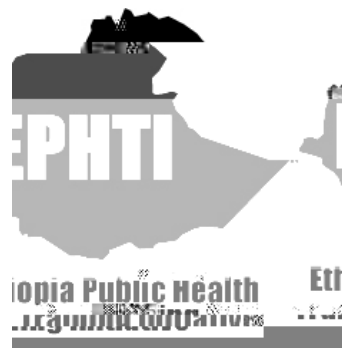


MODULE

# *Infection Control in Health Care Facilities*

Diploma Program  
For the Ethiopian Health Center Team



Tadesse Anteneh, Tariku Lambiyo, Keneni Gutema, Girmay Abraham,  
Asamnew Abayneh, Barana Balta, Dawit Assefa, and Tariku Gelda

Hawassa University

In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center,  
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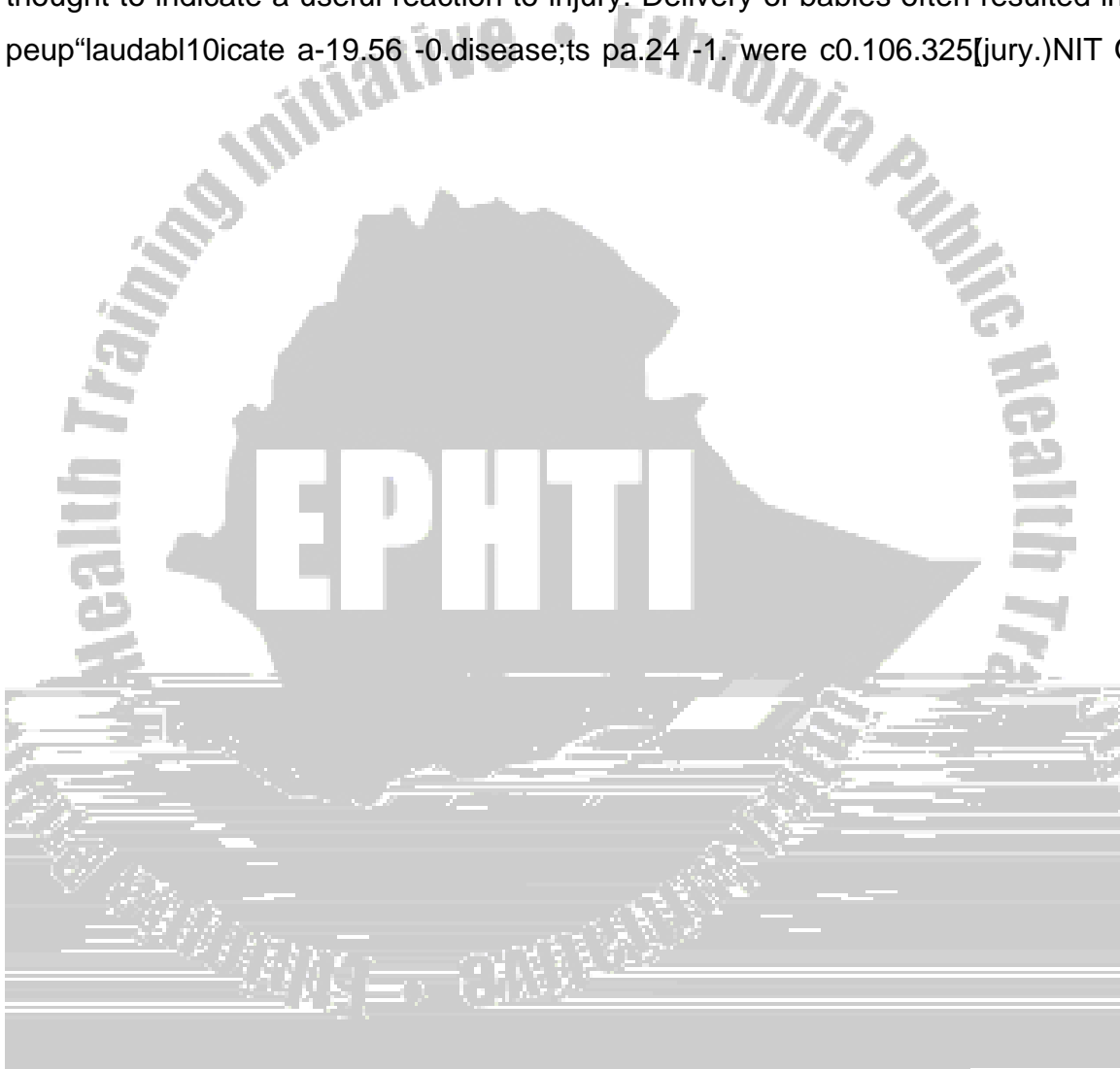
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# UNIT ONE

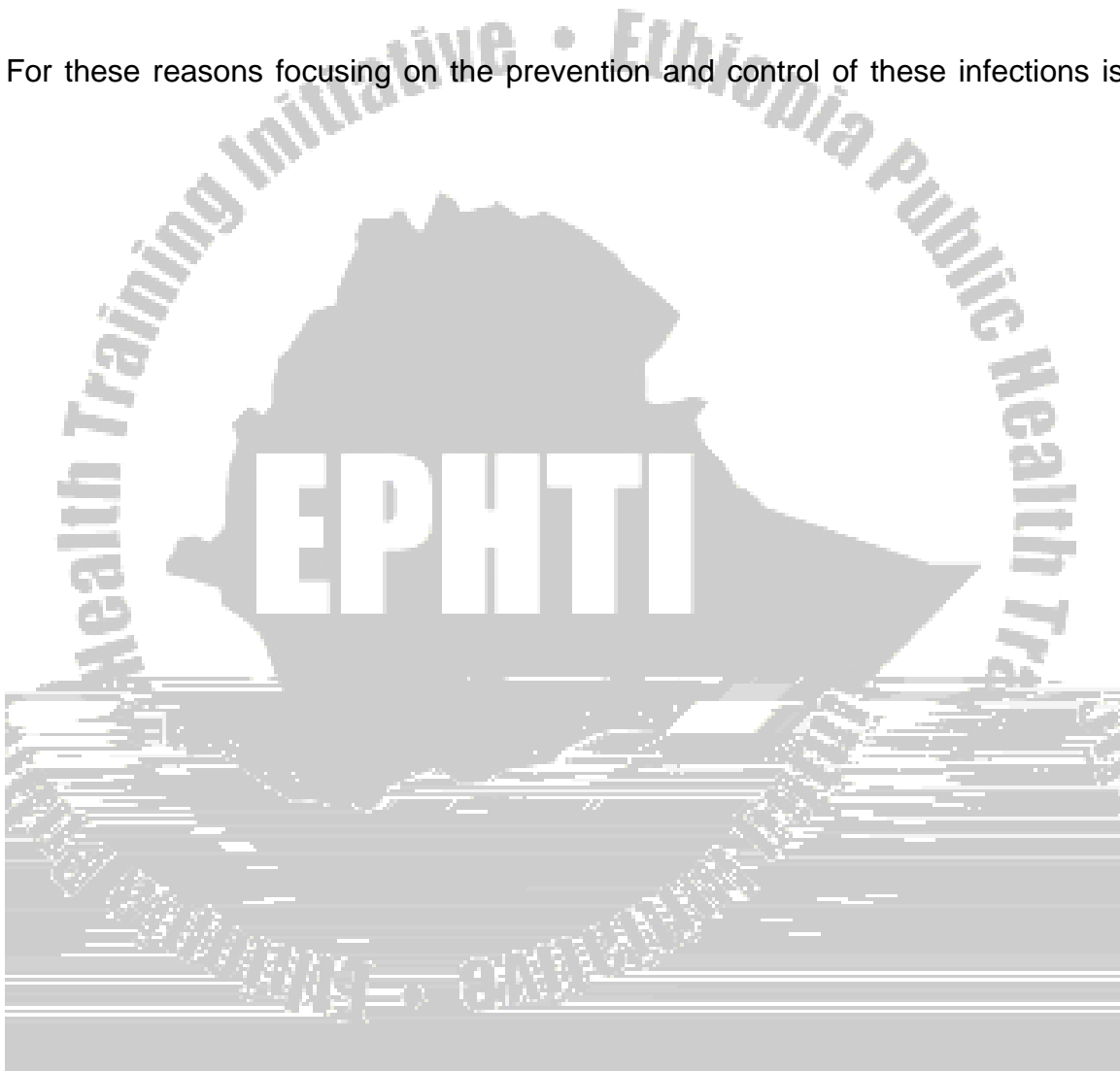
## INTRODUCTION

“A century ago hospitals were hazardous places. Postoperative infection was so common that suppuration was referred to as “laudable pus”; its presence was thought to indicate a useful reaction to injury. Delivery of babies often resulted in peup“laudabl10icate a-19.56 -0.disease;ts pa.24 -1. were c0.106.325[jury.]NIT ONE s



- 3) The manifestation of infection is obscured (overshadowed) by the initial illness which delays early detection and treatment.
- 4) They are in many cases resistant to the commonly used antibiotics and some, such as HIV, are not curable.
- 5) Once infection in health care facilities occurs, it requires a lot of effort to eradicate.

For these reasons focusing on the prevention and control of these infections is



techniques of specimen collection and handling, as well as the safety precautions necessary in the laboratory setting. It also deals with the identification of causative agents.

We hope this module will serve as a guide and readily available reference on infection prevention and control in the health facilities in Ethiopia by providing basic and-up-to-date information in this area. The writers would like to inform readers that this module is not a substitute for any book or written material developed on the subject. Finally it should be noted that the contents are periodically revised and are subject to changes to meet requirements of new scientific developments in the area.

## **1.1 Purpose and use of the module**

Modules are educational materials prepared from scientific theories and current research. A careful synthesis of these materials by the module development team results in the comprehensive document or module.

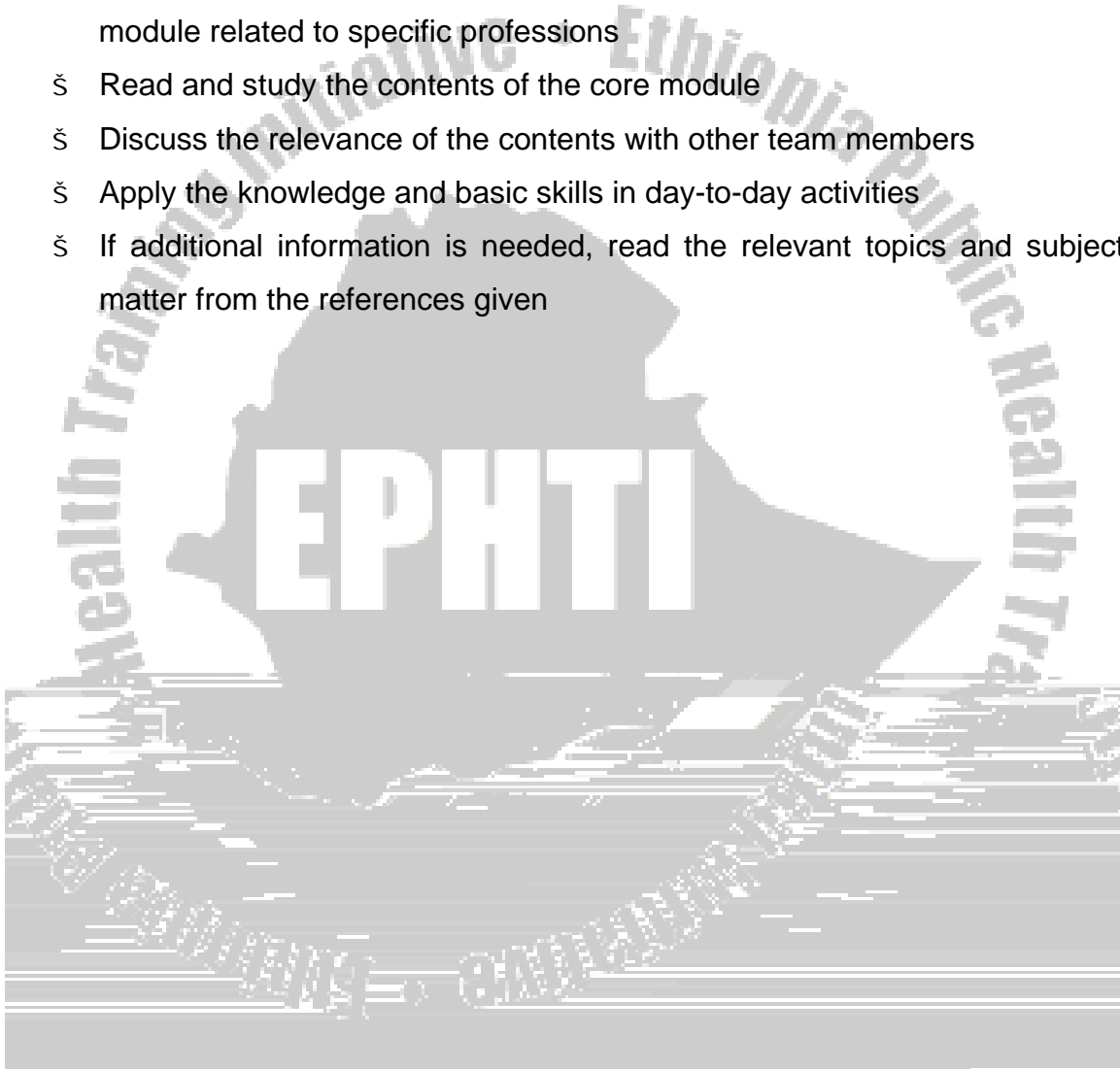
This module mainly focuses on, and emphasizes, teamwork in solving health center problems viz. Health Officers, Public Health Nurses, Environmental Health, and Medical Laboratory Technicians all working together in various health center programs.

This module aims to:

## 1.2 Directions for use of this module

In order to make the most effective use of this module the reader should adhere to the following directions:

- § Read the introduction and purpose of the module first.
- § Read the pre-test and attempt to answer the questions from the core module related to specific professions
- § Read and study the contents of the core module
- § Discuss the relevance of the contents with other team members
- § Apply the knowledge and basic skills in day-to-day activities
- § If additional information is needed, read the relevant topics and subject matter from the references given





**UNIT TWO**  
**CORE MODULE**

**2.1. Pre-and Post-test**

**2.1.1. Pre- and post-tests for the Health Ce**



4. Infection control and prevention in HCFs requires knowledge that:
- A. Microbial resistance patterns are important



9. Who are the members of waste management committee in infection control in HCFs?

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10. What are the responsibilities of the Head of the Health Center in infection control management committees?

- a) \_\_\_\_\_
- b) \_\_\_\_\_
- c) \_\_\_\_\_
- d) \_\_\_\_\_
- e) \_\_\_\_\_

11. What are the types of surveillance in HCFs?

- a) \_\_\_\_\_
- b) \_\_\_\_\_

12. Describe the common infection syndromes in HCFs.

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13. List the steps in out break investigations in HCFs.

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14. Write the responsibilities of department heads in infection control in HCFs.

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## 2.1.2. Pre and post tests for specific categories of the Health Center Team (from the Satellite Module)

### 2.1.2.1. Health Officers

**Directions:** Answer the following questions accordingly.

1. Regarding wound infections which one of the following is true?
  - A. Prophylactic antibiotics with tetanus antitoxin are the best in wound infection control and prevention
  - B. Proper wound management includes thorough cleaning and debridement of the wound
  - C. Presence of foreign bodies (e.g. catheter, suture) increases the risk of wound infection
  - D. All accidental wounds should be primarily sutured
  - E. B and C.
2. For pneumonia in a HCF:
  - A. The commonest cause is S. pneumonia
  - B. A patient with mental change is at high risk
  - C. It can be treated effectively using commonly used antibiotics
  - D. It can be easily diagnosed
  - E. All of the above.
3. Which one of the following is wrong regarding IV related bacteremia?
  - A. Coagulase negative staphylococcus species are the commonest cause
  - B. Primarily caused by contaminated IV fluids
  - C. History and physical examination are not important for diagnosis
  - D. Treatment doesn't involve the removal of the IV line
  - E. It is not a life threatening infection.

4. To reduce the risks of UTI in HCFs which of the following is correct?
- A. Avoid unnecessary catheterization
  - B. Irrigate with antiseptic solutions
  - C. Aseptic techniques should be followed during insertion
  - D. Use of a condom catheter in a male when prolonged catheterization is indicated
  - E. None of the above.
5. A 40 year old male patient came to the HC with complaints of trauma to his left foot secondary to a traffic accident two hours ago. The patient sustained extensive soft tissue injury with obvious injury to the muscle tissues with visible bone, blood vessels and nerves. There was gross contamination of the wound with soil with visible gravel and pieces of wood. There was however no sign of fracture or neurovascular damage.
- The management of this patient includes:
- A. Cleansing, debridment, systemic antibiotics and tetanus antitoxin
  - B. Primary closure of the wound
  - C. Urgent referral to the hospital
  - D. Leaving wound open/undressed
  - E. All of the above.
6. Which one of the following microbial classes is a major cause of infection in the HCF?
- A. Bacterial
  - B. Viral
  - C. Fungal
  - D. Helminthic.

7. Which one of the following risk factors contributes to the development of UTI in HCFs?
- A. Catheterization
  - B. Instrumentation
  - C. Urinary tract anomalies
  - D. All of the above.
8. Which of the following bacteria is a major cause of UTI?
- A. Proteus mirabilis
  - B. Enterococcus
  - C. Escherichia coli
  - D. Pseudomonas aeruginosa

#### 2.1.2.2. Public Health Nurses

**Directions: Answer the following questions accordingly**

1. Which of the following types of decontamination ensure the destruction of pathogens from clients/objects?
- A. Cleaning
  - B. Disinfection
  - C. Sterilization
  - D. All of the above.
2. What is the normal level of temperature and duration of boiling at sea level for disinfection?
- A. 90°C for 20 minutes
  - B. 100°C for 20 minutes
  - C. 121°C for 10 minutes
  - D. None of the above.

3. Which of the following types of barrier methods stop the spread of micro-organisms from clients to staff?
- A. Gloves
  - B. Masks
  - C. Eye glasses
  - D. Aprons and gowns
  - E. All of the above.
4. Which types of sterilization is/are ultimate alternatives for non-reusable materials in Health care facilities?
- A. Flaming
  - B. Steaming under pressure
  - C. Autoclaving
  - D. Incinerating.
5. Which of the following dressing techniques is not part of the guidelines for keeping wound sites clean?
- A. No need to determine the type of wound for dressing
  - B. Keep all articles sterile in contact with the wound
  - C. Keep the wound clear
  - D. Protect skin from irritations.
6. The following are true for parental procedures except:
- A. Clean the site with antiseptic solutions
  - B. Allow time to dry antiseptics
  - C. Start a circular motion from outside to inside during cleaning
  - D. None of the above.
7. Which of the following techniques is acceptable preparation for entering into a solution room?
- A. Obtain needed equipment
  - B. Enter to wear gown and mask
  - C. Wash hands after gowning
  - D. Remove watch and articles before gowning
  - E. All except C.

8. Which of the following types of hand washing are most widely used in health center facilities before a procedure involving contact with tissues?
- A. Soap and running water





### 2.1.2.3. Medical Laboratory Technicians

*Directions: Answer the following questions accordingly*

1.



5. Specimens are not acceptable for laboratory tests when one of the following is noted.
- A. There is no patient's name identification number km
  - B. The label on the request form and the label on the collection container do not match
  - C. The wrong collection tube has been used
  - D. All of the above.
6. List the preferred method for preserving a urine specimen if the sample cannot be tested within 2 hours of being collected.
7. What is the main purpose of any waste disposal program in the laboratory?

#### 2.1.2.4. Sanitarians

**Directions: Answer the following questions accordingly**

1. All are infectious waste found in health care facilities except:
- A. Tissues and materials or equipment that have been in contact with blood
  - B. Pathological wastes such as organs, body parts and human fetuses
  - C. Tissues and materials or equipment that have been in contact with body fluids
  - D. All of the above
  - E. None of the above.
2. Waste is not generated in which one of the following areas/rooms in health care facilities?
- A. Patient room
  - B. Delivery room
  - C. Kitchen
  - D. Laboratory
  - E. None of the above.

3. Describe the five main elements of an outbreak investigation in health care facilities.

- a).....
- b).....
- c).....
- d).....
- e).....

4. What are the steps in the safe management of infectious waste in health care facilities?

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5. Describe the different parts of a single chamber incinerator.

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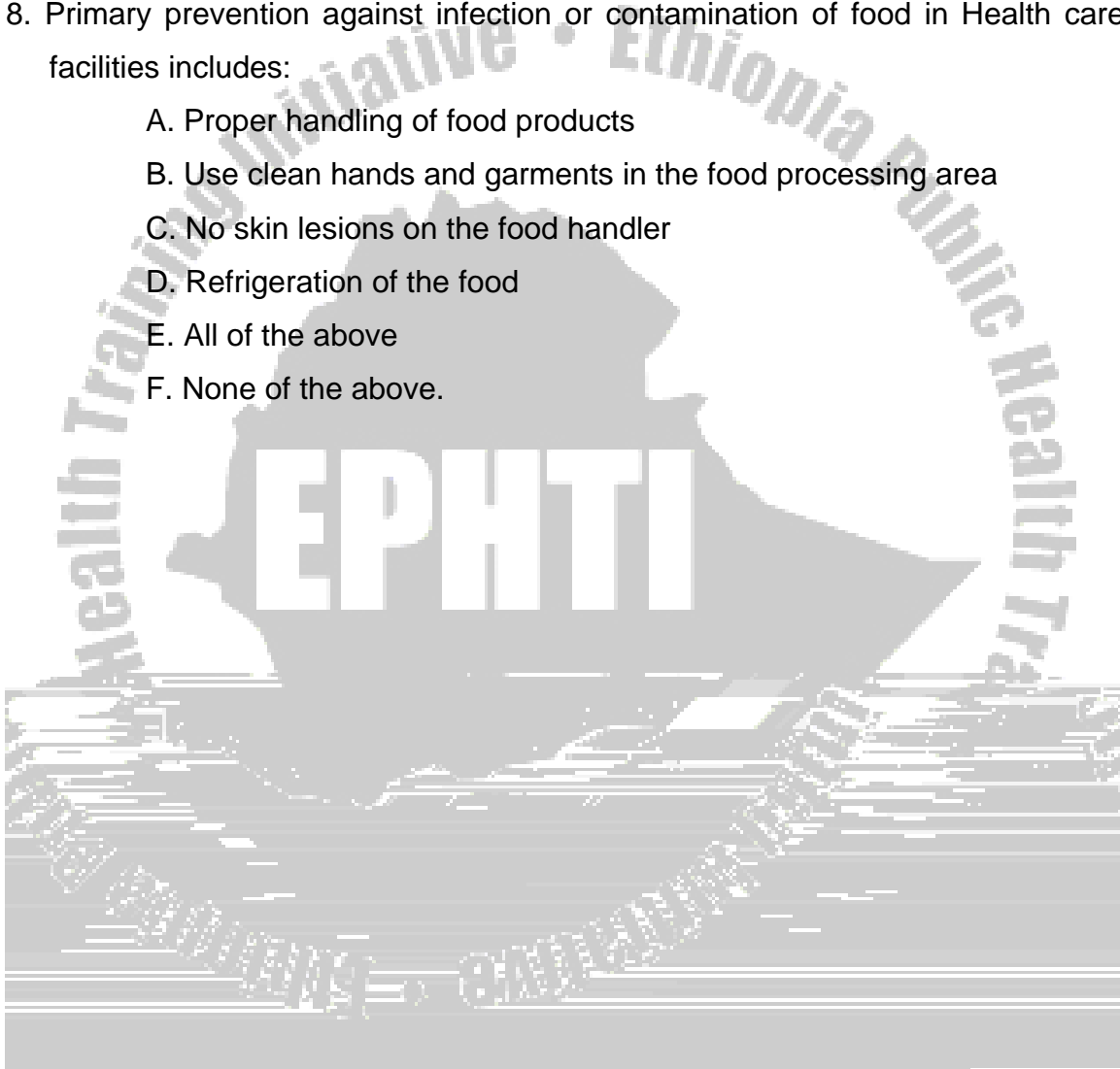
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6. For disposal of which of the following wastes is infection control in a placenta pit used?

- A. Pathological waste
- B. Sharp
- C. Garbage
- D. All of the above
- E. None of the above.

7. All are advantages of single-chamber incineration except:
- A. Good disinfection efficiency
  - B. Drastic reduction of waste
  - C. Inefficiency in destruction of thermally resistant chemicals and drugs
  - D. No requirement for highly qualified operators.
8. Primary prevention against infection or contamination of food in Health care facilities includes:
- A. Proper handling of food products
  - B. Use clean hands and garments in the food processing area
  - C. No skin lesions on the food handler
  - D. Refrigeration of the food
  - E. All of the above
  - F. None of the above.



## **2.2. Significance and brief description of the problem**

Health Care Facility infections are major health problems. Implementation and innovation of different aseptic techniques and antibiotics reduced the rate of infection in Health care facilities significantly worldwide from the 19<sup>th</sup> Century onwards. The problem of infections in Health care facilities however is still a major concern in developing countries like Ethiopia. This is largely due to poor sanitary facilities, poor waste management and lack of awareness regarding disease transmission and control. However the severity and magnitude of this problem is different for different levels depending on the types of health services provided, the number and the types of patients served. Micro-organisms cause most of the infections in Health care facilities and have now become resistant to the commonly used antibiotics making the management of these infections very costly. Infections are usually associated with high mortality and morbidity and as a result caused immense economic, social and health problems. The best management which is less costly and more effective regarding these infections is prevention and control

## **2.3. Learning Objectives**

### **2.3.1. General Objective**

3. Identify the standard precautions for infection prevention and control in health care facilities
4. Transmit health information and education for clients, family visitors and refresher training for staff on infection control in health care facilities
5. Organize an infection control and surveillance committee for routine monitoring, early detection and management of infections.

## 2.4. Case Study

W/o Shumbe Alako, an 18 year old primigravida mother from Koke peasant association of Igache Woreda, SPNNR, came a month ago to the Yirgachefe Health Center with a main complaint of abdominal pain of 10 hours duration. She had antenatal care in the same health center and no abnormality was detected both on repeated physical examination and during routine laboratory tests.

On her arrival to the health center, she was allowed to stay on the waiting benches for a few hours because the delivery room staff were, as usual, attending to a number of second stage mothers.. After a few hours the mid-wife in the delivery room observed W/o Shumbe pushing very hard and ordered the janitor to clean up the delivery couch. She had used the delivery couch earlier when she attended to the delivery of another laboring mother. The janitor informed her that she had already consumed the water in the tanker and the detergents. The desperate mid-wife, who feared W/o Shumbe may expel the baby on the soiled ground, put the laboring mother on the soiled

A week after the discharge, W/o Shumbe came to the health center because she had developed a persistently high-grade fever for the past two days. The Public Health Officer at the outpatient department took her history and conducted a physical examination and nothing pertinent was found except a body temperature of 39<sup>0</sup>C. Thinking probably of acute febrile illnesses which is malaria, the Officer sent W/o Shumbe to the laboratory for a blood film examination. Contrary to the physician's expectation she was found to have a negative result for Plasmodium species. He sent her back home with empirical treatment for presumed malaria. He also gave her advice to come back after two days if she had no response or her condition got worse.

Though she took the anti-malarial drugs as ordered, her fever persisted. Then she noticed an offensive vaginal discharge for two days as well as severe abdominal pain. her husband brought her back to the health center because she was getting very ill. The diagnosis of puerperal fever was made. A specimen of the vaginal discharge and blood were taken and were urgently sent to the laboratory. The laboratory findings indicated the following:

- § Gram negative rods
- § WBC 11,000/mm<sup>3</sup>
- §

Firstly the Committee assessed the general condition of the delivery room. They found that the delivery room is crowded with clients and the staff were busy attending to successive laboring mothers. In addition they observed delivery sets are thrown here and there, adequate water is not available for cleaning delivery couches and that the room lacks appropriate places for disposal of wastes. They were also astonished to see placental tissues, fecal matters and blood in every corner of the room. Back at the Health Center Head's Office, the Committee designed appropriate measures to tackle the problems observed in the delivery room.

## **2.5. Definition**

Infections in health care facilities are infections that occur in health care facilities like health centers, health posts, hospitals, etc

## **2.6. Commonest infections in health care facilities**

Infection in HCFs has become a major health problem especially in the health institutions located in developing countries. Therefore identification of these infections, their source and some factors



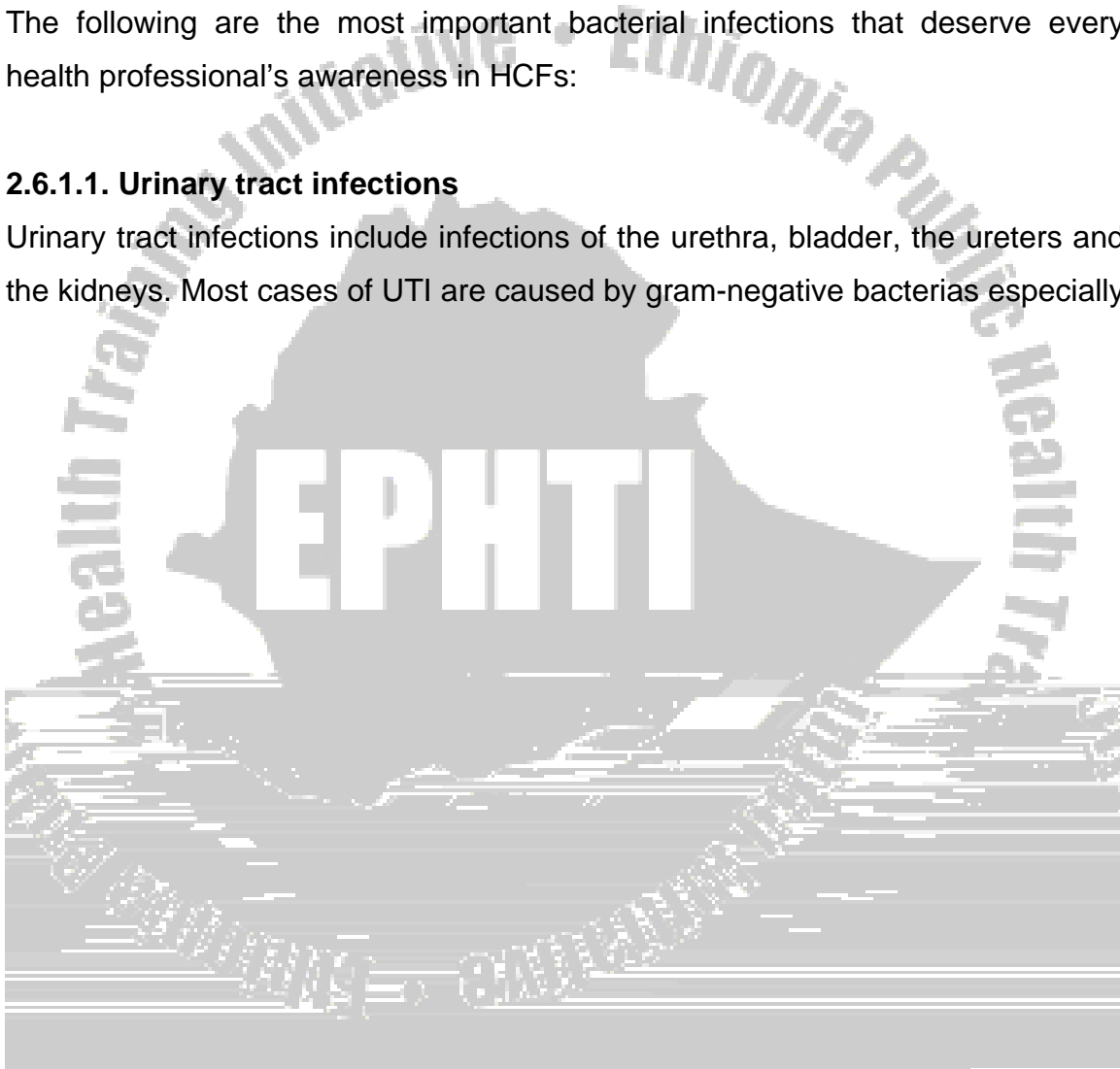
### **2.6.1. Bacterial infections**

Bacteria are the major cause of infections in HCFs. The Gram-negative bacteria are most commonly isolated pathogens from all sites of infection. This is mainly because of the abundant anti-microbial that affects gram-negative bacteria for which the bacteria develops resistance.

The following are the most important bacterial infections that deserve every health professional's awareness in HCFs:

#### **2.6.1.1. Urinary tract infections**

Urinary tract infections include infections of the urethra, bladder, the ureters and the kidneys. Most cases of UTI are caused by gram-negative bacterias especially



Gram negative

- § Escherichia coli
- § Pseudomonas aeruginosa

Special attention should be given to unclean burn wounds where micro-organisms like clostridium species and pseudomonas are mostly isolated.

#### **2.6.1.3. Air-borne infections**

These are infections transmitted by inhalation of pathogenic (disease causing) micro-organisms. Pneumonia, which literally means acute infection of the lung, is one the leading causes of death, especially in children, in the developing world. Though streptococcus pneumoniae is a common cause at the community level, staphylococcus aureus is known for its aggressiveness in health care facilities.

Tuberculosis is the other common bacterial infection of the lung in health care facilities. This chronic infection of the lung is caused by Mycobacterium tuberculosis. With the advent of HIV, multi-drug resistance tuberculosis is becoming a problem that needs attention by all health workers in health care facilities.

#### **2.6.1.4. Relapsing fever**

This is a common acute febrile illness in situations of poor hygienic and is caused by bacteria called borrelia recurrentis. Relapsing fever, if not identified early, can result in deadly complications. It needs joint management by all health worker teams in health care facilities.

### **2.6.2. Non-Bacterial causes of infections**

Previously it was mentioned that bacteria play a major role in nosocomial infections. Though not as common as bacteria other micro-organisms like viruses, fungi, protozoas, helminthes and ricketssias also play a major role in causing infection in health care facilities.

The most common ones include:

### **2.6.2.1. HIV/AIDS**

Acquired immunodeficiency syndrome is



#### **2.6.2.4. Fungal infections**

Dermatophytes (tinea), Candida and aspergillus species are the most frequently encountered fungal pathogens in health care facilities. “Ringworm” infections of the skin caused by tinea species are common in poor hygienic set ups in health care facilities.

Candida albicans is the candida species most commonly identified in health care facilities. It is the normal flora of the skin and gastro intestinal tract. Unsupervised or prolonged use of medication, which perhaps is due to a lack of awareness by health professionals, can result in the colonization of this pathogen in all body areas.

Aspergillus species are also common in the environment. Air is the principal route of transmission of aspergillus. Acquisition of this fungal species might result in chronic respiratory infections.

#### **2.6.2.5. Helmenthic infection**

Poor handling of stool specimens especially in the laboratory set-up might result in the common helmenthic infection. These common helmenthic infections include ascariasis, taeniasis, and hookworm infections. Infection due to entrobius vermicuclaris, which is highly contagious, is also possible in health care facilities where hygienic care is poor.

#### **2.6.2.6. Ricketisial disease**

One important cause of acute febrile illness in health care facilities which arises due to poor sanitary conditions is typhus (caused by ricketisia typhi). The health care worker has to give due attention to hygienic control of the disease (like proper washing and ironing of bed sheets, pajamas, fumigation of wards...).

## 2.7. Epidemiology of infection in health care facilities

### 2.7.1. Sources of infection in health care facilities

In health care facilities the source of infection could be different equipment used for different procedures, the patient, the health personnel and other auxiliary staff or the inanimate environment itself.

The epidemiological problem of nosocomial infection may have three categories:





micro-organisms. Additionally prolonged use of antibiotics helps in the emergence of anti-microbial resistant bacteria.

#### **2.7.2.5. Procedures**

Certain procedures need sterile techniques. Failure to follow these techniques leads to localized or systemic infection. One common example is catheterization. During this procedure aseptic techniques are needed otherwise there will be contamination of the urinary tract with skin or fecal bacteria. Patients will then present symptoms of a urinary tract infection.

#### **2.7.2.6. Immune Status of Patients and pre-existing co-morbidities**

Especially these days when we have increasing numbers of patients with HIV, immune status is a major factor that contributes to infection in health care facilities.

Others factors include patients with diabetes mellitus and some with metabolic/genetic disorders are also prone to some forms of infection.

Pre-existing co-morbidities can directly on impact the immune system such as with HIV or cancer. Co-morbidities such as malnutrition or diabetes can impact on the immune system in an indirect but still potent manner as well. Malnutrition is a critical “host” factor that needs to be considered.

### **2.7.3. Transmission of infection**

Infectious micro-organisms may reach the patient by direct contact with other patients, with health personnel, contact with contaminated materials (fomites) or contact with contaminated air droplets.

#### **2.7.3.1. Direct contact**

On entry to health care facilities individuals who are said to be infectious should be isolated. Hand washing is the single most important isolation precaution

because it removes organisms acquired from infected people. If the patient is going to transmit the micro-organism by air it is better to place him in a private room. The health care personnel should wear protective devices if he/she is going to come into contact with potentially infectious fluids that can be transmitted between the patient and the health care worker.

#### **2.7.3.2. Airborne spread**

Air is a major vehicle for dissemination of micro-organisms. The most common infections transmitted through airborne droplets include tuberculosis (especially multi-drug resistant TB), meningitis (especially meningococcal meningitis at times of epidemics) and others. Isolation is indicated if the patient is known to have great potential to transmit these micro-organisms.

#### **2.7.3.3. Contaminated fomites and fluids**

Fomites are inanimate objects other than food and water. Therefore contact of any instrument with open wounds, mucous membrane or internal organs of the body represents a mechanism of transmissi





### **2.8.1. Hand-washing**

This is the easiest and cheapest method of infection prevention practiced by human-beings for centuries.

Staff should practice hand-washing on arrival at work, before and after contact with clients, after handling



**Caution:** Alcohol can dry your skin. To prevent this you can mix alcohol (100 ml of 60-90% alcohol) with 2 ml of glycerin, propyl alcohol or sorbitol.

## **2.8.2. Barrier methods (Protective Wear)**

### **2.8.2.1. Gloves**

Proper use of gloves is an effective barrier for infection, protecting both clients and staff from pathogenic organisms.

There are three types of gloves:

- a. Surgical gloves: These are used when there is contact with blood and tissues under the skin (e.g. operative procedures).
- b. Single use or disposable gloves: Single use examination gloves are very thin and can easily be torn, thus their use is limited to procedures involving contact with intact mucous membranes and are disposed of after single use.
- c. Utility or heavy-duty

#### **2.8.2.4. Gowns**

Waterproof aprons prevent micro-organisms from the health worker's arms, body and clothing from entering the client and protect the health worker's skin and clothing from splashes of blood, other body fluids and soiling.

### **2.8.3. Handling, transporting and processing of fused or soiled instruments, linens and client care equipments**

#### **2.8.3.1. Handling and disposal of sharp instruments**

Injuries with needles and other sharp items are the leading causes of accidental infections of health workers by blood borne micro-organisms. Such injuries to health workers usually occur:

- § When recapping, bending or breaking hypodermic needles
- § When they are struck by a person carrying unprotected sharp instruments
- § When using many sharp instruments in small confined spaces and hands are difficult to see (e.g. operations in a cavity).
- § When handling and disposing of waste containing sharp instruments
- § When giving injections
- § When sharp instruments show up in unexpected places like linen.

##### **2.8.3.1.1. Care during injections**

Both client and health worker are at risk of infection during injections. The client could be infected if the needle, syringe or medication is contaminated and the health worker can be struck or splashed with blood if the patient suddenly moves.

To prevent these risks

- Always use new or properly sterilized syringes and needles for each client (one syringe and needle for one patient)
- Take proper care of the injection site
- Wash with water and soap if the skin has visible dirt.
- Clean with an antiseptic swab by wiping in a circular motion from the center outwards.

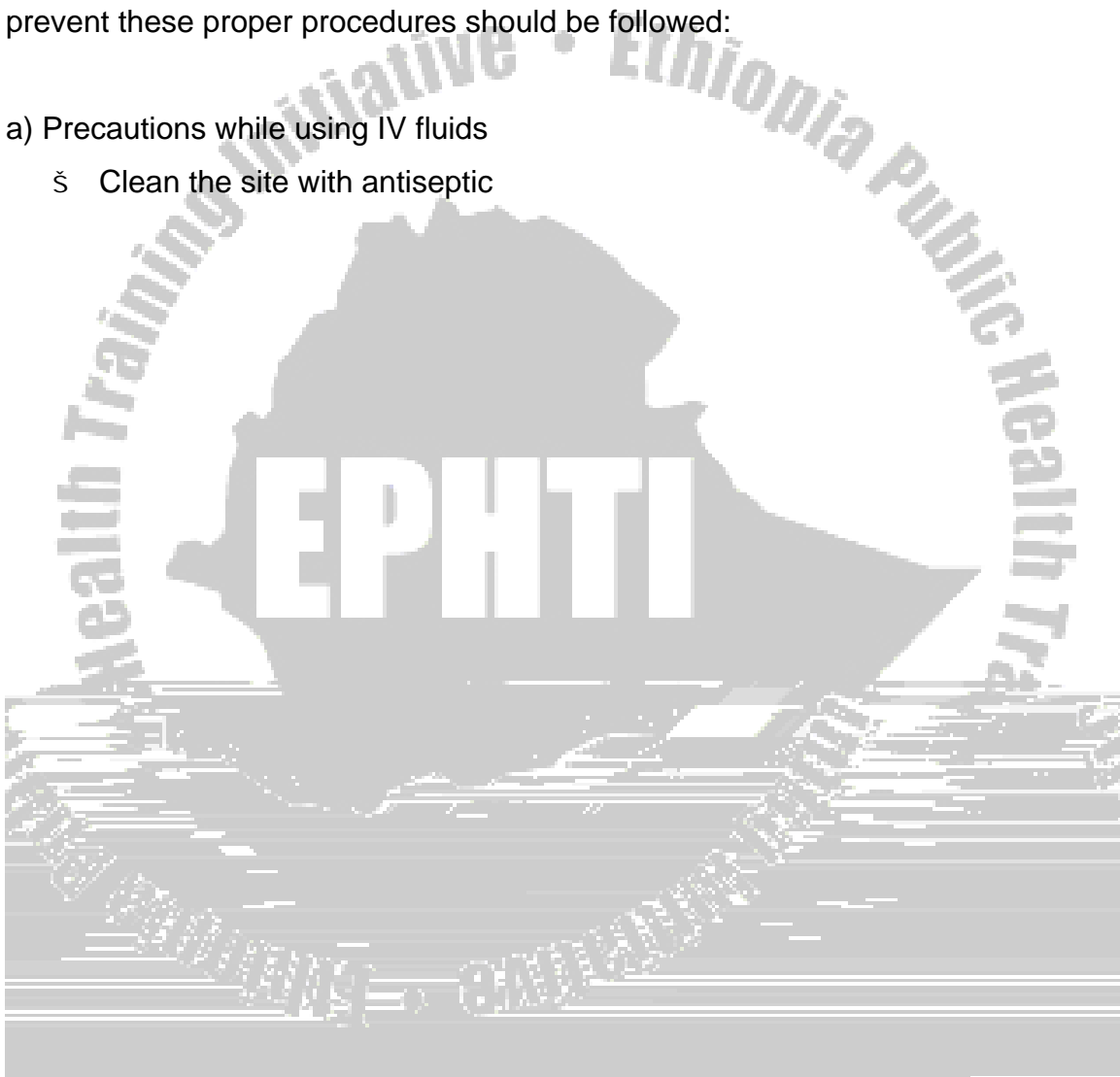
- Advise clients not to move during injections
- Compress the site, bleeding or not, with a cotton swab after the injection.

#### **2.8.3.1.2. Careful use of intravenous (IV) fluids and multi-dose vials**

Infections are often transmitted through the faulty use of these items, therefore to prevent these proper procedures should be followed:

##### a) Precautions while using IV fluids

- š Clean the site with antiseptic





Disposal: Improper disposal of sharp materials causes infection and injuries throughout the community. In our society children are at a very high risk of infection and injury as they may use some sharp items and syringes for playing.

### **2.8.3.2. Instrument processing**

Proper handling and processing of instruments reduces infection transmission to clients and staff. This must be routine procedure before any clinical or surgical procedure. The four steps of instrument processing include decontamination, cleaning, sterilization or high-level disinfection (HLD), and use of storage.

#### **2.8.3.2.1. Decontamination**

This is the first step in instrument processing for reuse. Decontamination makes the instruments safer to handle by killing many micro-organisms including viruses (such as hepatitis viruses and HIV) with decontamination solutions.

#### **2.8.3.2.2. Cleaning**

Cleaning is the process that refers to scrubbing with a brush, detergent and water. It removes organic material, dirt and foreign matter that can interfere with sterilization or HLD and reduces the number of micro-organisms on instruments.

*Note: Use detergent to easily remove grease, oil and other foreign matter. If hand soap is used for cleaning, the fatty acids in the soap will react with the minerals of hard water leaving a residue or scum that is difficult to remove.*

#### **2.8.3.2.3. Sterilization or High Level Disinfection (HLD)**

Sterilization ensures that items are free of micro-organisms killing all bacteria and their endospores, viruses, fungi, protozoa, etc. For this reason it is recommended for items like needles and surgical instruments that come into contact with blood or tissue under the skin.



items that come into contact with broken skin or intact mucous membranes.

There are three types of HLD: boiling, chemical HLD, and steaming. You





the different types of sterilization and HLD and the items/instruments for which they are suitable to use.

#### **2.8.3.2.4. Storage**

In this sub section you are going to be introduced to the method of proper storage of processed items/instruments to prevent them from getting contaminated. Storage of instruments or other items should not be in solutions, store them dry. Micro-organisms can live and multiply in both antiseptic and disinfectant solutions and items left soaked in contaminated solutions can lead to infections in clients.

Therefore for optimal storage place sterile packs in closed cabinets in areas that are not heavily trafficked, that have moderate temperatures and are dry and of low humidity. Under such storage conditions and with minimal handling, properly wrapped items can be considered sterile as long as they remain intact and dry.

#### **2.8.4. Environmental cleanliness and waste disposal**

In the previous sections you have learnt about the major types of infection prevention and control such as hand washing, barrier methods and safe handling and processing of sharps and instruments. In this section you are going to be briefly introduced to environmental cleanliness and waste disposal at health care facilities. Maintenance of environmental cleanliness and good hygiene of health facilities is a cornerstone in promoting health and the prevention of disease. However this is not the case in Ethiopia where it is common to see a health facility compound with piles of medical waste as well as dirty wards and examination rooms. Health

## 2.8.4.1. Environmental cleanliness and hygiene

### 2.8.4.1.1. House-keeping

#### a) Guidelines for cleaning clinics

Write and post a cleaning schedule

Wear utility gloves when cleaning

Use a damp or wet mop or cloth for walls, floors and surfaces instead of dry dusting or sweeping

Scrub to remove dust or micro-organisms

Wash surfaces from top to bottom, so that debris falls to the floor and is cleaned up last

Change cleaning solutions whenever they appear dirty. As heavily soiled solution may not kill micro-organisms

#### b) Cleaning solutions

Three types of solutions are used for house-keeping in the health facilities.

In your institution you should have all of them as they are used to clean the health facility in different situations.

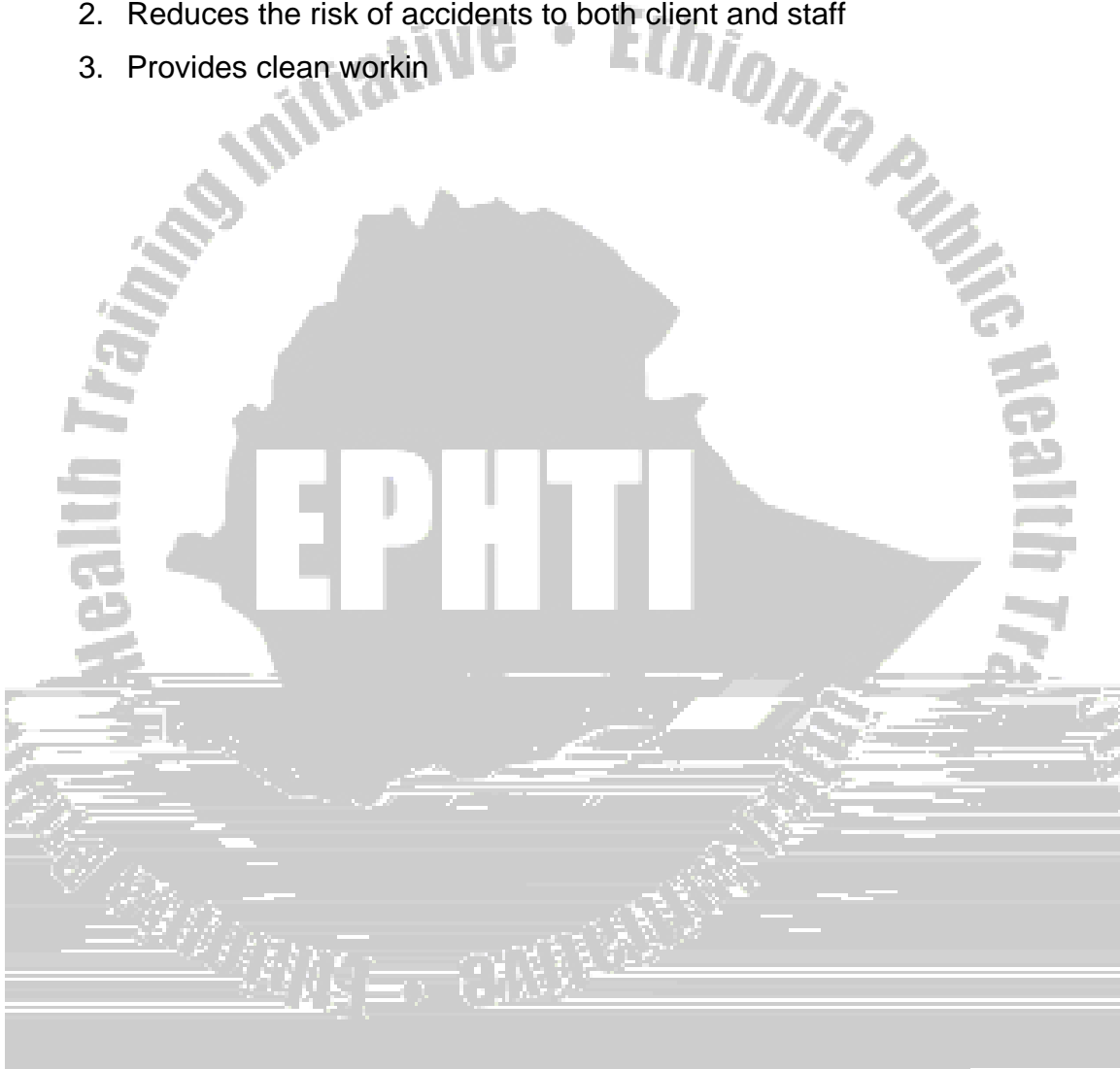
Plain detergent and water: 1 part detergent to 100 parts water



disinfectants, film developers etc) and radioactive substances (unwashed liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper).

#### **2.8.4.2.2. Benefits of proper waste disposal**

1. Reduces the risks of spreading infections to staff, clients, visitors
2. Reduces the risk of accidents to both client and staff
3. Provides clean workin



a. Solid medical wastes: Use one of three methods of disposal;

#### Burning

Wear utility gloves and shoes during disposal of medical waste

It is the best method as it sterilizes and reduces the amount of waste in an incinerator or oil drum. Open burning is only used in the absence of these methods

#### Burying

The next best option, the pit should have a fence or wall to limit access to it and prevent scavenging of waste

#### Transporting to an off site disposal site

This is transporting to an open community dump and is the least desirable alternative. Educate people about how they should handle the waste to prevent themselves from potential accidents.

b. Liquid medical waste: You should always wear utility gloves and shoes when handling and transporting liquid medical wastes.

Avoid splashing the liquid on to the floor, other surfaces, yourself or others.

Carefully pour liquid waste into a sink, drain, flush toilet or latrines. Rinse with water to remove any remaining waste on these disposal sites. Disinfect the container with 0.5% for 10 min.

c. Sharps: Disposal of sharps is best done by burning in industrial incinerators. However industrial incinerators may not be available in most health facilities in this country. Therefore you may use a metal container for sharps, needles syringes etc. When it is two-

third full, put in a fuel and ignite it. Burn it until the fire goes out on its own.

## **2.9. Health education in the control of infection**

Health education plays a major role in the control of infection in health care facilities for all involved parties. Teaching at different levels of sophistication is required for patients and their families, visitors, auxiliary staff and even health care professionals. Health care professionals may need only a “refresher” course given their experience.

### **2.9.1. Health education to patients, families and visitors**

Health education to patients should focus on areas such as

#### For patients who can support themselves

- § Maintaining their personal hygiene and cleanliness such as body washing and hand washing before meals and after using toilets
- § Having good communication with attendants and health professionals about the progress of their illness
- § Reporting if their wound is causing pain or discharge, redness, swelling or fever
- § Knowing the proper dietary intake and good drug compliance. This helps the patient to get well quicker and prevents infections in HCFs
- § Practicing the standard precautions with strict follow up.

#### For health care attendants and visitors who sometimes are the cause of infections in patients

- § Encouraging hand washing after using toilets and before feeding should be encouraged. In this regard pediatric patients are common victims of infection through contaminated care attendants
- § Avoiding room congestion by attendants and visitors in order to avoid air-borne infections

- § Discouraging giving non prescribed drugs
- § Discouraging non-sterile manipulation of indwelling lines
- § Caring and supporting the unconscious or the disabled (e.g. turning over frequently)
- § Proper collection and handling of patient's vomitus, sputum or other bodily secretions
- § Discouraging the application of scientifically unproven solutions or herbal medicines on wounds which may then play a major role and infection spread in health care facilities.

### **2.9.2. Basic training for auxiliary staffs of HCFs**

This should focus on:

- § Proper handling and washing of utensils, medical and surgical equipment and discharges from patients. These may other wise be a major source of infection
- § Proper disposal of discharges from patients like placenta, debrided parts and other body fluids should be ensured
- § Syringes, blades and other sharp disposable items should be discarded with great care to a safe place (sharp collection box or dust bins)
- § Patient's bed should be cleaned before it is given to another patient
- § Types and applications of standard precautions should be strictly followed.

### **2.9.3. Refreshment training for health professionals in the control of infection in HCFs**

- § Different techniques of sterilization and disinfection
- § Sterile handling of certain groups of patients and instruments
- § Proper handling, storage, transportation and washing of bed mattresses as well as disposal of solid and liquid wastes

- § Provision of safe water and adequate water supply for the HCFs
- § Provision of safe and nutritious food for the patients
- § Assessing the temperature, air conditioning, illumination, cleanliness and proper housing conditions of the rooms in HCFs.
- § Washing hands before and after examining patients, before buttoning ward coats, putting on and taking off gowns and before eating
- § Type and application of standard precautions should be strictly followed.

## **2.10. Waste management and infection control committee**

In the previous sections you have read about the common infections in health care facilities, their source, distribution, predisposing conditions, transmission and their impact on patients, staff and the community. You were then introduced to standard precautions for prevention and control in health care facilities and how to create awareness in staff (auxiliary and health), clients and their attendants and the community at large. In this section you will be learning about the waste management and infection control committee, its composition and duties.

The proper management of health care waste depends largely on good administration and an organized effort by all staff of the health care facility actively participating in safe handling, transporting and disposing of wastes to prevent infection. This requires the formation of a committee who can coordinate and monitor the overall waste management plan after its implementation.

### **2.10.1. The formation of waste management and infection control committee of a health care facility**

The head of the health care facility (health center/health post) should form this committee and chair the team.





- Monitoring the efficiency of the waste disposal system
- Insuring adequate training of staff on waste management

### **2.10.2.2. Waste management and infection control officer**

The waste management and infection control officer is directly responsible to the head of the health center, and should

- Control the internal collection of waste containers and their transport to the storage facility on a daily basis, the correct use of storage facilities and prevent unsupervised dumping of waste containers on the ground
- Supervise attendants and auxiliary staff assigned for waste collection and disposal
- Ensure waste containers, protective gloves and clothing and collection trolleys are available at all times
- Ensure that waste is disposed of in the specified time and location
- Ensure the training of staff of the health care facilities to make them aware of their responsibilities in waste segregation and storage
- Coordinate and monitor all departments regarding waste management efforts
- Advise the departments about infection control methods and monitor their proper implementation
- Ensure and co-ordinate surveillance of infection in HCFs.

### **2.10.2.3. Nurse and health center manager**

They are responsible for training nursing staff, medical assistants, health center attendants and ancillary staff on the correct procedures for segregation, storage, transport and disposal of waste. They should

- Participate in the training of staff
- Control the overall waste handling and disposal management as a support to the waste management and infection control officer
- Provide the necessary inputs for waste management and infection control of waste bags and containers, protective clothing etc.

#### **2.10.2.4. Department heads**

They are responsible for segregation, storage and disposal of waste in their departments. Therefore they should

- Insure that all health and auxiliary staff are aware of the procedures of segregation and storage of waste and that all personnel comply with the highest standards possible
- Continuously work with waste management and the infection-control officer to monitor working practices for failures or mistakes
- Ensure that staff members in their departments are given training
- Encourage the nursing and medical staff to be vigilant that attendants and auxiliary staff follow correct infection control and waste management procedures at all times.

#### **2.10.2.5. Supply officer (optional)**

He/she should

- Ensure a continuous supply of items required for waste management .

#### **2.10.3. Surveillance for infections in health care facilities**

The waste management and infection control committee of a health facility should establish a surveillance system as part of the infection control efforts. The

**Table 3: Common infection syndromes in HCF**

Urinary tract infection	Post-abortal sepsis
Surgical wound infections	Neonatal sepsis
Puerperal sepsis	Meningitis
Fever	Pneumonia

Steps in Diagnosis

1. Daily regular examination of patients to detect newly developed infections
2. Carry out “septic screening” in patients suspected of having infectious body fluids (blood, urine and aspirates) and have swabs of infected tissues sent for culture analysis before antibiotics are started
3. Identify any infectious agent in the laboratory, its sub type and drug sensitivity
4. Adjust treatment according to the drug sensitivity
5. Compile data by laboratory analysis

### **2.10.3.3. Compiling data**

To determine the presence of an outbreak regular compiling of data on the number of cases and the bacterial isolates is essential. The ward should keep records of patients with infections acquired in the HCF, the clinical manifestations and the micro-organisms isolated and drug sensitivities. This data is compiled weekly and then monthly.

The waste management and infection control committee should discuss the data regularly and review infection control strategies. They should then send the data to a central data collecting point (e.g. MOH).

The committee is responsible through its waste management and infection control officer to compile all information into a report and ensure regular follow up of an outbreak investigation as well as the training of health/auxiliary workers on infection control.

### **2.10.3.4. Investigation of an outbreak**

An outbreak is an increase in the number of cases of an infectious syndrome.

What do you do if you have an outbreak in a health facility?

The WMIC committee should designate a staff member to investigate the outbreak and coordinate different departments to bring the outbreak under control.

Steps for investigating an outbreak

1. Formulate a case definition.
2. Using the case definition show how statistically the current rates are significantly higher than pre outbreak rates.

5. Review charts of infected patients and develop line lists containing demographic data (data of admission and procedures, ward location and dates) and potential risk factors.
6. Plot a time line with data for all common events. The number of cases is plotted on the Y-axis and the time interval between infection and potential risk factor on the X-axis.
7. Formulate a hypothesis regarding the source of infection and mechanisms of transmission.
8. Perform a case-control study, comparing infected patients of the same age, sex and service with exposure to potential risk factors.
9. Institute temporary infection control measures.
10. Obtain cultures of suspected common sources, just by referring the samples where cultures are available.
11. Continue surveillance to document efficacy of control measures.
12. Write a report of the investigation for the WMIC committee.
13. Review infection control policies related to the outbreak and revise if necessary.

### **2.11. Learning activities: Case study continued**

Based on the history of W/o Shumbe in Section 1.4 of the Core Module, different points of discussion are incorporated in Satellite Modules. Discuss these points. Your teacher can help you.

## UNIT THREE

### SATELLITE MODULES

#### 3.1. Satellite module for Public Health Officers

##### 3.1.1 Introduction

###### **Purpose and use of the module**

This module can be used in the training of Health Officers that are in actual training or those already in service for infection control in health care facilities.

###### **Directions for using the module**

For a better understanding of this module, the Health Officers are advised to:

Read the purpose, the use and the directions for using the module in section 3.1.2 and 3.1.3 and follow the instructions

After doing so, do the pre tests in section 2.1 and then go through all the topics of the core module

Then read the satellite modules for your respective profession with special emphasis to the subject matter. However don't forget to read the satellite module for the other categories

Read the reference materials listed to supplement your understanding

Do the post test pertaining your profession in section 2.1 of the core module and evaluate yourself by referring to the keys in unit seven

##### 3.1.2 Learning Objectives (Specific objectives for Public Health Officers)

After reading this module the HO will be able to:

1. Know the most common types of HCF infections.

2. Know etiologies and risk factors for each category of infections in health care facilities.
3. Describe diagnostic methods for infections in health care facilities.
4. Describe the management, prevention and control measures of infections in health care facilities.
5. Know the HO's role in the control of HCF infections.

### 3.1.3. The common types of HCF infections

The most common types of nosocomial infections are

1. Urinary tract infection - 28%
2. Surgical wound site infection - 14%
3. Pneumonia -17%
4. Primary blood stream (intravenous catheter related) infection - 16%
5. Sepsis

#### 3.1.3.1. Etiologies of the common HCF infections

**Table 1.1 Pathogen distribution (percentage) for major sites of nosocomial infections**

Pathogen	UTI	Wound infection	Pneumonia	Blood stream infection	Total
Escherichial coli	26	10	6	6	16
Enterococci	16	13	2	8	12
Pseudomonas aeruginosa	12	8	17	4	11
Staphylococcus aureus	2	17	16	16	10
Coagulase negative staphylococci	4	12	2	27	9
Enterobacter spp.	6	8	11	5	7
Klepsiella pneumoniae	6	3	7	4	5
Candida albicans	7	2	4	5	5
Proteus mirabilis	5	4	3	1	4
Streptococcus spp.	0	3	1	4	2
Serratia marcescens	1	1	4	1	2
Citobacter spp.	2	2	1	1	2



### 3.1.3.2. Clinical presentations

A common presentation of the HCF infection is the occurrence of new fever after admission, usually 48hrs. To diagnose a nosocomial infection one must use clinical clues from a patient's presentation, procedures that have been done to him/her, the treatment the patient is having and other risk factors. So a careful history, physical examination, laboratory and imaging diagnostic workups are important.

During patient evaluation particular attention should be paid to the respiratory system, genitourinary systems, gastro-intestinal tract (GIT) and musculoskeletal system.

#### History:

- § Cough
- § Chest pain
- § Change in sputum characteristics (color, amount, content)
- § Flank pain
- § Dysuria, urinary frequency, costovertebral angle (CVA) tenderness, suprapubic pain,
- § Diarrhea
- § Headache
- § Leg pain and swelling
- § Other features related to the patient's admission, like current presence of urinary catheter, IV device, NGT, endotracheal tube, tracheotomy tube, surgical wound, new medication administered, etc. should be asked about.

**The physical examination:** This should be directed at possible sources of infection such as

Wound sites for signs of inflammations like swelling, tenderness, hotness, redness and presence of pus

Lungs (chest examination) for increased or decreased tactile fremitus, abnormal percussion note, rhonchi, crepitations, bronchial breath sounds, decrease in air entry, etc.

Urinary catheter and the color of the urine, pus or other signs of inflammation around the urethral meatus and the proper connection of the catheter with the drainage tube

IV device insertion site and wet dressing of insertion site, presence of pus, indurations or local heat

Skin for rashes.

**Diagnostic work up:** CBC, B/F (Blood film), U/A (Urine analysis), sputum Gram stain or AFB stain, Gram stain of pus or other discharges from infection site, CXR.

### 3.1.3.3. Individual HCF infections

#### 1. Catheter related UTI

**Incidence:**

This is the commonest type of HCF infection that accounts for 40% of HCF infections.

**Risk factors:** The six principal risk factors are

- a. Female sex
- b. Prolonged duration of catheterization
- c. Lack of appropriate catheter care like disconnection of the catheter and drainage tube
- d. Open drainage.
- e. Debilitated patients
- f. Lack of proper aseptic technique during catheterization.

**Etiology:** Escherichia coli, enterococci and pseudomonas aeruginosa are the commonest pathogens in decreasing order (Refer to tab 1.1 for others).

**Pathogenesis:** This is different in males and females

Female: Periurethral colonization with pathogens trucking up the short female urethra.

Male: No periurethral colonization but intraluminal spread of infection to the bladder.

**Clinical presentation:** Most cause minimal symptoms

Fever

Pyuria

Dysuria

CVA tenderness

Urinary frequency

Supra pubic tenderness

Flank pain

Hematuria.

**Complication:** Gram-negative sepsis is the commonest complication

**Investigations:** WBC- leukocytosis, U/A –WBC, RBC, bacteria casts. Refer to the higher center for culture and sensitivity if there is no response to the usual antibiotics.

**Management** can be categorized into two: Antibiotics and supportive treatment

**Antibiotics:** Drug resistance is a common problem. Where urine culture facility is not available empirical antibiotic therapy to cover the commonest causative agents is the only option.

**Oral medications for patients with minimal symptoms**

Ampicillin

Ciprofloxacin

Ofloxacin

Cotrimoxazole

#### **IV-medications for more severe illnesses including acute pyelonephritis and urosepsis**

Ampicillin + Gentamycin  
Ceftriaxone or ceftazidime

**Duration of treatment:** 7-21 days depending on the severity of infection and causative agent.

#### **Supportive treatments**

Rehydration  
Analgesics  
Change catheter or if possible remove it

#### **Preventive measures**

Proper catheter care  
To avoid unnecessary prolongation of catheterization period follow aseptic techniques during catheterization and catheter manipulation,  
Screening and treating pre-existing UTI before surgery  
Avoid unnecessary catheterization  
Use supra pubic cystostomy or condom catheters (for males) when prolonged catheterization is indicated.

## **2. Wound Infection**

This is the second most common type of HCF infection. Evaluations of fever in the admitted patient should include examining wound sites. Wounds can be classified into two:

1. Accidental wounds (contaminated wounds): This is associated with high risk of infection.
2. Surgical wounds: These are associated with less risk of infection.

**Risk factors:**

**Host factors**

Old age, infancy

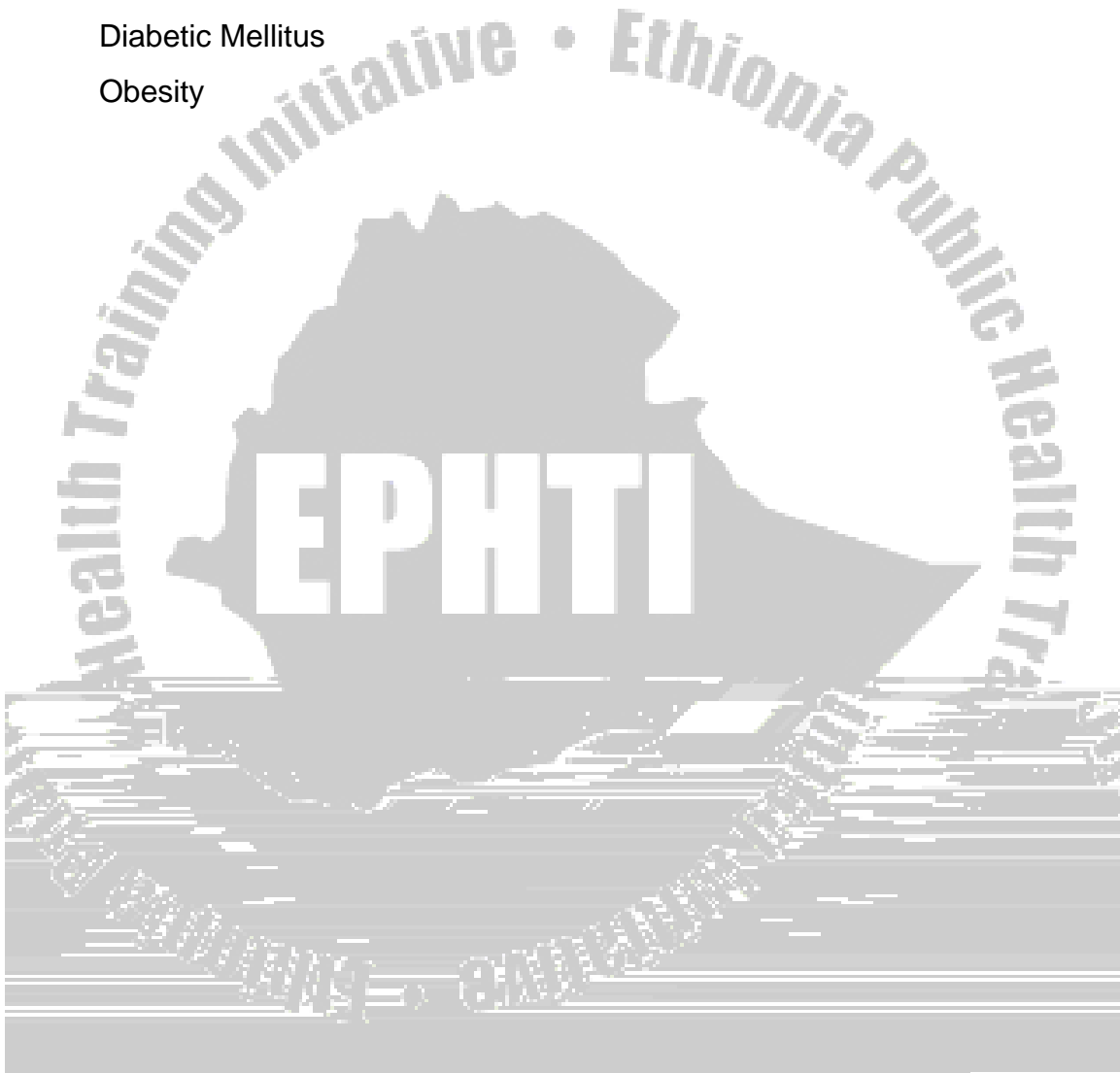
Malnutrition

Immunocompromised state

Immuno suppressive drugs like corticosteroids, and cytotoxic drugs

Diabetic Mellitus

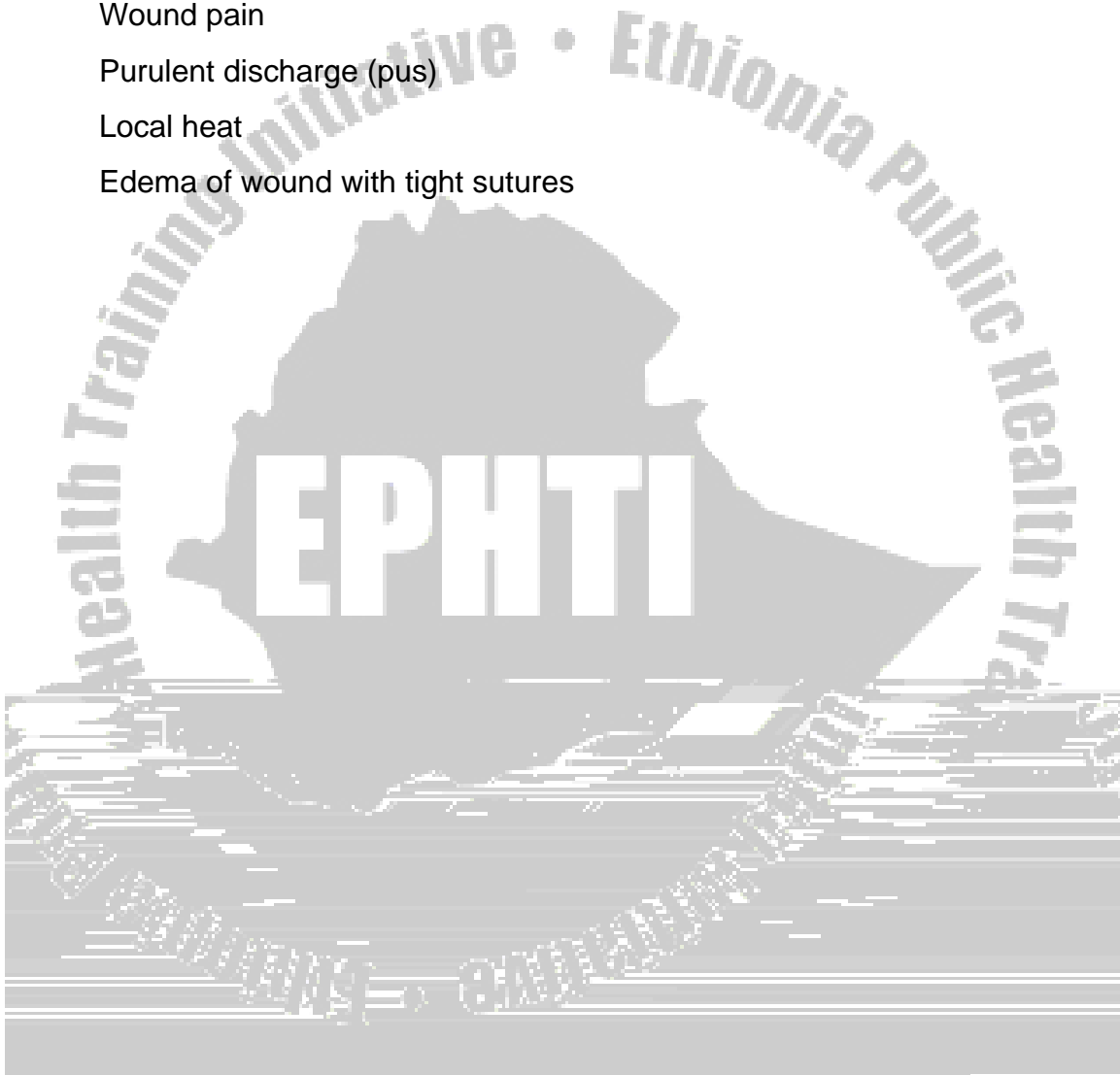
Obesity



Enterococcus,  
Coagulase negative staphylococcus Spp.  
E.coli.

**Clinical features :**

Fever  
Wound pain  
Purulent discharge (pus)  
Local heat  
Edema of wound with tight sutures



Re-examine the wound after 2-3 days

Dress with sterile gauze

Undertake daily wound care

If a surgical wound is infected remove the stitches over the infected area, drain the pus, clean and debride the area and do daily dressing

Note: Grossly contaminated wounds are wounds caused by RTA, war injuries, industrial injuries, with obvious contamination with feces, soil, cow dung and wounds caused by animal bites.

#### **Antibiotics:**

Ampicillin, cloxacillin, CAF or metronidazole

IV penicillin + Gentamycin

Cloxacillin + CAF (chloramphenicol)/ Metronidazole

± Gentamycin

Ceftriaxone/ceftazidime

#### **Prevention of wound infection.**

Proper wound management is by far the most important and effective way of wound infection control and prevention. See the topic under local wound management

Prophylactic antibiotics

Local anti septic ointment like in burn wounds

Administer IM tetanus antitoxin after skin test

Correct underlying problems like malnutrition, anemia, Diabetic Mellitus,

Treat pre-existing active infections

Proper handling of the tissues during surgical procedures and wound management

Follow aseptic techniques during any surgical procedures

Use sterile gloves and other barriers

Sterile medical equipment properly

Adopt hand washing habits between patients during examination and any other medical procedure.

#### 4. Pneumonia

**Epidemiology.** This is the third most common type of HCF infection. HCF acquired pneumonia is a life threatening illness raising mortality to as high as 50% if left untreated.

##### Risk factors

Patients with altered mental status

Patient with NGT

Elderly

Patients with severe underlying illness

High risk patients on antacid or H2-blockers for stress ulcer prophylaxis

Immunosuppression.

**Etiology:** The commonest in decreasing order are (Refer to table 1.1)

P. aeruginosa,

St. aureus,

K.Pneumoniae .

**Pathogenesis:** Colonization of the oropharynx and stomach is an important step and then aspiration occurs usually during sleep and facilitated by NGT, endotracheal intubations or delayed gastric emptying. As for gastric colonization, bacterial count in the stomach increases with raised PH, which is the problem with the H2 blockers or antacid administration gastric colonization causes retrograde oropharyngeal colonization.

**Clinical features:** Diagnosing nosocomial pneumonia is a difficult task and the criteria used are in the presence of risk factors.



**History:**

Fever

Cough

Purulent sputum with or without change of color

Patient need for respiratory support without other causes (fluid overload, pneumothorax, pulmonary thromboembolism, atelectasis)

Chest pain.

**Physical Examination:**

Tachypnea

Tachycardia

Decrease or increase tactile fremitus

Dullness

Rales

Bronchial breath sound.

**Investigations:**

WBC and Differential – Leukocytosis with neutrophil predominance

CXR – for new and progressive infiltrates (if available)

Sputum gram stain – in presence of minimal contamination of epithelial cells <10 and polymorphonuclear cells >25 per low power field, identification of common causative agents may help.

**Management:** Can be divided into two

1. Supportive care
2. Antibiotic treatment

**Supportive care:**

Analgesics

Fluid and electrolyte monitoring

Chest physiotherapy

Postural drainage

Antibiotics:

As antibiotic resistance is a major problem, knowledge of drug sensitivity patterns for flora at a particular HCF is important.

Empirical treatment of antibiotics depends up on

Sputum gram stain

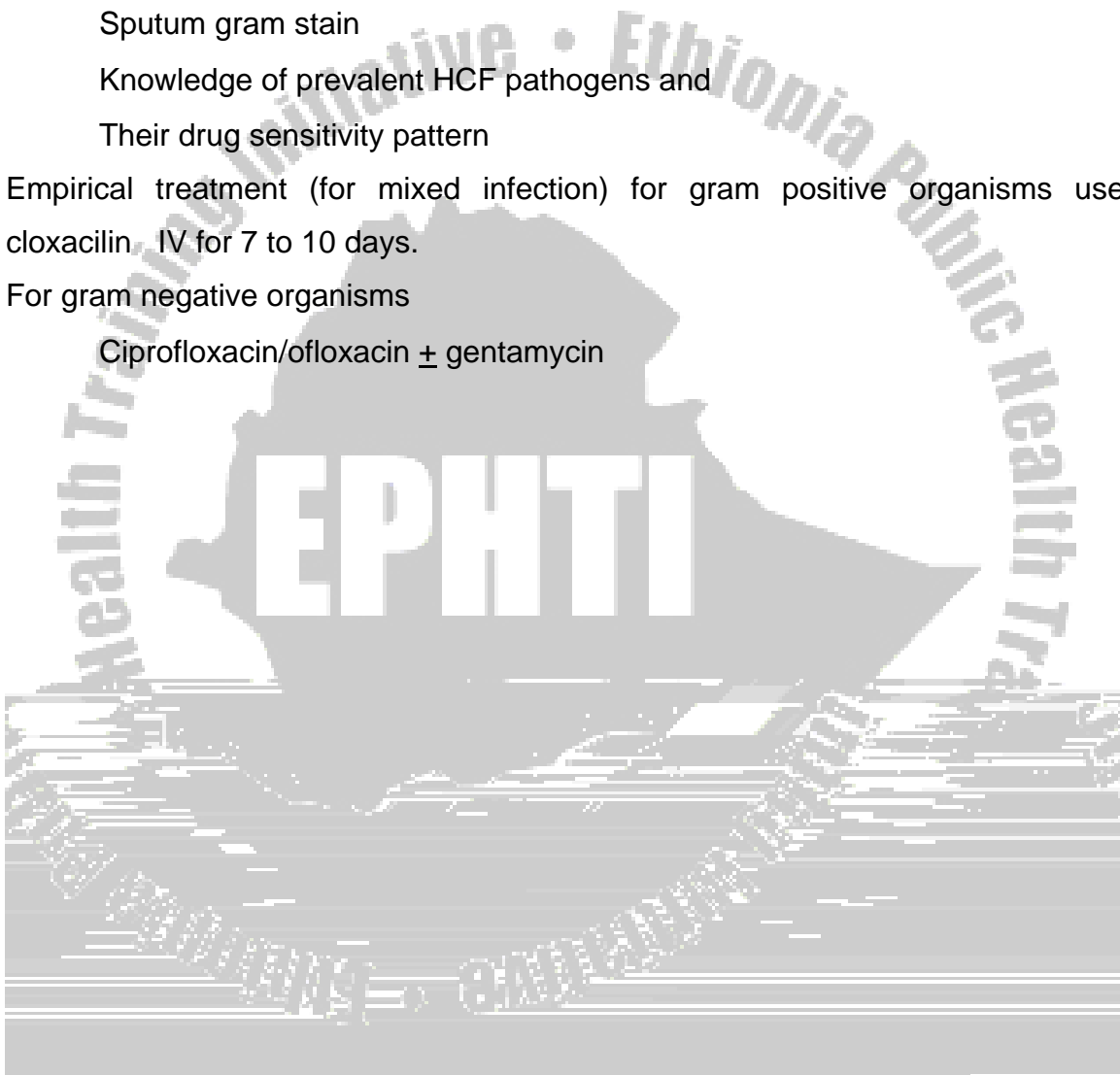
Knowledge of prevalent HCF pathogens and

Their drug sensitivity pattern

Empirical treatment (for mixed infection) for gram positive organisms use cloxacilin. IV for 7 to 10 days.

For gram negative organisms

Ciprofloxacin/ofloxacin  $\pm$  gentamycin



Contaminated cannulas  
Hematogenous.

### **Etiologies**

Normal flora of the skin like staph. aureus and strept. Epidermidis.

### **Predisposing factors**

Duration of catheterization > 72 hours  
Plastic catheter > steel needle  
Cut down > precutaneous insertion  
Emergency > elective insertion  
Break down in skin integrity  
Number of cannula manipulations  
Violations of aseptic rules

### **Clinical features**

Fever  
Local inflammation sign at insertion of the cannula  
Erythema  
Swelling  
Purulent discharge  
With or without sign and symptoms of sepsis.

### **Investigation**

Gram stain from the insertion site

### **Management**

Removal of the cannula often will result in resolutions  
Antibiotics if signs of inflammation persist  
The drug of choice is ampicillin / cloxacillin for 5-7 days.

## Prevention

Proper training on appropriate way of securing I.V cannulas

Apply appropriate antiseptic technique while securing I.V canulas

For long I.V catheterization it should be changed every 48-72 hours

### 3.1.4. Learning Activities: Case study continued

Refer to the Case Study on in section 1.4 of the Core Module and discuss the following questions:

1. What are the main causes of puerperal fever?
2. Describe the environment of the delivery room W/o Shumbe had attended.
3. What are the responsibilities of the Health Center Team to stop infection?
4. What are pre-requisites to address prevention and control of infections?
5. Who is responsible for the development of infection at the Health

## 3.2. Satellite module for Public Health Nurses

### 3.2. Introduction

#### 3.2.1. Purpose and use of the module

The aim of this satellite module is to equip trainees with knowledge and skills required to take responsibility to identify and handle the source of infections effectively and to prevent and control infections.

#### Directions for using the satellite module

For a better understanding of this module, the Public Health Nurses are advised to:

Read the purpose, the use and the directions for using the module in section 2.2.2 and 2.2.3 and follow the instructions

After doing so, do the pre tests in section 1.1 and then go through all the topics of the core module

Then read the satellite modules for your respective profession with special emphasis/TT6 1 Tfh

### 3.2.2. Learning Objectives (Specifi





. 0.5 – 1%







### 3.2.4.2. Preparation of Intramuscularly and intravenous sites

**Purpose:** To remove as many micro-organisms as possible from the patients skin, including patient's own normal flora in order to prevent abscesses at the injection site.

#### Preparation of intramuscularly site

##### Equipment / supplies

- 70% Alcohol
- Cotton swabs

##### Procedures

Clean the skin with an alcohol swab using a circular motion starting at a central spot and moving towards the outer zone

Allow time for alcohol to dry on the skin prior to injection. This takes at least 30 seconds.

#### Preparation of intravenous injection site

##### Antiseptic

- . 1-2% Tincture of iodine
- . Povidine-Iodine solution (betadine)
- . 70% alcohol

Cotton swab

##### Procedures

Apply the antiseptic agent liberally in a circular motion starting from a central spot and moving outwards

Allow the antiseptic to dry on the skin. This takes at least 30 seconds prior to needle insertion

Clean your fingers with alcohol before touching the site if vein palpitation is necessary.

### 3.2.4.3 Dressing techniques

#### Purpose

To prevent infection by keeping the wound clean, to promote healing and to make the patient comfortable.

#### General guideline

Determine the need for dressing by the type of wound

- a. Abrasions tend to heal without dressing
- b. Lacerations may require dressing depending on the extent of injury
- c. Punctures may need dressing, also depends on the extent of injury
- d. Surgical incision may need dressing depending on whether there is drainage from the wound
- e. Burns

Keep all articles that come in contact with a wound sterile by handling with sterile gloves or sterile forceps to prevent contamination of the wound.

Prevent spread of infection by:

- a. Separating contaminated articles from clean articles
- b. Placing soiled dressings in a covered garbage container for disposal by incineration
- c. Washing you hands before and after the care of the wound.

Keep wounds clean and dry to promote healing

Hold dressings that require frequent changes in place with binders. This will protect the skin from irritation by eliminating the use of adhesive tape.

#### Equipment

Sterile dressing set

Forceps

Small bowl



Wash your hands or rub with alcohol and air dry  
Pour cleaning or antiseptic solution into a sterile bowl  
Clean the skin around the wound with soap and water  
Clean the wound with a solution using a cotton swab for each downward stroke  
Apply a dry dressing with sterile gloves and sterile forceps, then secure with tape, gauze, or binders  
Wash your hands.

#### **3.2.4.4. Isolation technique**

The spread of infections within HCFs requires three essential elements; a source of infecting organisms, a susceptible host and a means of transmission for the organisms. The principle behind isolation techniques is to create a physical barrier that prevents the transfer of micro-organisms. The barriers created for effective isolation should be appropriate to the goal of preventing the spread of selected micro-organisms from the patient to the environment or from the environment to the patient.

#### **General procedures for isolation:**

Check the type of isolation ordered for the patient in order to plan for care  
Identify the type of infection or the reason for protective precautions  
Check the equipment on the door or in the anteroom and inside the room to be sure you have everything you need for the procedure you intend to perform.  
Wash your hands for infection control  
Gather any equipment you need  
Identify the patient to be sure you are performing the procedure on the correct patient  
Explain to the patient what you are doing

Carry out the aspects of isolation technique necessary for the type of isolation ordered when entering the room

Give care as planned

Carry out the aspects of isolation technique necessary for the type of isolation ordered when leaving the room

Involve the following criteria

- All necessary equipment readily available
- All aspects of the particular isolation procedure correctly carried out
- Patient cared for safely and in a comfortable mode

Record the care given appropriately.

### **Specific isolation procedures**

A variety of specific procedures are used as part of isolation. These include how to enter and leave the room and procedures to care for equipment and supplies in the isolation room.

### **Preparing the room**

Preparation of the room for isolation depends on the type of isolation required but the following general preparations are recommended

A private room with running water

A sign on the outside of the door indicating what preparation is needed before entering the room and which type of isolation is being carried out

A stand of some sort (often a bedside stand is used) placed just outside the door to hold isolation laundry badge, gowns, masks, gloves and other items specific to the care of an individual patient

A waste basket lined with plastic

Thermometers and blood pressure equipment, including a stethoscope, which should be left in the room

Special containers as needed for used needles, syringes and instruments.



## **Masks**

Masks protect against airborne micro-organisms and droplet nuclei on which they are carried (for details refer to the core module).

## **Gloves**

Gloves are always used in isolation in the same way that they are used for other patients. Gloves should be kept inside the room so that they can be put on and changed as needed when providing care (for detail refer core module).

## **Double bagging**

You may use a double-bagging technique for contaminated items removed from an isolation room. One nurse inside of the room and another nurse outside carry out this procedure. This procedure may be used for wet linen or for items that are being sent to another department. Basic steps are

If you are the inside nurse, place used items in appropriate containers.

Take care not to fill the bags too full, as it makes double-bags difficult to handle without breaking. Carefully close and secure the bag.

If you are the outside nurse form a cuff on another bag, spreading it to receive the bag from the nurse on inside. The cuff protects your hands from contact with the contaminated items inside the bag.

If you are the inside nurse place the bag holding the contaminated items directly into the bag being held by the outside nurse. Be careful to touch only the inside of the bag.

If you are the outside nurse fold over and carefully secure the top of the outside bag.

Mark the bag in the manner prescribed by the facility for proper sterilization or for the destruction process to be carried out

Color coding dangerous bags might help the staff to notice it from a distance.

Dispose of the bag in the proper place.



### **Caring for linen**

Care should be taken to touch only the inside of the laundry bag with the soiled linen or contaminated hands (refer to core module).

### **Leaving the room**

This procedure assumes that you are wearing a gown, mask and gloves. It can be modified if you are not using all three.

Complete your work in the room

Remove your gloves and dispose of them as described previously

Untie waist ties

Wash your hands

Untie neckline ties, dropping the gown over

Roll off the gown, touching the inside only and turning the gown inside out as you take it off.

Touching the ties only, untie your mask and discard it in a wastebasket or, if it is a cloth mask, in a laundry hamper.

Wash your hands

Using a paper towel as a barrier on the doorknob, open the door. Discard the paper towel inside the room

Wash your hands outside the room.

**Table – Summary of isolation precautions**

	Contact isolation	Droplet isolation(droplet>5microns)	Airborne isolation(droplet<5microns)
Room	Preferably private or cohort with other patients with same microorganism	Preferably private or cohort with other patients with same microorganism privet	Privet with door. keep door closed
Gloves	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact
Gown	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact
Mask	Not necessary	If within 1m of patient	Must be worn when entering room
Patient care equipment	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact	When in contact with infective materials or patient contact
Patient transport	Avoid if possible	Avoid if possible-patient must wear mask	Avoid if possible-patient must wear mask

### **Isolation preparations**

Two main systems are used for placing the patient in isolation; disease-specific isolation precautions and category-specific isolation precautions.

### **Disease-specific isolation precautions**

Under this each infectious disease is considered separately and guidelines that use only those procedures considered necessary to attain the goal are then setup. An advantage of this system is that it is adaptable to individualized care

plans. It is also more logical because it minimizes unnecessary precautions and equipment use.

### **Category specific isolation precautions**

This approach has separate instructions for diseases fitting into various categories which are determined by how the organisms are transmitted. The five types of isolations generally used in this system are; strict isolation, respiratory isolation, wound and skin precautions, enteric precautions and blood/body fluid precautions.

#### **3.2.4.5. Learning Activity: Case study continued**

Refer to the case study on in section 1.4 of the Core module and discuss the following questions:

1. What are the main causes of puerperal fever?
2. Describe the environment of delivery room W/o Shumbe had attended.
3. What are the responsibilities of the Public Health Nurse to stop infection?
4. What remedies do you suggest to correct such a situation?

### **3.3. Satellite module for Medical Laboratory Technicians**

#### **3.3.1. Introduction**

##### **3.3.1.1. Purpose and use of the module**

This module can be used in the training of medical laboratory technicians that are

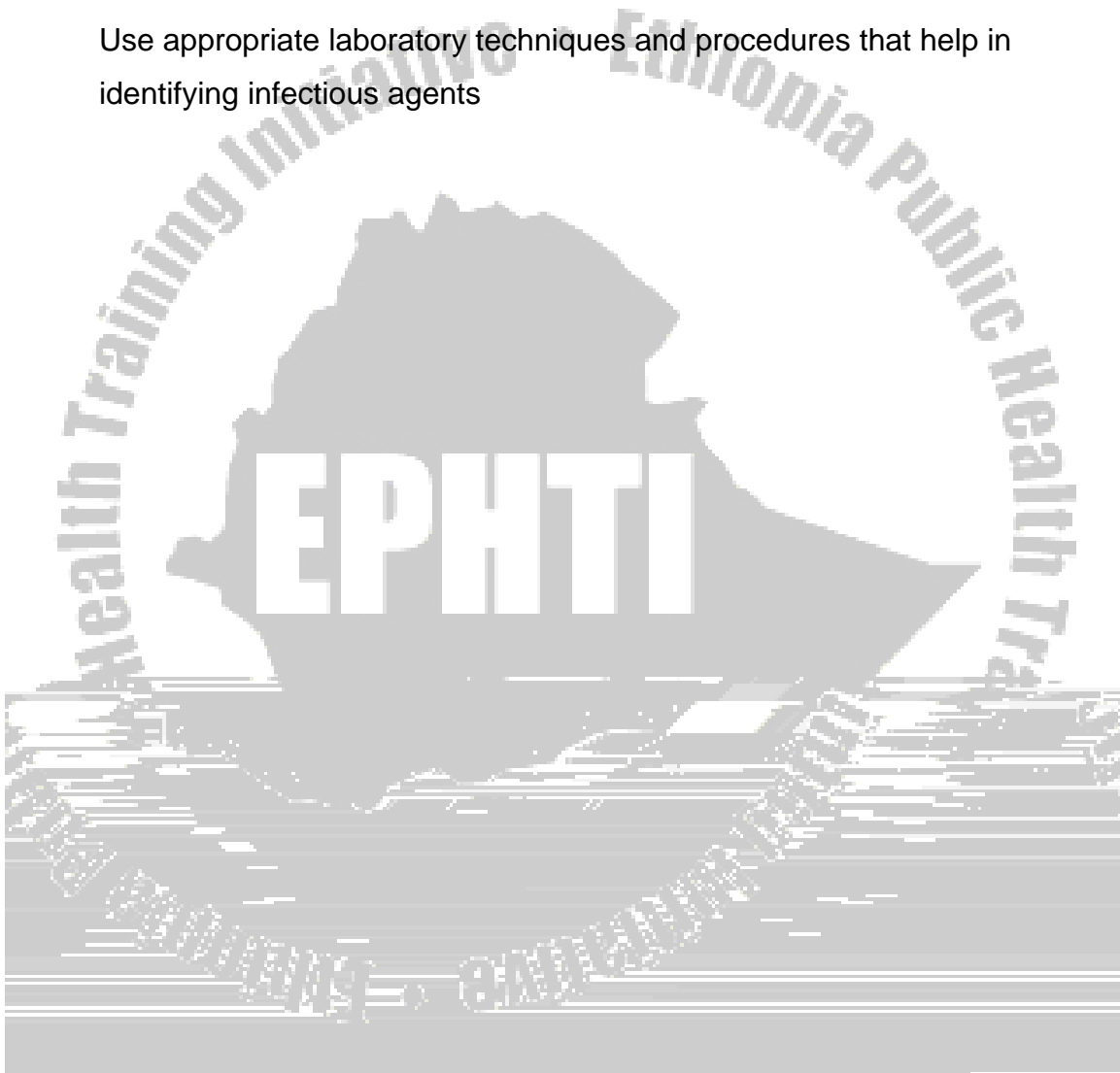


### 3.3.2. Learning Objectives (Medical laboratory technicians specific)

At the end of reading this satellite module the laboratory technician will be able to:

Identify different specimen collection procedures and proper handling for infection control

Use appropriate laboratory techniques and procedures that help in identifying infectious agents



Several different kinds of specimen are analyzed routinely in clinical laboratories but the specimen most often tested is blood, stool, urine and sputum. The specific requirements for specimen collection are discussed throughout each procedure in this satellite module.

### **3.3.3.1 Stool Specimen**

The most frequently performed parasitological procedure is the stool examination. The detection and identification of parasites such as an adult worm, larvae, eggs, trophozoite and cysts depends on proper collection.

Stool specimen should be collected in a clean container made of cardboard, preferably plastic-covered. The specimen should be collected and covered without being contaminated with urine. The amount collected depends on the test to be done. During collection follow the following procedure correctly:

#### **Procedure**

Provide the patients with specimen containers with tight-fitting lids

Collect sufficient quantity of stool. It should contain at least 4 ml (4cm<sup>3</sup>) of stool

Examine the stool as soon as possible

If specimens cannot be examined in the above time-frame, put them in an available preservative (e.g. formaldehyde solution).

### **3.3.3.2. Blood specimen**

Any discussion concerning blood specimens must begin with collection procedures for blood. There are two general sources of blood for clinical laboratory tests; peripheral or capillary blood and venous blood. This applies to all areas of the clinical laboratory. For small quantities of blood for some hematological determination, capillary blood is suitable. This is obtained from the capillary bed by a puncture of the skin. The tip of the finger is the site most commonly punctured. For large quantities of blood a puncture is made directly

into a vein using a sterile syringe and needle. A vein in the upper forearm (or antecubital fossa) area is most often chosen for vein puncture as these veins are easily palpable and fairly well fixed.

Special precautions need to be taken when collecting specimens, especially blood specimens and when testing specimens and handling infected materials. Safety measures involved in the collection of blood include the careful handling and disposal of syringe and needles. Do not collect capillary blood by mouth suction.

Specimen containers must be leak-proof. A special carrying tray should be used for collecting blood. It should have separate compartments for holding clean equipment, specimens and contaminated articles. The careless handling of a specimen may result in the contamination of fingers and working surfaces and particularly in the formation of aerosols (air born droplets). The inhaling of infected aerosols is a common cause of infection.

### **3.3.3.3. Sputum specimen**

A patient suspected of pulmonary tuberculosis should submit three sputum specimens for microscopy. The chances of finding tubercle bacilli are greater with three sputum samples than with two samples or one sample. Secretions build up in the airways overnight so an early morning sputum sample obtained deep from the lung (not saliva) is more likely than a sample later in the day to contain tubercle bacilli. It may be difficult for an outpatient to provide three early morning sputum samples. Therefore in practice sputum sampling follows this procedure:

## **Types of Sputum Collection**

### **Spot – Morning – Spot**

**Day one** – Sample One: patient provides and “on the spot” sample under supervision when she/ he presents themselves to the health institution.

**Day two** – Sample two: patient brings an early morning sample

**Day three-** Sample three: patient provides another “On the spot” sample under supervision.

Advantage:

It can be done in one day

The patient will not suffer any more delays than would have been done in the three morning specimen procedure (i.e. the rate of infection will be decreased).

Disadvantage:

It may give a false negative result.

### **Morning - Morning - Morning (3M)**

Collect three consecutive morning sputums by providing sputum cups

Advantage:

It concentrates the bacilli so it avoids false negatives.

Disadvantage:

Time consuming.

The client may not comply with procedure or may not return samples.

Increases the rate of infection.

### **3.3.3.4. Urine Specimen**

Before specimens are collected the containers must be cleaned and thoroughly dried. Disposable containers of plastic or coated paper are available in many sizes and are provided with lids to reduce bacterial and other types of contamination.



A freshly voided urine specimen is adequate for most urinalysis except the microbiological culture. The patient should be instructed to void directly into a clean, dry container or a clean, dry bedpan so the specimen can be transferred to an appropriate container. Catheterization can be used if a urine specimen is likely to be contaminated with vaginal discharge or menstrual blood. All specimens should be immediately covered and taken to the laboratory. If the sample is going to be delayed the technician should know how to preserve it and which method of preservative is used for preserving the sample.

### **Methods of Preservation of Urine**

In urinalysis if the sample is going to be delayed the lab technician should use either of the following preservatives:

#### **Physical method**

**Refrigeration:** This is most satisfactory of all preservation methods. The chemical changes that occur in the urine can be slowed down by refrigeration at  $2-8^{\circ}\text{C}$ . Freezing shouldn't be used always unless you want to transport it because it will destroy formed elements (RBC, WBCs).

#### **Chemical methods**

In this method we use different chemicals (refer table 1 below). The chemicals should be proportional to the urine volume and the sample should be handled carefully, despite this it may contain dangerous infectious agents like HBV.

**Table 1: Type of preservatives with their advantages and disadvantages**

Types of preservatives	Advantage	Disadvantages	Other information
Refrigeration	No interference with Chemicals	Raises specific gravity Precipitates urates	Prevents bacterial growth for at least 24 hrs
Freezing	For transportation of specimens (i.e. to send to referral hospital)	Destroys formed elements	
Toluene	Best for preservation of chemical constituent (like Ketone bodies)	It is flammable	Add 2 ml of toluene per 100 ml of urine
Thymol	Preserves glucose and 5 elements well	Interfere with protein test	Add small dissolving 5 mmdm/100ms of urine
Boric acid	Preserve protein and formed elements	Precipitates uric acid	Keep P <sup>H</sup> (of urine at about 6)
Formalin (formaldehyde)	Excellent sediment preservative	Interferes with copper reduction test for glucose	1 drop 40% per 30 ml of urine 10 ml for 24 hrs Prevents bacterial growth

### **3.3.3.5 Swabs and other body fluids**

Most bodily fluids contain highly infectious micro-organisms so special precautions should be taken during collection and handling. For example spinal fluid, pericardial fluid, synovial fluid and plural fluid should be with drawn from the corresponding body areas via a needle and syringe. The sterile fluid should be placed in a sterile vial which is sealed. The vials are placed and transported to the reference laboratory after doing routine testing.

During swab sample collection and processing the swab should be sterile to avoid contamination to the client as well as the sample itself.

Specimens can become airborne when the stopper is popped off a blood-collecting container or a urine tube is centrifuged.

When the cap is being removed from a specimen tube or a blood collection tube, the top should be covered with a disposable pad or a special protective pad. The tube should be held away from the body and other clients. With regarding to the staining procedure, refer to the following text:

### **3.3.4. Laboratory techniques and procedures**

#### **3.3.4.1. Direct saline preparation for stool examination**

Routine microscopic examination of stool specimens with physiological saline helps to detect and identify the stages of some parasitic organisms. It is simple and rapid. A small amount of stool is mixed with a drop of physiological saline on a slide and examined microscopically. A direct saline preparation allows observation of pus cells, red cells, cysts of protozoa, helminthes ova, and helminthes larvae.

#### **Procedure**

Place a drop of physiological saline (0.85% W/V) in the center of the slide.

With an applicator stick, pick

### 3.3.4.2. Gram staining technique



Decolorize the smear by slowly adding 50% acetone/alcohol solution. Do not over decolorize the smear. This stage should last 15 seconds

Counter stain by covering the smear with safranin or with dilute carbol fuchsin. Leave for 30 seconds

Wash the smear in a thin stream of clean water to remove excess stain

Allow the smear to drain dry, the smear is now ready for examination.

#### **3.3.4.3. Ziehl Neelsen staining technique**

This technique is the most widely used method in the identification of AFB from sputum smears in small laboratories. A smear is made on a slide and fixed to prevent the specimen from being washed off. The slide is then heated to melt the waxy substance found on the cell wall of the bacteria which enables the stain to penetrate and stain the organism. This is the principle of the test. In order to avoid contamination and pollution of the environment carefully adhere to the following procedure:

##### **Procedure**

During collection assemble all the necessary materials and obtain the sample according to the standard procedure

Using a piece of stick transfer purulent material of the sputum to a slide and make a thin smear.

Allow the smear to air-dry in a safe place

Fix the smear with one or two drops of 70% ethanol (or methanol) for two to three minutes or by passing the slide about three times over a flame

Wash the stain with clear water

Cover the smear with 3 % acid alcohol for about 2 minutes until the smear looks pale-pink

Wash off the stain with clear water

Cover the smear with methylene blue (malachite green) stain for 30 seconds



It is important to establish a safety policy for every laboratory. Carefully plan the safety policy taking into account the hazards that may occur and the availability of safety appliances. Practice safety measures at all times. Constantly remind laboratory users of safety procedures through training and by placing posters at appropriate sites. If posters



Keep specimen tubes in racks

Do not mouth a pipette. Use rubber teats or pipette fillers

Avoid accidental pricks with used needles, lancets and other sharp

Instruments.

### 3.3.5.2. Precautions against chemical hazards





#### **3.3.5.4. Cleaning and washing**

Cleaning and disinfection of the working surface after contact with blood or other potentially infectious materials is of prime importance. Most disinfectants are less active in the presence of high concentrations of protein such as blood and other bodily fluids. These spilled fluids should first be absorbed as completely as possible with disposable towels or gauze pads prior to disinfection.

Cleaning and washing has two purposes:

1. To reduce the number of organisms contaminating an article. The article must be dried after cleaning or washing to avoid multiplication of surviving bacteria.
2. To remove dirt, grease and other organic matter (e.g. blood, feces) from an article.

#### **3.3.5.5.. Disinfection**

Disinfection is the removal of some or all pathogenic organisms from an item. Disinfection does not always destroy spores or bacteria (e.g. tetanus spores). Disinfectant methods commonly used in the health center laboratories include boiling water at 100<sup>0</sup>C or chemical disinfection.

##### **Chemical disinfection**

Chemical agents are less effective than heat for disinfection. The following groups of chemical agents are commonly used in the laboratory for disinfection:

1. Alcohol (e.g. methyl alcohol, ethyl alcohol, isopropyl alcohol) doesn't kill bacterial spores and fungi
2. Phenols (3%) or a phenol-containing solution kills a wide range of vegetative bacteria and some viruses including HIV. It doesn't kill bacterial spores and the hepatitis B virus
3. Halogens such as chlorine-releasing compounds (household bleach, 5%, bleaching power) and iodine kill viruses including HIV, vegetative bacteria, spores and fungi

4.



### 3.3.5.8. First-aid measures for medical laboratory technicians

Knowing what to do immediately when an accident occurs can help to reduce suffering and the serious consequences of an accident.

All laboratory workers should have a ba



If the bleeding doesn't stop seek medical help

### 3.3.5.11. Emergency measures for chemical burns



3. What laboratory tests do you suggest to diagnose such a situation?
4. What would be the role of the laboratory technician in collecting samples and culturing the specimen?

### **3.4. Satellite module for Sanitarians**

#### **3.4.1. Introduction**

##### **3.4.1.1. Purpose and use of the module**

This module can be used in the training of sanitarians that are in actual training or those already in service for infection control in health care facilities.

##### **3.4.1.2. Directions for using the module**

For a better understanding of this module the Sanitarians are advised to follow the following directions:

Read the purpose, the use and direction for using the module in section 1.1 and 1.2 and follow the instructions

After doing so, do the pre tests in section 2.1 and then go over all the contents (topics) of the core module

And then read the satellite modules of your respective profession with special emphasis to the subject matter. However don't forget to read the satellite modules of the other categories

Read the reference materials listed to supplement your understanding

Do the post test pertaining to your profession in section 1.1 of the core module and evaluate yourself by referring to the keys in unit seven.

#### **3.4.2. Learning Objectives (specifically for Sanitarians)**

After completion of this satellite module the Sanitarian will be able to:

1. Identify source and type of infectious waste in the health care facilities.
2. Describe steps in safe management of infectious waste in health care facilities.

3. Ensure the availability of a hygienic food supply, adequate and safe water supply, safe handling of medical equipment and linens and good housing condition in health care facilities.
4. Identify the role of the Sanitarian on the infection control committee in health care facilities.
5. Plan different methods of training in management of infectious wastes in health care facilities.

### 3.4.3. Types and sources of infectious wastes

#### 3.4.3.1. Types of infectious wastes

**Biological wastes** are suspected of containing pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or number to cause disease in susceptible hosts. These categories :

Infectious agents from laboratory work

Wastes from deliveries and minor surgeries contaminated with infectious diseases (e.g. tissues and materials or equipment that have been in contact with blood or other body fluids)

Waste from infected patients (e.g. excreta, dressing, vomitus, diarrhea, from infected or surgical wounds, clothes heavily solid with human blood or other body fluids)

Any other instruments or materials that have been in contact with infected persons.

**Pathological wastes** such as wastes consisting of tissues, organs and body parts, human fetuses, blood and bodily fluids.

**Sharps** are items that could cause cuts or puncture wounds including am7-[ )-06T as crmic needl bods Tfpam7-fbm39suf Tc0.206d05 0 g

### 3.4.3.2. Sources of health-care wastes

Infection control in health care facilities requires identification of the sources where the wastes are generated or produced. Development of a sketch map indicating the source is very important. From this information the following areas can be identified as the potential sources of infectious wastes in the health center:

**Patient rooms:** Mainly infectious waste such as dressing bandages, sticking plasters, gloves, disposable medical items, used hypodermic needles and intravenous sets, bodily fluids and excreta, contaminated packaging and meal scraps.

**Minor surgical operating and delivery room:** Mainly anatomical wastes such as tissues, fetuses, other infectious wastes and sharps.

**Laboratories:** Mainly wastes generated from handling of stool, urine, blood and other bodily fluids.

**Support units:** Mostly non-infectious waste generated from dieting, patient ward, pharmacy and surrounding area with a small percentage of infectious wastes.

### 3.4.3.3. Outbreak investigation

Health care facility infectious disease out breaks often get more attention because they are due to unique organisms, unique circumstances (e.g. contaminated instruments or solutions) and/or other unique but controllable events. Thus an outbreak or epidemic offers a chance to make a major impact by eliminating or controlling the source or conditions leading to it.

Recognizing an outbreak often depends on good baseline surveillance in the health care facilities. The routine tabulation of infections will establish the “normal” rates from which an outbreak provides a distinct variation and leads one to consider the possibility of an out break.

Epidemic outbreaks are most likely to result in blood stream infection, then surgical wound infections, pneumonias, gastrointestinal infections, sepsis and lastly in meningitis. However when an outbreak occurs an investigation should be undertaken so that the problem is identified as to time, place, situation, organism and affected individuals. This may allow appropriate measures to be taken to abort the outbreak or to prevent further outbreaks.

Full scale outbreak investigations are carried out by the epidemiologist in conjunction with the infection control practitioner. The ultimate goal of the investigation is to determine the control measures for the outbreak of the involved disease.

There are five main elements in any outbreak investigation:

- Identification of the problem

- Write a case definition

- Epidemiologic description

- Formulate hypothesis

- Implement control measures to stop the outbreak infection.

Therefore primary caregivers must be watchful for subtle signs of infection for the occurrence of epidemics by making sanitary surveys on environmental health conditions and by evaluating the routine record of patients admitted to the health center. To tackle this problem there should be adequate sanitary measures in the health center.



### 3.4.4. Safe management of infectious wastes

#### 3.4.4.1. Waste management

All activities, administrative and operational, and all those who are involved in the handling, treatment, conditioning, storage and disposal of waste should participate in waste management.

#### 3.4.4.2. Waste generation

Waste generation depends on numerous factors such as established waste management methods, type of health care establishment, hospital specialization, proportion of reusable items employed in health care activities and proportion of patient treatment on day-care basis.

Action to be taken in health care waste management:

- Assessment on (quantitative and qualitative) waste production
- Evaluation of local treatment and disposal options
- Segregation of health care waste from general waste
- Establishment of internal rules for waste handling
- Assignment of responsibilities within the health-care establishment
- Choice of suitable or better treatment and disposal options

#### 3.4.4.3. Segregation and packaging

**Segregation:** This is the systematic separation of solid waste into designated categories. Careful segregation and separate collection of health-care facilities waste may be somewhat onerous for health personnel but it is the key. Sound management of health care waste segregation can substantially reduce the quantity of health care waste that requires specialized treatment. To make separate collection possible, health personnel at all levels, especially sanitarian, nurse, supportive staff and cleaner should

where tissues, solid items and organs are separately stored. Separate containers for sharps are also needed.

The following important points should be noted

Infectious wastes are to be disposed of in the same way. They should not be collected separately

Sharps are collected separately and incinerated

Infectious stools from patients should be collected in baskets because of the need for disinfection

Discharge to sewers or to the environment may contribute to the spread of the disease

Plastic or metal containers for infectious waste should be disinfected, for example with sodium hypochlorite (bleach) before reuse. The bags should be sealed or containers firmly closed before they are filled to three-quarters of their capacity. The equipment should be simple, robust and locally available.

### **Safe handling and storage**

**Handling:** This is the functions associated with the movement of solid waste materials, excluding storage, processing and ultimate disposal.

**Storage:** This is the placement of waste in a suitable location or facility where isolation, environmental and health protection, and human control (e.g. monitoring for radioactivity, limitation of access) are provided.

Health care facilities cleaning personnel should be informed about the potential risks posed by handling. They should be trained in safe handling procedures and should wear protective aprons and gloves. The waste should be collected daily. General waste may be stored in convenient places that facilitate collection by any method of disposal, but infectious waste should be stored in a closed room. Waste should not be stored close to patients or where food is prepared.

#### **3.4.4.4. Treatment and disposal of infectious waste in health care facilities**

Health care facilities with very limited resources should reuse sharps such as glass syringes with needles and scalpels. Only items that are designed for reuse i.e. that withstand the sterilization process, should be reused in this way. Before reuse scalpels, syringes, needles and other sharps must be thoroughly cleaned and sterilized; disinfection alone is inadequate. Any failure in the sterilization process may result in the transmission of severe infections.

For health care establishments with few resources and applying minimal waste management programmers affordable treatment and disposal methods for infectious waste may be classified into three categories:

- Thermal processes
- Disinfection
- Containment processes

#### **Thermal processes**

##### Static-grate single-chamber incineration

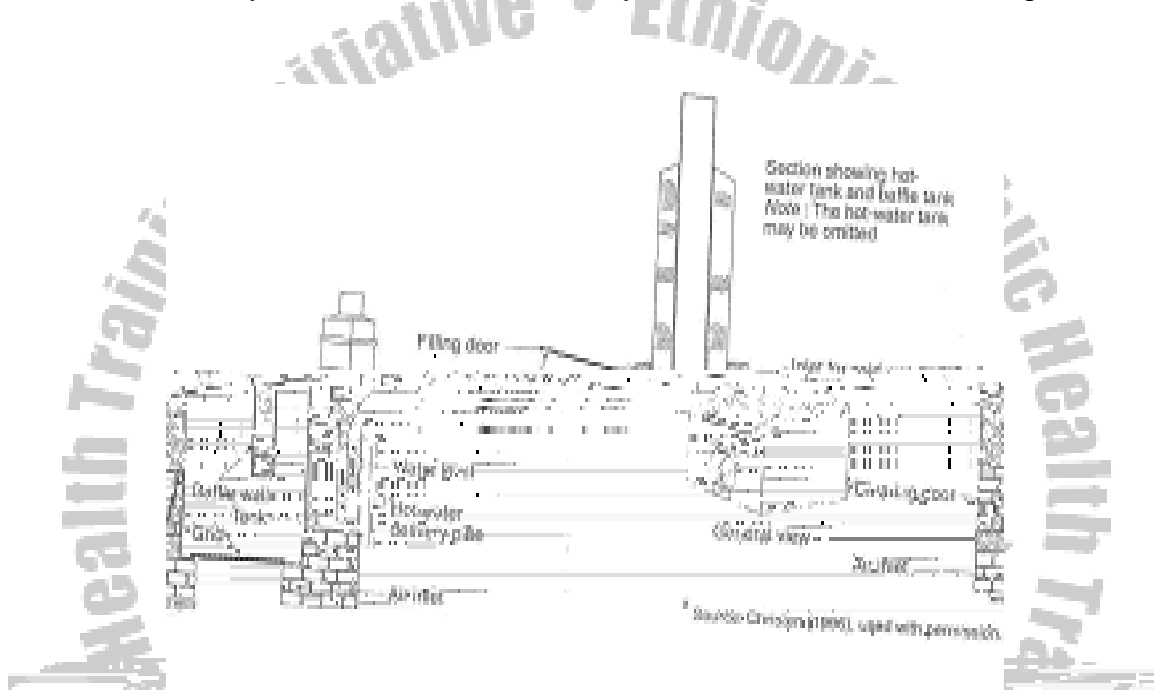
Waste may be burned in a simple furnace with a static grate and natural airflow. De-ashing, loading, and unloading operations are carried out manually. The low heating value of properly segregated health care waste is high enough for combustion. The burning efficiency may reach 90 - 95%, i.e. 5 - 10% of the material may remain unburnt in the ashes and slags. The operating temperature will be around 300°C, which will kill most micro-organisms.

#### **Advantages**

- Good disinfections efficiency
- Drastic reduction of waste; the weight and volume residual ashes and slages are about 20% those of the original waste
- No requirement for highly qualified operators
- Relatively low investment and operation costs

## Disadvantages

- Generation of significant emissions containing atmospheric pollutants including flue gases and fly ash, may produce odors which can be limited by not incinerating halogenated plastics
- Periodic removal of slag and soot necessary
- Inefficiency in destruction of thermally resistant chemical and drugs



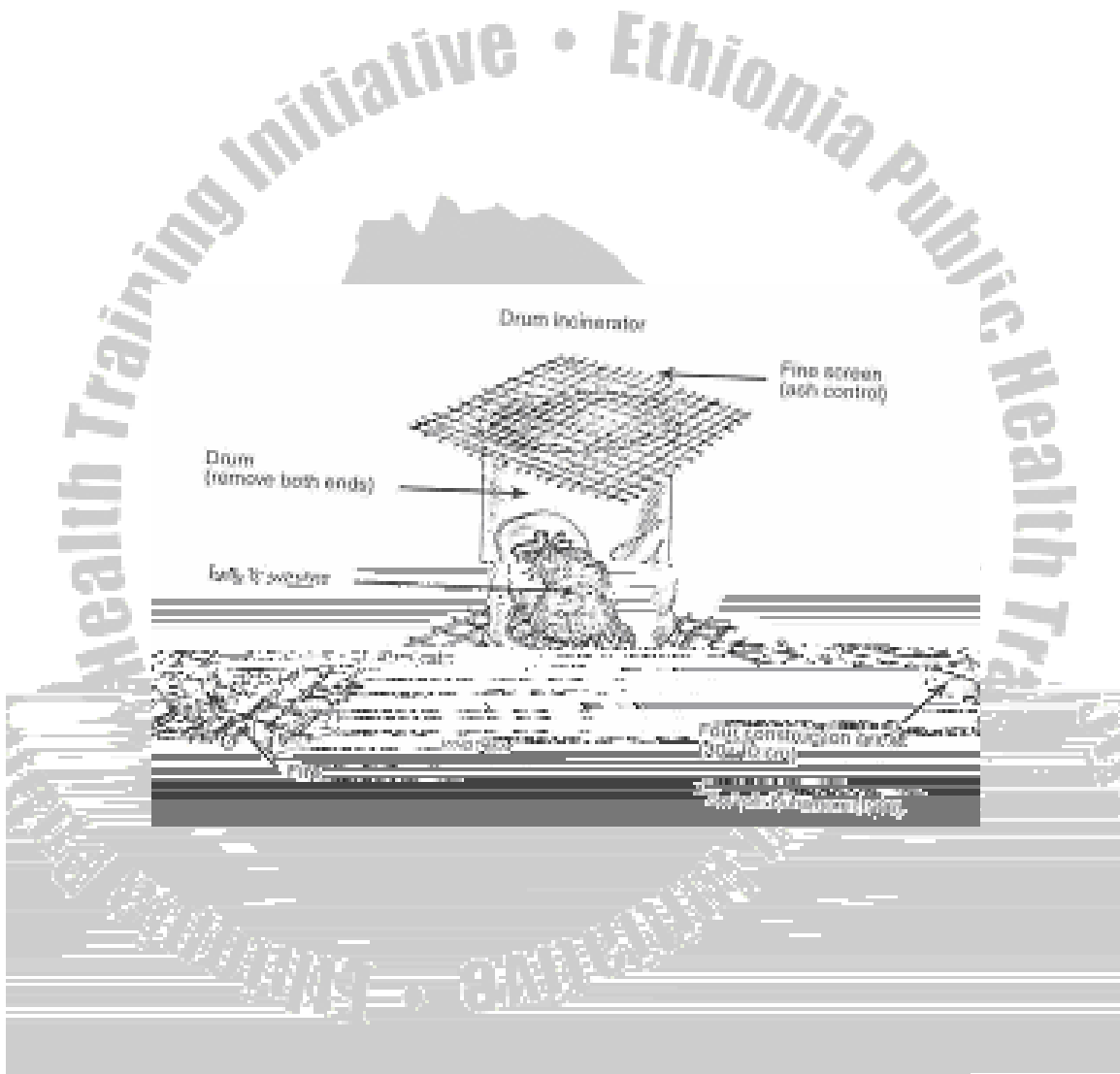
Source: *A manual on infection control, 1992*

Figure1: Bailleal single chamber incinerator

## Drum or brick incinerators

Where a single chamber incinerator is not affordable or available simple confined burning may be applied. A steel drum or wall of bricks or concrete can be erected over a screen or fire grate and covered with a second screen to prevent dispersion of ashes or light material. The waste is placed inside and burned with the help of manual ventilation and the addition of kerosene if necessary. Constant supervision is essential to prevent any spread of fire to the surrounding area. The combustion efficiency may reach 80 - 90% and kill 99% of the micro-organisms. The temperature of the fire will not exceed 200°C and this process

should be used only in emergency situations or when



communities. The area within which the burning is carried out should be fenced to prevent unauthorized persons and animal from entering.

Confined burning e.g. in a drum incinerator should always be preferred, as the risk to personnel of contact with the waste or with partly burned residues is then lower. It has to be noted however that the burning process emits toxic gases and particulates into the atmosphere.

**Advantages**

Same as for drum or brick incinerator.



## **Advantages**

- Efficient
- Environmentally sound
- Relatively low investment and operation costs
- Long lasting and low maintenance

## **Disadvantages**

- Qualified operators essential
- Inadequate for anatomical, pharmaceutical and chemical wastes and waste that are not easily penetrated by steam.
- The health center autoclave used for sterilization has limited capacity for treatment of certain quantities of waste.

## **Chemical sterilization of reusable sharps**

Chemical sterilization of scalpels, syringes with needles and other reusable sharps may be considered as an alternative or complementary method to thermal sterilization. After thorough cleaning and drying, the sharps are placed in a tank and exposed to a strong disinfecting gas or liquid, such as ethylene oxide, formaldehyde or glutaraldehyde.

## **Advantages**

- Highly efficient (may be more efficient than thermal sterilization)

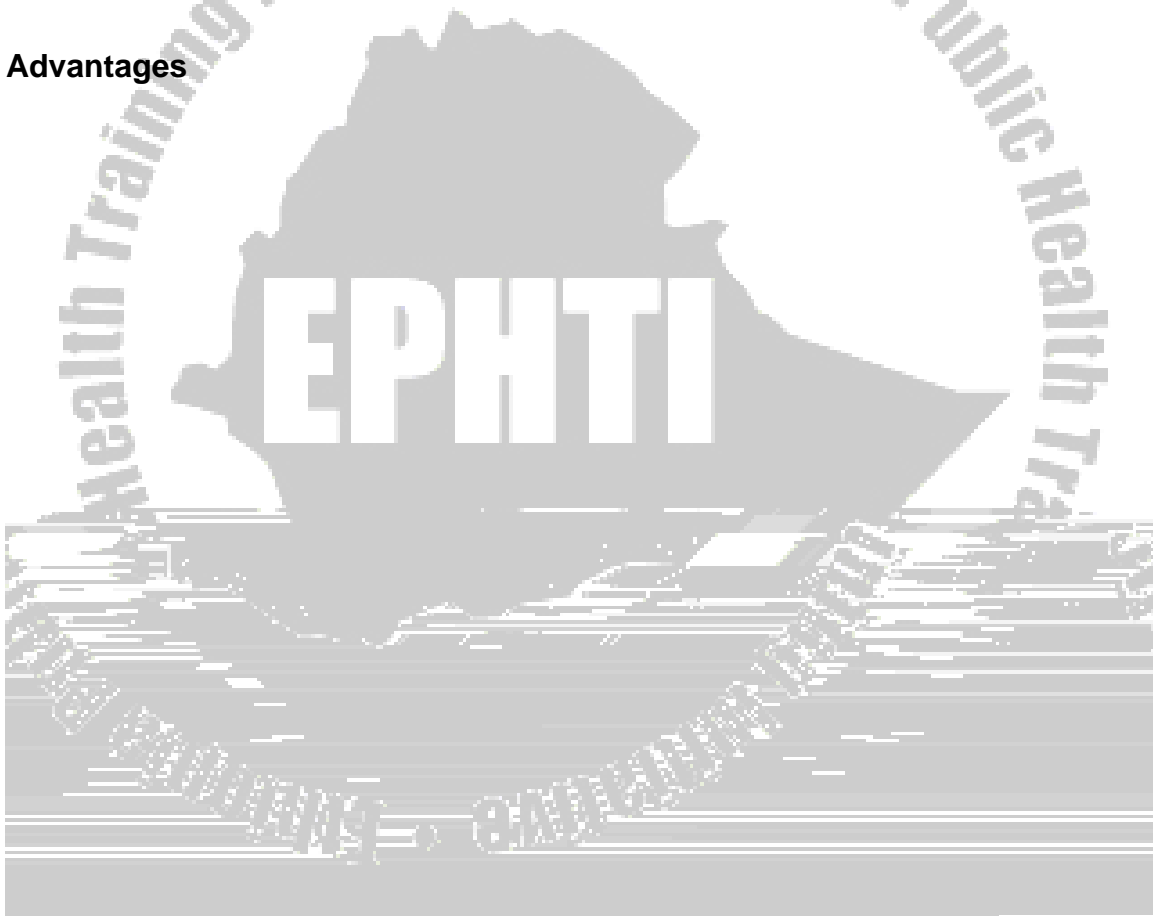
## **Disadvantages**

- Trained operators essential
- Costly when the chemical disinfectants are expensive
- Uses hazardous substance that necessitates safety measures

### **Chemical disinfection of infectious stool**

Buckets containing stool or vomitus of patients with acute diarrhea may be disinfected through addition of chlorine oxide powder or dehydrated lime oxide (CaO). For example, vibrio cholera, the causative agent of cholera is not very resistant and its elimination does not require the use of very strong chemical disinfectants. In emergency situations these measures should also be applied in the field to prevent the spread of the disease (e.g. cholera epidemics). This procedure could be applicable for disinfection of infectious stool and vomitus produced from the patient.

### **Advantages**





Therefore site selection for excavation of the pit should take into consideration factors to minimize pollution of water sources and contamination of the soil as well as other sanitary considerations necessary to protect the environment and safeguard the health of individuals and community.

### **2.4.5. Health care facilities hygiene and infection control**

Management of health-care waste is an integral part of health-care facilities hygiene and infection control. Health care waste should be considered as a reservoir of pathogenic micro-organisms that can cause contamination and give rise to infection. If waste is inadequately managed these micro-organisms can be transmitted by direct contact, in the air or by a variety of vectors. Infectious waste contributes in this way to the risk of nosocomial infections putting the health personnel and patient at risk.

This section outlines the basic principles of prevention and control of infection that may be required in health care facilities. It should be stressed here that other environmental health considerations such as adequate physical facilities, water supply and sanitation facilities for patient, visitor, and health worker are also important.

#### **3.4.5.1. Area of exposure to infectious disease**

Many potential biological agents exist in health care unit environments. Those working in laundries, housekeeping, laboratories, nursing stations and dietary sections are highly exposed to biohazards from the patients they handle, from the specimens they collect and from the clothes, needles and pans they handle and from their general day to day activities. The following areas are potential exposures to infectious diseases in health care facilities:

### **Laboratory**

Health personnel such as laboratory technicians and other health professionals working on biological specimens are at risk with biological hazards in the laboratory. Specimens such as blood, pus, stool and other tissue samples may lead to exposure of the workers to infections.

### **Laundry**

Workers in laundries are exposed to discharges from patients by virtue that they are constantly in contact with soiled linens, night dresses and washable articles that are sent to the laundry for cleaning every day.

### **Housekeeping**

Everything that comes in contact with the patient's room must be cleaned whether the occupying patient had an infectious process or not. This includes cleaning the floor, all furniture and bathrooms with a cleansing agent. Disposable equipment should be thrown away after use. Reusable objects must be cleaned thoroughly before sterilization of blood, tissue or bodily secretions. These may interfere with the sterilization or disinfection process. The use of a brush for cleaning purposes helps to remove materi



Patients may be at increased risk of food borne illnesses because of intrinsic problems with immuno-suppression underlying illnesses achlorhydria (age, antacid use) and prior use of antibiotics.

The most common bacterial causes of food associated outbreaks are salmonella species or enteropathogenic Escherichia coli. Almost all of such outbreaks are attributable to contaminated food generally involving an infected food handler, although cross contamination between patients can occur. It is important for the infection control practitioner to know the common types of organisms that could be involved so as to be able to launch an appropriate investigation. An investigation must be able to define sources, mode of spread and method of prevention of spread. Investigation of possible food borne outbreaks must include collection of case control data on types of food eaten by both affected and well individual so as to find specific food that was associated with the transmission of the outbreak and exclude others that were not.

Food handlers should not only observe proper cleaning procedures for food and of their own hands and utensils but also be well educated about food preparation procedures. Efforts with food handlers should emphasize the importance of these basic principles of personal hygiene, especially hand washing, the importance of individual food worker diseases, the proper inspection and handling and serving and storing of food and the proper methods of waste disposal.

Primary prevention against infection or contamination of the food include:

Proper handling of food products (raw or cooked)

Use clean hands and garments in the food processing areas

No skin lesion on the food handlers

Refrigeration of the food products at a safe temperature in order to prevent growth of bacteria

Adequate cooking of foods.

Food preparation areas require sinks and towel supplies separate from diaper changing facilities. Hands must be washed with soap before food preparation. Food should be refrigerated and any unused food should be discarded within 24 hours.

### **Water**

Water systems are an integral part of any health care facility and must be maintained so as to deliver sterile non-infectious water. Since the water supply is unique to health care unit, periodic check ups for the potability of the drinking water is very crucial. This will generally consist of "coliform" counts per milliliter of water. In this circumstance the annual or more frequent assessment of water purity should be recorded by the infection control committee.

#### **3.4.5.2. Methods of reducing infectious disease**

Good personal hygiene practices are important in cleanliness and in the prevention of body and breath odors. Good hygiene can also serve to promote relaxation and increased circulation. The following are methods of reducing infectious disease in health care facilities:

### **Bathing**

Bathing with warm water is helpful to keep open pores and sweat ducts which helps prevent skin infections. However excess use of strong hand and bodily soaps may cause skin drying or irritation which can increase the risk of some infections. After bathing drying between toes and other skin folds assists in preventing fungal infections.

When skin becomes infected, infected area as well as uninfected skin becomes more heavily colonized and an increased number of micro-organisms are shed. This results in higher probability that bacteria will be transferred to inanimate objects and other people by direct contact or by air via contaminated skin flakes.

### **Shampooing and finger-nail cleaning**

Hair has the potential to carry pathogenic bacteria. Since head or body hair is continuously and erratically shed the hair should be kept clean. In critical circumstances such as cooking, surgery or operation of delicate machinery, hair should be kept under cover with an appropriate covering.

While finger-nail cleaning and clipping has aesthetic importance, their role in disease transmission is unknown. Certainly the area under the nail can serve as a potent reservoir for bacteria. It would appear wise to ensure nail cleanliness in the general hygienic approach to infectious disease prevention.

### **Hand washing**

Hand washing is the single most important procedure for preventing infection. Most of the important pathogens in the health care facilities are transmitted by the hands of health care workers from patient to patient. Careful hand washing reduces the transmission of infection dramatically. For example 50% reduction rates in diarrhea were observed in centers adopting a careful hand washing regime.

Proper hand washing is defined as a vigorous brief rubbing together of all surfaces of lathered hands, followed by rinsing. The components to good hand washing include:

Soap

Running water

10 seconds of friction

Turning off faucet with paper towel

The purpose of hand washing is to remove microbial contamination acquired by recent contact with infected or colonized patients or environmental sources.

Hand washing is always important

After touching wounds

After using the rest room

Before preparing food or eating food

In addition, hand washing is indicated after situations involving contact with mucous membranes, blood and bodily fluids and after touching inanimate objects that are likely to be contaminated.

### **Fecal waste disposal**

Proper disposal of waste is an important component of general sanitation. Availability of flush toilets, good sewage drainage and disposal site are very important in control of infectious disease transmission in health care facilities. For example infectious diarrhea often spreads from person to person either by the vehicle of contaminated food or water or by hand to hand to mouth contact. Appropriate hand-washing after defecation is a modern concept. Bathing with soap and water is an excellent decontaminant except for the rare circumstances when dealing with extremely contagious fecal organisms such as shigella.

### **Vector control**

Insect vectors are important infectious diseases transmitted in health care facilities. They are classified into biological and mechanical vectors. Biological vectors such as mosquitoes, fleas, lice and mechanical vectors such as house flies and cockroaches are responsible for the transmission of infection in health care facilities from infected case to susceptible individual where poor environmental sanitation, cleanliness and personal hygiene may be a problem.

Therefore appropriate prevention and control measures should be well organized and conducted to get rid of this problem in health care facilities.

### **Food preparation habits**

Food poisoning, ingestion of contaminated food or water, can be related to bacteria, bacterial toxins, parasites, viruses or toxic food. In health care facilities outbreaks, toxin producing *Escherichia coli*, shigella or salmonella are the most frequent causes of food-transmitted enteric infections. Inadequate refrigeration is one of the most common factors in







do not conduct patient care on the floors of patient's rooms, there is no apparent need to develop a culture for sterility. Thus the necessity for keeping supply items and inanimate surfaces clean in the health care facilities is in large part aesthetic.

### **The health center air**

When the air circulation within the health care facility is not maintained in such a way that clean air is brought in from the outside, adequate ventilation does not remove particulate material. The particulate material is responsible for airborne transmission of infectious disease agents. Transmission of mycobacterium tuberculosis, varicella zoster virus, small pox, influenza, measles and possibly rubella and mumps is very possible. Air-borne transmission of other diseases appears to be very infrequent. Therefore health care facilities should provide adequate ventilation and spacing to avoid this problem.

### **Training**

A policy for the management of health care waste cannot be effective unless it is applied carefully, consistently and universally. Training health care personnel in implementing the policy is thus critical if a waste management program is to be successful. The overall aim of training is to develop awareness of the health, safety and environmental issues related to health care waste and how these can affect employees in their daily work. It should highlight the roles and responsibilities of health care personnel in the overall management programme. Health and safety at the work place and environmental awareness are the responsibility of all and in the interests of all employees to be trained.

### **Public education on hazards linked to infectious waste in health care facilities**

Promotion of the appropriate handling and disposal of medical waste is important for community health and every member of the community should have the right to be informed about potential health hazards.

The objectives of public education on health-care waste are as follows:

To prevent exposure to health-care waste and related health hazards, this exposure may be voluntary, in the case of scavengers, or accidental, as a consequence of unsafe disposal method

To create awareness and foster responsibility among patients and visitors to health care establishments regarding hygiene and health care waste management

To inform the public about the risk linked to health-care waste, focusing on people living or working in close proximity to or visiting health-care establishment, families of patients treated at home and scavengers on waste dumps.

The following methods can be considered for public education on risks, waste segregation, or waste disposal practices:

Poster exhibition on health care waste issues including the risk involved in scavenging discarded syringes and hypodermic needles

Explanation by the staff of health care establishments to incoming patients and visitors on waste management policy. This may be difficult to achieve, in which case the distribution of leaflets should be considered.

Information poster exhibition in health care facilities at strategic point such as waste bin locations, giving instruction on waste segregation. Posters should be explicit, using diagrams and illustrations to convey the message to as broad an audience as possible, including illiterate people.

### **Education and training of health care personnel**

All health care personnel, include medical doctors, should be convinced of the need for a comprehensive health care waste management policy and related training and of its value for the health and safety of all. This should ensure their collaboration in the implementation of such a policy. Separate training activities



below. They should be able to carry out all procedures in accordance with the instructions without help from others:

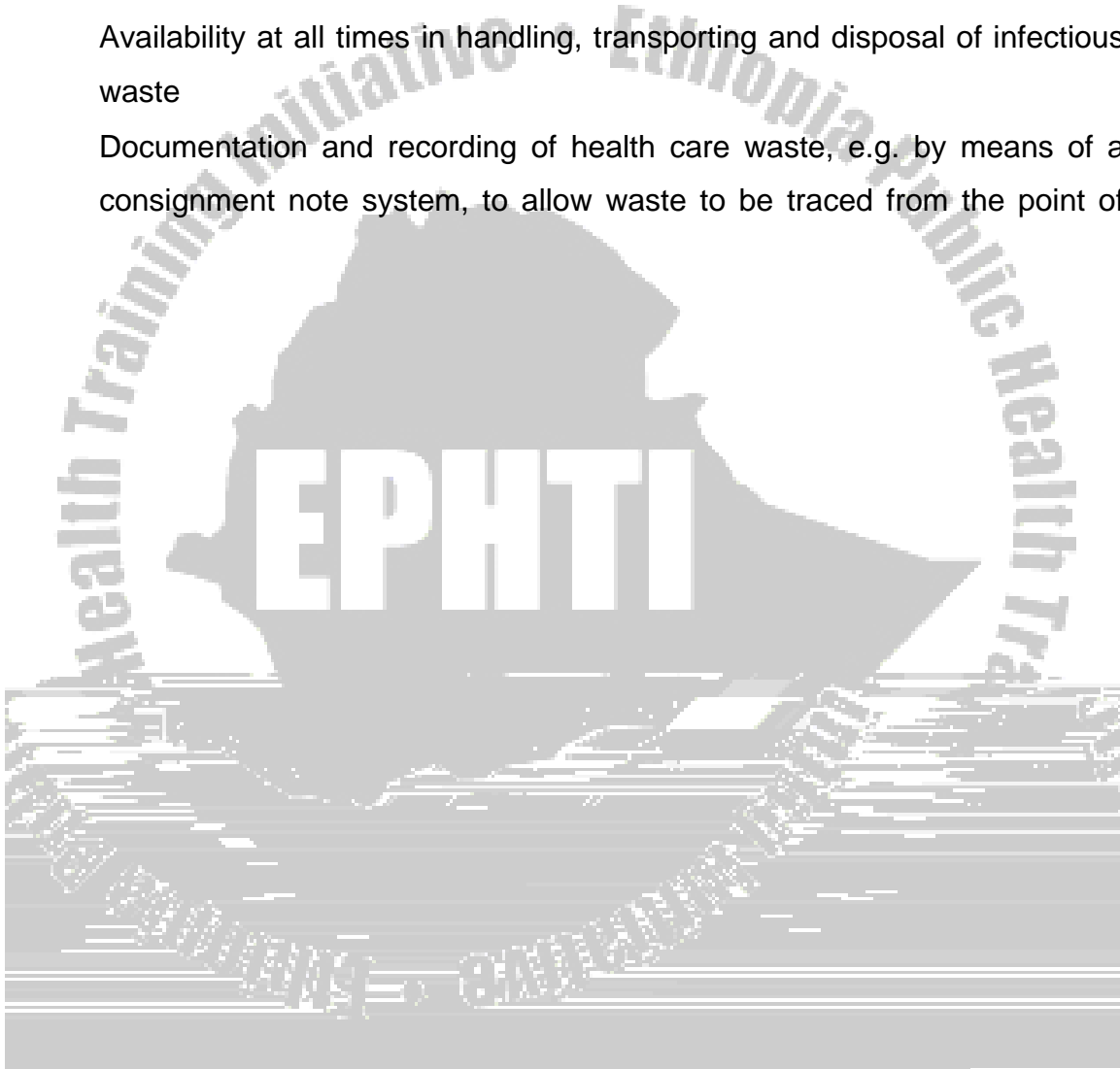
Correct procedures for handling, loading and unloading waste bags and containers

Procedures for dealing with spillages or other accidents

The wearing of protective clothing and strong foot wear at all times

Availability at all times in handling, transporting and disposal of infectious waste

Documentation and recording of health care waste, e.g. by means of a consignment note system, to allow waste to be traced from the point of



Define and Describe the types of commonest

facilities.

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## UNIT FOUR

### ROLE AND TASK ANALYSIS

**Table 4.1 Knowledge Objectives and Essential Tasks of the Health Center Team (Health Officers, Public Health Nurses, Medical Laboratory Technicians, and Sanitarions)**

	Learning Objectives	Health Officer	PHN	Med Lab Tech	Sanitarian	Learning Activities
<b>Knowledge</b>	Define and Describe the types of commonest infections in health care facilities.	Define and Describe the types of commonest infections in health care facilities.	Define and Describe the types of commonest infections in health care facilities.	Define and Describe the types of commonest infections in health care facilities.		
	List the etiologies and predisposing factors for HCF infections	List different causes of HCF infections and their association with the different risk factors	List different causes of HCF infections and their association with the different risk factors	List different causes of HCF infections and their association with the different risk factors		
	Describe the magnitude and contribution of HCF infection to overall community problems	Pinpoint the prevalence and contribution of HCF infection to overall community problems	Pinpoint the prevalence and contribution of HCF infection to overall community problems	Pinpoint the prevalence and contribution of HCF infection to overall community problems		
	Explain the standard precautions in infection prevention and control in health care facilities	Describe the standard precautions in infection prevention and control in health care facilities	Describe the standard precautions in infection prevention and control in health care facilities	Describe the standard precautions in infection prevention and control in health care facilities		
	Describe the assessment of HCF infections and its investigation	Enumerate the clinical manifestations and complications of HCF infections	Describe the clinical manifestations and complications of HCF infections	Describe the clinical manifestations and complications of HCF infections		
	Describe the principle and treatment methods of HCF infections	Explain how to treat HCF infections and the principles underlying it	Describe how to administer the treatment and advise the patients	Describe how to administer the treatment and advise the patients		

<b>Knowledge</b>	Describe diagnostic methods for infections in health care facilities	List the diagnostic methods for infections in health care facilities	List the diagnostic methods for infections in health care facilities	List diagnostic methods for infections in health care facilities	List diagnostic methods for infections in health care facilities	and describe what advice should be given to patients Description of the diagnostic methods for infections in health care facilities
	Describe the management, prevention and control measures of infections in health care facilities	Describe the management, prevention and control measures of infections in health care facilities	Describe the management, prevention and control measures of infections in health care facilities	Describe the prevention and control measures of infections in health care facilities	Describe the prevention and control measures of infections in health care facilities	Description of the management, prevention and control measures of infections in health care facilities
	Identify different specimen collection procedures and proper handling for infection control			Identify different specimen collection procedures and proper handling for infection control		Identification of different specimen collection procedures and proper handling for infection control
	Know how to properly prepare and dispose of the various types of waste products generated in HCF	Know how to properly prepare and dispose of the various types of waste products generated in the wards	Know how to properly prepare and dispose of the various types of waste products generated in wards	Know how to properly prepare and dispose of the various types of waste products like sharp materials, liquid and solid wastes generated in the laboratory	Know how to properly dispose of the various types of waste products generated in the HCFs	Proper preparation and disposing of the various types of waste products like sharp materials, liquid and solid wastes generated in the laboratory and wards
	Know how to properly decontaminate a work area when a hazardous spill has occurred and in general how to keep work areas clean.	Demonstrate how to properly decontaminate a work area when a hazardous spill has occurred and in general how to keep work areas clean.	Demonstrate how to properly decontaminate a work area when hazardous spill has occurred and in general how to keep work areas clean.	Demonstrate how to properly decontaminate a work area when a hazardous spill has occurred and in general how to keep work areas clean.	Demonstrate how to properly decontaminate a work area when a hazardous spill has occurred and in general how to keep work areas clean.	Proper decontamination of the work area when hazardous spill has occurred and generally keep the work areas clean.
	Know the basic steps of first aid measures	Know the basic steps of first aid measures	Know the basic steps of first aid measures	Know the basic steps of first aid measures	Know the basic steps of first aid measures	Know the basic steps of first aid measures

**Table 4.2. Attitude Objectives and Essential Tasks of the Health Center Team (Health Officers, Public Health Nurses, Medical Laboratory Technicians, and Sanitarians)**

	Learning Objectives	Health Officer	PHN	Med Lab Tech	Sanitarian	Learning Activities
<b>Attitude</b>	U hold the idea that HCF infections are caused by micro-organisms					
	Believe in the importance of standard precautions in HCF infection prevention and control					
	Believe in conducting health education for clients, families and refresher training for staff in infection control					
	Believe in organizing surveillance committee for monitoring, defection and esher tr in infection control					
	Believe in organizing surveillance committee for 5 7.9 in infection cfection contr4 0.4794ar0 Tc0 J0 -1.5038 36.84 17.94 0.47998 ref 265.32 101.8for n and					
	monits in HCF					

s u r v e i l l a n c e

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monits in HCF

**Table 4.3. Practice Objectives and Essential Tasks of the Health Center Team (Health Officers, Public Health Nurses, Medical Laboratory Technicians, and Sanitarians)**

	Learning Objectives	Health Officer	PHN	Med Lab Tech	Sanitarian	Learning Activities
<b>Practice</b>	Identify the causes and the source of common infections in HCFs and demonstrate their appropriate management	Demonstrate the management principle; identify the etiologic agents and sources of commonest infection in HCFs				
	Identify the standard precaution in infection prevention and control	Demonstrate the standard precautions in infection prevention and control in health care facilities				
	Conduct health education for clients, families and refresher training for staff in infection control	Conduct health education for clients, family visitors and refresher training for staff on infection control in health care facilities				
	Organize infectious control committee for routine monitoring early defecation and management of HCF infections	Organize infectionize is				
	Demonstrate how to do laboratory tests to isolate the causes of HCF infections					
	Demonstrate the process of assessing HCF infections					



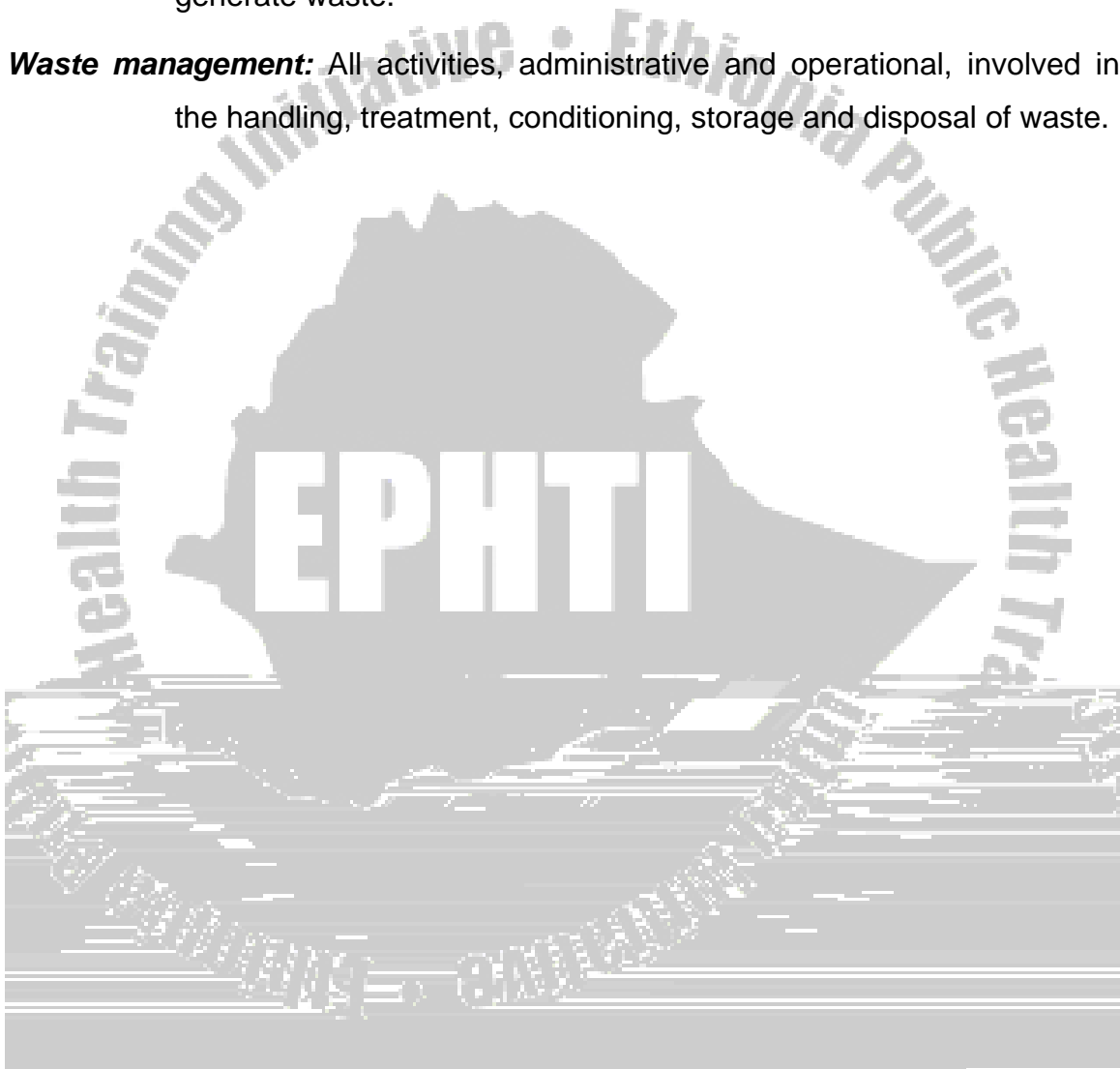
<b>Practice</b>	Demonstrate procedure of cleaning, disinfection and sterilization according to the given outline	-	Demonstrate correct cleaning procedure, disinfect and sterilize equipments in HCFs, prepare patients for surgical and non-surgical procedures	Demonstrate correct cleaning procedure, disinfect and sterilize equipments in HCFs	-	Cleaning, disinfecting, and sterilizing of equipments and preparation of patients for non-surgical cases
	Plan different methods of training in management of infectious waste in health care facilities	Plan different methods of training in management of infectious waste in HCFs	Plan different methods of training in management of infectious waste in HCFs	Plan different methods of training in management of infectious waste in HCFs	Plan different methods of training in management of infectious waste in HCFs	Planning different methods of training in management of infectious waste in HCFs
	Implement safety precaution for the prevention of infection in the laboratory setting		Implement safety precaution for the prevention of infection in the laboratory setting	Implement safety precaution for the prevention of infection in the laboratory setting	Implement safety precaution for the prevention of infection in the laboratory setting	Implement safety precaution for the prevention of infection in the laboratory setting
	Ensure the availability of hygienic food supply, adequate and safe water supply, and safe handling of medical equipment and linens and good housing conditions in health care facilities	Ensure safe handling of medical equipment and linens and good housing conditions in health care facilities	Ensure safe handling of medical equipment and linens and good housing conditions in health care facilities	Conduct food and water analysis and check safe handling of lab equipment and good housing conditions in health care facilities	Ensure the availability of hygienic food supply, adequate and safe water supply good housing conditions in health care facilities	Ensuring the availability of hygienic food supply, adequate and safe water supply, safe handling of medical equipment and linens and good housing conditions in HCFs



**Storage:** The placement of waste in a suitable location or facility where isolation, environmental and health protection and human control (e.g. monitoring for radio activity, limitation of access) are provided.

**Waste generator:** Any person, organization or facility engaged in activities that generate waste.

**Waste management:** All activities, administrative and operational, involved in the handling, treatment, conditioning, storage and disposal of waste.



## ABBREVIATIONS

- AFI - Acute Febrile Illness  
AIDS - Acquired Immuno Deficiency Syndrome  
CHW - Community Health Worker  
EH - Environmental Health





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**King M., et al.** Primary Surgery, Non-Trauma. Vol I, 1987

**Linne J.J. and Ringsrud K.M.**



# UNIT SEVEN

## ANNEXES

### Annex 1: Answer Keys

#### 2.1. Keys for the Core Module (all Categories)

Q.No. 1. D

Q.No. 2. D

Q.No. 3. B

Q.No. 4. E

Q.No. 5. A

Q.No. 6. E

Q.No. 7. E

**Q.No. 8.** Patients, families, and visitors need to have health education. Also the auxiliary staff and the health professionals need basic or refresher training because all of the above mentioned groups of individuals are responsible for the control of infections in HCFs.

**Q.No.9.** Head of the health center, department heads, and hygienist.

**Q.No. 10.**

- § Formation of waste management and infection control committee
- § Appoint waste management and infection control officer
- § Allocation of sufficient financial and personnel resources
- § Monitor the efficiency of waste disposal system
- § Insure adequate training of staff on waste management

**Q.No. 11.**

- § Active surveillance
- § Passive surveillance

**Q.No. 12.**

- § Urinary tract infections
- § Surgical wound infections
- § Puerperal sepsis

**Q.No. 13.**

The answer is found in the core module on page 39.

**Q.No. 14.**

- a. Ensuring that the auxiliary staff are aware of the procedure in segregation and storage of wastes and check that all of them are at the highest standard.
- b. Work with waste management committees.
- c. Ensuring that staff members in their departments are getting training.

**2.2. Keys for the satellite modules (Specific Professional Categories)**

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- Q.No.4. D  
Q.No.5. A  
Q.No.6. C  
Q.No. 7. E  
Q.No. 8. B  
Q.No. 9. E  
Q.No. 10. C  
Q.No. 11. C, D

### 2.2.3. Medical Laboratory Technicians

- Q.No. 1. D  
Q.No. 2. C  
Q.No. 3. D  
Q.No. 4. E  
Q.No. 5. D  
Q.No. 6. Refrigerator  
Q.No.7. To isolate any possible hazardous waste from all health workers, laboratory personnel, and clients.

### 2.2.4. Sanitarians

- Q.No. 1. E  
Q.No. 2. E  
Q.No. 3. a. Identification of the problem  
b. Write a case definition  
c. Epidemiological description  
d. Formulate a hypothesis  
e. Implement control measures to stop the outbreak  
Q.No. 4. a. Waste generation  
b. Segregation and packaging  
c. Handling and storage  
d. Treatment and disposal

- Q.No. 5.** a. Chemning  
b. Furnace  
c. Ash pit

**Q.No. 6. A**

**Q.No. 7. C**

**Q.No. 8. E**

**Q.No. 9. E**

**Q.No. 10. D**

