorrect storage and packing of gauze drum

Gauze drum must be closed after sterilization.

| *Figure 84*
Correct gauze drum after sterilization

Step of Steam Sterilization

Step 1: Clean, disinfect, rinse, dry and check all instrument/ items before packing

Step 2: Arrange all packs and drums in the chamber of the autoclave in a way that allows steam to circulate freely during sterilization

Step 3: Follow the manufacturer's instructions whenever possible. If none then use 121 °C (250 °F) and 106 kP/15 lbs/inch2 (psi) for 30 minutes. Begin timing when the autoclave reaches the desired temperature and pressure.
Step 4: Allow to cool before opening.
Step 5: Remove packs.
Step 6: Place sterile packs in closed cabinets. Packs can be kept for one week unless they become wet or contaminated.

Remember: When instruments and equipment are sterilized by high pressure steam, all surfaces have to be reached by the steam. For example, steam sterilizing closed containers will sterilize only the outside of the containers not the contents inside!

The pick up forceps and their containers should be autoclaved each morning. If they are not sterilized properly, all sterile instruments and supplies will be contaminated immediately.

It is necessary to check the efficiency of the autoclave on a regular basis. Bacterial indicators should be inserted inside a pack and then sterilized. The indicators should have changed colour indicating the autoclave is functioning as intended.

It is necessary to check the efficiency of the autoclave on a regular basis. Bacterial indicators should be inserted inside a pack and then sterilized. The indicators should have changed colour indicating the autoclave is functioning as intended.

Autoclave maintenance

The autoclave should be checked each time it is used to make sure that it is functioning properly. Before using the autoclave, check the gaskets, gauges, pressure and safety valves for defects and ensure that they are working properly. Clean the chamber and cover regularly.

The autoclave is not working correctly if:

- Steam escapes from the safety valve instead of the pressure valve. If this happens, the pressure valve must be cleaned and inspected.
- Steam comes out from under the lid or around the door. If this happens, the gasket must be cleaned, dried or replaced.

If any repairs are necessary, they should be made before the autoclave is used again.

| *Figure 85*
Examples of poorly maintained sterilizers

Photo on the left shows moisture is leaking from the pressure cooker therefore pressure is not maintained and sterilization is not possible.

NOTE

Pressure cooker is acceptable when autoclave is not available,

BUT

Temperature and pressure MUST be monitored to guarantee sterilisation!

If no temperature and pressure gauge, do not use the apparatus for sterilisation.

| *Figure 86*
Proper pressure cooker sterilizer

Remember: Always sterilize instruments and other items for the correct amount of time at the correct pressure and temperature.

Be sure items are completely dry both before sterilizing and before removing them from the autoclave.

Make sure the sterilizer is packed correctly

Summary of Temperature and Pressure when autoclaving process[18]

1. **In standard autoclave (103.4 kilopascal)**
   - For liquids and items in wraps
   - Process time 15 minutes at 121°C at (15 pounds/square inch).

[18] IFIC. Chapter 12 Cleaning, Disinfection, and Sterilisation. 2011

2. In high-vacuum autoclaves (206.8 kilopascal)

The air from the steriliser chamber is first vacuumed out and then steam is introduced allowing faster and better penetration throughout the entire load.

- Process times of 3 minutes at 134°C at about (30 pounds/square inch).

3.2 Dry-heat sterilization Procedure

Steps of dry-heat sterilization

Step 1: clean, and dry all instruments/ equipment and check the cleanness and the shape

Step 2: Put unwrapped instruments either in a box or place on a tray or shelf. Closed container or boxes.

Step 3: Place instruments/ equipment in the dry heat sterilizer, and heat to the designated temperature. Once the sterilizer reaches the designated temperature, start the timer. Do not open the door or add more instruments during the procedure. Once the desired time has been reached, turn off the sterilizer.

Step 4: Leave items in the sterilizer to cool before removing. When they are cool take off single items using sterile forceps and use or store immediately.

Step 5: Store items properly.

Proper storage is as important as the sterilization process itself. For boxed instruments, store for up to one week. For single items, if sterile transfer forceps are used, they can be stored for up to 24 hours.

The most common time-temperature relationships for sterilization with dry heat sterilizers[19]

Temperature range (°C)	Holding Time at temperature In minutes (hour)
170 °C	60 minutes (1hour)
160 °C	120 minutes (2 hours)
150 °C	150 minutes (2.5 hours)
140 °C	180 minutes (3 hours)

Note:

Because dry heat can dull sharp instruments and needles, these items should not be sterilized at temperatures higher than 160 degrees C.

[19] US CDC. Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008

Maintenance of dry heat sterilizer

Maintenance of dry-heat sterilizer should be part of every sterilization procedure. If the sterilizer does not reach the correct temperature, sterilization will not be achieved.

Maintenance of dry heat ovens

Maintenance of dry-heat ovens should be part of every sterilization procedures. If the ovens do not reach the correct temperature, sterilization will not be achieved.

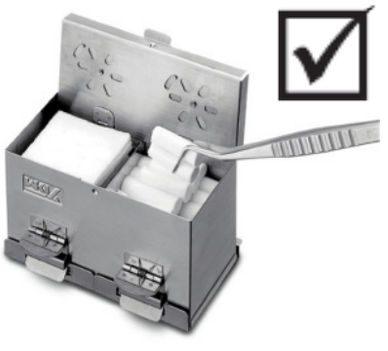
Be sure to:

- Keep the sterilizer clean.
- Check that the temperature gauge is working correctly on a regular basis- every week by putting a thermometer in the sterilizer and comparing the temperature reading with the one on the gauge.

Tips to avoid contamination of gauze after sterilisation process

Cotton and gauze should never be left soaking in alcohol as it can become contaminated and be a source of infection. Take gaze one by one, close the lid of box immediately after used, pour disinfectant on each gaze (outside the box).

Incorrect handling of cotton and gauze



Correct handling of cotton and gauze

Keep in mind that as soon as the box is open, the gauze is no longer sterile. Where available, prefer single sterile cotton pack or set. Despite its cost, overall it could be cheaper by not having the sterilisation cost and avoiding NI.

ANNEX X

SPECIFIC RECOMMENDATIONS FOR CONTACT PRECAUTION

Requirements	Contact Precautions
Single Room	Yes, or Cohort with patient with same pathogen in consultation with infection prevention and control focal point.
Negative Pressure	No
Hand Hygiene	Yes Hand cleaning with soap and water or AHR
PPE for staff/ visitor	
Gloves	Yes, If there is direct contact with the patient or their environment Rubber gloves, when cleaning, disinfecting
Gown/Apron	Yes, If there is direct contact with the patient or their environment.
Mask	Standard Precautions Use to protect face if splash or aerosol likely
Protective eyewear	Standard Precautions Use to protect eyes if splash likely to be generated
Rubber boots	Standard precautions When risk of infected liquid on the foot, walking where contaminated floor
Patient Equipment	Designated equipment (1 equipment/ 1 patient) Or if not possible clean and disinfect before to use to the next patient. To avoid infection of other patients (nosocomial infection) via contaminated equipment.
Transport of Patients (inside and outside of hospital)	• limit transport, only when necessary • Notify the area receiving patient. • choice un-crowed way to transport patient inside of hospital • transport staff need to wear PPE for contact precautions • PPE for patient: ◦ Put a drape on top of the patient (to avoid risk of contamination of the environment during the transport)

	◦ If patient has also respiratory symptoms, patient should wear surgical mask during the transport • Clean and disinfect transport material or vehicle
After leaving the isolation room	• when transferring patient from outside to isolation unit, use the dedicated entrance for infectious patient, if available • Take off PPE in the ante-room (if ante-room is not available, in the dedicated area – e.g. corridor) and perform hand hygiene
Room Cleaning	• Refer to **Annex 15** and Hospital Cleaning Procedure • Cleaner staff wear PPE for contact precaution plus rubber gloves, rubber boots and impermeable apron • May require additional cleaning with a disinfectant solution depending on the pathogen.
Remarks	• Everyone entering in the isolation room or unit, need to record their name and contact in the logbook. • Patient Medical Records/document, pen, mobile phone… must not be taken into the room. • Put a sign contact precaution room.

CONTACT PRECAUTIONS

Staff, Visitors, Family, must report to nursing desk before entering

Staff, Visitors, Family, must

- Perform hand washing before entering and when leaving
- Wear disposable gloves and gown/ apron before enter
- Leave patient care equipment, food in the room and inform unit staff
- When leaving the isolation room, take off PPE (in anteroom or designated area) and
- Perform hand hygiene

ANNEX XI

SPECIFIC RECOMMENDATIONS FOR DROPLET ISOLATION

Requirements	Droplet Precautions
Single Room	Yes or Cohort with patient with same pathogen (in consultation with infection control professional, or infectious diseases physician). It is recommended that single patient rooms be fitted with ensuite facilities. In the advent of no ensuite facilities, a toilet and bathroom should be dedicated for individual or cohort patient use.
Negative Pressure*	No
Hand Hygiene	Yes Hand cleaning with soap and water or water-free alcohol based skin cleanser.
PPE for staff/ visitor	
Gloves	Standard Precautions Use to protect for anticipated contact with blood and body substances.
Gown/Apron	Standard Precautions Use to protect where soiling or splashing are likely.
Mask	Yes Surgical Mask Take off mask after leaving patients room.
Protective Eyewear	Yes
Handling of Equipment	Standard Precautions Avoid contaminating environmental surfaces and equipment with used gloves.
Transport of Patients	• Respiratory hygiene for coughing and sneezing patients suspected of having an infectious respiratory illness. • Surgical mask for patient when they leave the room.

	• Patients on oxygen therapy must be changed to nasal prongs and have a surgical mask over the top of the nasal prongs for transport (if medical condition allows). • Advise transport staff of level of precautions to be maintained (droplet precautions). • Notify area receiving the patient. • Clean and disinfect transport material or vehicle.
Alert	• When cohorting patients, they require minimum of one metre of patient separation. • Visitors to patient room must wear a surgical mask and protective eyewear (if unable to maintain 1 meter distance) and perform hand hygiene. • Patient Medical Records must not be taken into the room. • Signage of room.
Room Cleaning	• Refer to **Annex 15** and Hospital Cleaning Procedure • May require additional cleaning with a disinfectant agent depending on organism. • Consult with infection control professional.

DROPLET PRECAUTIONS

Staff, Visitors, Family must report to nursing desk before entering

Staff, Visitors, Family must

- Perform hand washing before entering and before leaving the room
- Wear at least surgical mask and eyes protection when entering room
- Leave patient care equipment in the room and inform unit staff
- When leaving the isolation room, take off PPE (in anteroom or designated area)
- Perform hand washing

ANNEX XII SPECIFIC RECOMMENDATIONS FOR AIRBORNE ISOLATION

Requirements	Airborne Precautions
Single Room	**Yes** Door closed It is recommended that single patient rooms be fitted with ensuite facilities. If no en-suite facilities, a toilet and bathroom should be dedicated for individual patient use.
Negative Pressure*	**Yes**, if available otherwise single room with door closed and window open
Hand Hygiene	**Yes** Hand cleaning with soap and water or water-free alcohol based skin cleanser
PPE for staff/ visitor	
Gloves	Standard Precautions Use to protect for anticipated contact with blood and body substances
Gown/Apron	Standard Precautions Use to protect where soiling or splashing are likely
Mask	**Yes**, N95 or P2 Mask (perform fit check each time a mask is worn to ensure it fits the face firmly with no gaps between the mask and the wearers face according to manufacturer instructions prior to entering room) Take off mask after leaving patient room
Protective eyewear	Standard Precautions Use to protect eyes if splash likely or where aerosol may be generated
Handling of Equipment	Standard Precautions Avoid contaminating environmental surfaces and equipment with used gloves
Transport of Patients	• Surgical mask for patient when they leave the room • Patients on oxygen therapy must be changed to nasal prongs and have a surgical mask over the top of the nasal prongs for transport (if medical condition allows). • Advise transport staff of level of precautions to be maintained (airborne).

	• Respiratory hygiene for coughing and sneezing patients suspected of having an infectious respiratory illness. • Notify area receiving patient. • Clean and disinfect transport material or vehicle.
Alert	• Respiratory hygiene for coughing patients • Visitors to patient room must also wear P2 or N95 mask and perform hand hygiene • Signage of room indicating precautions to be applied • Patient Medical Records must not be taken into the room.
Room Cleaning	• Refer to Annex 15 and Hospital Cleaning Procedure. • May require additional cleaning with a disinfectant agent depending on the organism. • Consult with infection control professional.

AIRBORNE PRECAUTIONS

Staff, Visitors, Family, must report to nursing desk before entering

Staff, Visitors, Family must

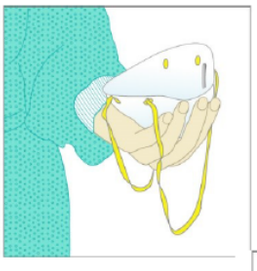
- Perform hand washing before entering
- Wear particulate respirator (N95) before enter
- Leave patient care equipment in the room and inform unit staff
- When leaving the isolation room, take off PPE (in anteroom or designated area) and
- Perform hand washing

* Where there are competing patient priorities for a negative pressure room, Infection Control and infectious diseases/microbiology staff must be consulted.

ANNEX XIII

PARTICULATE RESPIRATOR FITNESS TEST PROCEDURE AND SPECIFICATION

Particulate Respirator Fit Test



1 Cup the respirator in your hand with the nosepiece at your fingertips allowing the headbands to hang freely below your hand.

2 Position the respirator under your chin with the nosepiece up.

3 Pull the top strap over your head resting it high at the back of your head. Pull the bottom strap over your head and position it around the neck below the ears.

4 Place fingertips of both hands at the top of the metal nosepiece. Mould the nosepiece (USING TWO FINGERS OF EACH HAND) to the shape of your nose. Pinching the nosepiece using one hand may result in less effective respirator performance.

5 Cover the front of the respirator with both hands, being careful not to disturb the position of the respirator.

5A Positive seal check	5B Negative seal check
- Exhale sharply. A positive pressure inside the respirator = no leakage. If leakage, adjust position and/or tension straps. Retest the seal. - Repeat the steps until respirator is sealed properly.	- Inhale deeply. If no leakage, negative pressure will make respirator cling to your face. - Leakage will result in loss of negative pressure in the respirator due to air entering through gaps in the seal.

Particulate Respirator Specification in various part of the world[20]

94-95%filtration of particulate < 5 micro

- Australia/ New Zealand: P2 (94%)
- China: II (95%),
- European Union: Conformite Europeenne-certified filtering facepiece class 2 (FFP2) (95%)
- Japan: 2nd class (95%)
- Republic of Korea: 1st class (94%)
- US: National Institutes for Occupational Safety and Health (NIOSH)-certified N95 (95%)

99.7 -99.9% filtration of particulate < 5 micro

- Australia/ New Zealand: P3 (99.95%)
- China: I (99%)
- European Union: Conformite Europeenne-certified filtering facepiece class 3 (FFP3) (99.7%)
- Japan: 3rd class (99.9%)
- Republic of Korea: special (99.95%)
- US: National Institutes for Occupational Safety and Health (NIOSH) - N100 (99.7%).

20 IPC of epidemic-and pandemic-prone acute respiratory diseases in health care. WHO Interim Guidelines. June 2007.

ANNEX XIV

MEASLES AND ISOLATION PRECAUTIONS

1. BACKGROUND

Measles is a highly infectious, acute viral illness that can lead to serious complications and death. Measles virus is an RNA virus in the genus Morbillivirus within the family paramyxovirus. There are 24 known measles virus genotypes and one serotype.

2. SUSPECTED MEASLES CASE DEFINITION

Any person with fever and maculopapular rash (non-vesicular)

OR

Any person in whom a clinician suspects measles or rubella infection

3. TRANSMISSION

Measles is one of the most contagious viral infectious diseases known. Approximately 9 out of 10 susceptible persons coming in close contact with a measles patient will develop measles. More than 93%–95% population immunity is needed to prevent measles outbreaks. The virus is transmitted by airborne spread or by direct contact with infectious droplets when an infected person breathes, coughs, or sneezes. **Measles virus can remain infectious on surfaces and in the air for up to two hours after an infected person leaves an area.** Following exposure to measles virus, viral replication occurs in the nasopharynx and local lymph nodes. Primary viremia occurs 2–3 days after exposure, and secondary viremia occurs 5–7 days after exposure with viral spread throughout the body. The average incubation period for measles is 14 days (range 7–21 days), from exposure to rash onset.

Persons with measles are usually considered infectious from 4 days before until 4 days after rash onset. In Cambodia, the high measles virus transmission period occurred during the dry season from December to May, with epidemics occurring every 3–4 years in the pre-vaccine era.

4. CLINICAL PRESENTATION

The prodromal period begins with **high fever, malaise, cough, conjunctivitis,** and **coryza**. After another 3–4 days, the typical maculopapular rash appears and spreads from head (behind ears and hairline) to trunk to lower extremities.

Bluish-white Koplik's spots may be seen in the oral mucosa 1–2 days before rash onset and 1–2 days after rash onset. Koplik's spots are pathognomonic, or specifically indicative, of measles, but are difficult to observe at the right time.

Generally, patients improve 3–4 days after rash onset and are fully recovered 7–10 days after rash onset. The rash fades in the order it appeared with desquamation

and discoloration. Immunocompromised patients may not develop rash. Persistent diarrhea with protein-losing enteropathy may ensue, particularly in infants.

Complications associated with measles infection include:

- otitis media (5–15%),
- pneumonia (5–10%),
- post-infection encephalitis (1/1000) , and
- a rare (1/10,000–1/100,000) long-term sequelae of measles infection is subacute sclerosing panencephalitis (SSPE), a fatal disease of the central nervous system that generally develops 7–10 years after infection.

The risk for severe or fatal measles is highest among those who are aged <5 years, living in overcrowded conditions, malnourished (especially vitamin A deficiency), pregnant, or immunocompromised. In developing countries, the CFR among young children may reach 5–10%, with a majority of deaths attributable to pneumonia.

5. DIFFERENTIAL DIAGNOSIS

The differential diagnosis for suspected measles includes rubella (German measles), scarlet fever (group A Streptococcus), erythema infectiosum (parvovirus B19), roseola infantile (human herpesvirus 6), enterovirus (echovirus, coxsackievirus), meningococcemia, infectious mononucleosis, typhoid, dengue, Kawasaki disease, and others.

6. PREVENTION

WHO recommends children receive ***two doses of MCV.***

In Cambodia, **MR vaccine is administered through routine immunization services, free of charge, at 9 and 18 months of age**. Periodic SIAs provide additional opportunities to receive MR vaccination, regardless the previous vaccination history. Measles vaccine effectiveness is approximately 85% when given at 9 months of age and 95% when given at ≥12 months of age.

7. TREATMENT

There is **no antiviral treatment for measles**. Severe complications from measles can be avoided by ensuring good nutrition adequate fluid intake, and early case management. Dehydration should be treated with oral rehydration solution or intravenous fluids according to established treatment protocols. Antibiotics should be prescribed to treat eye and ear infections, and pneumonia. Case management should include administration of vitamin A. This treatment restores low vitamin A levels caused by measles even in well-nourished children and can help prevent eye damage and blindness, as well as reduce measles fatalities by 50%. Two doses of vitamin A should be administered, once immediately upon diagnosis, and once 24 hours later. The recommended age-specific daily doses are:

- 50,000 IU for infants younger than 6 months of age
- 100,000 IU for infants 6–11 months of age
- 200,000 IU for children 12 months of age and older

8. ISOLATION

- Suspected measles patients should be **isolated until 4 days after appearance of rash.**
- Care should be taken in hospital settings to use proper infection control practices (e.g. isolation, negative pressure) as **measles is extremely contagious.**
- There is high risk of nosocomial transmission among non-immune healthcare workers and other patients, including unimmunized infants.
- **It is recommended for them to be cared for at home** unless measles patients have complications requiring hospitalization or follow-up.

9. CASE INVESTIGATION

- All hospitals, health centers, clinicians, and other health practitioners are required to **notify suspected measles or rubella cases immediately** to the operational district (OD), provincial health department (PHD) or National Immunization Program (NIP) by phone call or the fastest means possible.
- All reported suspected cases should first be verified as meeting the suspected measles or rubella case definition by PHD or OD surveillance officers.
- Upon verifying that the case meets the case definition, the surveillance officer or Expanded Program on Immunization (EPI) manager in the OD/PHD should initiate the case investigation, **within 48 hours of notification.**
- Investigators should carefully fill the **Case Investigation Form (CIF)**, completing all the variables **especially 10 key variables**.[21] A blood (serum) sample should be collected for laboratory testing. Because patients might leave the clinic and not return, the CIF should be filled and specimens collected at the initial health facility visit. This can be completed by trained clinicians in health facility, with the OD/PHD to follow-up and complete the case investigation.

(For case investigation, specimen collection and shipment, please find details in **Vaccine Preventable Disease (VPD) surveillance guidelines**)

ANNEX XV EXAMPLES OF TRIAGE PROCEDURE

All triage zone for Infectious Disease (ID) should be established away from crowded area, before patient entering in HCF (before OPD, ER). Select a well-ventilated area, outside when possible.

1. Droplet route of transmission

(e.g. triage to identify suspected AI, Influenza, MERS patient …)

a. Patient in waiting area

- Surgical mask for patient
- Material to perform hand hygiene, and respiratory hygiene
- Distance of at least 1 meter between seats

b. For staff

- Organize a physical distance/barrier of at least 1 meter between staff and patient
- PPE for staff: surgical mask, eyes protection
- When touching patient (e.g. take temperature) wear disposable gloves
- Use a screening form
- When interviewing the patient, the patient should seat side way, and not answering face to face
- If patient is suspected to have ID, transfer patient to the identified droplet isolation area to continue further examination or transfer patient to a better equipped HCFs
- If patient is not suspected to have ID, patient goes back to normal OPD (normal circuit).
- After triage, HCW takes off PPE and perform hand hygiene
- Trained cleaner with PPE for standard and droplet precautions, clean and disinfect equipment and surface touched by patient.

2. Example of triage patient for contact route of transmission

(e.g. triage to identify suspected cholera patient)

a. Patient waiting area

- Equipment for patient to perform hand hygiene
- Establish a distance of at least 1 meter between seats

b. For staff

- Keep a physical distance of at least 1 meter between staff and patient
- Triage staff wear when touching patient (e.g. take temperature): disposable gloves, and gown/apron.
- Use screening form for interviewing patient
- If patient is suspected to have ID, and needs to be hospitalized, transfer the patient to the identified contact isolation room, setting up for contact precautions; to continue further examination or transfer patient to a better equipped HCFs
- If patient is not suspected to have the ID, patient go to normal OPD (normal circuit).
- After triage, HCW takes off PPE and perform hand hygiene
- Trained cleaner with PPE for standard and contact precautions, clean and disinfect equipment and surface touched by patient

Example of triage patient for airborne route of transmission

(e.g. triage to identify suspected tuberculosis patient)

a. Patient waiting area

- Establish triage zone in well-ventilated area (e.g. outside is preferred)
- Equipment for patient to perform hand hygiene and respiratory hygiene
- Patient wear surgical mask
- Establish distance of at least 1 meter between seats

b. For staff

- Keep physical distance of at least 1 meter between staff and patient
- Triage staff wear
  - surgical mask if screening zone outdoor

    or
  - particulate mask if screening zone indoor (especially if not well ventilated room)

- Use screening form for interviewing patient
- If patient is suspected to have ID, and needs to be hospitalized, transfer the patient to the identified airborne isolation room, setting up for airborne precautions; to continue further examination or transfer patient to a better equipped HCFs
- If patient is not suspected to have the ID, patient go to normal OPD (normal circuit).
- After triage, HCW takes off PPE and perform hand hygiene
- Trained cleaner with PPE for standard and airborne precautions, and disinfect equipment and surface touched by patient.

ANNEX XVI

MANAGEMENT OF SHARP/NEEDLESTICK INJURIES[22]

Management of a sharp/needle sticks injury

1. Immediate management/first aid
2. Reporting of the incident
3. Documentation
4. Risk assessment, counseling and provision of post-exposure prophylaxis
5. Monitoring and follow up of the exposed health worker
6. Reporting and evaluation of the programme

Post-Injury Procedure

1. Immediate management - first aid

Immediately following an exposure to blood/ body fluid:

- HCW immediately stop his/her work, then

  Wash skin puncture/ cut with soap and water, and/or

  Flush splashes to the nose, mouth, or skin with water, and/or

  Irrigate eyes with clean water, saline, or sterile water

2. Reporting the incident of injury/exposure

Once first aid has been implemented,

- The HCW immediately inform their supervisor of the incident.
- The clinician in charge of occupational health perform a risk assessment of the injured HCW, including the need of post-exposure-treatment or prophylaxis (PEP)
- Start as soon as possible PEP as per recommendation

3. Documentation

- The incident must be documented
- Complete the injury form, and keep in a central and confidential place in the health facility.

  Refer to the "National Injection Safety Guidelines 2014, page 54" for more detailed information on the data to be collected.

[22] National Injection Safety Guidelines 2014 page 54

4. Risk assessment and provision of post-exposure prophylaxis (PEP)

- The designated staff member(s)/ clinician who the health worker is referred to MUST maintain confidentiality at all times.
- This staff member/ clinician needs to do a risk assessment, counsel the injured HCW and recommend further management.
- The source patient should be informed of the incident and permission sought for testing of HIV, HBV and HCV as soon as possible. The exposed person should also have baseline testing for the same viruses.
- Refer to "National ART Guideline for Adults and adolescents 2006" for more details on PEP for HIV in Figure12.

5. Monitoring and follow-up after an exposure

- The occupational health/ IPC focal point should monitor and following up the exposed HCW.
- Referral may be required if the HCF/ designated clinician does not have the qualifications or expertise to treat the injured HCW.

6. Evaluation of the programme

- Surveillance of sharps/needlestick injuries
- Refer to the "National Injection Safety Guidelines 2014, page 54" for more detailed information on the data to be collected.

ANNEX XVII

SPECIFIC IPC PROCEDURES WHEN MANAGING PATIENT IN ISOLATION ROOM/UNIT

1. Preparation of isolation Room / unit

- Isolate infectious patient in a single room
- If there is no single room, isolate in the cohort room
- In cohort room, always keep suspected cases separate from confirmed cases
- If single and cohort room, keep the single room for suspected cases and the cohort room for confirmed cases
- Avoid movement of infectious suspected and confirmed patients (only if crucial)
- Limit number of visitor (ideally only one)
    - Staff help the visitor select PPE base on route of transmission (refer chapter 4. Additional precautions)
    - visitor must be trained for wearing PPE
- Put a clear sign of restrictive area and fence around isolation room/unit (refer to annexes 9, 10, 11)
- Set up isolation room/ unit as per standard (refer 5.2 Standard of isolation room/ unit)
- Prepare the isolation room and ensure refurbishment of PPE/ material. See below example of check list to prepare isolation room.

Figure 87 | *Example of clear Sign around Isolation room*

The following items should be kept on the trolley at all times so that PPE is always available for healthcare workers (Table 7).

Table 7 Checklist for isolation room or area trolley or table

Equipment	Stock present
Eye protection (visor or goggles)	
Face shield (provides eye, nose and mouth protection)	
Gloves • reusable vinyl or rubber gloves for environmental cleaning • latex single-use gloves for clinical care	
Hair covers (optional)	
Particulate respirators (N95, FFP2, or equivalent)	
Medical (surgical or procedure) masks	
Gowns and aprons • single-use long-sleeved fluid-resistant or reusable non-fluid-resistant gowns • plastic aprons (for use over non-fluid-resistant gowns if splashing is anticipated and if fluid-resistant gowns are not available)	
Alcohol-based hand rub	
Plain soap (liquid if possible, for washing hands in clean water)	
Clean single-use towels (e.g. paper towels)	
Sharps containers	
Appropriate detergent for environmental cleaning and disinfectant for disinfection of surfaces, instruments or equipment	
Large plastic bags	
Appropriate clinical waste bags	
Linen bags	
Collection container for used equipment	

2. HCWs/staff in the isolation room /unit

- Apply IPC standard and adequate additional precaution(s) based on route of transmission
- For emerging infectious disease (EID), with unknown route of transmission, apply standard precautions and all additional precautions (contact+ droplet+ airborne), until the route of transmission has been identified (staff will wear FULL PPE, maximum protective personal equipment)
- Exclusively assigned trained staff (medical and non-medical)
    - If HCW is not trained, he/she must not wear PPE and enter in the isolation room
- Prior entering to the room:
    - HCW must record their name and contact details
    - Perform hand hygiene and wear PPE for identify route of transmission (following PPE procedure)
- After contact with isolated patient:
    - HCW must safely take off PPE, and thoroughly wash hands precautions (following PPE procedure)

a. PPE Procedure in Isolation room/ unit

The PPE to wear will depends on the type of isolation precautions; therefore several PPE procedures are possible. Keep in mind the steps of removing the PPE (from more contaminated to less), this will guide the step of putting on the PPE.

Example of PPE procedure when all PPE items are needed (based on assessment of the risk and route(s) of transmission.

A. Putting on PPE (when all PPE items are needed)

1

- Identify hazards and manage risk.
- Gather the necessary PPE.
- Plan where to put on and take off PPE.
- Do you have a buddy? Mirror?
- Do you know how you will deal with waste?

2 Put on a gown.

3 Put on particulate respirator or medical mask; perform user seal check if using a respirator.

4 Put on eye protection, e.g. face shield/goggles (consider anti-fog drops or fog-resistant goggles). Caps are optional: if worn, put on after eye protection.

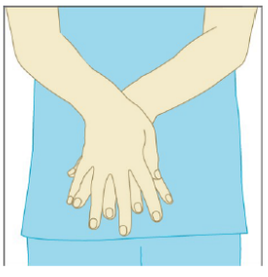
5 Put on gloves (over cuff).

B. Taking off PPE

1

- Avoid contamination of self, others and the environment.
- Remove the most heavily contaminated items first.

Remove gloves and gown:
- peel off gown and gloves and roll inside, out;
- dispose of gloves and gown safely.

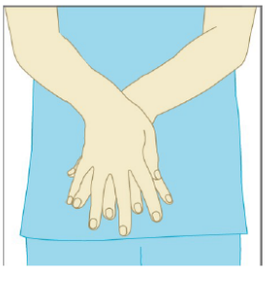


2 Perform hand hygiene.

3

- Remove cap (if worn).
- Remove goggles from behind.
- Put goggles in a separate container for reprocessing.

4 Remove respirator from behind.



5 Perform hand hygiene.

b. Environment Cleaning / Disinfecting

- Trained staff is wearing PPE depending on route of transmission, adding rubber gloves, impermeable apron, rubber boots.
- Refer to Chapter 3.4 for Environment Cleaning:
    - In isolation room, all surfaces (floor, table…) need to be cleaned, than disinfected once per day.

- When heavy contamination (blood, vomit, faeces) on surface and floor, take off spill, clean with detergent, disinfect with chlorine solution 0.5%.

- Refer to the list of disinfectant to select those that will inactivated the pathogen. The most common hospital disinfectant include:
  - Sodium hypochlorite (household bleach);
  - Ethyl alcohol 70%;
  - Phenolic compounds;
  - Quaternary ammonium compounds;
  - Peroxygen compounds.
- Refer to dilution table, to prepare the detergent disinfectant solution (Refer to Annex 6 "Preparation of Sodium Hypochlorite Solution Procedure")
- Some disinfectant solution, provide the two actions (detergent and disin fectant) in one product, follow instruction for that specific product.

Remark:

WHO discourages spraying occupied or unoccupied clinical areas or equipment with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.

c. Reprocessing reusable equipment

- Clean with detergent, then soak into chlorine solution 0.05% for at least 30 minutes, rinse and let it dry in a clean area.
- If using google or safety glasses, clean with detergent, then soak in chlorine solution 0.05% for 10 minutes (30 minutes can damage the goggle, glasses), thoroughly rinse (avoid irritation of eyes) and let it dry in a clean area, before reusing.

  Refer to Annex 6 for Preparation of Sodium Hypochlorite Solution Procedure.
- Contaminated equipment should be placed in clearly-labelled, leak-proof bags or closed container.
- Transport of equipment bag/container from the anteroom to the cleaning/ utility room
  - The trained staff wears disposable gloves and mask to transport the bag to the cleaning room.

- Place the leak-proof bag into a new bag (double bag)

or

- Disinfect the outside part of the container with e.g. chlorine solution 0.05%
- Use a wheeled bin with a lid or trolley (covered trolley is preferred) to transport the bag. The staff must not carry the bag/container.
- Clean and disinfect all surfaces of the trollies or bins, after each use

- Cleaning staff, like other staff need to check and record their temperature twice a day, and notify to chief of unit or IPC team, if any symptoms.

d. Soiled linen:

- Soiled linen must be proceeding by trained staff wearing PPE (depending on the pathogen route of transmission). At least wear rubber gloves, impermeable apron, and rubber boots (refer to Chapter 3.3.2 appropriate handling of soiled linen)
- Wash with detergent and disinfect linen daily.
- If there is any solid excrement such as faeces or vomit,
  - Remove carefully, and flush it down the toilet (if proper sewage) or in the sluice before linen is placed in its bag or container.
  - If not proper sewage, remove carefully, discharge in waste bag,
  - or decontaminate with disinfectant solution (concentration depending on the pathogen)
- Soiled linen should be placed in clearly-labelled, leak-proof bags or closed container.
- Transport of linen bag/container from the anteroom the laundry room
  - Place the leak proof bag into a new bag (double bag) or
  - Disinfect the outside part of the container with e.g. chlorine solution 0.05%
  - The trained staff wears disposable gloves and mask to transport the linen bag to the laundry
  - Use of a wheeled bin with a lid or trolley (covered trolley is preferred). The staff must not carry the bag/container.
  - Clean and disinfect all surfaces of the trollies or bins, after each use

- In the laundry room, trained staff wear PPE wearing PPE depending on the pathogen route of transmission, with rubber gloves, waterproof apron and rubber boots), wash infected linen with laundry machine:
    - In hot water of 70ºCelsius: wash with detergent or disinfectant (30 minutes).
    - In cold water (< 70ºCelsius): wash with detergent, then disinfectant that are active in cold water. When using bleach, rinse in clean water, and dry before reuse.
- Laundry staff, like other staff need to check and record their temperature twice a day, and notify to chief of unit or IPC team, if any symptoms

d. Health Care Waste Management (HCWM) of Infectious Waste

- Only trained staff, wearing PPE depending on the pathogen route of transmission, with rubber gloves, impermeable apron and rubber boots, must handling infectious waste in the isolation room/ IU (see Chapter 4 Additional Precautions)
- Dispose needle/sharps in a sharp-proof container (as per standard precautions), and never re-cap needles and/or separate needle from syringe before disposing in the container.
- Dispose infectious waste in a “biohazard” labelled waste bag, or leak-proof waste bag (refer Chapter 3.6 Appropriate HCWM)

Management of solid infectious waste

- Transport of infectious waste bag from isolation room/ unit to incinerator or designated pit:
    - Put the waste bag in another clean bag (double bagging) before exiting the isolation area or decontaminate container/bag with the infectious waste, with chlorine solution 0.05%.
    - Outside the isolation area, staff who is helping for double bagging, transport the decontaminated bags/containers, should wear at least gloves and disposable mask if outside the isolation zone.
- When storing bag/container with infected waste, before being properly manage
    - Do not stored them more than 24 hours
    - The store place must be protected by a fence to prevent entry by animals, children, or untrained personnel

- Management of waste bags with infected solid waste
    - Incinerate bags with infectious wastes (high temperature > 800oC.)
    - Bury in a designated pit of appropriate depth (e.g. 2 metres)

Management of infected liquid waste (blood, faeces, urine and vomit, grey water, etc.)

- With adequate PPE, depending on the pathogen route of transmission, adding eyes protection and surgical mask (if not worn)
    - Flush liquid waste (e.g. urine, liquid faecal waste) into the sewage system, if there is an adequate system in place.
    - Avoid splashing when disposing of liquid infectious waste to avoid possible generation of aerosols
- When hospital does not have an adequate system
    - Select adequate disinfectant solution for the pathogen
    - In general, disinfect liquid waste with chlorine 0.05% or 0.5% depending on the pathogen before disposing (e.g. disinfect cholera with chlorine solution 0.5%)
- Avoid splashing when pouring disinfectant solution

f. Handling of dead bodies

- Discourage any local practices (touching/ being in contact with the corpse) by HCW, family, friends...
- Dead body remains should not be sprayed, washed or embalmed.
- PPE to safely handle dead body. Refer to route of transmission, with at least:
    - Disposable gown with long-sleeves
    - Waterproof apron
    - Disposable, non-sterile gloves (over the cuffs of the gown)
    - Surgical mask (wear particulate mask if autopsy)
    - Eyes protection (preferable face-shield, or goggle)
    - Rubber gloves
    - Rubber boots
- Put corpse in waterproof/ impermeable body bag immediately; and transfer to the mortuary as soon as possible after death.

- Bury or incinerate corpse without delay
- Surveillance of staff who handle dead body (need to check and record their temperature twice a day, and notify to chief of unit, IPC team if any symptoms)

g. Occupational health

- Any staff and visitor who is entering in the isolation room/ isolation unit (IU), or has any contact with contaminated equipment, linen, waste, dead body MUST:
    - Register their name and contact details in the log book of isolation room/ unit, for contact tracing purpose.
    - Follow up health status, fever and other symptoms (refer to suspect case definition/ triage form)
    - Take and record temperature twice daily, for the entire incubation period after the last contact
    - Notify to chief of unit, IPC team, focal point if any symptoms
- Have a good hygiene, drink plenty of safe drinking water, and rest to avoid mistake due to overwhelmed, severe fatigue.
- Provide supervision and support from chief of IU, IPC focal point and director of hospital
- Promote preventive medicine:
    - No pregnant women should be working in isolation room/ unit
    - Provide psychological support to the staff/team who work in isolation room/ unit
    - Prevent heat illness/ dehydration (serious risk of heat illness while wearing PPE in tropical conditions)

For HCWs who are developing symptoms

- Stop work immediately or do not report to work
- Limit interactions with others
- Exclude themselves from area,
- Notify the chief of unit or focal point if any fever > 38°C. and/ or other symptoms (refer to case definition)
- Exposed persons must receive follow-up care (e.g. antiviral therapy when available), counselling and psychological support
- Inform supervisor, for contact tracing and follow-up of family, friends, co-workers and other patients, who may have been exposed to the disease through close contact with the infected HCW/staff.

Managing Blood/ Body fluid Exposure

- Persons including HCWs with percutaneous or muco-cutaneous exposure to blood, body fluids, secretions, or excretions from a patient with suspected or confirmed infectious disease, should immediately and safely stop any current tasks, and leave the patient care area.

- Safely take off PPE according to the steps in the procedure, in the anteroom

- Treat affected exposed area:

    - wash the affected skin surfaces or the percutaneous injury site with soap and water

    - Irrigate mucous membranes (e.g. conjunctiva) with copious amounts of water or an eyewash solution, and not with chlorine solutions or other disinfectants.

- Immediately report the incident to the chief of unit, IPC focal point (following hospital exposure procedure) as soon as the HCF staff exist the isolation room/ unit.

- Exposed persons should be medically evaluated for:

    - infectious disease (ID) (of isolated patient)

    - other potential exposures (e.g., HIV, HCV) if sharp/needle-stick injury

- Exposed persons must receive follow-up care, including:

    - fever monitoring, twice daily

    - period of recording symptoms will depend on the ID

    - Counselling and psychological support

- Immediate consultation with an expert in infectious diseases for any exposed person who develops fever, symptoms after exposure.

- If fever appears and other symptoms, isolate HCF staff, and follow procedure for ID suspected until a negative diagnosis is confirmed

  Or

- People suspected of having infected should be cared for/isolated, and the same recommendations outlined in this document must be applied until a negative diagnosis is confirmed.

- Conduct contact tracing and follow-up of family, friends, co-workers and other patients, who may have been exposed to Ebola virus through close contact with the infected HCW/ staff.

ANNEX XVIII

OCCUPATIONAL HEALTH AND SAFETY (OHS) FOR SPECIFIC CHEMICAL HAZARD

1. Latex Hypersensitivity

Allergic responses to latex material have been identified as a substantial issue for HCWs. The response is varied and may rarely be fatal.

The main adverse effect is a hypersensitivity reaction, appears as an eczematous local contact allergic dermatitis. It is usually not due to latex itself but primarily to chemicals added to the rubber during glove manufacturing.

HCFs should identify who are hypersensitive and with which latex product.

What to do when a HCW shows latex hypersensitivity?

- provide powder-free latex gloves, which significantly reduce latex allergy
- provide non-latex gloves (e.g. nitrile gloves)

2. Disinfectants

Exposure to disinfectants and cleaning solutions is a common cause of chemical injuries among HCFs' staff, with housekeepers and maintenance workers at greatest risk. For instance, glutaraldehyde (e.g to disinfect endoscope) irritates skin and mucous membranes and may cause allergic contact dermatitis, rhinitis, and asthma. Sodium hypochlorite (bleach, eau javel) is an irritant and, in high concentrations, may cause burns of the skin, mucous membranes and eyes. Soaps in handwashing is a common cause of skin irritation and less commonly contact dermatitis among nursing and medical staff. By using skin protecting lotions to prevent irritant contact dermatitis.

3. Ethylene oxide

Ethylene oxide is a colorless gas used to sterilize medical instruments. It has a distinctive sweet odor, but the average odor threshold is relatively high. Ethylene oxide is known as increasing risk of spontaneous abortion, mutagenicity, carcinogenicity (stomach, leukemia and other hematopoietic cancers) and neurotoxicity at higher exposure levels. Therefore a medical surveillance should focus on the hematopoetic, reproductive, renal, and nervous systems.

The area of highest exposure risk is in central sterilization areas, and risk reduction requires engineering controls and continuous or periodic air monitoring (preferably with an alarm system) as well as good work practices.

To prevent from chemical exposure, a good ventilation (e.g. open window, extraction fan) is necessary in the sterilization room, as well as a good maintenance of equip-

ment, to avoid leak of gas. Regular monitoring of the air should be done, to ensure that there is no remaining ethylene oxide gas in the room. Instruments sterilized with ethylene oxide must be aerated in aeration cabinets before they are used. Additionally to prevent dermal absorption or inhalation of ethylene oxide, HCFs staff, must wear appropriate PPE (gloves and mask).

4. Formaldehyde (formol)

Exposure risk areas include autopsy rooms, pathology laboratories and dialysis units. The adverse (negative) effects of formaldehyde are mainly respiratory symptoms, dermatitis, and hepatitis.

The preplacement and periodic examinations of the HCWs in contact with formaldehyde, should include baseline and periodic pulmonary, dermal, and hepatic evaluations. In areas were spills are likely to happen, spill absorbent materials and appropriate personal protective equipment (PPE) should be available.

5. Glutaraldehyde

Glutaraldehyde is a commonly used solution for high disinfection (e.g. endoscope). Absorption may occur by inhalation, dermal contact or ingestion. The negative effects are often allergic eczema, mucous membrane irritation in humans, and foetotoxicity. Prevention includes, wearing appropriate PPE, and having good room ventilation.

6. Asbestos

Asbestos is a group of fibrous materials used in isolation, fireproofing and building materials. Asbestos is a known human carcinogen. It's useis banned in several countries, but it is still present in many structures, and it is still frequently encountered during routine maintenance activities, renovation projects, and demolition for new construction.

Exposure to asbestos is the leading cause of mesothelioma, a rare cancer involving the lining of the lungs.

OHS should conduct surveillance and recordkeeping for workers with current exposure (e.g. worker in renovation of building and maintenance). Medical surveillance activities should include reinforcement of good work habits, such as wearing PPE, and smoking cessation should be emphasized, reinforced non-smoking law in hospital. Refer or follow labour law for Asbestos used.

7. Mercury

Mercury is present in various laboratories and some instruments, such as thermometer, sphygmomanometers, etc. It may also be present in gastrointestinal equipment and supplies, laboratory fixatives and reagents plumbing systems, batteries…

To prevent exposure, personnel should receive training in the hazard of mercury

expo-sure and importance of reporting spills. HCFs manager should order laboratory fixatives and reagents certified mercury free, and to replace mercury device with a safe and accurate substitutes for mercury thermometers and blood-pressure devices.

Personnel involved in the clean-up of spills should be trained and use respirator and appropriate PPE.

When conducting surveillance of exposed staff with spill mercury, the chemical analyses should specified the concentration detectable, still when it is low.

8. Lead and Cadmium

Lead and cadmium are known for its acute and chronic effects on human health. It is a multi-organ system toxicant that can cause neurological, cardiovascular, pulmonary, bone, renal, gastrointestinal, haematological and reproductive effects.

Compounds containing lead are frequently encountered in cancer radiation therapy centres. Although these compound generally present little in the way of fume hazards, processes such as crushing and filing may introduce lead dust into the working environment. Proper work hygiene is essential to minimize the potential hazards.

9. Anaesthetic Gases

Possible adverse effects among personnel heavily exposed to anaesthetic agents include hepatotoxicity, reproductive hazards and perceptual, cognitive and motor skill impairment.

Particular attention to safe work practices and proper use and maintenance of anaesthetic gas systems will significantly reduce potential for exposure. Area and personal monitoring are necessary to assure adequate control. Anaesthesia personnel should not identify gases by smell. In case it happens, the staff should inform directly and problem needs to be fixed as a priority.

Room ventilation turnover and local exhaust ventilation should meet mandated guidelines; and monitoring of ventilation of operating room as well as maintenance book should be mandatory.

10. Methyl Methacrylate

Methyl methacrylate is an acrylic substance used as cement for dental and orthopedic implants. It is compounded by mixing a powder and liquids that are provided separately and has been associated with mucous membrane irritation and headache in operating room personnel. It is known to cause both allergic dermatitis and asthma.

To prevent side effect, functioning exhaust ventilation from the site of use and mixing in a closed container should be in place to limit exposure.

11. Hazardous Drugs

Many pharmaceutical agents have been reported to be carcinogenic, mutagenic or teratogenic in animal studies and limited human studies. Studies of occupational exposures have shown detectable levels of antineoplastic and other drugs, such as Pentamidine and Ribavirin, in the air of hospital pharmacies with no ventilation hoods, and in patient rooms with no environmental control measures (no extraction fan).

Pharmacy personnel and nurses working with chemotherapeutic drugs have been reported to have increased mutagenic agents in their urine. It was demonstrated, that it was a link with poor maintenance of equipment, including ventilation system, and work practices.

Institutions that are using cytotoxic (antineoplastic) and other hazardous drugs, should develop regulations to ensure the safety of personnel dealing with.

Nurses and pharmacists are particularly susceptible to exposure to antineoplastic agents, but other employees, such as housekeepers handling contaminated linens, can have a potential exposure.

To prevent exposure, education and strict adherence to good procedure are necessary. Pharmacists should use vertical exhaust hoods and wear appropriate PPE. Nursing staff need to wearing PPE (mask and gloves), and must practice meticulous technique to avoid spills, leaks and accidental needle-stick injuries; to avoid skin absorption and inhalation exposure.

It is recommended that for personnel involved with preparation and administration of anti-neoplastic, their medical check-up also include hematologic and reproductive systems. Employees should be encouraged to immediately report any accidental exposures, following accident/ injuries procedure.

| Figure 88
Separated working areas, safety work-benches and reliable lead-over systems represent the most important technical protective measures when preparing chemotherapeutic agents.

(Photo from “Chemical EU guides page 237”)

12. Benzene

Human exposure to benzene is well recognised as a major public health concerned. It has been associated with a range of acute and long-term effects. Acute effects include headache, dizziness, sleepiness, confusion, tremors and loss of consciousness; and eye and skin irritant. Long-term adverse health effects and diseases, including cancer and aplastic anaemia. Benzene is highly volatile, and exposure occurs mostly through inhalation. Public health actions are needed to reduce the exposure of both workers and the general population to benzene.

To prevent from benzene exposure in the HCFs, use of benzene-containing products should be avoided, discourage indoor use of un-flued oil, and prohibit smoking inside building.

13. Peracetic acid[23]

Peracitic acid is effective against bacteria, fungi, and viruses. It is is used as a disinfectant in the food and medical industries, as a bleaching agent in the paper and textile industries, and in HCFs as a high level disinfectant, when sterilization process is not possible.

Peracitc acid is known to be occupational health hazard to its volatile property, with a risk of fire and explosion.

When exposed to peracitic acid, worker can have a risk:

- Inhalation, following symptoms can occurs:
    - burning sensation,
    - cough, and difficulty of breathing/shortness of breath,
    - sore throat.
- Skin: MAY BE ABSORBED! Redness. Pain. Blisters. Skin burns.
- INGESTION: Abdominal pain, burning sensation, Shock or collapse.
- EYES: Redness. Pain. Severe deep burns.

Example of eyes irritation due to peracetic acid

[23] Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8. Chapter 7 Peracetic Acid1a Acute Exposure Guideline Levels. 2010 by the National Academy of Sciences. Available at http://www.ncbi.nlm.nih.gov/books/NBK22000

How to prevent:

- Do not have open flames, NO sparks, and NO smoking. NO contact with flammable substances. NO contact with hot surfaces.
- If above 40.5°C, use a closed system, ventilation, and explosion-proof electrical equipment. Do NOT expose to friction.
- To prevent exposure,
    - Work in a well-ventilated area, with local exhaust, or breathing protection.
    - Use protective gloves. Protective clothing.
    - Use Face shield or eye protection in combination with breathing protection.
    - Do not eat, drink, or smoke during work.

Please refer to "Laboratory Safety Manual for other hazards from other specific chemicals used in laboratories".

Post-exposure procedure: Management of Chemical Exposure

1. Immediate management/first aid

+ Inhalation of volatile:

- Fresh air, rest. Stay half-upright position.
- Refer for medical attention.

+ Skin exposure:

- First rinse with plenty of water, then remove contaminated clothes and rinse again.
- Refer for medical attention.

+ In case of eyes exposure:

- First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then consult with a doctor.

+ In case of ingestion:

- Rinse mouth. Do NOT induce vomiting.

2. Report the incident.

3. Document the accident.

4. Conduct risk assessment, counselling and provision of post-exposure prophylaxis.

5. Conduct monitoring and follow up of the exposed health worker.

6. Report and evaluate the programme.

ANNEX XIX

INTERNATIONAL FEDERATION OF INFECTION CONTROL RECOMMENDATIONS (IFIC 2016) FOR DESIGN OF A GENERAL HOSPITAL WARD

Room	Basic	Standard	Ideal
Patients´ rooms/ bays **Each room must have a sink for hand washing and space for gloves and aprons.**	If you must have wards with many beds, you should also have some bays or, ideally, single rooms to cohort or isolate infectious patients. Each room must have a sink for hand washing and space for gloves and aprons. Each room must be equipped with alcohol-based hand rub.	Patients´ rooms/ bays Each room must have a sink for hand washing and space for gloves and aprons.	One bed per room. The room should be big enough to house 2 beds, for family member or another patient. Each room must have a sink for hand washing and space for gloves and aprons. Each bed must be equipped with alcohol-based hand rub.
Isolation rooms for infectious patients	Recommended, preferably with en-suite wash and separate toilet.	Some single rooms with en-suite wash/shower and toilet.	Some single rooms with en-suite wash/shower and toilet. At least 2 of these rooms should have >12 HEPA-filtra-ted air changes per hour and anterooms with negative pressure
Distance between beds	Minimum 1 metre.	2 metres recommended.	More than 2 metres is recommended.

Patients´ toilets	Toilets on each ward.	Sex-specific toilets on each ward, at least en-suite toilets in single rooms	En-suite toilets for each room.
Wash/shower/ bathroom **One shower room per ward should be big enough for a shower bed or bathtub**	At least one wash/ shower or bathroom on each ward in combination with toilet.	En-suite wash/ shower for each patient room, recommended in combination with toilet.	En-suite wash/ shower/toilet room for each patient room.
Other toilets	Separate toilets for both healthcare workers (HCW) and visitors.	Separate sex-specific toilets for both HCWs and visitors.	Separate sex-specific toilets for both HCWs and visitors.
Nurses´ workrooms (preparing care)	At least one room for both clean and dirty work. Organise a maximum distance between clean and dirty work areas to ensure separation.	Sharps must be collected in containers that can be properly closed One room for clean work (preparing medications) and one room for dirty work (cleaning/ disinfection of medical products, bedpans and perhaps instruments). On large wards more rooms may be necessary to reduce walking distances.	Sharps must be collected in containers that can be properly closed One room for clean work (preparing medications) and one room for dirty work (cleaning/ disinfection of medical products, bedpans and perhaps instruments). On large wards more rooms recommended to reduce walking distances.
Nurses' rooms	One room for organising work and breaks.	One room for organising work and one for breaks.	One room for organising work and one for breaks.
Doctors´ treatment/ examination rooms	One room desirable.	At least one room.	At least one room.

Waste room	There should be a specific area, preferably outside the ward, for the storage of waste awaiting collection. Waste sacks should be kept in large containers for collection.	Separate room for waste disposal. May be combined with room for dirty work.	One special room for waste storage.
Kitchen	Small kitchen with sink and refrigerator.	Small kitchen with sink and refrigerator.	Small kitchen with sink and refrigerator.
Storage of clean equipment and products	At least one great storage room.	At least one great storage room.	At least one great storage room.
Bed reproces-sing (including cleaning of mattress and bedstead) **Sheets, blankets, pillows sent to laundry**	Bed reprocessing in patient room, not in corridor.	Bed reprocessing in patient room or in a re-served room on the floor.	Bed reprocessing in patient room or centralised.
Changing room for staff **(if uniform is from the hospital)**		Centralised or one room only for changing on the ward.	Centralised or one room only for changing on the ward.
Housekeeping and laundry room	Separate area for storing agents for cleaning and disin-fection. Sacks for dirty laundry.	One room with sink, Dis-infectants, cleaning agents and cleaning cart. Sacks for dirty laundry.	One room with sink, Dis-infectants, cleaning agents and cleaning cart. Sacks for dirty laundry.

ANNEX XX

PRE-OPERATIVE PATIENT PREPARATION PROCEDURE

Skin preparation for surgical/clinical procedures

First, make sure the surgical/procedure site has been cleaned with soap and water. Apply antiseptic and gently disinfect (do not scrub) the skin in a circular motion–beginning in the centre of the site and moving out–using sterile cotton balls, cotton wool, or gauze sponges held by a sponge forceps.

NOTE:

Shaving is no longer recommended because it causes small nicks and breaks in the skin where bacteria can grow and multiply. Hair around the site may be clipped short if it might interfere with the procedure.

Preparation for the vagina, cervix, and other mucous membranes

Using sterile cotton balls, cotton wool, or gauze sponges held by a sponge forceps apply an antiseptic liberally to the vagina and cervix before instrumentation of the uterus. Alcohol and alcohol-based antiseptics should not be used on the vagina, cervix, or other mucous membranes because they easily irritate these tissues.

Before giving an injection

Wipe the patient's skin at the intended injection site with an antiseptic solution to minimize the number of microorganisms and reduce the risk of infection.

- If there is visible dirt, wash the injection site with soap and water.
- Using a fresh swab, wipe the site with an antiseptic, wiping in a circular motion from the centre outward.
- If alcohol is used, allow the alcohol to dry in order for maximum effectiveness in reducing microorganisms.

Remember:

Good patient preparation helps reduce the risk of postoperative infection by lowering the chances that bacteria from the patient's skin will infect the wound.

ANNEX XXI SURGICAL HAND SCRUB PROCEDURE

Before invasive procedures (e.g. any operation), and before wearing sterile gloves and sterile scrub/ attire it is essential to perform surgical hand scrub, to reduce resident and transient skin flora to a minimum; and avoid colonisation of sterile gloves during surgical procedure.

All staff must maintain good personal hygiene:

- Keep nails short and pay attention to them when washing your hands – most microbes on hands come from beneath the fingernails.
- Do not wear artificial nails or nail polish.
- Take off all jewellery (rings, watches, bracelets) before entering the operating theatre.
- Wash hands and arms with a non-medicated soap before entering the operating theatre area or if hands are visibly soiled.
- Remove debris underneath the fingernails using a nail cleaner before the first procedure in the morning.
- Nailbrushes should not be used as they may damage the skin and encourage
- shedding of cells.
    - If used, nailbrushes must be sterile, once only (single use). Reusable autoclavable nail brushes are available at market.

Material

- Plain or antiseptic soap (liquid soap is preferred)
- Antiseptic agent
- Running water, when no running water is available:
    - use a bucket with a tap
    - use 2 buckets, one with clean water with a ladle and one empty bucket
- Sterile towels must be used, to dry hands after surgical hand scrub

Procedure: perform surgical hand scrub for 2 - 4 minutes

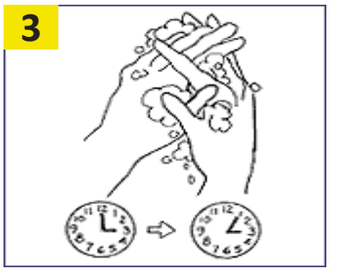
Steps 1 & 2

Take off jewelries and watch.

Hold hands above the level of the elbow and wet hands thoroughly.

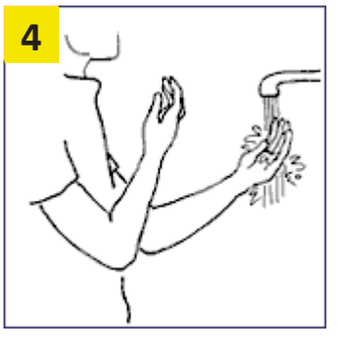
Step 3

Apply soap and run water from area of least contamination (hands) to most contamination (arms).



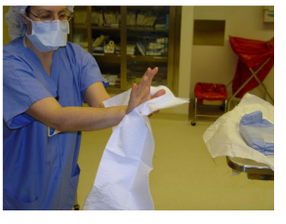
Step 4

- Holding your hands up above the level of your elbow, apply the antiseptic.
- Using a circular motion, begin at the fingertips of one hand and lather and wash between the fingers, continuing from fingertip to elbow.
- Wash between all fingers. Move from fingertips to the elbow of one arm and repeat for the second arm. Moving from area of least contamination to area of most contamination decreases the possibility of spreading.
- Continue washing in this way for 2- 4 minutes.



Step 5

Dry hands…. With **sterile** drape



Step 6

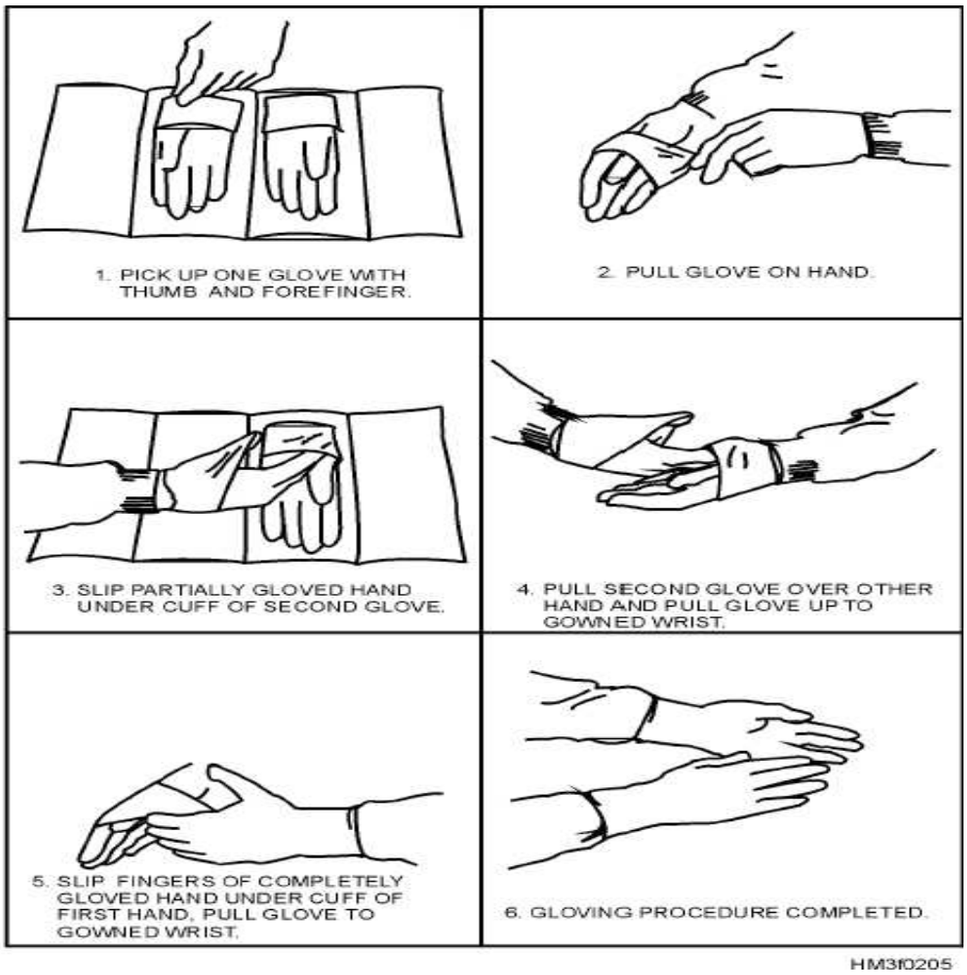
Keep your hands above the level of your waist and do not touch anything before putting on sterile surgical gloves. Contact with soiled objects contaminates clean hands. The area below the level of the waist is considered unclean.

| ***Figure 89***
Steps for surgical hand scrub

ANNEX XXII WEARING SURGICAL / STERILE GOWN PROCEDURE

Figure 90 **|** *WEARING SURGICAL / STERILE GOWN PROCEDURE*

ANNEX XXIII WEARING SURGICAL GLOVES PROCEDURE



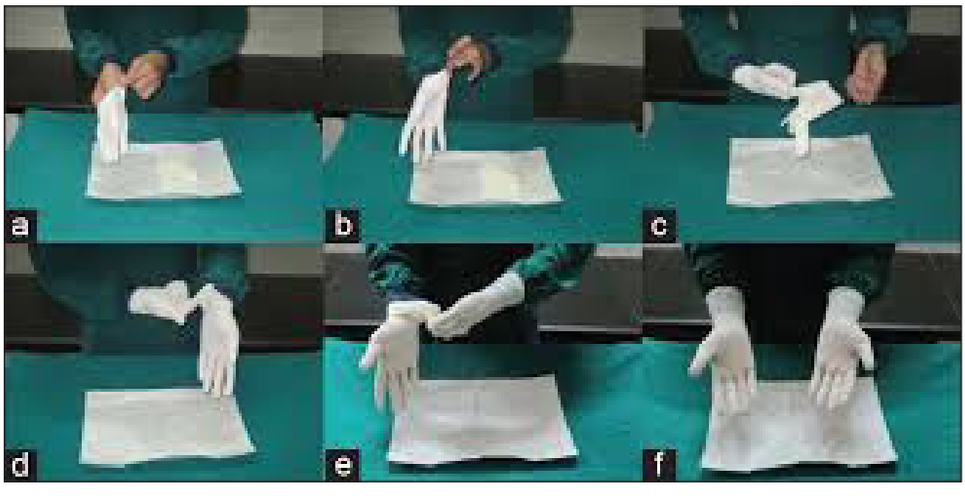


Figure 91 **|** *Wearing surgical gloves procedure*

Gloves are cuffed to make it easier to put them on without contaminating them. When putting on sterile gloves, remember that the first glove should be picked up by the cuff only. The second glove should then be touched only by the other sterile glove.

Remember:

The outside of a package that contains sterile items is not sterile itself. If you are gloving alone, be sure to open the outer glove package before you perform surgical scrub

Sterile surgical gloves can become contaminated:

- If you touch the outside of a sterile glove with an un-gloved hand
- If you touch anything that is not sterile-including your face or clothing outside the sterile field-while wearing the gloves
- If your glove becomes torn or punctured
- If your gloved hands drop below the level of your waist

If your gloves become contaminated: Change your sterile gloves

- Stop whatever you are doing.
- Step away from the sterile field.
- Take off the contaminated glove.
- If your hands are soiled with blood or other matter, perform surgical scrub and put on new gloves. If not, put on a new glove, making sure not to contaminate the uncontaminated glove.

Tips for removing surgical gloves

As you take off the gloves, avoid allowing the outside surface of the gloves to come in contact with your skin, because the outer surface will have been contaminated with blood and other body fluids. Avoid letting the gloves snap, as this may cause contaminants to splash into your eyes or mouth or onto your skin or other people in the area.

Take off used gloves before touching anything: Countertops, faucets, and pens and pencils are frequently contaminated because healthcare workers touch them while wearing used gloves.

ANNEX XXIV CREATING AND MAINTAINING A STERILE FIELD

A ***sterile field*** is an area created by placing sterile towels or surgical drapes around the procedure site and on the stand that will hold sterile instruments and other items needed during the procedure. When a service provider is properly dressed in sterile surgical attire, the provider's sterile area is the only area that should come in contact with the sterile field. Only sterile objects and personnel may be allowed within the sterile field.

- When a sterile field is created around a procedure site, items below the level of the draped patient are outside the field and are not sterile.
- A properly gowned and gloved provider's sterile area extends from the chest to the level of the sterile field.
- Areas below the level of the draped patient are considered non-sterile.
- Only sterile items are free of potentially harmful microorganisms. Once a sterile object comes in contact with a non-sterile object or person or with dust or other airborne particles, the object is no longer sterile. If even one non-sterile object or person enters the sterile field, the field is no longer sterile. For example, sterile objects become contaminated if you touch the object with your bare hand, if the object comes in contact with dust or other airborne particles, or if the object is held below the level of the sterile field.

Maintaining a Sterile Field

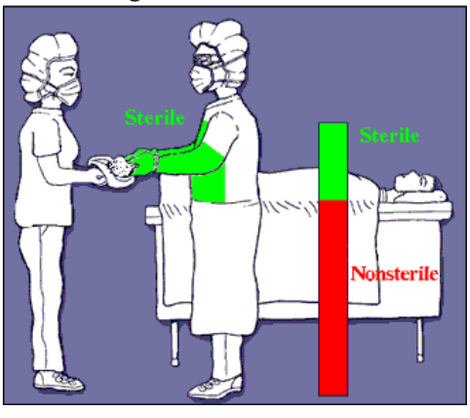


Figure 92 | *Sterile field in OR*

- Place only sterile items within the sterile field.
- Recognize that the edges of a package containing a sterile item are considered unsterile.
- Do not contaminate sterile items when opening, dispensing, or transferring them.
- Do not allow sterile personnel to reach across unsterile areas or to touch unsterile items.
- Consider items located below the level of the draped client to be unsterile.
- Do not allow non sterile personnel to reach across the sterile field or to touch sterile items.
- Open, dispense, and transfer items without contaminating them.

- Do not place sterile items near open windows or doors.
- Recognize and maintain the service provider's sterile area.
- If a sterile barrier has been wet, cut, or torn, consider it contaminated.
- Recognize that a sterile or high-level disinfected (HLD) barrier that has been penetrated (wet, cut, or torn) is considered contaminated.
- Be conscious of where your body is at all times, and move within or around the sterile or HLD field in a way that maintains sterility or HLD status.
- When in doubt about whether something is sterile, consider it contaminated.

ANNEX XXV

INFORMATION ON DESIGN OF INTENSIVE CARE UNITS[24]

Introduction

The aim of this document is to provide practical, evidence based (where appropriate) written materials about construction, design and renovation in health care facilities, that can be used in the co-operation between Infection control personnel, building planners and engineers.

SIG recommendations are given in three levels:

- **Basic -** even with severely limited resources, this is what you should do as a minimum
- **Standard –** this is what you should aim for in less wealthy countries
- **Ideal –** if you have the resources, this is what you could do

Recommendation

Room	Basic	Standard	Ideal
Corridor for patients, staff and supplies	Doors to staircase/ public corridor	closed doors to staircase/public corridor	Doors to ante-room leading to public corridor.
Single room with hand wash basin	Some single rooms should be available	Some single rooms must be available. Room area 25 m^2	Most rooms should be single-bed rooms. Room area 25-30 m^2
Ventilation for airborne infection			One to two rooms should have ventilation with possibility to get a negative pressure (including the ante-rooms) (for infectious patients), with HEPA filter (for hematology/ oncology patients) and 6-12 air changes/h

[24] International Federation of Infection Control Recommendations (IFIC) - 2010

Multiple bed room with one hand wash basin per room	Minimum 1.5 meter between beds	Minimum distance 2 m between beds	Minimum distance 2 m between beds
Patient shower		One room for patient to be showered on a shower bed	Single rooms with en-suite possibility to shower patient
Observation and report space	Necessary.	Necessary including ECG (and blood pressure…) observation	Necessary including online ECG (and blood pressure, blood gas etc) observation
Space for consultation between medical staff and relatives	Necessary	Necessary	Separate room should be available
Space for family/ visitors (close to ICU)	Separate space for visitors, with toilet and facilities for food preparation	Separate room for visitors, with toilet, shower and small kitchen	Separate rooms for visitors, with toilet, shower and small kitchen
Clean utility space / clean working space Sharps must be collected in closed containers	One designated space for clean work.	One room for clean work (preparing medications and infusions)	One room for clean work (preparing medications and infusions) per 4-5 single rooms
Laboratory		Space for blood gas analysis machine and refrigerators for i.v. fluids and blood transfusions.	Room for blood gas analysis machine and refrigerators for i.v. fluids and blood transfusions.
Room for cleaning and disinfection of medical devices	Space for cleaning and disinfection of medical devices including ventilators and fluid pumps.	Room with washer-disinfector, space for reprocessing of ventilators and fluid pumps.	Room with washer disinfector and endoscopy disinfector, space for reprocessing of ventilators and fluid pumps.

Housekeeping room	Separate space for cleaning and disinfecting agents	Room with sink, disinfectants, cleaning agents and cleaning cart.	Room with sink, disinfectants, cleaning agents and cleaning cart.
Dirty working room	Designated space for dirty work.	Room for cleaning and disinfection of bedpans and washbasins	Rooms with flusher-disinfector for cleaning and disinfection of bedpans and washbasins.
Waste room for waste in bags / containers and dirty laundry	Specific space for waste.	Space for waste, might be included in dirty working room.	Room for waste only, with doors to department and outside corridor.
Storage of clean and sterile equipment and products and clean laundry	Separate room.	Separate room, with locked doors.	Separate room, with locked doors.
Changing room for staff	Room with washbasin and dispensers for alcoholic hand rub, liquid soap and towels.	Rooms with washbasin and dispensers each for both sexes. Showers and toilets for each sex. Space for clean and dirty laundry.	Rooms with washbasin and dispensers each for both sexes. Showers and toilets for each sex. Space for clean and dirty laundry.