

The United Republic of Tanzania
Ministry of Health and Social Welfare



NATIONAL INFECTION PREVENTION AND CONTROL GUIDELINES FOR HEALTHCARE SERVICES IN TANZANIA

A POCKET GUIDE FOR HEALTHCARE PROVIDERS

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- 3 National Infection Prevention and Control Pocket Guide for Healthcare Services in Tanzania; February 2007
- 4 Mwongozo wa Taifa wa Kuinga na Kudhibiti Maambukizo katika Utoaji wa Huduma za Afya; Kiongozi cha Mfukoni kwa Watoa Huduma za Afya Tanzania; Aprili 2007

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ARV	Anti-Retroviral
CDC	Centers for Disease Control and Prevention
CPR	Cardio-Pulmonary Resuscitation
CSSD	Central Sterilization Supply Department
CTC	Care and Treatment Clinic
FIFO	First In, First Out
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
HLD	High-Level Disinfection
HP	Healthcare Provider
IPC	Infection Prevention and Control
IUD	Intra-Uterine Device
IV	Intravenous
MMWR	Morbidity and Mortality Weekly Report
MRSA	Methicillin-Resistant <i>Staphylococcus aureus</i>
MVA	Manual Vacuum Aspiration
NACP	National AIDS Control Programme
NGO	Non-Governmental Organization
ORS	Oral Rehydration Solution
OSHA	Occupational Safety and Health Administration
PEP	Post-Exposure Prophylaxis
PPE	Personal Protective Equipment
RSV	Respiratory Syncytial Virus
SARS	Severe Acute Respiratory Syndrome
SIGN	Safe Injection Global Network
TB	Tuberculosis
TP	Total Parts
WHO	World Health Organization
WHO/SEARO	World Health Organization/South East Asia Regional Office

FOREWORD

Infection is one of the leading causes of morbidity and mortality in Tanzania. It is one of the five direct causes of maternal deaths in our country. Treating infection is costly and even when successful; it may leave long lasting and debilitating conditions.

The Ministry of Health and Social Welfare is committed to ensuring safe, quality healthcare services are provided to its people countrywide. Infection Prevention is a critical component of quality in health services.

Infection (communicable diseases) can spread through various routes i.e. airborne, droplet, blood and other body fluids, contact (direct and indirect), fecal-oral, food borne, and vector borne.

The emergency of HIV/AIDS has complicated the whole picture of infection prevention and control by increasing the number of people at risk of infection. Increased numbers of tuberculosis cases and endemicity of cholera in some parts of Tanzania, call for special attention on safe and effective infection prevention and control measures.

The intent of this *Pocket Guide* is to provide all healthcare providers with a quick reference to the essentials of Infection Prevention and Control practices in a simple, readable and easily understandable way. This will be the standard of care against which healthcare providers will be measured in their practices.

The Ministry of Health and Social Welfare in collaboration with development partners is dedicated to supporting the implementation of evidence based Infection Prevention and Control practices in healthcare settings in Tanzania. This dedication, coupled with healthcare providers' efforts on compliance to the Standard Precautions for Infection Prevention and Control, will play a key role in improving the quality of healthcare services in the country.



Hilda Ausi Gondwe
Permanent Secretary
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Team of Infection Prevention and Control experts who contributed to the development of this guide. Their names are in **Appendix 4**.

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We would also like to extend our gratitude in advance to all those who on being exposed to this pocket guide will feel it is their duty to offer quality services to the clients and also give us their constructive criticism and comments for improving the guide.



Dr. Deo M. Mtasiwa
Chief Medical Officer
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HOW TO USE THE POCKET GUIDE

INTRODUCTION

Infection Prevention and Control (IPC) refers to placing a barrier between the host and microorganisms (bacteria, viruses, parasites and fungi). The protective barrier can be physical, mechanical or chemical, and helps to prevent or control the spread of organisms from client to client, staff to client and vice versa. IPC practices are precautionary, protective measures taken to avoid invasion of the body by harmful organisms. The IPC practices described in this Pocket Guide are intended for use in all types of healthcare facilities in Tanzania.

This Pocket Guide has been developed by the Ministry of Health and Social Welfare of Tanzania to aid healthcare providers in healthcare facilities and elsewhere to understand and use evidence-based IPC practices.

CONTENT AND ORGANIZATION

The material in this Infection Prevention and Control Pocket Guide is divided into 18 topics. Each topic stands on its own. However, the topics are arranged in such a way that the reader needs to know some basic IPC principles. The first principle of IPC—“the disease transmission cycle”—is described briefly under Standard Precautions. All other topics, such as Transmission-Based Precautions, Personal Protective Equipment (PPE), Hand Hygiene and the rest, are based on the same principle of breaking the disease transmission cycle. Therefore, the reader is strongly advised to read the guide in the order in which the topics are presented.

USERS OF THE GUIDE

The expected users of the Pocket Guide include:

- All healthcare providers and trainers from government, faith-based, private for-profit, not for-profit and NGO health facilities and institutions
- People working at community level to promote quality healthcare services, including frontline healthcare providers, facility health management committees and home-based care workers
- Individuals, groups and international organizations engaged in healthcare service provision
- Policymakers, health managers, program officers and health administrators
- Various health teams including regional and council health management teams



CHAPTER ONE

1. INTRODUCTION

The IPC practices described in this Pocket Guide are intended for use in **all** types of healthcare facilities in Tanzania.

IPC in healthcare facilities has four primary objectives:

- Prevent patients/clients from nosocomial infections (hospital-acquired or healthcare-related infections)
- Protect healthcare providers (HPs) from occupational infections
- Protect communities from infectious diseases
- Prevent environmental pollution

Situation analysis of IPC in Tanzania

The situational analysis revealed that IPC practices were poor due to the following reasons:

- Lack of guidelines and standards for certain procedures
- Inadequate knowledge and skills among HPs
- Deficiency of equipment and materials
- Inadequate supportive supervision
- Inadequate renovation and maintenance of infrastructure

Teaching HPs how to protect themselves, their patients/clients and the community is very important. If HPs know how to protect themselves and consistently use these measures, they will help protect their patients/clients and the community as well.

CHAPTER TWO

2. STANDARD PRECAUTIONS

2.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define the term “Standard Precautions”
- Explain components of Standard Precautions
- Explain disease transmission cycle
- Explain how Standards Precautions break disease transmission cycle

2.2 Definition

Standard Precautions are a simple set of effective practice guidelines (creating a physical, mechanical or chemical barrier) to protect HPs and patients/clients from infection with a range of pathogens including bloodborne pathogens. The practices are used when caring for all patients/clients regardless of diagnosis.

They apply to blood, all body fluids, secretions and excretions (except sweat), non-intact skin and mucous membranes. Because no one really knows which organisms clients or patients may have at any time, it is essential that Standard Precautions be used all of the time.

2.3 Components of Standard Precautions

The following actions create protective barriers to prevent infections in clients, patients and HPs, and provide the means for implementing Standard Precautions:

- **Consider every person** (patient or staff) as potentially infectious and susceptible to infection
- **Use appropriate hand hygiene** techniques including handwashing, hand antisepsis, antiseptic handrub and surgical hand scrub
- **Wear Personal Protective Equipment (PPE)** including gloves, masks, goggles, caps, gowns, boots and aprons
- **Appropriately handle** sharps, patient care and resuscitation equipment, linen, and **appropriately manage** patient placement and patient environmental cleaning
- **Safely dispose of infectious waste materials** to protect those who handle them and prevent injury or spread to the community
- **Process instruments** by decontamination, cleaning and then either sterilization or high-level disinfection (HLD) using recommended procedures

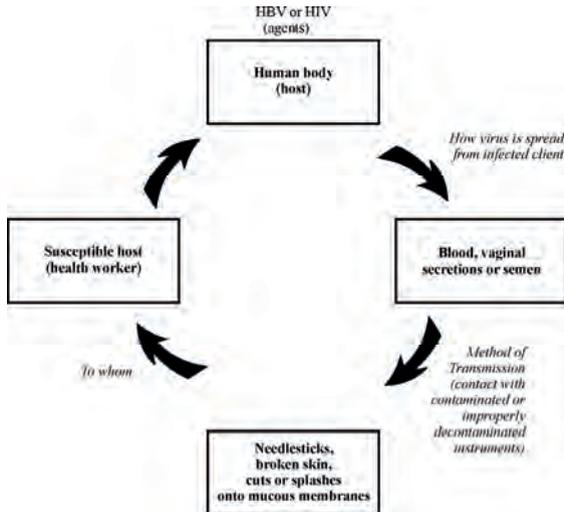
2.4 How Standard Precautions Break the Disease Transmission Cycle

Proper infection prevention practices are fundamental to quality of care. A safe work environment is essential to protect HPs, patients and communities. Standard Precautions break the disease transmission cycle (**Figure 2-1**) in one of the following four ways:

1. Reducing the number of infection-causing microorganisms present (e.g., through practicing hand hygiene, cleaning instruments and prepping skin prior to intravenous [IV] insertion);

2. Killing or inactivating infection-causing microorganisms (e.g., through hand hygiene with an antiseptic or waterless, alcohol preparation or reprocessing of instruments);
3. Creating barriers to prevent infectious agents from spreading (e.g., through wearing PPE or covering the mouth when sneezing); or
4. Reducing or eliminating risky practices (e.g., by passing sharps using hands-free technique, using disposable gloves instead of none, disposing of syringes at point of use).

Figure 2-1. The Disease Transmission Cycle



CHAPTER THREE

3. TRANSMISSION-BASED PRECAUTIONS

3.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define transmission-based precautions
- Explain standard precautions based on symptoms and signs presented by a patient/client
- Describe precautions for air, droplet and contact routes of disease transmission

3.2 Definition

This is a second level of precautions intended for use in patients **known** or **highly suspected** of being infected or colonized with pathogens transmitted by:

- Air (tuberculosis, chicken pox, measles, etc.);
- Droplet (flu, mumps, rubella); or
- Contact (hepatitis A or E and other enteric pathogens [includes fecal/oral transmission], herpes simplex, and skin or eye infections).

If there is any question about an infectious process in a patient without a known diagnosis, implementing Transmission-Based Precautions should be considered, based on the patient's signs and symptoms (empiric basis) until a definitive diagnosis is made. The "empiric use" of these precautions is illustrated in **Table 3-1**.

Moreover, where healthcare resources, including laboratory testing, are limited, diagnosis-based isolation precautions are not helpful in practice. In these circumstances, the isolation system should be completely based on the clinical findings (signs and symptoms).

Table 3-1. Empiric Use of Transmission-Based Precautions (by signs and symptoms)

AIRBORNE	DROPLET	CONTACT
Cough, fever and upper lobe chest findings (dullness and decreased breath sounds)	Severe, persistent cough during periods when pertussis/flu is present in community	Acute diarrhea in an incontinent or diapered patient Diarrhea in adult with history of recent antibiotic use
Cough, fever and chest findings in any area in HIV-infected person or at high risk for HIV	Meningitis (fever, vomiting and stiff neck)	Bronchitis and croup in infants and young children
Rashes (vesicule or pustule)	Hemorrhagic rash with fever Generalized rash of unknown cause	History of infection with multidrug-resistant organisms (except tuberculosis [TB]) Vesicular rash Abscess or draining wound that cannot be covered

3.3 Airborne Precautions

3.3.1 Definition

These precautions are designed to reduce the nosocomial transmission of particles 5 µm or less in size that can remain in the air for several hours and be widely dispersed (**Table 3-2**). Microorganisms spread wholly or partly by the airborne route include chicken pox

(varicella virus) and measles (rubeola virus). Airborne precautions are recommended for patients with either **known** or **suspected** infections with these agents.

Table 3-2. Airborne Precautions

Used in addition to Standard Precautions for a patient known or suspected to be infected with microorganisms transmitted by the airborne route

PATIENT PLACEMENT



- Private room.
- Door closed.
- Room air is exhausted to the outside (negative air pressure) using fan, air conditioner or other filtration system.
- If private room not available, place patient in room (negative air pressure as above) with patient having active infection with the same disease, but with no other infection (cohorting).
- Check all visitors for susceptibility before allowing them to visit.

RESPIRATORY PROTECTION



- Wear a mask.
- If severe acute respiratory syndrome (SARS) or bird flu is known or suspected, wear a particulate respirator (N95 mask) if available, or a mask.
- If chicken pox or measles:
 - Immune persons—no mask required.
 - Susceptible persons—do not enter room.
- Remove mask after leaving the room and place in a plastic bag or waste container with tight-fitting lid.

PATIENT TRANSPORT



- Limit transport of patient to essential purposes only.
- During transport, patient must wear mask.
- Notify area receiving patient.

Adapted from: ETNA Communications 2000.

3.3.2 Staff

Staff should remember:

- Educate patients who may have TB about the mechanisms of *M. tuberculosis* transmission and the reasons they should comply with the recommendations.
- Teach these patients to cover their nose and mouth with a disposable tissue (or cloth) when they cough or sneeze to prevent droplets from entering air.

3.3.3 Respiratory Hygiene/Cough Etiquette

The following measures to contain respiratory secretions are recommended for all individuals (staff, patients and visitors) with signs/symptoms of a respiratory infection.

- Cover the nose/mouth when coughing or sneezing;
- Use tissues to contain respiratory secretions and dispose of the tissue in the nearest waste container after use;
- Perform hand hygiene (e.g., handwashing with non-antimicrobial soap and water, alcohol-based handrub or antiseptic handwash) after having contact with respiratory secretions and contaminated objects/materials.

Healthcare facilities should ensure the availability of materials for adhering to respiratory hygiene/cough etiquette in waiting and service provision areas for patients and visitors:

- Provide tissues and no-touch waste containers for tissue disposal.
- Provide conveniently located dispensers of alcohol-based handrub; where sinks are available, ensure that supplies for handwashing (e.g., soap and disposable towels) are consistently available.
- Advise anyone who is coughing (patients and visitors) to use masks.

When possible, encourage persons in common waiting areas who are coughing to sit at least 1 meter (3 feet) away from others.

Post visual alerts at the entrance to and inside the outpatient facilities (e.g., emergency departments, physicians' offices, outpatient clinics) with instructions to the patients and the persons who accompany them to practice respiratory hygiene/cough etiquette and inform a staff member of their symptoms as soon as possible. A person with a cough should be provided with a mask.

3.3.4 Message to give patients and visitors

Serious respiratory illnesses like influenza, respiratory syncytial virus (RSV), whooping cough and severe acute respiratory syndrome (SARS) are spread by:

- Coughing or sneezing
- Unclean hands

To help stop the spread of germs:

- Cover your mouth and nose with a tissue when you cough or sneeze.
- If you don't have a tissue, cough or sneeze into your upper sleeve, not your hands.
- Put your used tissue in the waste container.

Clean your hands after coughing or sneezing:

- Wash with soap and water, or
- Clean with alcohol-based hand cleaner.

Note: You may be asked to put on a surgical mask to protect others.

3.4 Droplet Precautions

These precautions reduce the risks for nosocomial transmission of pathogens spread wholly or partly by droplets larger than 5 µm in size (e.g., *H. Influenzae* and *N. meningitides*; *M. Pneumoniae*, flu, mumps and rubella viruses). Other conditions include diphtheria, pertussis (whooping cough), pneumonic plague and streptococcal pharyngitis (scarlet fever in infants and young children). Using droplet precautions protects the upper respiratory tract as well as the conjunctiva of the eye and mucous membranes of the mouth and nose.

Droplet precautions are simpler than airborne precautions because the particles remain in the air only for a short time and travel only a few feet; therefore, contact with the source must be close for a susceptible host to become infected (**Table 3-3**).

Table 3-3. Droplet Precautions

Use in addition to Standard Precautions for a patient known or suspected to be infected with microorganisms transmitted by large-particle droplets (larger than 5 µm).

PATIENT PLACEMENT



- Private room; door may be left open.
- If private room not available, place patient in room with patient having active infection with the same disease, but with no other infection (cohorting).
- If neither option is available, maintain separation of at least 1 meter (3 feet) between patients.

RESPIRATORY AND EYE/MUCOUS MEMBRANE PROTECTION



- Wear a mask and goggles or face shield if within 1 meter of patient.

PATIENT TRANSPORT



- Limit transport of patient to essential purposes only.
- During transport, patient must wear a mask.
- Notify area receiving patient.

Adapted from: ETNA Communications 2000.

3.5 Contact Precautions

These precautions reduce the risk of transmission of organisms from an infected or colonized patient through direct or indirect contact (**Table 3-4**). They are indicated for patients infected or colonized with enteric pathogens (hepatitis A or echo viruses), herpes simplex and hemorrhagic fever viruses and multi drug (antibiotic)-resistant bacteria. Interestingly, chicken pox is spread both by the airborne and contact routes at different stages of the illness. Among infants, there are a number of viruses transmitted by direct contact (rhinoviruses causing colds or rotavirus causing diarrhea). In addition, contact precautions should be implemented for patients with wet or draining infections that may be contagious (e.g., draining abscesses, herpes zoster, impetigo, conjunctivitis, scabies, lice, wound infections).

Table 3-4. Contact Precautions

Use in addition to Standard Precautions for a patient known or suspected to be infected or colonized with microorganisms transmitted by direct contact with the patient's secretions/excretions or indirect contact with environmental surfaces or patient care equipment.

PATIENT PLACEMENT



- Private room; door may be left open.
- If private room not available, place patient in room with patient having active infection with the same microorganism, but with no other infection (cohorting).

GLOVING



- Wear clean, non-sterile examination gloves when entering room.
- Change gloves after contact with infectious material (e.g., feces, wound drainage).
- Remove gloves before leaving patient room.

HANDWASHING



- Wash hands with soap and water or an antibacterial agent, or use a waterless, alcohol-based antiseptic handrub, after removing gloves.
- Do not touch potentially contaminated surfaces or items before leaving the room.

GOWNS AND PROTECTIVE APPAREL



- Wear clean, non-sterile gown when entering patient room if patient contact is anticipated or patient is incontinent, has diarrhea, an ileostomy, colostomy or wound drainage not contained by a dressing.
- Remove gown before leaving room. Do not allow clothing to touch potentially contaminated surfaces or items before leaving the room.

PATIENT TRANSPORT



- Limit transport of patient to essential purposes only.
- During transport, ensure precautions are maintained to minimize risk of transmission of organisms.

PATIENT CARE EQUIPMENT



- Reserve non-critical patient care equipment for use with a single patient if possible.
- Clean and disinfect any equipment shared among infected and non-infected patients after each use.

Adapted from: ETNA Communications 2000.

Note: HPs should be aware that vector-borne transmission refers to transmission by animal, including insect, vectors. Vector-borne transmission occurs when vectors such as mosquitoes, flies, rats and other vermin transmit microorganisms.

CHAPTER FOUR

4. HAND HYGIENE

4.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define the terms hand hygiene and hand washing
- List indications for hand hygiene
- Differentiate different hand hygiene techniques
- Explain how to improve hand hygiene
- Discuss other issues of considerations related to hand hygiene

4.2 Definitions

4.2.1 Hand Hygiene

Hand hygiene practices (handwashing, handrub and surgical hand scrubbing) are intended to prevent hand-borne infections by removing dirt and debris and inhibiting or killing microorganisms on skin. This includes not only most of the organisms acquired through contact with patients and the environment (transient), but also some of the permanent ones that live in the deeper layers of the skin (resident).

Hand hygiene includes care of hands, nails and skin. It significantly reduces the number of disease-causing microorganisms on hands and can minimize cross-contamination (e.g., from HP to patient) and is a key component in minimizing the spread of disease and in maintaining an infection-free environment. Hence, failure to perform appropriate hand hygiene is considered to be a leading cause of nosocomial infections.

4.2.2 Hand Washing

This is a process which mechanically removes soil and debris from skin and reduces the number of transient microorganisms.

Remember: If tap water is contaminated, use water that has been boiled for 10 minutes and filtered to remove particulate matter (if necessary), or use chlorinated water—water treated with a dilute bleach solution (sodium hypochlorite) to make the final concentration 0.001%.

4.3 When to Perform Hand Hygiene

HAND HYGIENE should be done before:

- Examining (direct contact with) a patient/client; and
- Putting on **sterile** surgical gloves prior to any invasive or surgical procedure, or examination gloves for routine procedures such as a pelvic examination

HAND HYGIENE should be done after:

- Any situation in which hands may become contaminated, such as:
 - handling soiled instruments and other items;
 - touching mucous membranes, blood or other body fluids (secretions or excretions); and
 - having prolonged and intense contact with a patient.
- Removing gloves.

Remember: Hands should be washed with soap and clean water (or an antiseptic handrub can be used) after removing gloves because the gloves may have tiny holes or tears, and bacteria can rapidly multiply on gloved hands due to the moist and warm environment within the glove.

4.4 Hand Hygiene Techniques

4.4.1 Hand Washing

This is a process which mechanically removes soil and debris from skin and reduces the number of transient microorganisms. Handwashing with plain soap and clean water is as effective in cleaning hands and removing transient microorganisms as washing with antimicrobial soaps and causes less skin irritation.

Steps:

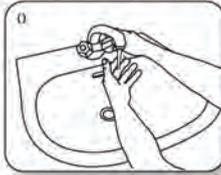
- Thoroughly wet hands.
- Apply a handwashing agent (liquid soap); an antiseptic agent is not necessary.
- Vigorously rub all areas of hands and fingers for 10–15 seconds (tip: 10 average breaths), paying close attention to fingernails and between fingers.
- Rinse hands thoroughly with clean running water from a tap or bucket.
- Dry hands with paper towel or a clean, dry towel or air dry them.
- Use a paper towel or clean, dry towel when turning off water if there is no foot control or automatic shut off.

Note:

- If bar soap is used, provide small bars and soap racks that drain.
- Use running water and avoid dipping hands into a basin containing standing water; even with the addition of an antiseptic agent, microorganisms can survive and multiply in these solutions.
- Do not add soap to a partially empty liquid soap dispenser. This practice of “topping off” dispensers may lead to bacterial contamination of the soap.
- When soap dispensers are reused, they should be thoroughly cleaned before filling.
- When no running water is available, use a bucket with a tap that can be turned off to lather hands and turned on again for rinsing, or use a bucket and pitcher.
- Used water should be collected in a basin and discarded in a latrine if a drain is not available.

Figure 4-1. Handwashing Technique with Soap and Water

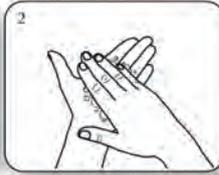
Handwashing Technique with Soap and Water



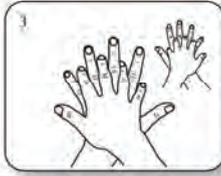
Wet hands with water



apply enough soap to cover all hand surfaces



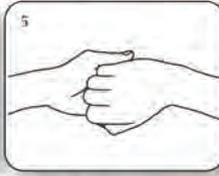
rub hands palm to palm



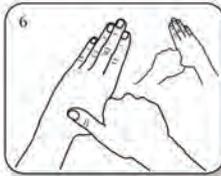
right palm over left dorsum with interlaced fingers and vice versa



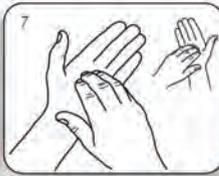
palm to palm with fingers interlaced



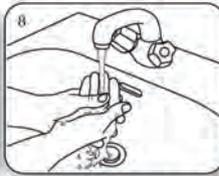
backs of fingers to opposing palms with fingers interlocked



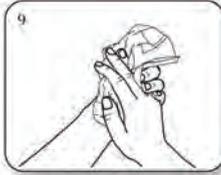
rotational rubbing of left thumb clasped in right palm and vice versa



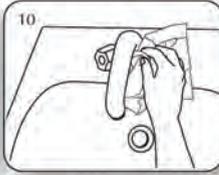
rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa



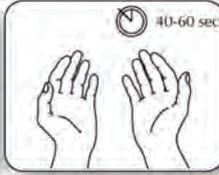
rinse hands with water



dry thoroughly with a single use towel



use towel to turn off faucet



...and your hands are safe.

Modified according to EN1500

Source: World Health Organization (WHO) 2005.

4.4.2 Hand Antisepsis

This process removes soil and reduces or slows the growth of both transient and resident flora on the hands.

The technique is similar to plain hand washing except that it involves use of an antimicrobial agent instead of liquid soap.

Hand antisepsis should be done **before**:

- Examining or caring for highly susceptible patients (e.g., premature infants, elderly patients, those with advanced AIDS);
- Performing an invasive procedure such as placement of an intravascular device; and
- Leaving the room of patients on contact precautions (e.g., flu, hepatitis A or E) or who have drug resistance infections (e.g., methicillin-resistant *S. aureus* [MRSA]).

Even where there is no running water, handwashing is possible and is required.

If there is no running water, consider using a:

- Bucket with a tap (see **Figure 4-2**)
- Pitcher or jug to pour water over hands
- Waterless, alcohol-based handrub solution

Drying hands after washing

Avoid using common towels: used or dirty towels may harbor microorganisms and contaminate hands even after proper handwashing.

- Use paper towels.
- Air dry hands.
- Use a small, personal towel that is replaced or cleaned when wet or dirty.
- Use a waterless, alcohol-based handrub.

4.4.3 Antiseptic Handrub

This process inhibits or kills transient and resident flora.

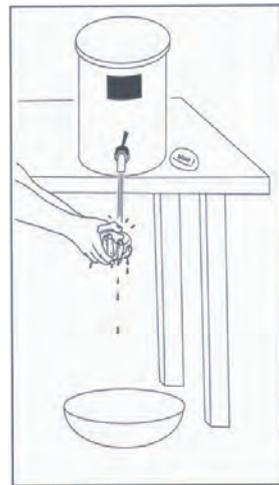
Use of a waterless, alcohol-based handrub product is more effective in killing transient and resident flora than antimicrobial hand washing agents or plain liquid soap and water.

This is quicker and easier to perform, and gives a greater initial reduction in hand flora when hands are not visibly soiled. These handrubs also contain a small amount of an emollient such as glycerine, which protects and softens skin. To be effective, an adequate amount of handrub solution should be used.

The technique for performing a waterless antiseptic handrub is:

- Apply enough alcohol-based handrub to cover the entire surface of hands and fingers (about a teaspoonful or 5 cc).

Figure 4-2. Bucket-tap



- Rub the solution vigorously over the hands (covering thumbs, palms and backs of hands including between fingers, tips of fingers and under nails) until thoroughly dry.

Since alcohol-based handrubs do not remove soil or organic matter, if hands are visibly soiled or contaminated with blood or body fluids, handwashing with soap and water should be done first. In addition, to reduce the “build up” of emollients on hands after repeated use of alcohol-based handrubs, washing hands with soap and water every 5–10 applications is recommended. Handrubs containing only alcohol as the active ingredient have limited residual effect (i.e., have limited ability to prevent growth of bacteria being applied) compared to those containing alcohol plus chlorhexidine.

Note: A non-irritating, waterless alcohol-based handrub can be made by adding 2 mL glycerine, propylene glycol or sorbitol to 100 mL alcohol (e.g., 2 mL of glycerine in 100 mL of 60–90% ethyl or isopropyl alcohol solution).

Figure 4-3. Hand Hygiene Technique with Alcohol-Based Handrub

Hand Hygiene Technique with Alcohol-Based Formulation



Modified according to EN1500

Source: World Health Organization (WHO) 2005.

4.4.4 Surgical Hand Scrub

The process mechanically removes soil, debris and transient organisms and to reduces resident flora prior to performing any invasive surgical procedure for the duration of the procedure. The goal is to prevent wound contamination by microorganisms from the hands and arms of the surgeon and assistants.

For many years, preoperative hand scrubbing protocols required at least a 6–10 minute vigorous scrub with a brush or sponge, using soap containing an antiseptic agent (chlorhexidine or an iodophor). This practice, however, has been shown to damage the skin and can result in increased shedding of bacteria from the hands. Several studies suggested that neither a brush nor a sponge is necessary to reduce the bacterial counts on hands of surgical staff to acceptable levels. For example, a 1–2 minute handwashing with 4% chlorhexidine or 7.5% povidone-iodine followed by application of an alcohol-based agent was shown to be as effective as a 5-minute hand scrub with an antiseptic soap. As a result, the guidelines for performing the general surgical scrub technique have been made less harsh and take less time to perform.

The steps of surgical hand scrub include:

- Remove rings, watches and bracelets.
- Thoroughly wash hands and forearms to the elbows with liquid soap and water.
- Clean under the nails.
- Rinse with clean, running water thoroughly.
- Apply an antiseptic agent.
- Vigorously scrub all surfaces of hands, fingers and forearms for at least 2 minutes.
- Rinse hands and arms thoroughly with clean water, holding hands higher than the elbows.
- Keep hands up and away from the body, do not touch any surface or article, and dry hands with sterile dry towel or air dry.
- Apply 5 mL (about 1 teaspoonful) of a waterless, alcohol-based handrub to hands, fingers and forearms and rub until dry; repeat application and rubbing two more times for a total of at least 2 minutes, using a total of about 15 mL (3 teaspoonfuls) of handrub.
- Put sterile surgical gloves on both hands.

Before entering operating theatre and starting surgical hand scrub preparation:

- Keep nails short.
- Do not wear artificial nails or nail polish.
- Remove all jewelry (rings, watches, bracelets) before entering the operating theatre.
- Wash hands and arms with a non-medicated soap before entering the operating theatre area or again if hands are visibly soiled.
- Clean under the nails. Use a soft brush, gauze or a toothpick. (Hard brushes should not be used as they may damage the skin and encourage shedding of cells.)
- Dry thoroughly with a clean, dry towel or air dry.

4.5 How to Improve Hand Washing Practices

- Provision of adequate water supply and liquid soap and antiseptics
- Provision of health facilities with running water
- Creating awareness of health workers of all health professions on the importance of improving hand washing practices through:
 - Wide dissemination of current guidelines for hand hygiene practices
 - Involvement of everybody at the health facility
 - Use successful educational techniques including monitoring and positive feedback
 - Use participatory performance improvement approaches targeted to all health care staff to promote compliance

4.6 Other Considerations Regarding Hand Hygiene

4.6.1 Hand Lotions and Hand Creams

While use of hand lotions, creams and moisturizers by HPs should be encouraged, it is recommended that the products be supplied in either small, individual-use containers that can be easily carried, or in pump dispensers that cannot be refilled, to reduce the possibility of their becoming contaminated. (To avoid confusion, these dispensers should not be located near dispensers of antiseptic solutions and should be clearly marked.) By contrast, oil-based barrier products, such as those containing petroleum jelly (Vaseline[®] or lanolin), should not be used because they damage latex rubber gloves.

4.6.2 Lesions and Skin Breaks

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

4.6.3 Fingernails

Research has shown that the area around the base of nails (subungual space) contains the highest microbial count on the hand. In addition, several recent studies have shown that long nails may serve as a reservoir for gram-negative bacilli (*P. aeruginosa*), yeast and other pathogens. Moreover, long nails, either natural or artificial, tend to puncture gloves more easily. As a result, it is recommended that nails be kept moderately short—not extending more than 3 mm (or 1/8 inch) beyond the fingertip.

4.6.4 Artificial Nails

Artificial nails (nail wraps, nail tips, acrylic lengtheners, etc.) worn by HPs can contribute to nosocomial infections. In addition, because there is evidence that artificial nails may serve as a reservoir for pathogenic gram-negative bacilli, their use by HPs should be restricted, especially by surgical team members, and those who:

- Work in specialty areas such as neonatal and intensive care units (ICUs),
- Care for patients highly susceptible to infection, or
- Manage patients who have infections with resistant organisms.

4.6.5 Nail Polish

Chipped nail polish supports the growth of larger numbers of organisms on fingernails compared to natural nails. Dark colored nail polish may prevent dirt and debris under fingernails from being seen and removed.

4.6.6 Jewelry

It is suggested that surgical team members and other healthcare providers not wear rings or bracelets because it may be more difficult for them to put on surgical gloves without tearing or contaminating them.

Note: The indications for hand hygiene are well-known, but guidelines for best practices continue to evolve. Current recommendations for HPs are:

- When skin is damaged or frequent handwashing is required, a milder, less irritating plain soap (without antiseptic agent) should be used to remove soil and debris.
- If antimicrobial action is desired and hands are not visibly dirty, an antiseptic handrub should be used, rather than washing hands with medicated antiseptic soap.
- For staff who frequently wash their hands (30 times or more per shift), hand lotions and creams should be provided in order to reduce irritation of the skin.

CHAPTER FIVE

5. PERSONAL PROTECTIVE EQUIPMENT

5.1 Objectives

At the end of this chapter, a healthcare provider should be able to:

- Define personal protective equipment (PPE)
- Explain the importance of using personal protective equipment when providing healthcare services
- Describe the various types of PPE and their uses
- Explain how PPE blocks the spread of microorganisms.

5.2 Definition

PPEs are mechanical barriers that help prevent the spread of microorganisms from person-to-person (patients, healthcare clients or health worker) and equipment, instruments and environmental surfaces to people. PPE includes: caps, eyewear, masks, aprons, gowns, gloves, scrub suits, drapes and boots or closed shoes.

Clients and HPs are the major source of microorganisms that cause infection following a surgical or other invasive procedure. Sources include people's hair and scalp, their skin, nose and mouth, blood and body fluids, and their hands.

It is important for healthcare providers to wear PPE, such as gloves, masks/respirators, eyewear (face shields, goggles or glasses), caps, gowns, mackintoshes, aprons, boots and other items whenever they are at risk of contact with contaminated materials or blood and body fluids. Managers are responsible for ensuring that healthcare facilities have adequate protective clothing for the staff.

For protection from blood and other body fluids (e.g., during a delivery or cesarean section) the HP should wear a plastic apron underneath the cotton cover gown. When fabric is used, it should be white or light in color to show dirt and contamination easily.

Remember: Caps, masks or drapes made from paper should never be reused because there is no way to properly clean them. *If you can't wash it, don't reuse it.*

5.3 Gloves

Gloves protect hands from infectious materials and protect patients from microorganisms on staff members' hands. They are the most important physical barriers for preventing the spread of infection, but they must be changed between each patient/client contact to avoid cross-contamination.

- Gloves are usually worn any time there is likely to be contact with mucous membranes, blood, body fluids, secretions or excretions during patient/client contact or when handling contaminated wastes or cleaning or disinfecting instruments, equipment and surfaces.
- Gloves should not be worn during routine procedures such as bed making, unless items or surfaces are contaminated.

Principles:

- All staff should wear appropriate gloves prior to contact with blood, body fluids, secretions or excretions from any patient/client.
- A separate pair of gloves must be used for each patient/client to avoid cross-contamination.
- It is preferable to use new and single-use (disposable) gloves.

Which types of gloves to use:

- **Disposable examination gloves** should be used for performing medical examinations and procedures such as pelvic exams or drawing blood.
- **Sterile surgical gloves** should be used for performing surgical or invasive procedures.
- **Clean, heavy-duty household (utility) gloves** should be used for cleaning instruments, equipment and contaminated surfaces and for housekeeping, laundry and mortuary tasks as well as for handling or disposing of contaminated waste.

Table 5-1. Glove Requirements for Common Medical and Surgical Procedures

TASK OR ACTIVITY	ARE GLOVES NEEDED?	PREFERRED GLOVES ^a
Blood pressure check	No	
Temperature check	No	
Injection	No	
Blood drawing	Yes	Exam ^b
IV insertion and removal	Yes	Exam ^b
Pelvic examination	Yes	Exam
Intrauterine device (IUD) insertion (loaded in sterile package and inserted using no-touch technique)	Yes	Exam
IUD removal (using no-touch technique)	Yes	Exam
Manual vacuum aspiration (using no-touch technique)	Yes	Exam
Norplant [®] implants insertion and removal	Yes	Sterile Surgical
Vaginal delivery	Yes	Sterile Surgical
Cesarean section or laparotomy	Yes	Sterile Surgical
Handling and cleaning instruments	Yes	Utility
Handling contaminated waste	Yes	Utility
Cleaning blood or body fluid spills	Yes	Utility/Exam

^a Although **sterile gloves** may be used for any surgical procedure, they are **not** always required. In some cases, examination gloves are equally safe and less expensive.

^b This includes new, "never" used individual or bulk-packaged examination gloves (as long as boxes are stored properly).

Adapted from: Tietjen, Cronin and McIntosh 1992.

5.3.1 Double Gloving

Even the best quality, new latex rubber surgical gloves may leak up to 4% of the time.¹ Moreover, latex gloves—especially when exposed to fat in wounds—gradually become weaker and lose their integrity.

Although double gloving is of little benefit in preventing blood exposure if needle sticks or other injuries occur, it may decrease the risk of blood-hand contact. The following are reasonable guidelines for when to **double glove**:

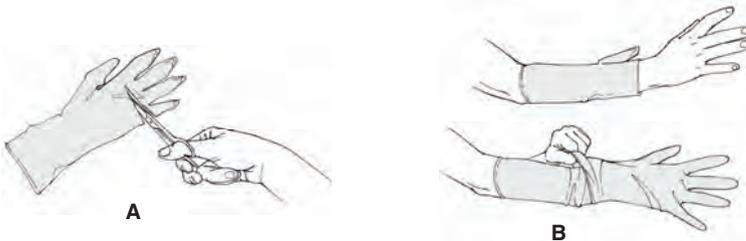
- The procedure involves coming in contact with large amounts of blood or other body fluids (e.g., vaginal deliveries and cesarean sections).
- Orthopedic procedures in which sharp bone fragments, wire sutures and other sharps are likely to be encountered.

In general, for surgical procedures that are short (30 minutes or less) and involve minimal exposure to blood or mucous secretions (e.g., laparoscopy or minilaparotomy), double gloving is probably not necessary.

Whether or not the surgeon, assistant or nurse should double glove should be considered carefully, especially in areas where the risk of contracting bloodborne pathogens, such as HIV, is high (>5% prevalence).

If you need **protection of forearm(s) you should use gauntlet gloves or if not available**, you can create a gauntlet glove from surgical gloves as shown below:

Figure 5-1. Creating Gauntlet Gloves from Surgical Gloves



Note: When using latex rubber gloves, do not use hand cream or lotions that contain mineral oil, petroleum jelly (Vaseline) or lanolin to protect your hands, because they may cause the gloves to break down within minutes.

5.3.2 Removing and Discarding Gloves

- Gloves shall be changed between patient care activities and procedures with the same patient.
- Gloves shall be removed before moving to another patient or after completion of a specific task.
- Remove gloves and dispose them into the appropriate container for contaminated waste.

¹ The “acceptable” leak rate for new surgical and examination gloves designated by regulatory agencies is up to 4% (Davis 2001).

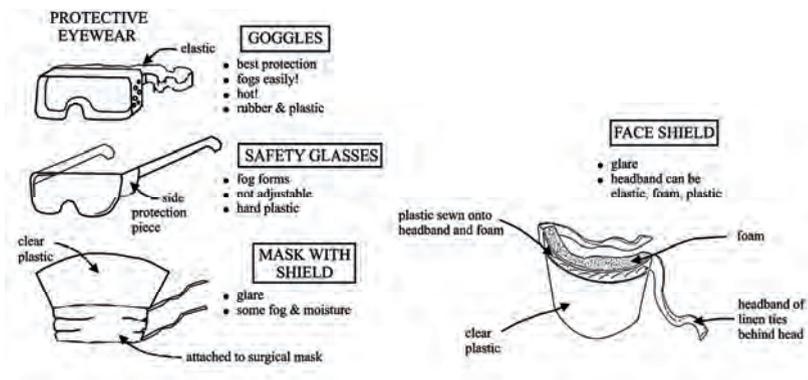
5.3.3 DOs and DON'Ts about Gloves

- Do wear the correct size glove, particularly surgical gloves. A poorly fitting glove can limit your ability to perform the task and may be damaged (torn or cut) more easily.
- Do change surgical gloves periodically during long cases as the protective effect of latex rubber gloves decreases with time and unapparent tears may occur.
- Do keep fingernails trimmed moderately short (less than 3 mm or 1/8 inch beyond the finger tip) to reduce the risk of tears.
- Do pull gloves up over cuffs of gown (if worn) to protect the wrists.
- Do use water-soluble (non fat-containing) hand lotions and moisturizers often to prevent hands from drying, cracking and chapping due to frequent handwashing and gloving.
- Don't use oil-based hand lotions or creams, because they will damage latex rubber surgical and examination gloves.
- Don't use hand lotions and moisturizers that are very fragrant (perfumed) as they irritate the skin under gloves.
- Don't store gloves in areas where there are extremes in temperature (e.g., in the sun, or near a heater, air conditioner, ultraviolet light, fluorescent light or X-ray machine). These conditions may damage the gloves (cause breakdown of the material they are made of), thus reducing their effectiveness as a barrier.

5.4 Eyewear

Eyewear protects staff in the event of an accidental splash of blood or other contaminated fluid by covering the eyes. Eyewear includes clear plastic goggles, safety glasses, face shields and visors. Glasses with plain lenses are also acceptable, if they have side shields attached. Masks and eyewear should be worn when performing any task during which an accidental splash into the face could occur (e.g., when performing cesarean section or vaginal delivery or when cleaning instruments) and when patients are on droplet precautions. If face shields are not available, goggles or glasses and a mask can be used together.

Figure 5-2. Eyewear



5.5 Masks

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

Respirators are specialized types of masks, called particulate respirators (such as N-95), which are recommended for situations in which filtering inhaled air is considered important (e.g., for the care of a person on airborne precautions). They contain multiple layers of filter material and fit the face tightly so that no air leaks around the mask when the HP breathes.

Figure 5-3. Particulate N-95 Respirators



Adapted from: World Health Organization (WHO) 2004.

5.6 Scrub Suits and Gowns

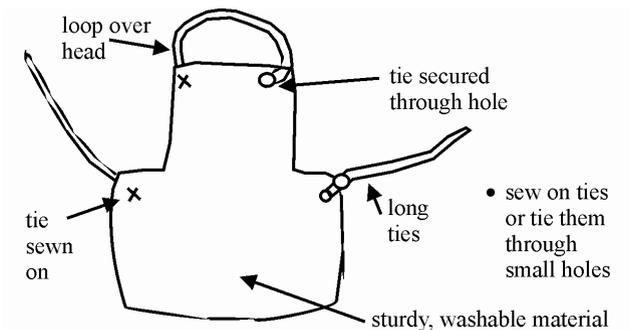
Scrub suits or covergowns are worn over, or instead of, street clothes. The main use of covergowns is to protect the HPs' clothing. A scrubsuit usually consists of drawstring pants and a shirt. A V-neck shirt must not be cut so low as to slide off the wearer's shoulders or expose men's chest hair.

Surgical gowns were first used to protect patients from microorganisms present on the abdomen and arms of the healthcare staff during surgery. Surgical gowns made of fluid-resistant materials do play a role in keeping blood and other body fluids off the skin of personnel, particularly in operating, delivery and emergency rooms. Lightweight cloth gowns offer little protection and do not provide an effective barrier because moisture can easily pass through them, allowing contamination. Jeans material (denim) or canvas, on the other hand, is too dense for steam penetration (i.e., cannot be sterilized), is difficult to wash and takes too long to dry. The HP can wear a plastic or rubber apron underneath the gown to prevent contact of the skin with blood and body fluids. If large spills occur, the best things to do is shower or bathe as soon after completing the procedure as possible.

5.7 Aprons

Mackintoshes or plastic aprons are usually used to protect clothing or skin from contamination. Aprons made of rubber or plastic provide a waterproof barrier along the front of the HP's body and should also be worn during procedures where the likelihood of splashes or spillage of blood, body fluids, secretions or excretions is likely (e.g., when conducting deliveries).

Figure 5-4. Apron



5.8 Footwear

Footwear is worn to protect feet from injury by sharp or heavy items or fluids that may accidentally fall or drip on them. For this reason, sandals, “thongs” or shoes made of soft materials (cloth) are not acceptable. Rubber boots or leather shoes are acceptable, but they must be kept clean and free of contamination from blood or other body fluid spills.

5.9 Drapes

Surgical drapes (sterile) made of cloth can be placed around a prepared surgical incision to create a work area. Although this area is often called the “sterile field,” it is **NOT** sterile. Cloth drapes allow moisture to soak through and can help to spread organisms from skin, even after surgical cleansing with an antiseptic agent, into the incision. Thus, neither sterile gloved hands nor sterile or high-level disinfected instruments and other items should touch drapes once they are in place. Using towel drapes to create a work area around the incision limits the amount of skin that needs to be cleaned and reminds the surgical team not to touch the patient.

Remember:

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

Table 5-5. Personal Protective Equipment

TYPE OF PPE	MUST BE USED FOR	PRIMARILY PROTECTS
Mackintosh or apron	Situations in which splashing or spillage of blood, body fluids, secretions or excretions is likely	Service provider
Closed boots or shoes (open sandals are not acceptable)	Situations involving sharp instruments or in which spillage of infectious agents is likely (e.g., deliveries, surgical procedures)	Service provider
Caps, gowns/scrub suits, masks, aprons, drapes	Invasive procedures in which tissue beneath the skin is exposed (e.g., surgical procedures)	Service provider and client
Goggles or glasses, masks, apron or mackintosh	Situations in which splashing of blood, body fluids, secretions or excretions is likely	Service provider
Masks	Situations that call for airborne or droplet transmission precautions	Service provider and client
Sterile drapes	Major or minor surgical procedures	Client (Note: They provide limited protection, as even sterile cloth drapes do not create a sterile field)

CHAPTER SIX

6. SAFE HANDLING OF SHARPS DURING PROCEDURES

6.1 Objectives

At the end of this chapter, a healthcare provider should be able to:

- Define sharps and safe injections
- Explain the importance of safe handling of sharps
- Describe the hands free technique

6.2 Definitions

6.2.1 Sharps

Sharp instruments include anything capable of puncturing the skin (scissors, needles, scalpels or blades, etc.).

In healthcare settings, injuries can occur easily from sharp instruments, especially during surgical procedures. Preventing injuries and exposure to infectious agent is mandatory.

6.2.2 Safe Injection

A safe injection is one that:

- Does not harm the client,
- Does not expose the provider to any avoidable risk, and
- Does not result in any waste material that is dangerous to the community.

6.2.3 Hands-Free Technique

The hands-free technique is a safer method of passing sharp instruments during surgical procedures.

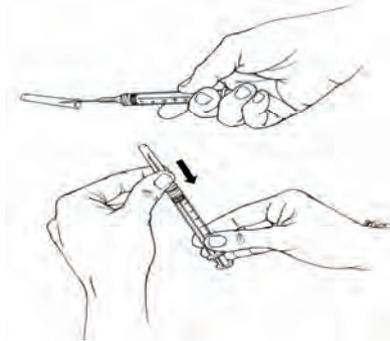
6.3 Safe Injection Practices

Instructions:

- Use each needle and syringe only once.
- Skin preparation for injections:
 - If the injection site is visibly soiled, wash the site with soap and water and dry with a clean towel, and then give the injection. According to the World Health Organization and its Safe Injection Global Network (SIGN), swabbing of clean skin—with an antiseptic solution—prior to giving an injection is not necessary. If swabbing with an antiseptic is done, use a clean, single-use swab and maintain product-recommended contact time. Do not use cotton balls stored wet in multi-use containers.
 - Clients receiving injections regularly (e.g., using Depo-Provera® for contraception) should be taught to wash the injection site (arm or buttock) with soap and clean water just prior to coming to the clinic or receiving the injection at their home.
- Dispose of the needle and syringe in a puncture-resistant container placed within arm's reach at point of use.

- Never leave a needle inserted in a vial cap (e.g. X-pen vial, chloramphenicol vial) to withdraw multiple doses.
- Precautions to take while handling injection equipment:
 - Always keep fingers behind the needle.
 - Do not disassemble the needle and syringe after use.
 - Do not recap, bend or break needles prior to disposal. If necessary, a one-handed recap method should be used, for example, after drawing blood using Vacutainer® or blood gas:
 - First, place the cap on a hard, flat surface and remove hand from the cap.
 - Next, hold the syringe with one hand and use the needle to “scoop up” the cap.
 - Finally, when the cap covers needle completely, use the other hand to secure the cap on the needle.
- Do not over-fill sharps containers—filling them more than three-quarters ($\frac{3}{4}$) full may cause needle stick injuries.

Figure 6-1. One-Handed Recap Method



Remember: Always keep fingers behind the needle.

6.4 Instructions for Hands-Free Technique

- The “hands-free” technique for passing sharp surgical instruments should always be used.
- A sterile kidney basin or other suitable container (safe or neutral zone) should be used.
- The container is placed on the sterile field between the surgeon or clinician and assistant.
- The assistant puts individual instruments in the container as they are needed.
- The surgeon or clinician takes them from the container, and returns them to the container after using them.

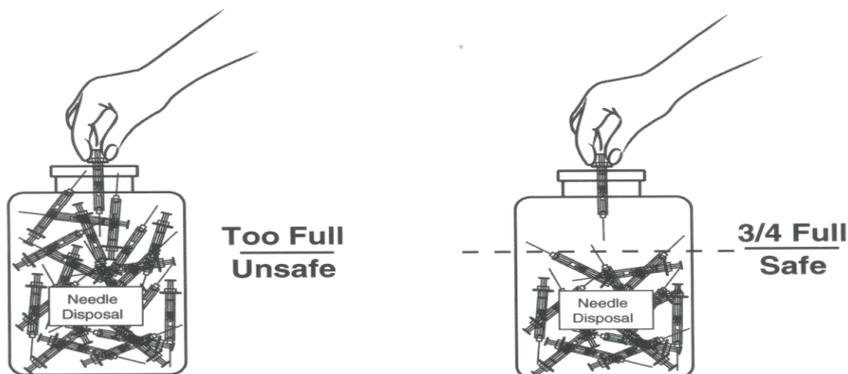
6.5 Sharps Disposal

The principle of sharps disposal is to prevent potential harm and transmission of disease from injury with a contaminated sharp object.

- Always dispose of sharps in a puncture-resistant container.
- Do not handle sharps carelessly—they should be disposed of directly, without manipulation (e.g., do not recap, remove or bend needles).
- Dispose of sharps immediately after use at the point of use.
- Ensure that sharps containers are readily available and conveniently located so that HPs do not have to carry sharp items any distance before disposal (preferably within arm’s reach).
- Sharps containers should be easy to see, recognize and use. Mark them clearly so that people will not unknowingly use them for disposing of garbage or discarding cigarettes.
- Don’t shake a container to settle its contents and make room for more sharps.
- Don’t place containers in high traffic areas (outside patient rooms or procedure rooms).
- Use only a puncture-resistant, disposable sharps container.
- Dispose of the sharps container as a whole unit (incinerate, bury or encapsulate).

Manufactured sharps containers are available in some healthcare settings and are the best solution for safe sharps disposal. A puncture-resistant container can be made from a readily available object such as a heavy cardboard box with an opening small enough to prevent someone from trying to remove the discarded sharp objects.

Figure 6-2. Safe Use of Sharps Containers



CHAPTER SEVEN

7. POST-EXPOSURE PROPHYLAXIS (PEP) GUIDELINES

7.1 Objectives

At the end of this chapter, a healthcare provider should be able to:

- Define post-exposure prophylaxis (PEP)
- Describe the common procedures presenting risk of exposure to blood and other body fluids
- Explain levels of risks of transmission of blood borne pathogens (HIV, HBV, HCV) for an exposed person
- Explain the roles and responsibilities of health facility management
- Explain six stages of PEP

7.2 Introduction

If a HP is exposed to blood or other body fluids, either by a needle stick/sharps injury or a splash to a mucous membrane, conjunctiva or non-intact skin, the person should be offered PEP. PEP is the management of this exposure.

7.3 Definition

Post-exposure prophylaxis is the immediate provision of medication following an exposure to potentially infected blood or other body fluids in order to minimize the risk of acquiring infection

7.4 The Risk of Transmission of HIV, HBV and HCV

The risk of transmission through percutaneous (needle stick) exposures from:

- HIV-positive patients is estimated at 0.3%
- Hepatitis B (HBV)-positive patients is estimated at 30–40%
- Hepatitis C (HCV)-positive is estimated at 0–10% (average 1.8%)

7.5 Body Fluids Known, Presumed and Not Known to be Infectious

Body fluids known to be infectious	Body fluids presumed to be infectious	Body fluids NOT known to be infectious (if not visibly bloody)
Blood Any fluid with blood Semen Vaginal secretions Breast milk	Cerebral spinal fluid Pleural fluid Pericardial fluid Peritoneal fluid Amniotic fluid Synovial fluid	Tears Saliva Urine Feces Sweat Emesis

Note: Consider any body fluid as infectious unless proven otherwise. The risk of transmission increases with larger volumes of fluid and more severe injuries.

7.6 Common Procedures Which Present a Risk of Exposure

The most common procedures presenting a risk of exposure to blood and other body fluids include the following:

- Taking blood samples from arteries or veins and samples of other body fluids
- Inserting an IV line and handling drips especially in emergency situations
- Activities related to surgery, particularly during major surgical interventions for long duration or where hemorrhage may occur
- The handling of blood or infectious body fluids by laboratory staff
- Activities related to handling, pre-disinfection/cleaning of contaminated medical devices
- Handling and disposal of infectious waste
- Providing injections/intravenous medication

7.7 Roles of Clinicians responsible for PEP

Clinicians responsible for PEP should assess the time of exposure, first aid measures taken and risk of HIV, HBV and HCV transmission following accidental exposure.

7.8 Factors influencing the risk of exposure

Factors that influence the risk of exposure are:

- The depth of the injury
- The size (caliber) of the needle
- Whether the needle/sharp object was visibly contaminated with blood
- Whether the procedure involved placing a needle directly in an artery or vein
- Whether the needle was a hollow bore needle or a solid needle
- Viral load of the source patient

The clinician should be able to judge whether the injury poses a high or low risk of HIV transmission.

For percutaneous exposure, high risk is associated with:

- A deep injury
- Large size needle
- Visible blood in the device (needle/other sharp object)
- Needle placed in patient artery or vein
- Hollow needle

Low risk is associated with:

- Superficial injury
- Small size needle
- No visible blood contamination
- Injury with solid needle or lancet

For exposure with mucous membranes and non-intact skin (e.g., skin with dermatitis, abrasions), high risk is associated with a large volume of blood or body fluid splashes. Low risk is associated with a small volume (drops) of blood or other body fluids.

7.9 Roles of Health Facility Management to Ensure Better Provision of PEP Services

In a health facility, the management should do the following to ensure better provision of PEP to health workers:

- Assign one person responsible for PEP and state clearly where a HP should report immediately following exposure.
- All staff including cleaners should be given information to ensure they know about PEP.
- Ensure PEP services are available for all 24 hours of each day, including weekends.
- When the person responsible for PEP is off duty, inform all who replaces him or her.
- Ensure that PEP drugs are always accessible by the person responsible for PEP.
- Guarantee confidentiality.

7.10 Steps to Follow Once a HP is Exposed to Blood and Other Body Fluids

The following are the steps to follow once a HP is exposed to blood or other body fluids:

7.10.1 PEP Step 1: Treatment of Exposure Site

- Wash with soap and water as soon as possible.
- Flush mucous membranes with clean water.
- Flush exposed eyes with a liter of clean water or normal saline solution.
- Get a tetanus immunization or booster, if indicated, for a needle stick (e.g., > 10 years since immunization).

Remember: The application of caustic agents (e.g., bleach) or disinfectants to the exposure site is not recommended and may do more harm than good. There is no evidence that squeezing a puncture site helps prevent infection or that the use of antiseptics is better than soap.

7.10.2 PEP Step 2: Report and Document

- The accident should be reported to a senior work supervisor immediately.
- An injury report form should be filled out as soon as possible.

7.10.3 PEP Step 3: Evaluate the Exposure

- HPs should be evaluated within 2 hours (rather than days) after their exposure and started on prophylaxis, if indicated, and not later than 72 hours after exposure.
 - If determined to be exposed to HIV, they should be counseled and tested for HIV; baseline testing and further follow-up of the exposed person is necessary.
 - Baseline testing of the exposed HP should include the following tests: Full blood count, liver function tests, renal function tests and pregnancy testing for female HP if the status is not known

- Exposed individuals who either are known to be HIV-positive or found to have positive results on HIV testing should not be offered prophylaxis. They should be referred to the care and treatment clinic (CTC) for long-term management of their HIV infection.
- The risk of HBV exposure should be assessed and the immune status of the client (e.g., history of jaundice, hepatitis, previous immunization with HBV vaccine) should be determined. If the status is unknown, continue assessment.

7.10.4 PEP Step 4: Evaluate the Exposure Source

- This should be started immediately after the HP has agreed to start PEP.
- If HIV status is unknown, perform HIV diagnostic testing after obtaining the person’s consent.
- Because most occupational HIV exposures occur at odd hours when counseling and HIV testing of the exposed person cannot be done, the initial PEP treatment should involve the use of the basic regimen.
- HPs should be referred to a PEP physician who will then decide whether to continue with PEP and will select the appropriate regimen.
- Do not test discarded needles or syringes for viral contamination.
- If the source person is not known, evaluate the exposure as though at high risk for infection.

7.10.5 PEP Step 5: Provision of Anti-Retroviral (ARVs) Drugs for PEP

A combination of time passed since exposure, magnitude of exposure, condition of a source person and HIV status of the exposed individual should guide a clinician to decide whether or not to start/continue the exposed person on prophylactic treatment and whether to provide dual or triple therapy.

PEP should be initiated as soon as possible, preferably within two (2) hours. PEP is not indicated for exposures that occurred more than seventy two (72) hours previously. The recommended regimen and drugs are shown below.

ARV regimen (number of drugs) for risk categories	
Risk category	ARV regimen
High risk	Triple therapy
Low risk	Dual therapy
Note: Nevirapine is not recommended for PEP.	

Recommended Drugs for PEP

For low-risk HIV exposures, a combination of Zidovudine (AZT) and Lamivudine (3TC) should be used. For exposures that pose a high risk for transmission, triple therapy is recommended as indicated below.

Two drug regimen

Zidovudine (AZT) 300 mg 12 hourly + Lamivudine (3TC) 150 mg 12 hourly for 4 weeks

Triple therapy regimen

Zidovudine (AZT) 300 mg 12-hourly + Lamivudine (3TC) 150 mg 12-hourly + Efavirenz® (EFV) 600 mg once at night for 4 weeks or combined Lopinavir (LPV)/Ritonavir® (i.e., LPV/r 133.3/33.3 mg) three caps 12-hourly.

(Efavirenz [EFV] is contraindicated in pregnancy, i.e., do a pregnancy test prior to use.)

Side Effects

All of the antiretroviral agents have been associated with side effects. Many of these can be managed symptomatically. Possible side effects are mainly gastrointestinal (e.g., nausea and vomiting), but malaise, fatigue and headache have also been reported.

Note: Refer to current NACP/MOHSW–National HIV/AIDS Care and Treatment Guidelines for more details and updates on ARV regimen for PEP, dosage, side effects and their management.

7.10.6 PEP Step 6: Follow-Up of HPs exposed to HIV

- HIV antibody testing should be performed for at least 6 months post-exposure (i.e., at 6 weeks, 12 weeks and 6 months) even if the HPs do not want PEP.
- If PEP is used, HPs should be monitored for drug toxicity by testing at baseline and again 2 weeks after starting PEP. Minimally, it should include a full blood picture, renal and hepatic function tests.
- Exposed HPs who choose to take PEP should be advised of the importance of completing the prescribed regimen.
- Counseling on possible HIV transmission during the follow-up period should be done. The exposed HP should be counseled about having safe sex (use of condoms) or abstinence.
- The exposed HP should not donate blood, plasma, organs, tissue or semen.
- Female HP should be counseled on FP methods and avoiding pregnancy for up to 6 months.
- Prophylaxis should be continued for 4 weeks, if tolerated.
- The exposed individual should be evaluated within 72 hours as additional information about the source is obtained including serologic status, viral load, current treatment, any resistance test results or information about factors that would modify recommendations.

Remember:

HIV—PEP should be:

- Initiated as soon as possible (within 2 hours)
- Administered for 4 weeks
- Discontinued if the source person is determined to be HIV-negative or the exposed person is HIV-positive

HBV—

- If HBV-susceptible, get hepatitis B immunoglobulin (HBIG) 5mL IM (intramuscularly) within 7 days of exposure, and also give the first dose of HBV vaccine, which should be repeated at 1 and 6 months.

HCV—

- There is no post-exposure vaccine or drug prophylaxis for hepatitis C (immunoglobulin is ineffective). Prevention of exposure, therefore, is the only effective strategy for prevention of HCV.

CHAPTER EIGHT

8. SKIN PREPARATION PRIOR TO SURGICAL PROCEDURES

8.1 Objectives

At the end of this chapter, a healthcare provider should be able to:

- Define the terms antiseptics and antisepsis
- Explain the reasons for skin preparation prior to surgical procedures
- Identify types of antiseptics and their uses
- Identify criteria for selection of antiseptics
- Describe the procedure for skin preparation
- Describe the procedures for cervical or vaginal preparations for minor procedures
- Explain the procedures for storing and dispensing of antiseptics

8.2 Definitions

8.2.1 Antiseptics

Antiseptics or antimicrobial agent (terms used interchangeably) are chemicals that are applied to the skin or other living tissue to inhibit or kill microorganisms (both transient and resident) thereby reducing the total bacterial count.

8.2.2 Antisepsis

Process of reducing the number of microorganisms on skin, mucous membranes or other body tissue by applying an antiseptic agent

8.3 Reasons for Skin Preparation

The reasons of use of antiseptics for skin preparations prior to surgical procedures are:

- Antiseptic solution minimizes the number of microorganisms around the surgical site that may contaminate the tissues or mucous membranes and cause infection.
- Antiseptics remove as many microorganisms as possible without damaging or irritating the skin or mucous membrane on which they are used
- Some antiseptic solutions have a residual effect, meaning their killing action continues for a period of time after they have been applied to skin or mucous membranes. Hence when such antiseptics are used, they should be left on the site for some time to act, e.g. when iodine is used, it should be left for at least 2 minutes to act.

8.4 Types of Antiseptics and Their Uses

8.4.1 Types of Antiseptics

- Alcohol-based solutions (tinctures) of iodine or chlorhexidine
- Alcohols (60–90% ethyl, isopropyl or “methylated spirit”)
- Chlorhexidine gluconate (2–4%) (e.g., Hibitane®, Hibiscrub®, Hibiclens®)
- Chlorhexidine gluconate and cetrimide, various concentrations at least 2% (e.g., Savlon®)

-
- Iodine (3%); aqueous iodine and alcohol-containing (tincture of iodine) products
 - Iodophors (7.5–10%), various other concentrations (e.g., Betadine®)
 - Chloroxylenol (Para-chloro-metaxylenol or PCMX) (0.5–3.75%), various other concentrations (e.g., Dettol®)
 - Triclosan (0.2–2%)

8.4.2 Uses of Antiseptics

Antiseptics are used for:

- Hand hygiene
- Skin preparation prior to surgical procedures
- In cervical or vaginal preparations
- Wound dressing

8.5 Criteria for Selection of antiseptics

The following is the selection criteria:

- It should be safe
- Its microbial activity should be known
- It should have instructions on how to use
- It should have a residual effect
- Should be cost effective
- Should be accepted by the government/Authority
- On disposal should not be hazardous to the community and environment
- Should be user friendly

Select the antiseptic solution based on their microbiologic activities and potential uses (see **Appendix 1**) from the following recommended products:

8.6 Instructions for Skin Preparation

- Do not shave hair around the operative site. Shaving increases the risk of infection because the tiny nicks in the skin provide an ideal setting for microorganisms to grow and multiply. If hair must be cut, trim the hair close to the skin surface with scissors immediately before surgery.
- Ask the patient about allergic reactions (e.g., to iodine preparations) before selecting an antiseptic solution.
- If the skin or external genital area is visibly soiled, gently wash it with soap and clean water and dry the area before applying the antiseptic.
- Do not allow the antiseptic to pool underneath the client's body; this can irritate or burn the skin.
- Using dry, sterile forceps and new cotton or gauze squares soaked in antiseptic, thoroughly cleanse the skin. Work from the operative site outward for several

centimeters. (A circular motion from the center out helps to prevent recontamination of the operative site with local skin bacteria.)

- Use sterile gauze or cotton swab/pad to clean the skin prior to surgery.
- Allow the antiseptic enough time to be effective before beginning the procedure. For example, when an iodophor is used, allow 2 minutes or wait until the skin is visibly dry before proceeding, because free iodine, the active agent, is only released slowly.

8.7 Instructions for Cervical or Vaginal Preparation for Minor Procedures

For cervical and vaginal antiseptics, prior to inserting a uterine elevator for minilaparotomy or doing an endometrial biopsy, select an aqueous (water-based) antiseptic such as an iodophor (povidone-iodine) or 2–4% chlorhexidine gluconate (e.g., Hibiclens) or Savlon if properly prepared. Do not use alcohols or alcohol-containing preparations, such as Dettol. Alcohols burn, and they also dry and irritate mucous membranes that in turn promote the growth of microorganisms. Remember, hexachlorophene (pHisoHex®) is neurotoxic and should not be used on mucous membranes, such as the vaginal mucosa, because it is readily absorbed.

- Ask the patient about **allergic reactions** (e.g., to iodine preparations) before selecting an antiseptic solution.
- If the external genital area is visibly soiled, gently wash it with soap and clean water and dry the area before applying the antiseptic.
- After inserting the speculum, apply antiseptic solution liberally to the cervix and vagina (two times). It is not necessary to swab the external genital area with antiseptic solution if it appears clean.
- If an iodophor is used, allow time (2 minutes) before proceeding.

8.8 Storing and Dispensing of Antiseptics

All antiseptics can become contaminated by microorganisms, which can then cause subsequent infection when used for handwashing or skin preparation. To prevent contamination of antiseptic solution:

- Use antiseptics in small quantities at a time.
 - If antiseptics are provided in large containers, pour a small quantity at a time into a smaller container for daily use.
 - Do not “top off” antiseptic dispensers.
- Never soak or store gauze or cotton wool in any antiseptic.
- Prepare fresh solutions regularly (at least weekly).
- Clean and thoroughly dry antiseptic containers before refilling.
- Antiseptic solutions should be stored in a cool, dark area. Never store them in direct sunlight or in excessive heat (e.g., upper shelves in a tin-roofed building).

CHAPTER NINE

9. PREVENTING INFECTIONS RELATED TO USE OF INTRAVASCULAR DEVICES

9.1 Objectives

By the end of this chapter a healthcare provider will be able to:

- Define intravascular devices
- Explain how pathogens may enter blood stream
- Explain techniques for reducing the risk of nosocomial infections (hospital-acquired or healthcare-related infections) associated with the use of intravascular devices
- Identify safe measures for changing fluids and infusion sets

9.2 Definition

Intravascular devices include butterflies, needles, cannulae and central venous catheters—both venous and arterial—to deliver sterile fluids, medications and nutritional products. They can also monitor blood pressure and other hemodynamic functions presents a risk for local and systemic bloodstream infections.

Most infections are caused by contamination with organisms from the patient’s skin or the HP’s hands during insertion with the IV device, providing a direct path to the bloodstream.

9.3 Ways of How Pathogens May Enter Blood Stream

Once the intravascular device is inserted, pathogens can be transferred into the bloodstream in four ways:

1. By traveling along the device at the insertion site (pathogens on the skin),
2. Through contamination of the hub (connection site of the device used),
3. Through contaminated infusion fluid, and
4. Through the bloodstream from another site of infection.

The risk of infection associated with the use of intravascular devices can be reduced by following recommended infection prevention practices related to their insertion (the use of aseptic technique) and by better management of the device once it is in place.

9.4 Techniques for Reducing the Risk of Nosocomial Infections Associated with the Use of Intravascular Devices

9.4.1 Hand Hygiene and Gloves

- Wash hands or use an antiseptic alcohol handrub before touching any of the IV set components.
- Use clean examination gloves or surgical gloves, which should be put on prior to insertion or just before touching the insertion site or the hub of the needle or catheter.
- Wash hands with soap and water after removing gloves.

9.4.2 Site Care and Dressings

- If the site for inserting the intravascular device is visibly dirty, wash it with soap and clean water and dry it before applying the skin antiseptic.
- Use 2% chlorhexidine gluconate, 10% povidone-iodine or 60–90% alcohol for skin preparation. If using povidone-iodine as the antiseptic agent, allow it to dry after applying or wait at least 2 minutes before insertion.
- Transparent, adherent dressings allow inspection of the site, act as tape to hold the intravascular device or needle, and may be more comfortable.
- Dressings can be left in place for up to 72 hours if they are kept dry. (They should be changed immediately if they get wet, soiled or loose.)
- Gauze and tape dressings need to be changed if inspection of the site is necessary.
- The intravascular device sites should be gently palpated daily for tenderness.

Remember:

- If the patient develops tenderness or fever without an obvious cause, inspect the insertion site of the intravascular device.
- Applying antimicrobial ointment around the insertion site does not reduce the risk of infection.

9.4.3 Peripheral Catheters (Venous and Arterial)—Site Selection and Change

- For adults, hand veins are preferred over arm veins, and arm veins over leg and foot veins. (Needles and intravascular devices inserted in leg and foot veins are more likely to cause inflammation at the insertion site or phlebitis.)
- Changing sites at 72–96 hours will reduce phlebitis and local infection.
- If only short-term (less than 48 hours) IV infusion is planned, straight or butterfly needles are less irritating than plastic intravascular catheters and have lower rates of infection.
- Because straight and butterfly needles frequently infiltrate, they should not be used with solutions that could cause tissue necrosis.

9.4.4 Central Venous Catheters—Site Care and Dressings

- If the site for inserting the catheter is visibly dirty, wash it with soap and clean water and dry it before applying the antiseptic.
- Insertion should be done using full barrier precautions (sterile gloves, gown, mask and site drapes) in a procedure area, not at the bedside.
- Use 2–4% chlorhexidine gluconate with alcohol, 10% povidone-iodine or 60–90% alcohol for skin preparation.

9.5 Changing fluids and infusion (administration) sets

9.5.1 Fluids

- Change infusion bottles or plastic bags with parenteral solutions every 24 hours.
- Change infusion bottles or plastic bags with lipid emulsion given alone within 12 hours.

9.5.2 Infusion (Administration) Sets

- These sets, including piggybacks, should be changed whenever they are damaged and at 72 hours routinely. (If the tubing becomes disconnected, wipe the hub of the needle or catheter with 60–90% alcohol and connect it to a new infusion set.)
- Tubing used to administer blood, blood products or lipid emulsions should be replaced within 24 hours.

Note:

- During insertion, do not allow blood to drip out on the patient's hand, forearm, bed or floor!
- Do not insert a needle as a vent into the infusion bag.
- The tourniquet should be washed with soap and water, rinsed and dried whenever visibly soiled, and wiped with 0.5% chlorine solution or 60–90% alcohol between patients.
- Carefully write the date and time of placement of the IV line and needle size on the dressing.

CHAPTER TEN

10. PREVENTING CATHETER-RELATED URINARY TRACT INFECTIONS

10.1 Objectives

At the end of this chapter a healthcare provider will be able to;

- Define urinary bladder catheterization
- List indications for urinary bladder catheterization
- Explain tips for preventing infections in catheterized patients

10.2 Definition

Placement of an indwelling urinary catheter should be performed only when other methods of emptying the bladder are not effective. Remove the urinary catheter as soon as it is not needed in order to prevent a urinary tract infection.

10.3 Accepted Indications for Catheterization

- For short-term management of incontinence (the inability to control urination) or retention (the inability to pass urine) not helped by other methods
- To measure urine output over several days in critically ill patients
- To instill medications
- For treatment of urinary outlet obstruction (blockage of the tube leading from the bladder to the outside, the urethra)
- For postoperative management of surgical patients with impaired bladder function (the most common routine use)

Other methods for management of urinary tract problems include: intermittent catheterization using a reusable “red rubber” straight catheter, condom catheters for male patients, adult diaper pads and bladder retraining.

Remember: Indwelling catheters should not be used for the long-term management of incontinence.

10.4 Tips for Preventing Infections in Catheterized Patients

- Remove the catheter as soon as possible.
- Ensure that the catheter collection system remains closed and is not opened.
- Caution the patient against pulling on the catheter.
- Check urine flow through the catheter several times a day to ensure that the catheter is not blocked.
- Avoid raising the collection bag above the level of the bladder.
- If it becomes necessary to raise the bag above the level of the patient’s bladder during transfer of the patient to a bed or stretcher, clamp the tubing.
- Before the patient stands up, drain all urine from the tubing into the bag.

-
- Empty the urine drainage (collection) bags aseptically through the emptying tube (port exit); do not touch the tip of the emptying tube to the side of the collection vessel, and do not permit the tip to touch the urine in the vessel.
 - If the drainage tubing becomes disconnected, do not touch the ends of the catheter or tubing. Wipe the ends of the catheter and tubing with an antiseptic solution before reconnecting them.
 - Do not allow the urine bag to touch or rest on the floor.
 - Wash the head of the penis and urethral opening for men or the perineal area and urethral opening for women after a bowel movement.
 - If frequent irrigation is required, change the catheter.

Note: Applying antiseptics (e.g., an iodophor such as Betadine[®]) or topical antibiotics to the perineal area (the urethral area for women and the head of the penis in men) does not reduce the risk of catheter-associated urinary tract infections.

Remember: Whenever a patient has an indwelling catheter in place, infection, including gram-negative septicæmia, can occur, so check daily for signs of infection—back or flank pain, cloudy urine or fever.

CHAPTER ELEVEN

11. INSTRUMENT PROCESSING

11.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define the terms used in processing instruments: decontamination, cleaning, high level disinfection (HLD) and sterilization
- Explain key steps in processing instruments
- Demonstrate ability to prepare dilute chlorine solution from the concentrated liquid or powder form

11.2 Definitions

11.2.1 Decontamination

A process that makes inanimate objects **safer** to handle by staff **before** cleaning (i.e., inactivates HBV, HCV and HIV and reduces the number of other microorganisms but does not eliminate them).

11.2.2 Cleaning

A process that physically removes all visible dust, soil, blood or other body fluids from inanimate objects as well as removing sufficient numbers of microorganisms to reduce risks for those who touch the skin or handle the object. It consists of thoroughly washing with soap or detergent and water, rinsing with clean water and drying.

11.2.3 Sterilization

Process that eliminates **all** microorganisms (bacteria, viruses, fungi and parasites) **including** bacterial endospores from inanimate objects by high-pressure steam (autoclave), dry heat (oven), chemical sterilants or radiation.

11.2.4 High-level disinfection (HLD)

Process that eliminates **all** microorganisms **except some** bacterial endospores from inanimate objects by boiling, steaming or the use of chemical disinfectants.

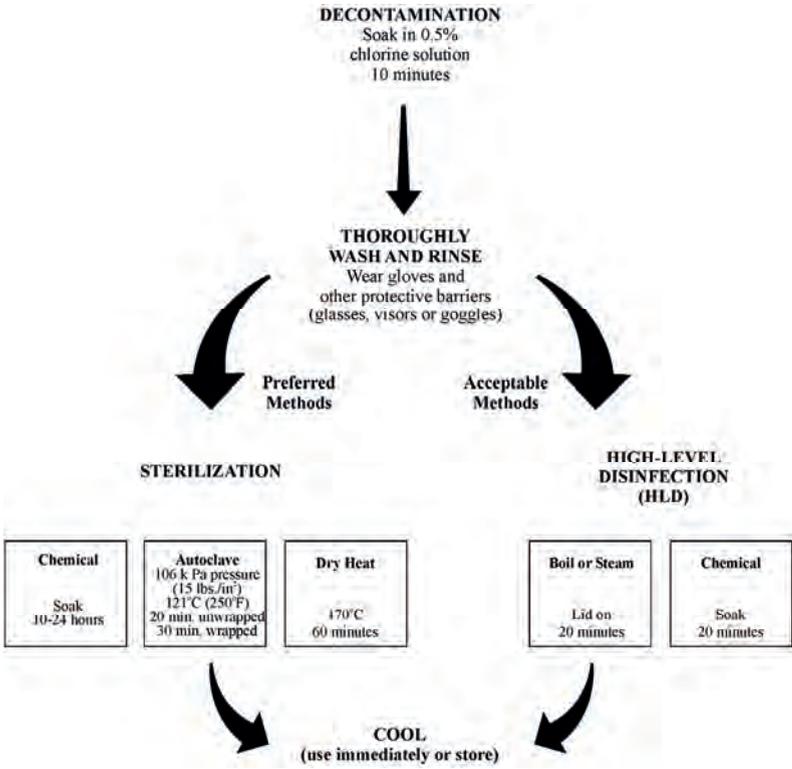
11.2.5 Disinfectant

A chemical that destroys or inactivates microorganisms on inanimate objects and surfaces.

11.3 Key Steps in Processing Instruments

The basic infection prevention processes recommended to reduce disease transmission from soiled instruments and other reusable items are **decontamination, cleaning** and either **sterilization** or **HLD**. Regardless of the type of operative procedure, the steps in processing surgical instruments and other items are the same. The steps are illustrated in **Figure 11-1**.

Figure11-1. Key Steps in Processing Contaminated Instruments and Other Items



11.3.1 Decontamination

Decontamination is the first step in handling used instruments and other items. It is important to decontaminate instruments and objects that may have been in contact with blood or body fluids so that they are safer to handle by personnel who will clean them. Immediately after use, all instruments should be placed in an approved disinfectant such as 0.5% chlorine solution for 10 minutes to inactivate most organisms, including HBV, HCV and HIV.

After completing a procedure:

- Leave on surgical or examination gloves post-procedure or put on utility gloves.
- Place all instruments in 0.5% chlorine solution* for 10 minutes for decontamination immediately after completing the procedure, making sure that all are submerged in the solution.
- Remove surgical gloves by turning inside out and dispose of gloves in a leakproof waste container or heavy-duty plastic bag.

* Do not mix chlorine solutions with either formaldehyde or with ammonia-based solutions because a toxic gas may be produced.

- Cover the decontamination container.
- Using utility gloves, clean all surfaces contaminated during the procedure by wiping them with a cloth soaked in 0.5% chlorine solution.
- Remove instruments from 0.5% chlorine solution after 10 minutes and immediately take them for cleaning.
- Change the decontamination solution daily, or more often if necessary (change when it becomes dirty).

Decontamination Tips

- Use a plastic, non-corrosive container for decontamination to help prevent:
 - dulling of sharps (e.g., scissors) due to contact with metal containers, and
 - rusting of instruments due to a chemical reaction (electrolysis) that can occur between two different metals (i.e., the instrument and container) when placed in water.
- Do not soak metal instruments that are electroplated (i.e., not 100% stainless steel) even in plain water for more than an hour because rusting will occur.

How to make a 0.5% chlorine solution for decontamination

A 0.5% chlorine solution can be made from readily available liquid or powder chlorine.

Liquid concentrate:

- Determine the concentration (% concentrate) of the chlorine solution.
- Determine total parts of water needed (use formula below).

Formula for Making a Dilute Solution from a Concentrated Solution

Check concentration (% concentrate) of the chlorine product you are using.

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

Mix 1 part concentrated bleach with the total parts water required.

Example: Make a dilute solution (0.5%) from 3.5% concentrated solution:

STEP 1: Calculate TP water: $\left[\frac{3.5\%}{0.5\%} \right] - 1 = 7 - 1 = 6$

STEP 2: Take 1 part concentrated solution and add to 6 parts water.

Table 11-1. Preparing Dilute Chlorine Solutions from Liquid Bleach (Sodium Hypochlorite Solution) for Decontamination and HLD

CHLORINE % AVAILABLE	PARTS OF WATER TO 1 PART OF BLEACH ^a	
	0.5%	0.1% ^b
2.4%	4	23
3.5%	6	34
3.6%	6	35
5%	9	49
6%	11	59
8%	15	79
10%	19	99
15%	29	149

^a Read as one part (e.g., cup or glass) concentrated bleach to x parts of water (e.g., JIK [0.5% solution]—mix 1 cup bleach with 6 cups water for a total of 7 cups).
^b Use boiled water when preparing a 0.1% chlorine solution for HLD because tap water contains microscopic organic matter that inactivates chlorine.

Adapted from: World Health Organization (WHO) 1989.

Powder concentrate:

- Determine the concentration (% concentrate) of the powder you are using.
- Determine grams of bleach needed (use formula below).

Formula for Making Chlorine Solutions from Dry Powders

Check concentration (% concentrate) of the powder you are using.

$$\text{Grams/Liter} = \left[\frac{\% \text{ Dilute}}{\% \text{ Concentrate}} \right] \times 1000$$

Mix measured amount of bleach powder with 1 liter of water.

Example: Make a dilute chlorine-releasing solution (0.5%) from a concentrated powder (35%).

STEP 1: Calculate grams/liter: $\left[\frac{0.5\%}{35\%} \right] \times 1000 = 14.2 \text{ g / L}$

STEP 2: Add 14.2 grams (14 g) to 1 liter of water.

Table 11-2. Preparing Dilute Chlorine Solutions from Dry Powders

AVAILABLE CHLORINE	GRAMS OF CHLORINE POWDER/ LITRE REQUIRED	
	0.5%	0.1% ^b
Calcium hypochlorite (70% available chlorine)	7.1 g/L ^a	1.4 g/L
Calcium hypochlorite (35% available chlorine)	14.2 g/L	2.8 g/L
NaDCC ^c (60% available chlorine)	8.3 g/L	1.5 g/L
Chloramine tablets ^d (1 g of available chlorine per tablet)	20 g/L (20 tablets/liter) ^d	4 g/L (4 tablets/liter) ^d
NaDCC-based tablets (1.5 g of available chlorine per tablet)	4 tablets/liter	1 tablet/liter

^a For dry powders, read x grams per liter (example: Calcium hypochlorite 7.1 grams mixed with 1 liter water).

^b Use boiled water when preparing a 0.1% chlorine solution for HLD because tap water contains microscopic organic matter that inactivates chlorine.

^c Sodium dichloroisocyanurate

^d Chloramine releases chlorine at a slower rate than does hypochlorite. Before using the solution, be sure the tablet is completely dissolved.

Adapted from: World Health Organization (WHO) 1989.

Remember: The objective of **decontamination** is to help protect individuals who handle—prior to cleaning—instruments and other items that have been in contact with blood or body fluids from serious diseases such as HBV, HCV and AIDS.

Once instruments and other items have been decontaminated, they can safely be further processed. This consists of cleaning and finally either sterilization or HLD.

11.3.2 Cleaning

Cleaning is important because it is an effective way to reduce the number of microorganisms, especially endospores that cause tetanus, on soiled instruments and equipment. Neither sterilization nor HLD is effective without prior cleaning.

Use of soap is important for effective cleaning because water alone will not remove protein, oils and grease.

- Liquid soap is preferred because it mixes more easily with water than bar or powdered soaps. In addition, liquid soap breaks up and dissolves or suspends grease, oil and other foreign matter in solution so that they can be removed more easily by the cleaning process.

Remember: If an item cannot be cleaned, it cannot be reused and should be discarded.

- Instruments should be washed with a soft brush in soapy water to remove all foreign matter—until they are visibly clean.
- Do not use abrasive cleaners (e.g., Vim[®] or Comet[®]) or steel wool as these products can scratch plastic or pit metal or stainless steel. These scratches then become a nesting place for microorganisms, making cleaning more difficult, as well as increasing corrosion (rusting) of the instruments.

- Thorough rinsing removes any soap residue, which can interfere with sterilization or HLD. After rinsing, items should be dried, especially if they will be sterilized or high-level disinfected using chemicals. Water on the instruments will dilute the solution and may cause the process to fail.

As shown in the table below, scientific studies have demonstrated that most microorganisms (up to 80%) in blood and other organic material are removed during the cleaning process. This confirms that thorough cleaning is effective and documents the importance of cleaning in producing a safe product for use during invasive procedures.

Table 11-3. Effectiveness of Methods for Processing Instruments

METHOD	EFFECTIVENESS	RECOMMENDED END TIME
Decontamination	Kills HBV and HIV and most microorganisms	10 minute soak
Cleaning (water only)	Up to 50%	Until visibly clean
Cleaning (soap and rinsing with water)	Up to 80%	Until visibly clean
Sterilization	100%	High-pressure steam, dry heat or chemical for recommended time
High-Level Disinfection	95% (does not inactivate some endospores)	Boiling, steaming or chemical for 20 minutes

Cleaning Tips

- Wear gloves while cleaning instruments and equipment. (Thick household or industrial gloves work well.) If torn or damaged, they should be discarded; otherwise they should be cleaned and left to dry at the end of the day for use the following day.
- Wear protective eyewear (plastic visors, face shields or goggles/glasses) and a plastic apron while cleaning instruments and equipment.
- Wash instruments with a soft brush (a toothbrush works well) in soapy water. Particular attention should be paid to instruments with teeth, joints or screws where organic material can collect. Special care should also be taken with rubber or plastic instruments (e.g., cannulae), to ensure that they do not get scratched. After cleaning, instruments should be thoroughly rinsed with clean water to remove soap residue that can interfere with chemical disinfectants used for HLD or sterilization.
- Cleaning thermometers:
 - Wipe with decontamination solution.
 - Wash with soap and water.
 - Rinse with clean water.
 - Towel or air dry.

Remember: Oral and rectal thermometers should never be mixed, even after cleaning. Keep them in separate containers.

11.3.3 Sterilization

Sterilization destroys all microorganisms, including bacterial endospores. It should be used for instruments and other items that come in direct contact with the blood stream or normally sterile tissues. Bacterial endospores are particularly difficult to kill because of their tough coating. Bacteria that form endospores include the clostridia species, which cause tetanus and gangrene.

Sterilization can be achieved by high-pressure steam (autoclave), dry heat (oven) or chemical sterilants, such as glutaraldehydes or formaldehyde solutions, or physical agents (radiation). Because sterilization is a process, not a single event, all components of this process must be carried out correctly for sterilization to occur.

Remember: Although flaming (rinsing an item with alcohol and lighting it) sometimes is viewed as a sterilization method, it is not effective.

Sterilization Using an Autoclave

High-pressure steam sterilization is the most inexpensive and effective method of sterilization, but is also the most difficult to do correctly. It is generally the method of choice for sterilizing instruments and other items used in healthcare facilities. Do not put plastic or rubber instruments or equipment in the autoclave unless the manufacturer's instructions say it is safe, as they will melt. Where electricity is a problem, instruments can be sterilized in a non-electric steam sterilizer using kerosene or other fuel as a heat source.

- Double wrap instruments in freshly laundered cloth or paper using envelope or square wrap technique.
- Arrange instrument packs on an autoclave cart or shelf; place in autoclave chamber to allow free circulation and penetration of steam to all surfaces.
- Sterilize wrapped items for 30 minutes. Time with clock at 121°C (250°F) and 106 kPa (15 lbs/in²).
- Wait until pressure gauge reads zero before opening lid or door 14–16 cm (5–6 inches); this may take 20–30 minutes.
- Allow packs to dry completely before removal; this may take up to 30 minutes; if damp or wet packs come in contact with any non-sterile item, they must be re-processed.
- Place sterilized packs on a surface padded with paper or fabric to prevent condensation.
- Allow packs to reach room temperature before storing them.
- Record sterilization conditions (time, temperature and pressure) in logbook.
- Monitor each load with mechanical (time, temperature and pressure) and chemical (internal and external chemical test strips) indicators.
- Test autoclaves daily with an air-removal test (Bowie-Dick Test) to ensure air removal.
- Test autoclaves weekly using a commercially available biological indicator.

Remember: Steam sterilization (Gravity): Temperature should be 121°C (250°F); pressure should be 106 kPa (15 lbs/in²); 20 minutes for unwrapped items; 30 minutes for wrapped items. Or at a higher temperature of 132°C (270°F), pressure should be 30 lbs/in²; 15 minutes for wrapped items. Allow all items to dry before removing them from the sterilizer.

Note: Pressure settings (kPa or lbs/in²) may vary slightly depending on the sterilizer used. When possible, follow manufacturers' recommendations.

Sterilization Using Dry Heat Oven

Dry-heat sterilization is accomplished by thermal (heat) conduction. Initially, heat is absorbed by the exterior surface of an item and then passed to the next layer. Eventually, the entire object reaches the temperature needed for sterilization. Death of microorganisms occurs with dry heat by a process of slow destruction of protein. Dry-heat sterilization takes longer than steam sterilization, because the moisture in the steam sterilization process significantly speeds up the penetration of heat and shortens the time needed to kill microorganisms.

Dry heat:

- 170°C (340°F) for 1 hour (total cycle time—placing instruments in oven, heating to 170°C, timing for 1 hour, and then cooling—is from 2–2.5 hours), or
- 160°C (320°F) for 2 hours (total cycle time is from 3–3.5 hours).
- Place metal instruments or glass syringes in a metal container with a lid; close the lid.
- Do not put plastic or rubber instruments or equipment in the dry heat oven unless the manufacturer's instructions say it is safe, as they will melt
- Place covered containers in oven and heat to desired temperature.
- After the desired temperature is reached, begin timing. The following temperature/time ratios are recommended:

170°C (340°F)	60 minutes
160°C (320°F)	120 minutes
150°C (300°F)	150 minutes
140°C (285°F)	180 minutes

- After cooling, remove containers and store.

Remember:

- Exposure time begins only after the sterilizer has reached the target temperature.
- Do not overload the sterilizer. (Leave at least 7.5 cm [3 inches] between the items and walls of sterilizer.) Overloading alters heat convection and increases the time required to sterilize.

Chemical Sterilization

An alternative to high-pressure steam or dry-heat sterilization is chemical sterilization (often called “cold sterilization”). If objects need to be sterilized, but using high-pressure steam or dry-heat sterilization would damage them or equipment is not available (or operational), they can be chemically sterilized.

- Prepare fresh solution of chemical sterilant as prescribed by the manufacturer and check to be sure solution is not out of date.

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- Submerge cleaned and dried items in 2–4% glutaraldehyde (e.g., Cidex®) or 8% formaldehyde* solution, completely covering all items.
 - Cover container and soak for appropriate time (8–10 hours for glutaraldehyde or at least 24 hours for formaldehyde).
 - Remove items from the chemical solution using sterile gloves or a sterile forceps/pickups.
 - Rinse items thoroughly with sterile water to remove all traces of chemical sterilant.
 - Use the item immediately or place it in a sterile, covered container.

11.3.4 High-Level Disinfection

Although sterilization is the safest and most effective method for the final processing of instruments, when sterilization is not possible or not indicated, HLD is the only acceptable alternative for processing instruments that will be reused. The HLD process destroys all microorganisms (including vegetative bacteria, tuberculosis, yeasts and viruses) except some bacterial endospores.

High-level disinfection can be achieved by boiling in water, steaming (moist heat) or soaking instruments in various chemical disinfectants. To be effective, all steps in performing each method must be monitored carefully.

HLD by Boiling

Boiling in water is an effective, practical way to high-level disinfect instruments and other items. Although boiling instruments in water for 20 minutes will kill all vegetative forms of bacteria, viruses (including HBV and HIV), yeasts and fungi, boiling will **not** kill all endospores reliably and thus will not achieve sterilization.

- Decontaminate and clean all instruments and other items to be high-level disinfected.
- If possible, completely immerse items in the water.
- Adjust the water level so that there is at least 2.5 cm (1 inch) of water above the instruments. In addition, make sure all bowls and containers to be boiled are full of water. Utensils that turn bottom side up may contain air pockets. Water must touch all surfaces to high-level disinfect them.
- Place lid on pot and bring water to a gentle, rolling boil.
- Reduce heat to keep water at a rolling boil (boiling too vigorously wastes fuel, rapidly evaporates the water and may damage the delicate instruments or other items).
- Start timing; in the HLD log, note time on the clock and record the time when rolling boil begins.
- Do not open the pot or add or remove instruments once the timing has begun.
- Keep at rolling boil for 20 minutes.
- Remove items with high-level disinfected forceps/pickups; never leave boiled instruments in water that has stopped boiling; as the water cools and steam condenses,

* Formaldehyde is acceptable, but it is not recommended due to issues of toxicity, irritation and carcinogenicity.

air and dust particles are drawn down into the container and may contaminate the instruments (Perkins 1983).

- Use instruments and other items immediately or, with high-level disinfected forceps, place in covered, dry high-level disinfected container and air dry. Once the instruments are dry, if any pooled water remains in the bottom of the container, remove the dry items and place them in another high-level disinfected container that is dry and can be tightly covered.

Remember: A gentle rolling boil is sufficient and will prevent instruments or other items from being bounced around and possibly damaged by striking other instruments or the side walls of the boiling pot.

Protecting the Life of Instruments That Are Frequently Boiled

Lime deposits may form on metal instruments that are frequently boiled. This scale formation, caused by lime salts in the water, is difficult to avoid. By following these steps, however, the problem of lime deposits can be minimized:

- Boil the water for 10 minutes at the beginning of each day before use. (This precipitates much of the lime in the water before objects are added.)
- Use the same water throughout the day, adding only enough to keep the surface at least 2.5 cm (1 inch) above the instruments to be high-level disinfected. (Frequent draining and replacing of water, and boiling too vigorously, increase the risk of lime deposits on instruments.)
- Drain and clean the boiler or pot at the end of each day to remove lime deposits.

HLD by Steaming

Boiling and steaming both use moist heat to kill microorganisms.

For steaming to be effective, the bottom pan must contain enough water to continue boiling throughout the steaming process. By contrast, large boiling pots are easier to use for metal instruments and do not have to be monitored the entire time to be sure that the process is being done correctly.

- After items have been decontaminated, thoroughly cleaned and rinsed, they are ready for HLD by steaming.
- Place items into one of the steamer pans with holes in its bottom.
- Repeat this process until up to three steamer pans have been filled with items; stack the filled steamer pans on top of a bottom pan containing water for boiling; a second (empty) pan without holes should be placed on the counter next to the heat source.
- Place a lid on the top pan and bring the water to a full rolling boil (when water only simmers, very little steam is formed and the temperature may not get high enough to kill microorganisms).
- Reduce the heat so that the water continues to boil at a rolling boil (when water boils too violently, it evaporates quickly and wastes fuel).
- When steam begins to come out between pans and lid, start the timer or note the time on a clock and record the time in the HLD log.
- Steam items for 20 minutes.

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- Allow items to air dry in the steamer pans before using.
 - Using a high-level disinfected forceps, transfer the dry items to a dry, high-level disinfected container with a tight-fitting lid (items can also be stored in the stacked and covered steamer pans).

Remember: Be sure there is sufficient water in the bottom pan for the entire 20 minutes of steaming.

HLD by Chemicals

Although a number of disinfectants are commercially available in most countries, four disinfectants—chlorine, glutaraldehydes, formaldehyde and hydrogen peroxide—are routinely used as high-level disinfectants. These chemicals can achieve high-level disinfection if the items being disinfected are thoroughly cleaned before immersion. A high-level disinfectant should be selected for use based on the characteristics of the items to be disinfected, the physical area in which it will be used (i.e., is it well-ventilated) and the personnel available to do the processing.

Key Steps in Chemical High-Level Disinfection:

- Decontaminate instruments and other items that may have been contaminated with blood and body fluids, and thoroughly clean and dry them before placing them in the disinfectant solution.
- Prepare fresh solution of chemical high-level disinfectant (2% glutaraldehyde [Cidex] or 8% formaldehyde* or 0.1% chlorine solution**) as prescribed by the manufacturer, or check to be sure solution is not out of date.
- Submerge clean, dried items in appropriate high-level disinfectant.
- Cover container and soak for 20 minutes.
- Remove all items from chemical solution using high-level disinfected or sterile gloves or forceps/pickups.
- Rinse items thoroughly with high-level disinfected water (water that has been boiled for 20 minutes) three times to remove all traces of chemical disinfectant.
- Place in high-level disinfected, covered container and air dry.
- Use immediately or store in a covered, dry high-level disinfected container.

11.4 How to Prepare a High-Level Disinfected Storage Container

High-level disinfected instruments or other items can be stored in a container with a tight-fitting cover that has been high-level disinfected.

There are two ways of preparing a high-level disinfected container: by boiling or by soaking in a 0.1% chlorine solution freshly prepared with boiled water or a 0.5% chlorine solution freshly prepared with tap water.

* Formaldehyde is acceptable, but is not recommended due to issues of toxicity, irritation and carcinogenicity.

** Do not mix chlorine solutions with either formaldehyde or ammonia-based solutions as a toxic gas may be produced; use high-level disinfected (boiled 20 minutes) or sterile water to prepare 0.1% chlorine.

Boiling is the preferred method for small containers. For large containers, using a **0.5% chlorine solution** to high-level disinfect the inside of the container is easier to do.

11.4.1 Boiling Procedure

- Put the clean container and its cover into a boiler or pot with a lid.
- Bring the water to a rolling boil.
- Start timer or note the time on a clock.
- Boil for 20 minutes.
- Remove with dry, high-level disinfected forceps or pickups.
- Allow the container and tight-fitting cover to air dry.
- Use immediately or store the covered container until needed.

11.4.2 Chemical Procedure

- Fill a clean container with freshly prepared 0.1% or 0.5% chlorine solution.
- Cover and allow to soak for 20 minutes.
- Pour out the chlorine solution. This solution can now be used for decontamination during the clinic session.
- Rinse thoroughly with boiled water at least two times to remove any traces of the chlorine solution.
- Allow the container and cover to air dry.
- Use immediately or store the covered container until needed.

11.5 Selection of Disinfectants

Disinfectants are classified depending on their ability to kill or immobilize some microorganisms (low or intermediate) or all microorganisms excluding endospores (high-level). (Chemicals that can kill all microorganism as well as all endospores are called sterilants.) The choice of which specific disinfectant to use depends on what you need to disinfect. Phenol, chlorine and quaternary ammonium compounds (QUATs) are used to disinfect non-critical surfaces such as floor, walls and other surfaces. Gutaraldehydes and formaldehydes are used to high-level disinfect or sterilize instruments and other critical use items.

Antiseptic are chemicals that inhibit the growth and reproduction of—as well as destroy some—microorganisms. Whereas disinfectants are harmful to human tissue and should not be used on skin or living tissue, antiseptics are used to prep the skin or tissue prior to an invasive procedure or for cleaning wounds. (Two chemicals, alcohol and iodine/iodophors, can be used both as an antiseptic and as a disinfectant. See Appendices 1 and 2.)

Disinfectants should be:

- Bactericidal
- Active against a wide range of microorganisms (wide antimicrobial spectrum)
- Not readily inactivated by organic material (e.g., cotton fibers, blood)

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- Rapid acting
 - Non-toxic to humans
 - Non-corrosive (to metal) and not cause deterioration (to cloth, rubber, plastics)
 - Cost-effective and available

11.6 Storage of Disinfectants

- Chemical disinfectants should be stored in a cool, dark area.
- Never store chemicals in direct sunlight or in excessive heat (e.g., upper shelves in a tin-roofed building).

11.7 Disposal of Used Chemical Containers and Used Chemicals

11.7.1 Disposal of Used Chemical Containers

- Glass containers may be washed with soap, rinsed, dried and reused. Alternatively, thoroughly rinse glass containers (at least two times) with water and dispose of by burying.
- Plastic containers used for toxic substances such as glutaraldehydes or formaldehyde should be rinsed (at least three times) with water and disposed of by burning or burying.

11.7.2 Disposal of Used Chemicals

Carefully pour wastes down a utility sink drain or into a flushable toilet and rinse or flush with water. Liquid wastes can also be poured into a latrine. **Avoid splashing.** Rinse the toilet or sink carefully and thoroughly with water to remove residual wastes.

11.7.3 Products That Should Not Be Used as Disinfectants

Many antiseptic solutions are used incorrectly as disinfectants. Although antiseptics (sometimes called “skin disinfectants”) are adequate for cleansing skin before surgical procedures, they are not appropriate for disinfecting surgical instruments. They do not reliably destroy bacteria, viruses or endospores. For example, Savlon (chlorhexidine gluconate with or without cetrimide), which is readily available worldwide, is often mistakenly used as a disinfectant.

Antiseptics that should not be used as disinfectants:

- Acridine derivatives (e.g., gentian or crystal violet)
- Cetrimide (e.g., Cetavlon®)
- Chlorhexidine gluconate and cetrimide in various concentrations (e.g., Savlon)
- Chlorhexidine gluconate (e.g., Hibiscrub, Hibitane)
- Chlorinated lime and boric acid (e.g., Eusol®)
- Chloroxylenol in alcohol (e.g., Dettol)
- Hexachlorophene (e.g., pHisoHex)
- Mercury compounds

Mercury solutions (such as mercury laurel), although low-level disinfectants, cause birth defects and are too toxic to use as either disinfectants or antiseptics.

Other products frequently used to disinfect equipment are 1–2% phenol (e.g., Phenol®), 5% carbolic acid (Lysol®) and benzalkonium chloride, a quaternary ammonium compound (Zephiran®). These are low-level disinfectants and should be used only to decontaminate environmental surfaces (e.g., floors or walls).

11.8 Storage of High-Level Disinfected or Sterile Instruments

Remember: Before using any sterile item, look at the package to make sure the seal is unbroken and the wrapper is intact, clean and dry (as well as having no water stains). If the package is dry and intact, you can be reasonably sure it is sterile, regardless of when it was sterilized.

11.9 Shelf Life

The shelf life of an item (i.e., how long it can be considered sterile) after sterilization is event-related. The item remains sterile until something causes the package or container to become contaminated; time elapsed since sterilization is not the determining factor. An event can be the creation of a tear or worn area in the wrapping, the package becoming wet or anything else that will enable microorganisms to enter the package or container. These events can occur at any time.

Therefore, the shelf life of a sterilized item depends on the following factors:

- Quality of the wrapper or container
- Number of times a package is handled before use
- Number of people who have handled the package
- Whether the package is stored on open or closed shelves
- Condition of storage area (e.g., humidity, cleanliness)
- Use of plastic dust covers and method of sealing

When packages become contaminated it is most often a direct result of frequent or improper handling or storage. To make sure that items remain sterile until you need them:

- prevent events that can contaminate sterile packs, and
- protect them by placing them in plastic covers (bags).

In some healthcare facilities where replacement of supplies is limited and the cloth used for wrapping is of poor quality, time as a limiting factor also serves as a safety margin. If plastic covers (bags) are unavailable for the sterilized items, limiting the shelf life to a specific length of time (e.g., 1 month) may be a reasonable decision as long as the pack remains dry and intact.

Handle and store instruments according to how they are processed, maintaining at least the same level of processing in storing them that was used in processing them.

Sterile instruments:

- must be handled only with sterile instruments (e.g., when removed from chemical sterilization solutions)
- must be stored in sterile containers

High-level disinfected instruments:

- must be handled with high-level disinfected or sterile instruments (e.g., when taken out of the boiler or chemicals)
- must be stored in high-level disinfected or sterile containers

11.10 Storage of Sterile Instruments and HLD Instruments

11.10.1 Storage of Sterile Instruments

- All sterile items should be stored in an area and manner whereby the packs or containers will be protected from dust, dirt, moisture, animals and insects. This storage area is best situated next to or connected to the location where sterilization occurs, in a separate enclosed area with limited access that is used just to store sterile and clean patient care supplies. In smaller facilities, this area may be just a room off the Central Supply Department or in the operating unit.
- Storage in a closed cabinet is preferred, in an area where dust is minimized.
- All stored instrument packs or containers must be clearly labeled with the date of processing.

11.10.2 Storage of High-Level Disinfected Instruments

- High-level disinfected instruments should be stored in a dry, high-level disinfected covered container (the cover as well as the container must be high-level disinfected).
- To keep the items high-level disinfected, the high-level disinfected containers should remain closed (no peeking) until the instruments are needed.
- If the instruments have not been used, reprocess them after 1 week.
- Storage in a closed cabinet is preferred, in an area where dust and lint are minimized.
- All stored instrument packs or containers must be clearly labeled with the date of processing.

CHAPTER TWELVE

12. HEALTHCARE WASTE MANAGEMENT

12.1 Objectives

By the end of this chapter a healthcare provider will be able to:

- Define common terms used in healthcare waste management
- Explain steps in healthcare waste management
- Explain sharps disposal tips
- Explain the recommended methods for final waste disposal

12.2 Definitions

12.2.1 Healthcare Waste

Healthcare waste is defined as total waste generated by medical activities and includes both contaminated (potentially infectious) waste and non-contaminated (non-infectious) materials.

12.2.2 Handling of Waste

Waste must be properly handled within the healthcare facility setting, even before it is taken for incineration, burial or other disposal, to protect clients, staff and the community.

12.2.3 Non-contaminated Waste

Non-contaminated waste poses no infectious risk to persons who handle it. Examples of non-contaminated waste include paper, trash, boxes, food remains, and bottles and plastic containers that contain products delivered to the clinic. *Non-contaminated waste can be picked up by the local authorities for disposal in municipal waste sites.*

12.2.4 Contaminated Waste

Contaminated waste is potentially infectious or toxic, if not disposed of properly. Contaminated waste includes blood, body fluids, secretions and excretions, and items that have come in contact with them, such as sharps and used dressings, as well as medicines, medical supplies or other chemicals that may be toxic. *Contaminated waste must be incinerated, burned or buried in designated contaminated/hazardous waste areas.*

12.3 Steps in Healthcare Waste Management

12.3.1 Waste Minimization

Devise policies and practices to reduce healthcare waste generation through:

- Restriction of purchase of supplies that produce a lot of healthcare waste
- Use of recyclable products at the on site or off site.
- Good management and control practices e.g. pharmaceuticals and chemicals through centralized purchasing
- Frequent ordering of small quantities rather than large amounts at one time
- Use of the oldest batch instead of the new (FEFO and FIFO rules)
- Use all contents in each open container before opening another container
- Frequent checking of expiry dates at the time of delivery

12.3.2 Segregation of Waste Materials

- The segregation of waste consists of separating the different waste materials based on the type, treatment and disposal practices. Containers suitable for each type of waste should be available and used as intended.
- Segregation takes place at the point where waste is generated. Segregation of waste shall be applied uniformly throughout the country.
- Never sort mixed wastes (e.g., do not try to separate uncontaminated from contaminated wastes, or combustible from non-combustible, after they have been combined).

Color Coding

The color-coding system aims at ensuring an immediate and non-equivocal identification of the hazards associated with the type of healthcare waste that is handled or treated. In that respect, the color-coding system shall remain simple and be applied uniformly throughout the country. All healthcare facilities shall apply the following color-coding system:

COLOR	TYPE OF WASTE
Yellow	Safety box containing the following: Needles and syringes, blades, broken glass, lancets, scissors, broken ampoules, slides and slide covers, etc.
Red	Wet, infectious materials: Blood, body tissues (amputations), body fluids (discharges), specimens (stool, sputum), placentas, wet dressings, catheters, blood infusion bags, etc.
Blue/Black	Non-infectious materials: Office papers, pharmaceutical packaging, plastic bottles, including water bottles, food remains, waste paper, trash, etc.

Collection:

- Waste should not be allowed to accumulate at the point of production
- Waste should be collected daily or as frequently as possible
- No bags should be removed from the segregation point unless they are labeled
- The bags or containers should be replaced immediately with new ones of the same type
- A supply of fresh collection bags or containers should be readily available at all locations where waste is produced

Storage:

- Storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect
- There should be a water supply, cleaning equipment, protective clothing and waste bags located conveniently close to storage areas
- Should be easily accessible to staff in charge of handling the waste
- It should be possible to lock the store to prevent access by unauthorized persons
- Easy access for waste-collection vehicles
- Storage area should be inaccessible to animals, insects and birds

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- Storage area should not be situated in the proximity of fresh food stores or food preparation areas
 - Healthcare waste handlers should weigh the amount of healthcare waste generated in a day and keep the record in a healthcare waste register

Transport:

- On-site transport:
HCW should be transported within the health facility by means of wheeled trolleys, containers, or carts that are not used for any other purpose and meet the following specifications:
 - Easy to load and unload
 - No sharp edges that could damage waste bags or containers during loading and unloading
 - Easy to clean
- Off-site transportation:
 - All healthcare providers are responsible for safe packing and adequate labeling of waste to be transported off-site and for authorization of its destination
 - All vehicles shall be cleaned and disinfected after use
 - All healthcare waste handlers shall wear protective equipment. They shall be properly trained in handling, loading and unloading, transportation and disposal of the yellow and red waste containers.

12.3.3 Treatment and Disposal of Healthcare Waste

Treatment and Disposal of Waste

Proper disposal of contaminated waste minimizes the spread of infection to healthcare personnel and to the local community. Infectious healthcare waste should be preferably incinerated, burned or buried.

Both the incinerator and burial site should be fenced with a gate and lock to prevent scavenging by both animals and people. Open piles of waste should be avoided because they:

- Pose infection risks and fire hazards
- Produce foul odors
- Attract insects
- Are unsightly

Contaminated Waste—Solids

- Contaminated wastes should be disposed of into a waste container during or immediately following a procedure.
- There should be a sufficient number of waste containers, in convenient locations, to minimize carrying contaminated waste from place to place.
- Waste bins should be decontaminated with 0.5% chlorine solution for 10 minutes and rinsed with water between each use.

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- Anyone handling waste containers should wear appropriate PPE (e.g., heavy-duty gloves, boots, aprons, eye wear, etc.).
 - If a patient or family member wants to take home body parts (or a placenta) for burial, first place them in a plastic bag and then into a rigid container (metal or plastic container) for transport.

Contaminated Waste—Liquids

- Liquid infectious wastes can be disposed of through a closed sewage or septic system by carefully pouring wastes down a utility sink drain or into a flushable toilet. Rinse the toilet or sink carefully and thoroughly with water to remove residual wastes. Avoid splashing.
- If a sewage system doesn't exist, dispose of liquids in a deep, covered hole, not into open drains.

In Case of a Cholera Epidemic

Hospital or health facility sewage also must be treated and disinfected. *Vibrio cholerae*, the causative agent of cholera, is easily killed with the use of disinfectants. Buckets containing stools from patients with acute diarrhea may be disinfected by the addition of chlorine oxide powder or dehydrated lime oxide.

Final Waste Disposal

- Burning
 - Rural health centers and dispensaries can use this option to burn waste in burning pits as per MOHSW guidelines.
 - **Open burning** of contaminated waste is not recommended because it is hazardous.
- Burying

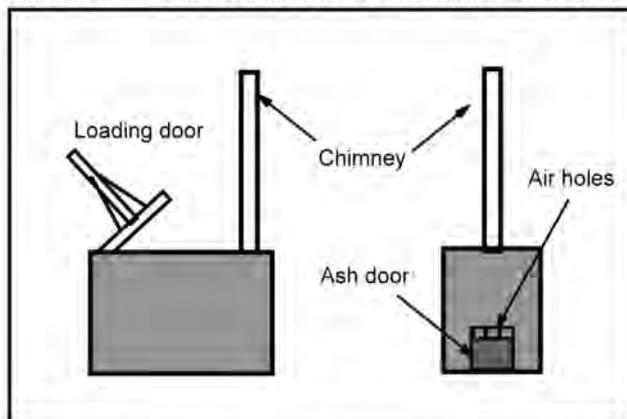
If incineration is not possible, all contaminated wastes must be protected and buried in a burial pit and covered with fresh soil daily to prevent:

 - waste from scattering
 - scavenging of the waste materials by people and or animals
 - attraction of insects
 - odor

Rural health facilities can use this option of disposal to dispose of placentas, sharps and other anatomical waste.
- Incineration
 - Incineration, which is a dry oxidation process, is used to reduce organic and combustible waste into inorganic incombustible matter at high temperature.
 - Incineration provides high temperatures and destroys microorganisms and therefore is the best method for disposal of contaminated wastes.
 - Incineration also reduces the bulk size of wastes to be buried.
 - Incinerators of the type Mark I and III De Montfort are recommended
 - It has been observed that De Montfort incinerators can burn up to a temperature of 1300 degrees C.

- Placentas and other anatomical waste can be disposed of in these incinerators.
- Ashes from the incinerator should be disposed in an ash pit.
- HCW, which cannot be re-used, recycled or dumped in a landfill site, should be incinerated.
- There should be an efficient monitoring system for proper functioning of incinerators.

Figure 12-1. General View of a Double-Chamber (De Montfort) Incinerator



12.4 Contaminated Waste Disposal Tips

- Use heavy-duty (utility) gloves and appropriate PPE when handling wastes.
- Decontaminate and clean utility gloves between uses.
- Always wash hands after handling contaminated wastes.
- Handle wastes carefully to avoid spills or splashes.
- Avoid transferring contaminated waste from one container to another.
- Incineration is the preferred method for waste disposal, as the heat will generally be sufficient to destroy infectious microorganisms.
- If incineration (either high or low temperature) is not possible, careful burial is the next best alternative.
- Dispose of used containers from toxic chemicals or medicines properly:
 - Rinse glass containers thoroughly with water; glass containers may be washed with detergent, rinsed and reused.
 - For plastic containers that contained toxic substances such as glutaraldehyde (e.g., Cidex or Sporicidin®), rinse three times with water and dispose of by incineration and/or burial; these containers may be used as sharps disposal containers, but do not reuse them for any other purposes.
- Equipment that is used to hold and transport wastes must not be used for any other purpose in the healthcare facility.

12.5 Sharps Disposal Tips

The principle of sharps disposal is to prevent potential harm and transmission of disease from injury with a contaminated sharp object. Before starting any procedure involving sharps, plan for their safe disposal after use.

- Use puncture-resistant sharps containers and work practices that minimize the unnecessary handling of sharps.
- Dispose of used sharps POINT FIRST into an approved sharps container.
- Keep fingers behind the needle or sharp at all times when disposing of it.
- Make sure that the sharps container is placed at point of use before the procedure begins.
- In areas where visitors have access, ensure that the sharps containers are out of reach of small children.
- Don't re-cap needles except in a laboratory where a Vacutainer needle is used or when taking blood for gases where you can use one hand to recap).
- Don't over-fill sharps containers.
- Don't hold sharps containers against your body when carrying or sealing them.
- Don't attempt to open a sealed sharps container.

CHAPTER THIRTEEN

13. TRAFFIC FLOW AND ACTIVITY PATTERNS

13.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define traffic flow and activity patterns in healthcare settings
- Explain space and equipment requirements for infection prevention and control
- Explain organization of a surgical unit
- Explain the guidelines for working in an operating room

13.2 Definition

Traffic flow and activity pattern means regulating the flow of visitors, patients and staff in order to prevent disease transmission in healthcare facilities. The number of microorganisms in designated areas tends to be related to the number of people present and their activities.

Remember: Contamination can be minimized by reducing the number of people (staff and patients as well as visitors) permitted into an area and by defining the activities that take place there.

An important objective of infection prevention is to minimize the level of microbial contamination in areas where patient care and instrument processing take place. Such areas include:

- Procedure areas where patients are examined and procedures are carried out
- Labor and delivery wards (although it is important for a woman giving birth in a facility to have at least one companion of her choice while ensuring privacy for all clients)
- Surgical units where major and minor operations are performed, including preoperative and recovery rooms
- Work areas where instruments are processed, including dirty and clean areas where soiled instruments, equipment and other items are first cleaned and are either high-level disinfected or sterilized and then stored

13.3 Space and Equipment Requirements

Healthcare facilities vary in the types of services they provide. The space and equipment requirements for the types of surgery typically performed are roughly the same. These include the following:

- Changing room and scrub area for clinic staff
- Preoperative area where clients are examined and evaluated prior to surgery
- Operating theatre
- Recovery area for patient observation after surgery (may be combined with the preoperative area)
- Processing area for cleaning and sterilizing or high-level disinfecting instruments and other items
- Space for storing sterile packs and/or high-level disinfected containers of instruments and other items

The recommended infection prevention practices for minimizing microbial contamination of specific areas in healthcare facilities are briefly described below.

13.4 Procedure Areas

- Limit traffic to authorized staff and patients at all times.
- Permit only the patient and the staff performing and assisting with procedures in the procedure room (the number of family members should be limited for obstetrical procedures).
- Inform patients that they can wear their own clean clothing.
- Ensure that staff wear attire and PPE appropriate for the procedures performed.
- Have covered containers filled with a 0.5% chlorine solution for immediate decontamination of instruments and other items once they are no longer needed.
- Have a leakproof, covered waste container for disposal of contaminated waste items (cotton, gauze, dressing) at point of use.
- Have a puncture-resistant container for safe disposal of sharps.
- Have storage space in procedure rooms for clean, high-level disinfected and sterile supplies. (Storage shelves should be enclosed to minimize dust and debris collecting on stored items.)

13.5 Surgical Unit

The surgical unit is often divided into four designated areas, which are labeled and defined by the activities performed in each, as follows:

- **Unrestricted area:** This area is the entrance from the main corridor and is isolated from other areas of the surgical unit. This is the point through which staff, patients and materials enter the surgical unit.
- **Transition zone:** This area consists primarily of dressing rooms and lockers. It is where staff put on surgical attire that allows them to move from unrestricted to semi-restricted or restricted areas in the surgical unit. Only authorized staff should enter this area.
- **Semi-restricted area:** This is the peripheral support area of the surgical unit and includes preoperative and recovery rooms, storage space for sterile and high-level disinfected items, and corridors leading to the restricted area. In this area the following should be observed:
 - Limit traffic to authorized staff and patients at all times.
 - Have a work area for processing clean instruments.
 - Have storage space for clean and sterile or high-level disinfected supplies with enclosed shelves to minimize dust and debris collecting on stored items.
 - Have doors limiting access to the restricted area of surgical unit.
 - Ensure that staff members who work in this area wear surgical attire and caps.
 - Ensure that staff wear clean, closed shoes that will protect their feet from fluid and dropped items.
- **Restricted area:**
This area consists of the operating theatre(s) and scrub sink areas. The following should be observed in this area:

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

13.6 Guidelines for Working in an Operating Theater

Enclose the operating theatre to minimize dust and eliminate flies; central air conditioning is preferred. (If windows are the only ventilation, provide tight-fitting screens.)

- The operating theatre should be located away from areas of the hospital or healthcare facility that are heavily traveled by staff and patients.

13.6.1 Before Surgical Procedures

- Place a clean, covered container filled with 0.5% chlorine solution or another locally available and approved disinfectant for immediate decontamination of instruments and other items once they are no longer needed.
- Place a plastic bag or leakproof, covered waste container for contaminated waste items (cotton gauze, old dressings).
- Place a puncture-resistant container for the safe disposal of sharps (e.g., suture needles, hypodermic needles and syringes, and disposable scalpel blades) at the point of use but without contaminating the sterile field.
- Place a leakproof, covered waste container for soiled linen away from sterile items.
- Organize tables and mayo and ring stands side by side in an area away from the traffic patterns and at least 45 cm (18 inches) from walls, cabinets and other non-sterile surfaces.
- Place a clean sheet, a lift sheet and arm-board covers on the operating theatre bed.
- Check and set up suction, oxygen and anesthesia equipment.
- Place supplies and packages that are ready to open on the tables, not on the floor.
- The mayo stand and other non-sterile surfaces that are to be used during the procedure should be covered with a sterile towel or cloth.

13.6.2 During Surgical Procedures

- Limit the number of staff entering the operating theatre to only those necessary for performing the procedure. Make the surgical team self-sufficient so that outside help is not required.

-
- Keep the doors closed at all times, except during movement of staff, patients, supplies and equipment.
 - Keep the number of people and their movements to a minimum; the number of microorganisms increases with activity.
 - Keep talking to a minimum in the sterile field.
 - Each scrubbed staff member should wear full surgical attire, including:
 - sterile surgical gown on top of scrub suit and a clean surgical cap that covers the head
 - clean, closed shoes (or boots that can be wiped clean) that protect the feet from fluids or dropped items
 - surgical gloves, protective eyewear and a mask covering the mouth, nose and any facial hair
 - Scrubbed staff should keep their arms and hands within the operative field at all times and touch only sterile items or areas.
 - Each non-scrubbed staff member should wear surgical attire, including:
 - clean scrub suit
 - clean surgical cap that covers the head
 - clean, closed shoes that protect the feet from fluids or dropped items, and a mask covering the mouth, nose and any facial hair
 - Non-scrubbed staff should stay at the periphery of the operating theatre, keeping their distance from sterile areas; they should not lean or reach over the operative field.
 - Clean accidental spills or contaminated debris in areas outside the surgical field with 0.5% chlorine solution as promptly as possible. (A non-scrubbed staff member wearing utility gloves should do this.)

13.6.3 After surgical procedures

- Non-scrubbed staff wearing utility gloves should do the following:
 - Collect all waste and remove it from the room in closed, leakproof containers.
 - Close and remove puncture-resistant containers when they are three-quarters full.
 - Remove covered containers of 0.5% chlorine solution with instruments and surgical gloves from the room.
 - Remove soiled linen in closed, leakproof containers.
 - Remove waste, soiled linen, soiled instruments and equipment, and supplies that have been opened but not used, in a leakproof, covered waste container. (Make sure that these items do not re-enter the restricted area.)

CHAPTER FOURTEEN

14. CENTRAL STERILIZATION SUPPLY DEPARTMENT (CSSD)

14.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define central sterilization supply department
- Describe the four areas in the CSSD

14.2 Definition

The CSSD is the area where instruments and equipment are processed, and where staff should be specially trained in handling, processing and storing instruments, equipment and other clean, sterile or high-level disinfected items. The CSSD is considered a semi-restricted area, so all the recommendations for traffic patterns and proper attire described above should be followed in the CSSD.

14.3 Areas of a CSSD

A CSSD consists of four areas:

1. the “dirty” receiving/cleanup area
2. the “clean” work area
3. the clean equipment storage area
4. the sterile storage area

14.4 Functions and Equipments Requirements

The function and equipment requirements for the four areas of a typical CSSD are summarized below:

14.4.1 “Dirty” Receiving/Cleanup Area

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

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

14.4.2 “Clean” Work Area

In this area, cleaned items are:

- inspected for flaws or damage
- packaged (if indicated), and either sterilized or high-level disinfected
- sent for storage as packaged, or air dried and placed in a sterile or high-level disinfected container

This area should have:

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

14.4.3 Clean Equipment Storage Area

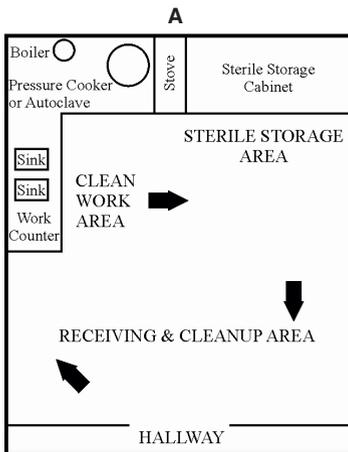
A place where clean equipment is stored on shelves (if possible enclosed). This area should have an office desk for record keeping and CSSD staff only should enter through this area.

14.4.4 Sterile Storage Area

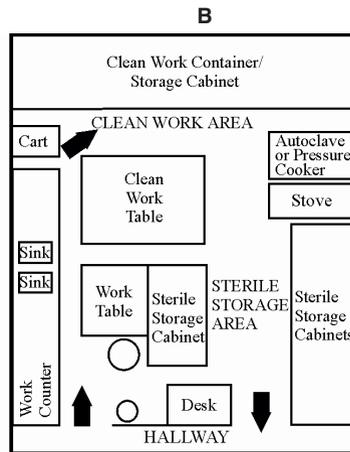
In this area, sterilized packs and covered sterile items are stored. This area should be separate from the central sterile supply area.

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

Figure 14-1a and b. Floor Plans for Instrument Cleaning, High-Level Disinfecting and Sterilizing Areas in a Clinic and Larger Health Facility



Design for small clinic with minimal service space available



Design for larger facility or where volume is greater

Source: SEARO/WHO 1988.

CHAPTER FIFTEEN

15. PROCESSING LINEN

15.1 Objectives

At the end of this chapter a healthcare provider will be able to:

- Define terms commonly used in processing linen
- Describe steps in processing linen

15.2 Definitions

15.2.1 Linens

Cloth items used by housekeeping staff and patients/clients (bedding, towels, cleaning cloths, gowns, caps, masks, scrub suits, surgical gowns, drapes and wrappers).

15.2.2 Soaps or Detergents (*terms used interchangeably*)

These are cleaning products (e.g., liquid and powder soap) that lower surface tension, thereby helping remove dirt, debris and transient microorganisms from linen.

15.2.3 Soiled or Contaminated Linen

These are linens from multiple sources within the hospital or clinic that have been collected and brought to the laundry for processing, regardless of whether or not they are visibly dirty.

15.2.4 Sorting.

This is the process of inspecting and removing foreign and in some cases dangerous objects (e.g., sharps or broken glass) from soiled linen before washing. This step is extremely important because soiled linen from the operating theatre or clinic occasionally contains sharps (e.g., scalpels, sharp-tipped scissors, hypodermic and suture needles, towel clips).

In processing linen, staff should be appropriately trained and regularly supervised to reduce the risk of contamination; staff at each healthcare facility should determine the best way to handle, process and store linens.

Note: Staff responsible for washing soiled items should wear utility gloves, protective eyewear, plastic or rubber aprons, and protective footwear.

15.3 Key Steps in Processing Linen

Table 15-1. Key Steps in Processing Linen

- | |
|---|
| <ul style="list-style-type: none">▪ Ensure that housekeeping and laundry personnel wear gloves and other PPE as indicated when collecting, handling, transporting, sorting and washing soiled linen.▪ When collecting and transporting soiled linens, handle them as little as possible and with minimum contact to avoid accident, injury and spreading of microorganisms.▪ Consider all cloth items (e.g., surgical drapes, gowns, wrappers) used during a procedure as infectious. Even if there is no visible contamination, the item must be laundered.▪ Carry soiled linen in covered containers or plastic bags to prevent spills and splashes, and confine the soiled linen to designated areas (interim storage areas) until transported to the laundry.▪ Carefully sort all linen in the laundry area before washing.▪ Do not presort or wash linen at the point of use. |
|---|

15.3.1 Collecting and Transporting Soiled Linen

Soiled linen should be collected after invasive medical or surgical procedures or when changing linen in patient rooms.

- Collect used linen in leakproof containers. If linen is heavily contaminated with blood or body fluids, carefully roll the contaminated area into the center of the linen and place in a leakproof bag.
- Be aware that cloth bags are adequate for the majority of patient care linen and require the same processing as their contents.
- Handle soiled linen as little as possible and do not shake it. This helps prevent spreading microorganisms to the environment, personnel and other patients.
- Do not double-bag or use additional precautions for used linen from patients in isolation; these measures are not necessary.
- Do not sort and wash soiled linens in patient care areas (Centers for Disease Control and Prevention [CDC] 1988; Occupational Safety and Health Administration [OSHA] 1991).
- Collect and remove soiled linen after each procedure, daily, or as needed, from patients' rooms.
- Transport collected soiled linen in closed, leakproof bags, containers with lids or covered carts to the processing area daily, or more often as needed.
- Transport soiled linen and clean linen separately. If there are separate carts or containers available for soiled and clean linen, they should be labeled accordingly. If not, thoroughly clean the containers or carts used to transport soiled linen before using them for clean linen.

15.3.2 Sorting Soiled Linen

The processing area for soiled linen must be separate from other areas such as those used for folding and storage of clean linen, patient care and food preparation. There should be adequate ventilation and physical barriers (walls) between the clean and soiled linen areas.

Sorting must be carefully performed because soiled linen (large drapes and towel drapes) from the operating theatre or other procedure areas occasionally contain sharps (e.g., scalpels, sharp-tipped scissors, hypodermic and suture needles, sharp-tipped towel clips). In addition, bedding from patients' rooms may contain soiled dressings and be bloodstained or wet with other body fluids.

15.3.3 Laundering Linen

All linen items (e.g., bed sheets, surgical drapes, masks, gowns) used in the direct care of a patient must be thoroughly washed before re-use. Soiled linen must be washed immediately to avoid staining. Decontamination prior to washing is not necessary, unless linen is heavily soiled and will be hand washed (repeated soaking of linen in chlorine, even dilute solutions, will cause the fabric to deteriorate more quickly). In addition, workers should not carry wet, soiled linen close to their bodies even if they are wearing plastic or rubber aprons.

Handwashing Linen

- Step 1: Wash heavily soiled linen separately from non-soiled linen.
- Step 2: Wash the entire item in water with liquid soap to remove all soil, even if not visible. Use warm water if available. Add bleach (e.g., 30–60 mL, about 2–3 tablespoons, of 5% chlorine solution) to aid cleaning and bactericidal action. Add soap (a mild acid agent) to prevent yellowing of linen, if desirable.
- Step 3: Check the item for cleanliness. Rewash if it is dirty or stained.
- Step 4: Rinse the item with clean water.

Machine Washing Linen

- Step 1: Wash heavily soiled linen separately from non-soiled linen.
- Step 2: Adjust the temperature and time cycle of the machine according to manufacturer's instructions and the type of soap or other washing product being used. Both cold and hot water washing cycles that include bleach reduce bacterial counts in the linen.

Note: For hot-water washing of linen:

- Use hot water above 71°C (160°F) and soap to aid in loosening soil.
- Add bleach and soap as above.
- Adjust the time cycle of the machine according to the manufacturer's instructions.

- Step 3: When the wash cycle is complete, check the linen for cleanliness. Rewash if it is dirty or stained. (Heavily soiled linen may require two wash cycles.)

The steps for drying, checking and folding linen for both hand- and machine-washed linens are the same:

- Step 1: Completely air or machine dry before further processing. Air dry in direct sunlight, if possible, keeping the fabric off the ground, away from dust and moisture.
- Step 2: After the linen is totally dry, check for holes and threadbare areas. If present, the item must be discarded or repaired before re-use or storage. (If there are any holes or many repaired areas, the item should not be used as a drape. It can be cut into pieces to be used as cleaning rags.)
- Step 3: Clean and dry linen should be ironed as needed and folded. For example, if a clean, dry drape is acceptable, the drape can be ironed before placing it on a shelf or in container for storage.

15.4 Storing, Transporting and Distributing Clean Linen

15.4.1 Storing Clean Linen

- Keep clean linen in clean, closed storage areas.
- Use physical barriers to separate folding and storage rooms from soiled areas.
- Keep shelves clean.
- Handle stored linen as little as possible.

15.4.2 Transporting Clean Linen

- Clean and soiled linen should be transported separately.
- Clean linen must be wrapped or covered during transport to avoid contamination.

15.4.3 Distributing Clean Linen

- Protect clean linen until it is distributed for use.
- Do not leave extra linen in patients' rooms.
- Handle clean linen as little as possible.
- Avoid shaking clean linen. It releases dust and lint into the room.
- Clean soiled mattresses by wiping with 0.5% chlorine solution before putting clean linen on them.

15.5 Guidelines for Processing Linens and PPE

Table 15-2. Guidelines for Processing Linens and Personal Protective Equipment (PPE)

ITEM	DECONTAMINATION	CLEANING	HIGH-LEVEL DISINFECTION	STERILIZATION
Aprons (heavy plastic or rubber)	Wipe with 0.5% chlorine solution and rinse with clean water between each procedure or each time they are taken off.	Wash with liquid soap and water. Rinse with clean water, air or towel dry at the end of the day or when visibly soiled. ^a	Not necessary	Not necessary
Footwear (rubber shoes or boots)	Wipe with 0.5% chlorine solution, rinse with clean water, at the end of the day or when visibly soiled.	Wash with liquid soap and water. Rinse with clean water, air or towel dry at the end of the day or when visibly soiled. ^a	Not necessary	Not necessary
Linens (caps, masks, scrub suits or covergowns)	Not necessary. (Laundry staff should wear plastic aprons, gloves, and protective foot- and eyewear when handling soiled items.)	Wash with liquid soap and water, removing all dirt particles. Rinse with clean water, air or machine dry. ^a Air-dried attire can be ironed before use.	Not necessary	Not necessary

ITEM	DECONTAMINATION	CLEANING	HIGH-LEVEL DISINFECTION	STERILIZATION
Protective eyewear (plastic goggles and face shields)	Wipe with 0.5% chlorine solution, rinse with clean water, after each procedure or when visibly soiled.	Wash with liquid soap and water. Rinse with clean water, then air or towel dry ^a after each procedure or when visibly soiled.	Not necessary	Not necessary
Surgical gowns, linen drapes and wrappers	Not necessary. (Laundry staff should wear plastic aprons, gloves and protective foot- and eyewear when handling soiled items.)	Wash with liquid soap and water, removing all particles. Rinse with clean water, air or machine dry. ^a	Not practical	Preferred
<p>^a If tap water is contaminated, use water that has been boiled for 10 minutes and filtered to remove particulate matter (if necessary), or use chlorinated water—water treated with a dilute bleach solution (sodium hypochlorite) to make the final concentration 0.001%.</p> <p>Source: Tietjen, Bossemeyer and McIntosh 2003.</p>				

CHAPTER SIXTEEN

16. HOUSEKEEPING

16.1 Objectives

At the end of this chapter a healthcare worker will be able to:

- Define housekeeping
- Identify selection criteria for cleaning products
- Describe cleaning methods
- Explain housekeeping guidelines

16.2 Definition

Housekeeping refers to the general cleaning of the facility environment, which includes floors, walls, tables and other surfaces as well as outside areas.

16.3 Importance of Housekeeping

General housekeeping is important in order to:

- Reduce the number of microorganisms that come in contact with clients or staff.
- Reduce the risk of accidents by preventing falls caused by a slippery floor following spillage of either body fluids or solutions.
- Provide a pleasant atmosphere.

16.4 How to Select Cleaning Products

Different types of cleaning products are available: liquid soap and detergents, disinfectants, combinations (detergent and disinfectant) and each type has different properties. An ideal cleaning product should accomplish the following criteria:

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

16.5 Personal Protective Equipment for Housekeeping Tasks

Healthcare providers doing housekeeping activities should wear personal protective equipment to prevent themselves from infectious organisms and or contamination from blood and other body fluids from patients as well as chemicals. The recommended PPE to be used during housekeeping activities are shown in **Table 16-1**.

Table 16-1. Recommended Personal Protective Equipment for Housekeeping Tasks

TYPE OF PPE	WHEN USED
Gloves (preferably household utility gloves) Shoes that protect the feet from accidentally dropped items and blood and body fluids	Handling disinfectant cleaning solutions Cleaning patient care areas Cleaning heavily contaminated areas Handling soiled linen Handling soiled items and instruments Handling or disposing of waste
Plastic or rubber apron, mask and protective eyewear	When spills or splashes are expected

16.6 Cleaning methods

16.6.1 Criteria for Selecting Cleaning Methods

Cleaning methods should be determined by the:

- Type of surface
- Amount and type of organic matter present
- Purpose of the area.

Most areas of the facility can be cleaned with detergent and water (low-risk areas such as waiting rooms and administrative areas). In high-risk areas where heavy contamination is expected, such as:

- Toilets and latrines, or
- For areas contaminated with blood, body fluids, secretions or excretions

A disinfectant such as 0.5% chlorine solution should be used. Using a disinfectant in addition to a detergent* is also recommended in other areas of high risk, such as the operating theater, staging preoperative and recovery area.

Common methods of cleaning are briefly described below.

16.6.2 Wet Mopping

This is the most common and preferred method to clean floors. There are three techniques:

- **Single-bucket (basin) technique**
One bucket of cleaning solution is used. The solution must be changed when dirty. (The killing power of the cleaning product decreases with the increased load of soil and organic material present.)
- **Double-bucket technique**
Two different buckets are used, one containing a cleaning solution and the other containing rinse water. The mop is always rinsed and wrung out before it is dipped into the cleaning solution. The double-bucket technique extends the life of the cleaning solution (fewer changes are required), saving both labor and material costs.

* Do not mix chlorine solutions with ammonia-based detergents, as a toxic gas may be produced.

▪ Triple-bucket technique

The third bucket is used for wringing out the mop before rinsing, which extends the life of the rinse water.

Remember: Do not dry mop or sweep the patient care areas. (This causes dust, debris and microorganisms to become airborne and contaminate clean surfaces.)

Note: The double- or triple-bucket method is recommended for cleaning in healthcare facilities, especially the operating room and other areas of the surgical suite.

16.6.3 Damp Dusting

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

- Clean cloth or mops are wetted with cleaning solution contained in a basin or bucket.
- Dry dusting should be avoided and dust cloths and mops should never be shaken to avoid the spread of microorganisms.
- Dusting should be performed in a systematic way, using a starting point as a reference to ensure that all surfaces have been reached.
- When doing high dusting (ceiling tiles and walls), check for stains that may indicate possible leaks. (Leaks should be repaired as soon as possible because moist ceiling tiles provide a reservoir for fungal growth.)
- Always wear utility gloves when cleaning surfaces that may have come in contact with blood, body fluids, secretions or excretions.

Remember:

- Cleaning should start with the least soiled area and move to the most soiled area and from high to low surfaces.
- Be aware that use of cleaning equipment that is not properly maintained can contribute to the spread infectious agents.
- Dry cleaning equipment completely before reuse; drying mops and cloths in the sun is best because the sun's ultraviolet rays can aid in killing microorganisms (wet cloths and mop heads are heavily contaminated with microorganisms).

16.7 Cleaning Contact Surfaces and Spills

Surfaces that come in contact with clients, such as examination tables and patient beds, must be kept clean and decontaminated to avoid cross-contamination of patients and staff.

- All surfaces that may come in contact with blood, body fluids, secretions or excretions (e.g., pelvic examination tables, operating tables) must be decontaminated by wiping them with a disinfectant solution (0.5% chlorine solution) after every client, regardless of whether they are visibly contaminated.
- Any surface that is visibly contaminated must be decontaminated by wiping with a disinfectant solution (0.5% chlorine solution) immediately after the procedure.
- Spills of blood, body fluids, secretions or excretions must be cleaned:
 - Small spills must be decontaminated by wiping with a cloth soaked in disinfectant solution (0.5% chlorine solution).

- Large spills should be flooded with disinfectant solution (0.5% chlorine solution); if feasible, allow the solution to sit for 10 minutes before mopping up, but do not create a hazard whereby someone might slip and be injured.

Table 16-2. Housekeeping Guidelines

AREA/SURFACE	FREQUENCY	PROCESS
Floors	Twice daily or more as needed	Use a clean wet mop and fresh detergent solution. Use a disinfectant cleaning solution when contamination is present.
Sinks	Daily or more often as needed	Scrub with a separated mop, cloth or brush and a disinfectant cleaning solution .
Lamps, chairs, tables and counters	Daily or when visibly dirty	Do damp dusting – wipe with a cloth dampened in a fresh detergent solution.
Walls, windows, ceilings and doors	Weekly or when visibly dirty	Clean using a damp cloth – wipe with a cloth dampened in a fresh detergent solution.
Procedure and examination rooms	After every procedure, and whenever visibly soiled	Wipe horizontal (flat) surfaces, equipment and furniture used for the procedures with a disinfectant cleaning solution . Change linen or paper on the examination table after each patient. Clean blood or other body fluid spills as described below.
Toilets	Wash at least three times daily and as needed	Scrub frequently with separate mop, cloth or brush and a disinfectant cleaning solution (e.g., Harpic®).
Operating theatre	At the beginning of every day	All flat (horizontal) surfaces (tables, chairs, etc.) should be wiped with a clean, lint-free moist cloth to remove dust and lint that may have collected overnight.
	Between every case	Wipe all surfaces and mattress pads with a disinfectant cleaning solution . Wipe all flat surfaces that have come in immediate contact with a patient or body fluids with a disinfectant cleaning solution .
	At the end of every day	Do a total cleaning or terminal cleaning (mopping floors and scrubbing all surfaces from top to bottom) of the operating theatre at the end of each day. (Remember to clean door handles, light switches, etc.)
Cleaning equipment (mops, brushes, etc.)	Between each use	If contaminated, decontaminate in 0.5% chlorine solution; Clean in soap or detergent and water. Sun dry until completely dry before next use.
Waste containers	Each time emptied	Wash with 0.5% chlorine solution and rinse well with clean water.

Note: For routine cleaning:

- Establish a schedule and provide written guidelines for cleaning environmental surfaces.
- Cleaning schedules should be developed according to the needs of each area of the healthcare facility.

CHAPTER SEVENTEEN

17. CLEAN WATER

17.1 Objectives

At the end of this chapter, a healthcare provider will be able to:

- Describe methods of preparing clean and safe water
- Explain how to store clean and safe water
- Explain how to prevent the spread of cholera

17.2 Methods for Preparing Clean Water

17.2.1 *By Boiling*

Water boiled for 5 minutes is considered safe to drink or to use in making oral rehydration solution (ORS) and infant formula (count from rolling boil).

17.2.2 *By Chlorination*

Add a small amount of a chlorine-releasing compound such as sodium hypochlorite. For example, only 10 mL (2 teaspoons) of a 0.5% chlorine solution are needed to make 20 liters (over 5 gallons) of water that is safe to drink.

Turbid (cloudy) water:

- Filter or allow the particulate matter (sediment) to settle if tap or well water is turbid.
- Carefully pour off the cleared water before being boiling or treating it.

Remember:

- Chlorination is not as effective in turbid (cloudy) water because the organic material combines with the free chlorine, reducing the concentration in the treated water.
- Boiled water is easily recontaminated because, unlike chlorinated water, it does not have any residual capacity to inactivate microorganisms.

17.3 Storage of Clean and Safe Water

Keep boiled/chlorinated water in a clean (disinfected) container, preferably one with a narrow mouth to prevent hands or utensils from touching the clean water.

Prepare clean water daily in all healthcare facilities. The preparation of clean water containing up to 10 ppm (0.001%) sodium hypochlorite solution is inexpensive, easy to do and often is needed during emergency situations (e.g., during floods or other natural disasters that may lead to heavy contamination of the water system).

Table 17-1. Guidelines for Using Clean Water

PURPOSE	PRETREAT (FILTER)	PREFERRED	ALTERNATIVE	CONCENTRATION (PPM) (PERCENT)	
Drinking, ORS and baby formula	+	Boiled	Chlorinated	1	0.001
Emergency use	±	Chlorinated	Boiled	10	0.001
Medical use (hand and instrument washing)	±	Chlorinated		10	0.001

Note: To make a 0.001% solution, add 1 cc of 5% chlorine solution to 5 liters of water or 10 cc of 5% chlorine solution to 50 liters of water. When using 3.5% chlorine solution, add 1 cc to 3.5 liters of water or 10 cc to 35 liters of water.

17.4 How to Prevent the Spread of Cholera

Cholera is spread through contaminated water. For several years it has been known that microscopic organisms in the water, called plankton, are the reservoir for *Vibrio cholerae*, the bacteria causing cholera.

To decrease the incidence of cholera, treat the drinking water. First, filter the water through several layers of cotton cloth and then add sodium hypochlorite (0.001% final concentration).

CHAPTER EIGHTEEN

18. INFECTION PREVENTION IN HOME-BASED CARE SETTINGS

18.1 Objectives

At the end of this chapter, a healthcare provider will be able to:

- Describe the principles of preventing infections in home based care settings
- Explain the guidelines for HPs on how to prevent infections in Home-Based Care Settings
- Explain how to prevent infection in home deliveries.

18.2 Introduction

Due to the high prevalence of chronic diseases such as TB and HIV/AIDS that result in increased numbers of hospitalized patients, many patients are cared for within their homes. This reality can put families, caregivers and other community members at risk. HPs have a responsibility to educate the families and caregivers about these risks, and also about the infection prevention practices that can reduce the risks.

Where highly contagious infectious diseases (e.g., cholera, TB) are present, the family and caregivers need to be educated about ways to minimize the risk of contamination. One of the benefits of home-based care is that it may be more comfortable and friendly for the chronically ill patient. The risks to caregivers and family must be weighed against the need for psychosocial support for the patient.

18.3 Issues to Consider When Giving Home-Based Care Services

18.3.1 Hand hygiene

- Thoroughly wash hands before and after contact with any patient, and after removing gloves, using soap and clean running water (for example, from a tap or poured from a jug); or
- Use alcohol-based handrub if hands are not visibly soiled.

18.3.2 Other instructions

- Keep patients in rooms with fresh air and plenty of light.
- Ensure that patients take any prescribed medication completely, as ordered.
- Make sure that patients have clean clothing and that they have clean, dry bed sheets at all times.
- Change bedridden patients' positions every two hours to prevent bed sores.
- Wear clean clothes and use clean surfaces, to prevent infection from dirty clothes or surfaces; surfaces such as clothing, cloth or plastic sheets should be washed with soap or detergent and dried in full sunlight; cloth should be ironed with a hot iron.
- Wear gloves when direct contact with tissue under the skin, blood, body fluids, secretions or excretions is expected.

-
- Ensure that women have sanitary pads, or pieces of cloth that have been washed and dried in full sunlight and ironed if possible, when they need them, and dispose of these properly, as you would other contaminated waste.
 - Encourage patients with coughs to carefully cover their mouths with a handkerchief (preferably) or their hands when coughing.
 - Encourage patients with diarrhea to use a toilet or latrine, and to carefully wash their hands with soap and clean, running water after every bowel movement and before eating or handling or preparing any food or drinks.
 - Cover mattresses and the like with plastic sheets that can be easily decontaminated and washed.

18.4 Guidelines for HPs on How to Prevent Infections in Home-Based Care Settings

For any procedures where the skin may be broken, and there may be contact with an open wound or sore, or where there may be contact with blood or other bodily secretions, caregivers should use the following guidelines:

- Practice good hand hygiene.
- Use gloves and plastic aprons when contact with blood and body fluids is anticipated.
- If the patient has a skin condition with open lesions/sores (broken skin), keep them clean and dry, and clean the lesions/sores with mildly salty water and cover them with a clean, dry dressing.
- Dispose of all materials that have come in contact with blood, body fluids, secretions or excretions carefully so that they do not pose a risk to members of the community. If they are to be reused, decontaminate them in 0.5% chlorine solution, clean and high-level disinfect them in 0.5% chlorine solution (or 0.1% chlorine solution prepared with boiled or sterile water).
- Dispose of any cloth or plastic sheets that come in contact with blood, body fluids, secretions or excretions; if they are to be reused, decontaminate them in 0.5% chlorine solution for 10 minutes, wash with soap or detergent, and dry in full sunlight (and iron the cloth).
- Wipe surfaces (e.g., mattresses, tables) that may have been in contact with blood, body fluids, secretions or excretions with a cloth that has been soaked in 0.5% chlorine solution.
- Burn and bury all materials that have come in contact with blood, body fluid, secretions or excretions (cloth or plastic sheets, razor blades, gloves, etc.); this is the best procedure. Waste should be buried in a deep hole and completely covered with soil so that it is not accessible to community members or children; it can also be disposed of in a deep pit latrine.
- Wear utility gloves when handling and disposing of contaminated waste products.

18.5 Preventing Infection in Home Deliveries

For women who deliver at home, in addition to the above guidelines, there are some specific requirements for conducting a clean delivery.

18.5.1 Supplies

In the preparation for delivery, the following delivery kit should be available:

- New razor blade
- New cord ties (string to tie the umbilical cord)
- Clean delivery surface (a plastic sheet is recommended; a cloth that has been well washed and fully dried in sunlight, and ironed if possible, is the next best alternative)
- Gloves
- Soap
- Clean and safe water
- Sanitary pads or pieces of cloth that have been washed and dried in full sunlight and ironed if possible
- Clean warm wrappings for the baby, which have been washed and dried in full sunlight and ironed if possible
- Running water for handwashing
- Clean protective clothing for the birth attendant

18.5.2 Infection Prevention and Control Guidelines

Together with the above supplies, the following are recommended:

- Avoid shaving hair,
- Decontaminate, clean and boil any reusable instruments, and
- Properly dispose any waste products.
- If there are large spills of blood, body fluids, secretions or excretions, pour 0.5% chlorine solution over the spill area and let it stand for 10 minutes before mopping it up.

Note: After delivery, place the placenta in a plastic bag or leakproof container, and bury or burn it.

APPENDIX 1: ANTISEPTICS: MICROBIOLOGIC ACTIVITIES AND POTENTIAL USES

GROUP	ACTIVITY AGAINST BACTERIA								POTENTIAL USES		COMMENTS
	Gram-Positive	Most Gram-Negative	TB	Viruses	Fungi	Endospores	Relative Speed of Action	Affected by Organic Matter	Surgical Scrub	Skin Preparation	
Alcohols (60–90% ethyl or isopropyl)	Ex	Ex	Ex	Ex	Ex	None	Fast	Mod	Yes	Yes	Not for use on mucous membranes Not good for physical cleaning of skin, no persistent activity
Chlorhexidine (2–4%) (Hibitane, Hibiscrub)	Ex	Good	Fair	Ex	Fair	None	Int	Slight	Yes	Yes	Has good persistent effect Toxicity to ears and eyes
Iodine preparations (3%)	Ex	Ex	Ex	Ex	Good	Fair	Int	Marked	No	Yes	Not for use on mucous membranes Can burn skin so remove after several minutes
Iodophors (7.5–10%) (Betadine)	Ex	Ex	Fair	Good	Good	None	Int	Mod	Yes	Yes	Can be used on mucous membranes
Para-chloro-metaxyleneol (PCMX) (0.5–4%)	Good	Ex	Fair	Good	Fair	Unk	Slow	Minimal	No	Yes	Penetrates the skin and should not be used on newborns
Triclosan (0.2–2%)	Ex	Good	Fair	Ex	None	Unk	Int	Minimal	Yes	No	Acceptability on hands varies
Ex—Excellent		Unk—Unknown			Mod—Moderate			Int—Intermediate			
<i>Source:</i> Tietjen L, D Bossemeyer and N McIntosh 2003.											

APPENDIX 2: PREPARING AND USING CHEMICAL DISINFECTANTS

CHEMICALS FOR STERILIZATION OR HIGH-LEVEL DISINFECTION

Disinfectant (common solution or brand)	Effective Concentration	How to Dilute	Skin Irritant	Eye Irritant	Respiratory Irritant	Corrosive	Leaves Residue	Time Needed for HLD	Time Needed for Sterilization	Activated Shelf Life ^a
Chlorine	0.1%	Dilution procedures vary ^b	Yes (with prolonged contact)	Yes	Yes	Yes ^c	Yes	20 minutes	Do not use	Change every 14 days, sooner if cloudy.
Formaldehyde (35–40%)	8%	1 part 35–40% solution to 4 parts boiled water	Yes	Yes	Yes	No	Yes	20 minutes	24 hours	Change every 14 days, sooner if cloudy.
Glutaraldehyde (Cidex)	Varies (2–4%)	Add activator	Yes	Yes (vapors)	Yes	No	Yes	20 minutes at 25°C ^d	10 hours for Cidex	Change every 14–28 days; sooner if cloudy.
Hydrogen Peroxide (30%)	6%	1 part 30% solution to 4 parts boiled water	Yes	Yes	No	Yes	No	20 minutes	Do not use	Change daily; sooner if cloudy.
CHEMICALS FOR DISINFECTION (alcohols and iodophors are not high-level disinfectants)										
Alcohol (ethyl or isopropyl)	60–90%	Use full strength	Yes (can dry skin)	Yes	No	No	No	Do not use	Do not use	If container (bottle) kept closed, use until empty.
Iodophors (10% povidone-iodine)	Approximately 2.5%	1 part 10% povidone-iodine to 3 parts water	No	Yes	No	Yes	Yes	Do not use	Do not use	If container (bottle) kept closed, use until empty.

^a All chemical disinfectants are heat- and light-sensitive and should be stored away from direct sunlight and in a cool place (<40°C).

^b See **Tables 11-1 and 11-2** for instructions on preparing chlorine solutions.

^c Only corrosive with prolonged (>20 minutes) contact at concentrations >0.5% if not rinsed immediately with boiled water.

^d Different commercial preparations of Cidex and other glutaraldehydes are effective at lower temperatures (20°C) and for longer activated shelf life. **Always** check manufacturers' instructions.

Adapted from: Rutala 1996.

APPENDIX 3: GUIDELINES FOR PROCESSING INSTRUMENTS AND OTHER ITEMS

Process	Decontamination is the first step in handling used items; it reduces risk of HBV, HCV and HIV viruses.	Cleaning removes all visible blood, body fluids and dirt.	Sterilization destroys all microorganisms, including endospores.	High-Level Disinfection destroys all viruses, bacteria, parasites, fungi and some endospores.
INSTRUMENTS OR OTHER ITEMS	DECONTAMINATION	CLEANING	STERILIZATION ^a	OR HIGH-LEVEL DISINFECTION ^b
Airways (plastic)	Soak in a 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse and wash immediately.	Wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary
Ambu bags and face masks for cardiopulmonary resuscitation (CPR)	Wipe exposed surfaces with gauze pad soaked in 60–90% alcohol or 0.5% chlorine; rinse immediately.	Wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary
Aprons (heavy plastic or rubber)	Wipe with 0.5% chlorine solution. Rinse with clean water. Between each procedure or each time they are taken off.	Wash with liquid soap and water. Rinse with clean water, air or towel dry at the end of the day or when visibly soiled.	Not necessary	Not necessary
Bed pans, urinals or emesis basins	Not necessary	Using a brush, wash with disinfectant solution (soap and 0.5% chlorine). Rinse with clean water.	Not necessary	Not necessary
Blood pressure cuff	If contaminated with blood or body fluids, wipe with gauze pad or cloth soaked with 0.5% chlorine solution.	If soiled, wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary

Process	Decontamination is the first step in handling used items; it reduces risk of HBV, HCV and HIV viruses.	Cleaning removes all visible blood, body fluids and dirt.	Sterilization destroys all microorganisms, including endospores.	High-Level Disinfection destroys all viruses, bacteria, parasites, fungi and some endospores.
INSTRUMENTS OR OTHER ITEMS	DECONTAMINATION	CLEANING	STERILIZATION ^a	OR HIGH-LEVEL DISINFECTION ^b
Diaphragms or fitting rings (used for sizing with clients)	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately.	Wash with soap and water. Rinse with clean water. Air or towel dry.	Not necessary but can be autoclaved at 121°C (250°F) 106 kPa (15 lbs/in ²) for 20 minutes (unwrapped).	Steam or boil for 20 minutes. Chemically high-level disinfect by soaking in 8% formaldehyde, or a 2–4% glutaraldehyde for 20 minutes. Rinse well in water that has been boiled .
Endotracheal tube (not recommended)	Not necessary	Wash with soap and water. Flush tube to clean inside. Rinse three times with clean water.	Not necessary	Steam or boil for 20 minutes. Chemically high-level disinfect by soaking in a 2–4% glutaraldehyde for 20 minutes. Rinse 3 times in water that has been boiled .
Exam or operating theatre tables or other large surface areas (carts and stretchers)	Wipe off with 0.5% chlorine solution.	Wash with soap and water if organic material remains after decontamination.	Not necessary	Not necessary
Feeding cups	Not necessary	Wash with soap and hot water.	Not necessary	Boil for 20 minutes, then dry and keep clean.
Footwear (rubber shoes or boots)	Wipe with 0.5% chlorine solution. Rinse with clean water. At the end of the day or when visibly soiled.	Wash with liquid soap and water. Rinse with clean water, air or towel dry at the end of the day or when visibly soiled.	Not necessary	Not necessary
IUDs and inserters (never reuse)	Not appropriate	Not appropriate	Not recommended. Most IUDs and inserters come in sterile packages. Discard if package seal is broken.	Not recommended

Process	Decontamination is the first step in handling used items; it reduces risk of HBV, HCV and HIV viruses.	Cleaning removes all visible blood, body fluids and dirt.	Sterilization destroys all microorganisms, including endospores.	High-Level Disinfection destroys all viruses, bacteria, parasites, fungi and some endospores.
INSTRUMENTS OR OTHER ITEMS	DECONTAMINATION	CLEANING	STERILIZATION ^a	OR HIGH-LEVEL DISINFECTION ^b
Laparoscopes	Wipe exposed surfaces with gauze pad soaked in 60–90% alcohol; rinse immediately.	Disassemble; then using a brush, wash with soap and water. Rinse with clean water, towel dry.	Sterilize daily using chemical sterilization. Soak in: a glutaraldehyde (usually 2%) for 10 hours, or 8% formaldehyde for 24 hours. Rinse with sterile water or water which has been boiled for 20 minutes three times.	Between cases, soak for 20 minutes in: a glutaraldehyde (usually 2–4%), or 8% formaldehyde, or 0.1% chlorine solution with boiled and filtered (if necessary) water. Rinse three times with water that has been boiled for 20 minutes.
Laryngoscope blades		Wash with soap and water and then rinse.	Not necessary	Soak in high-level disinfectant for 20 minutes, then rinse well in clean water.
Microscope slides	Soak in 0.5% chlorine solution for 10 minutes.	Wash with soap and water. Rinse with clean water. Air or towel dry.	Not necessary but can be autoclaved at 121°C (250°F) 106 kPa (15 lbs/in ²) for 20 minutes (unwrapped), or Dry heat for 1 hour at 170°C.	Steam or boil for 20 minutes. Soak in high-level disinfectant for 20 minutes and rinse.
PPE (caps, masks, covergowns) ^c	Not necessary (Laundry staff should wear plastic aprons, gloves and protective foot- and eyewear when handling soiled linen.)	Wash with soap and hot water. Rinse with clean water, air or machine dry. Wrap for reuse.	Not necessary	Not necessary

Process	Decontamination is the first step in handling used items; it reduces risk of HBV, HCV and HIV viruses.	Cleaning removes all visible blood, body fluids and dirt.	Sterilization destroys all microorganisms, including endospores.	High-Level Disinfection destroys all viruses, bacteria, parasites, fungi and some endospores.
INSTRUMENTS OR OTHER ITEMS	DECONTAMINATION	CLEANING	STERILIZATION ^a	OR HIGH-LEVEL DISINFECTION ^b
Stethoscopes	Wipe with gauze pad soaked in 60–90% alcohol.	If soiled, wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary
Storage containers for instruments (metal or plastic)	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately. ^c	Wash with soap and water. Rinse with clean water, air or towel dry.	Dry heat for 1 hour after reaching 170°C (340°F), or Autoclave at 121°C (250°F) and 106 kPa (15 lbs/in ²) for 20 minutes (30 minutes if wrapped).	Boil container and lid for 20 minutes. If container is too large: Fill container with 0.5% chlorine solution and soak for 20 minutes. Rinse with water that has been boiled for 20 minutes and air dry before use.
Suction bulbs (rubber)	Soak in a 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse and wash immediately.	Wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary
Suction cannulae (plastic) for manual vacuum aspiration (MVA)	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately.	Pass soapy water through cannulae three times, removing all particles.	Not recommended. (Heat from autoclaving or dry-heat ovens will damage cannulae.)	Acceptable: Steam or boil for 20 minutes. Chemically high-level disinfect by soaking for 20 minutes. Rinse well with boiled water and air dry before use or storage.
Surgical instruments (metal)	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately. ^c	Using a brush, wash with soap and water. Rinse with clean water. If to be sterilized, air or towel dry and wrap in packs or individually.	Preferable: Dry heat for 1 hour after reaching 170°C (340°F) ^e , or Autoclave at 121°C (250°F) and 106 kPa (15 lbs/in ²) for 20 minutes (30 minutes if wrapped). For sharp instruments: Dry heat for 2 hours after reaching 160°C (320°F). ^e	Acceptable: Steam or boil for 20 minutes. Chemically high-level disinfect by soaking for 20 minutes. Rinse well with boiled water and air dry before use or storage.

Process	Decontamination is the first step in handling used items; it reduces risk of HBV, HCV and HIV viruses.	Cleaning removes all visible blood, body fluids and dirt.	Sterilization destroys all microorganisms, including endospores.	High-Level Disinfection destroys all viruses, bacteria, parasites, fungi and some endospores.
INSTRUMENTS OR OTHER ITEMS	DECONTAMINATION	CLEANING	STERILIZATION^a	OR HIGH-LEVEL DISINFECTION^b
Thermometers (glass)		Wipe with 0.5% chlorine or alcohol if visibly soiled. Wash with soap and water. Rinse with clean water, air or towel dry.	Not necessary	Not necessary
Transfer forceps (cheatle) and container (metal)	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately. ^c (Reprocess per shift or when contaminated.)	Using a brush, wash with soap and water. Rinse with clean water. If to be sterilized, air or towel dry.	Preferable: Dry heat for 1 hour after reaching 170°C (340°F) ^e , or Autoclave at 121°C (250°F) and 106 kPa (15 lbs/in ²) for 20 minutes (30 minutes if wrapped).	Acceptable: Steam or boil for 20 minutes. Chemically high-level disinfect by soaking for 20 minutes. Rinse well with boiled water and air dry before use.
Straight Metal Urinary Catheters	Soak in 0.5% chlorine solution for 10 minutes prior to cleaning. Rinse or wash immediately. ^c	Using a brush, wash with soap and water. Rinse three times with clean water (inside and outside).	Preferable (metal only): Dry heat for 2 hours after reaching 160°C (320°F), or Autoclave at 121°C (250°F) and 106 kPa (15 lbs/in ²) for 20 minutes (30 minutes if wrapped).	Acceptable (rubber or metal): Steam or boil for 20 minutes.
Ventilator tubing or circuits	Not necessary	Using a brush, wash with soap and water. Rinse with clean water and air dry.	Not possible using an autoclave or dry heat oven.	Acceptable Steam or boil for 20 minutes. Air dry before use.

^a If unwrapped, use immediately; if wrapped, reprocess if package becomes damaged or contaminated.
^b If sterilization (dry-heat or autoclave) is not available, these items can be high-level disinfected either by boiling, steaming or soaking in a chemical disinfectant.
^c Avoid prolonged exposure (> 20 minutes) to chlorine solution (> 0.5%) to minimize corrosion (rusting) of instruments and deterioration of rubber or cloth products.
^d Paper or plastic gowns, caps or masks. Place in a plastic bag or leakproof, covered waste container for disposal.
^e Instruments with cutting edges or needles should **not** be sterilized at temperatures above 160°C to avoid dulling.

Adapted from: Tietjen, Bossemeyer and McIntosh 2003.

APPENDIX 4: LIST OF PARTICIPANTS FOR THE DEVELOPMENT OF THE IPC POCKET GUIDE

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