

Primary Health Care Initiatives (PHCI) Project
Contract No. 278-C-00-99-00059-00
Abt. Associates Inc.

INFECTION PREVENTION

LEARNING OBJECTIVES

- Describe the disease transmission cycle
- Define asepsis, antisepsis, decontamination, cleaning, high level disinfections and sterilization.
- Select the appropriate infection prevention procedures for different objects, depending on the extent of the contact they have with tissue and skin
- Identify barriers which can be used to protect an individual from infection
- Identify at least four situations where sterile or high level disinfected gloves are appropriate and demonstrate proper gloving technique
- Demonstrate the processing of contaminated instruments, gloves, and other items

TEACHING STRATEGIES:

- Large group discussion
- Practice common procedures such as putting on sterile gloves, the cleaning-sterilization cycle, etc.

MATERIAL AND EQUIPMENT NEEDED

- Several sets of packaged gloves for demonstration and practice
- Demonstration masks
- Basic infection prevention containers for demonstration

LEARNING POINTS

- **Instruments and Equipment Used in Infection Prevention**
 1. Sterilization devices (autoclave, hot air oven)
 2. A sterilization drum
 3. A storage container for sterilization forceps
 4. Chatel forceps for holding sterilized instruments
 5. Various types of surgical forceps (tooth forceps, non-tooth forceps, art forceps, needleholders)
 6. Medical instrument tray with lid
 7. Surgical scissors
 8. Kidney dishes
 9. A graded metal measuring device
 10. A double metal basin with stand
 11. A storage cabinet for instruments and equipment
 12. A set of IUD-insertion instruments

- **Other materials and instruments used**
 1. A sink and running water
 2. Medical gloves
 3. Thick, non-medical gloves
 4. Medical solutions
 5. Brushes for cleaning instruments
 6. Plastic containers
 7. Soap
 8. Receptacles for the disposal of used syringes
 9. Chlorine

- **Processes:** The proper use of infection prevention methods while offering health services leads to safety and well-being for both the health service provider and the recipient.

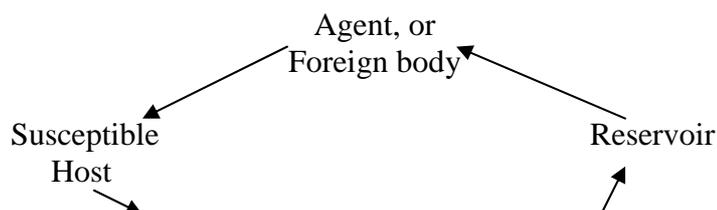
- **General concepts relating to infection prevention:**
 1. *Microorganisms:* Organisms which are invisible to the naked eye and can only be seen with the aid of a microscope; both harmful and benign microorganisms are found naturally in the surrounding environment, while those which are harmful may lead to infection or illness.
 2. *Infection:* The reaction of a host to a bacterial agent; hence, infection involves a bacterial invasion and multiplication by parasitic organisms, which in turn cause harmful side effects in the host organism.
 3. *Chain of infection:* This chain is composed of six parts: a) microbe, b) host, c) reservoir, d) point of entry, e) point of exit, and f) methods of transmission.
 4. *Microbe:* A parasitic organism (such as bacteria, fungi, and viruses) with the capacity to cause infection or disease.
 5. *Naturally occurring bacteria:* Benign bacteria which inhabit specific parts of the body (such as the eyes, the mouth, the ears, the skin, the genitals, and the intestines) and which, if they are relocated to some other area will become harmful. Bacteria which occur naturally in the mouth include *Streptococcus*, *Hemophilus*, and *Nisseria*.
 6. *Agent (or Host):* An organism which receives and incubates the microbe.
 7. *Reservoir:* The place or natural environment in which microorganisms exist and grow, such as the human body, the bodies of animals, soil, water, and food.
 8. *Point of entry:* The location at which the microbe enters the host, e.g., the digestive tract, the urinary tract, the reproductive tract, broken or burned skin, mucous membranes, and salivary membranes.

9. *Methods of transmission*: The means by which microorganisms are transferred from a point of exit to a new point of entry, such as water, air, insects, inanimate objects, and parts of the body such as the hands.
10. *Point of exit*: The location at which microorganisms escape from the reservoir, for example, through secretions of the digestive tract, the urinary tract, or the reproductive tract, or through the blood or tissues as a result of an injury to the skin.
11. *Decontamination or Disinfection*: Killing or preventing the growth of microbes, especially those which do not have spores; this is the first step in dealing with contaminated instruments in order to minimize the danger of contracting hepatitis and AIDS.
12. *Sterilization*: The process of killing all types of microbes, including those with spores.
13. *Spores*: The result of a process by which bacteria become encased in a thick protective covering which shields them from harsh external elements such as high temperatures and chemical substances; bacteria may remain thus encased until they encounter favorable conditions, at which point they become active once again.
14. *Cleaning*: The process of mechanically removing substances which cling to the object being cleaned, thereby improving the results of high-level disinfection or sterilization.
15. *High-level disinfection*: The process of destroying all viruses, bacteria, parasites and fungi as well as some spores by means of one of two methods: Either boiling or the use of chemical substances.

- **The danger of infection:**

After an injection has been given to a patient who is a carrier of hepatitis, the likelihood of infection occurring through contaminated blood is between 27% and 37%; if the patient is a carrier of the AIDS virus, the likelihood of infection may be as high as .4 %. Infection with HBV, or hepatitis: If a small skin wound no larger than 10[^] millimeters [?] is exposed unexpectedly to blood contaminated with HBV, this may introduce the microbe into the body and cause infection.

The Infection Prevention Cycle





- **Ways of protecting against infection:**

The placement of physical, mechanical or chemical barriers between microorganisms and people is an effective method of preventing the spread of disease (infection) from person to person, or from equipment, instruments or surfaces to people. Such barriers, which serve to break the cycle of infection, include the following:

1. Hand washing
2. Wearing gloves
3. The use of disinfectants and preparation of the skin
4. Decontamination, cleaning, high-level disinfection, and sterilization
5. Disposal of wastes.

1. Hand washing

Hand washing is the most important procedure in infection prevention, since it minimizes the number of microorganisms on the skin, which in turn serves to limit the possibility of spreading disease person to person.

- Washing the hands with water alone does away with 50% of the microbes clinging to them.
- The addition of soap to the water does away with 80% of such microbes.

One. When hands should be washed

Before: 1) the beginning of the work day, 2) examining a patient, 3) giving an injection or taking blood samples, 4) performing any procedure on a patient (such as insertion of an IUD, changing a wound, etc.), 5) putting on gloves, and 6) going home at the end of the work day.

After: 1) examining a patient, 2) removing gloves, 3) any procedure which has been performed on a patient, and 4) touching any part of the body, such as secretions, mucous membranes, etc.

Two. Requirements of hand washing: 1) water, 2) soap, 3) a perforated dish in which to place the soap, and 4) a clean, dry towel.

Three. How to wash the hands: 1) Remove all rings, watches, and fingernail polish; 2) Rub soap into your hands with a circular motion for 15-30 seconds; 3) Be sure not to touch the sink, which could be contaminated; 4) Turn off the faucet with a cloth or paper towel, and 5) Rinse suds off hands with clean running water, then dry them either by using a clean towel or by placing them under a hot air drier. (Note: Towels should be changed once they become damp.)

2. **Wearing surgical gloves**, which are one of the mechanical barriers which can reduce the chances of the transfer of infection between the service provider and the recipient.

One. When using gloves, make certain of the following: 1) that the gloves are used only once, 2) that their expiration date is not past, 3) that they are not torn, 4) that gloves are changed if they become accidentally contaminated, and 5) that you wash your hands before putting the gloves on.

Two. Procedures for putting on surgical gloves: 1) Choose the proper size of gloves; 2) Open sterilized instruments and equipment from the outside prior to opening the sterilized gloves; 3) Open the gloves in a clean, dry, spacious area, taking care not to touch the sterilized inner surface of the package; 4) Grasp the folded part of the gloves (that is, their inner surface), which is the area which will be in contact with the skin when they are worn; 5) Insert the fingers of the first hand in a downward motion, taking care to keep your fingers apart and not to touch anything; 6) Grasp the second glove with the hand which is already wearing a glove and insert the fingers in the sterilized, folded portion of the second glove; 7) Correct the positioning of your fingers inside the gloves, taking care not to let the gloves touch any part of your skin; 8) Take care to keep your hands above waist level while putting the gloves on so as to prevent contamination; 9) Before taking the gloves off, take care to remove any substances which may be clinging to them by immersing your hands in a .5 % chlorine solution; 10) Turn the gloves inside out as you take them off and be certain not to allow them to touch the skin of your hands or body, since they will have become contaminated.

Three. Proper disposal of used gloves: Used gloves should be disposed of by one of two methods: 1) soaking them for 10 minutes in a .5 % chlorine solution, then placing them in a securely closed container, or 2) putting them in a specially designated place to be burned.

3. Disinfectants (chemical substances which kill or halt the growth of most microorganisms):

Disinfectants Which May Be Used

Solution	Uses	Percentage Concentration
Alcohol	1. Disinfection of workers' skin 2. Sterilized metal medical equipment	70 % 90 %
Iodine	1. Cleaning the cervix before IUD insertion 2. Keeping medical equipment sterilized	10 % 10 %
Savlon	Disinfecting the skin and external genitalia	1 %
Chlorine	1. Disinfecting metal instruments 2. Disinfecting external surfaces 3. Disinfecting fabrics and rubber gloves	.5 % .5 % .5 %
Regular and Liquid Soap	1. Cleaning medical instruments 2. Cleaning needles 3. Cleaning external surfaces 4. Cleaning fabrics and other materials	Concentration varies depending on need

1. Preparation of medical solutions:

- 1) Medical solutions are to be prepared based on the following formula:

$$\frac{\text{Percentage concentration of concentrated solution}}{\text{Percentage concentration of The solution needed}} - 1 = \text{The amount of water which must be added to one part of the concentrated solution}$$

- 2) When preparing a .5 % chlorine solution from a previously existing 6 % chlorine solution, the following equation should be followed:

$$\frac{6\%}{0.5\%} - 1 = \frac{60}{5} - 1 = 10 - 1 = 11 \text{ parts water/1 part chlorine}$$

2. Preparation of skin and mucous membranes:

1. Hair is not to be removed from the site of the incision or stitches unless this is necessary, in which case the hair should be cut with scissors directly above the surface of the skin.
2. Alcohol should not be used on mucous membranes, since it could cause burns or redness.
3. When giving injections, the following should be observed: a) The injection site should be wiped with a piece of cotton soaked in a 60-90 % alcohol solution using a circular motion; and b) the site should be dried before the injection is given.

When disinfectants should be used: 1) Before giving any type of injection, 2) before cleaning the cervix prior to the insertion of an IUD (without the use of alcohol), and 3) before taking blood samples.

4. Methods of dealing with other used (contaminated) instruments and materials:

- One. Disinfection or decontamination renders objects safer to touch.
- Two. Cleaning mechanically removes most microorganisms.
- Three. Sterilization kills all microorganisms, including spores and cysts.
- Four. High-level disinfection kills all type of bacteria, viruses, fungi and parasites, as well as some spores.

(Note: The destruction of used materials should take place through proper disposal of contaminated materials and waste.)

The effectiveness of the various methods of infection prevention:

1. *Decontamination* by soaking materials for 10 minutes in a 0.5 % chlorine solution kills HBV and HIV.

2. *Cleaning* -- Washing with water alone removes approximately 50% of all microbes, while washing with soap and water followed by rinsing removes up to 80% of all microbes.
3. *High-level decontamination* destroys 95% of all microbes, though it does not destroy certain types of spores.
4. *Sterilization* destroys 100% of all microbes.

3. Decontamination

The first step in dealing with medical instruments, decontamination requires the following: 1) a plastic container of a suitable size, 2) water, 3) a chlorine solution, and 4) thick gloves.

The importance of decontamination: Due to the prevalence of pricks or wounds during the cleaning of pointed or sharp instruments, it becomes all the more important to disinfect such instruments for 10 minutes in a .5 % chlorine solution in order to protect workers from infection with hepatitis or AIDS.

Steps to follow in the process of decontamination:

1. In a plastic container, prepare enough .5 % chlorine solution to completely immerse the instruments.
2. Immediately following the use of all surgical instruments, immerse them in the prepared solution.
3. Before taking off surgical gloves, immerse your hands in a .5 % chlorine solution in order to remove any substances which might be clinging to the gloves.
4. Be sure not to soak instruments in the solution for more than 10 minutes.
5. Wear thick gloves to remove instruments from the solution.
6. Immediately after removing the instruments from the solution, rinse them with cold water to prevent them from becoming scratched or eroded.

4. Cleaning

Cleaning is a fundamental, necessary step because without it, the processes of high-level decontamination and sterilization become ineffective. The process of cleaning requires the following: 1) soap, 2) water, 3) brushes of various sizes, 4) thick gloves, and 5) a sink for cleaning instruments.

Steps to follow in the process of cleaning:

1. Put on thick gloves.
2. Submerge the instruments in a wash basin containing soap and water.
3. Use a toothbrush to clean the surgical instruments, taking care to scrub thoroughly inside all minute depressions or indentations.
4. Scrub all such depressions in the instruments while they are open.
5. Rinse the instruments with cold water.
6. Dry the instruments either with air or a dry towel.

(*Note: During the process of cleaning instruments, care should be taken to ensure that the sink or basin is low enough to prevent contaminated water from flowing back onto the body of the person doing the cleaning.*)

5. High-level Decontamination

Considered the only acceptable alternative when sterilization is not possible, high-level decontamination can be performed in one of two ways: 1) by boiling, or 2) by the use of chemical substances.

▪ **Boiling as a method of high-level decontamination:**

One. Boiling requires the following: 1) water, and 2) an electric boiler or some other heat source.

Two. Procedures:

1. Fill the boiler with sufficient water to completely submerge the instruments.
2. Disassemble and open all instruments.
3. Place the instruments in the water, making certain that they are completely immersed; then close the boiler tightly.
4. Wait until the water has come to a full boil, then begin timing the process.
5. Once water has come to a boil, allow instruments to boil for 20 minutes.
6. Do not add anything to the boiler, including water or other instruments, once boiling has begun; if anything is added, the timing must be begun all over again.
7. Remove the instruments with a sterilized forceps, then leave them to dry in the air for a short period of time.
8. Store the instruments in a tightly sealed, sterilized container, until it is time to use them.

(*Please note the following: 1) Instruments may be stored for one week in a tightly closed container; 2) After instruments are boiled, they must not be left in the water until it cools, since cold water is a suitable medium for the growth of microorganisms, and since they may begin to rust.*)

▪ **Decontamination by means of chemical substances:**

This method may be employed for the decontamination of instruments which cannot tolerate high temperatures.

Procedures to follow when decontaminating with chemical substances:

1. Once instruments have been washed [and dried], submerge them completely in the chemical solution.
2. Soak them for 20 minutes.
3. Remove the instruments with a large, sterilized forceps.
4. Instruments may either be used immediately, or stored for [a maximum of] one week in a tightly sealed container.

6. Sterilization

Sterilization takes place by one of two methods: 1) heat (dry or steam), or 2) the use of chemical substances. As for sterilization with heat, it takes place either in an autoclave (steam under pressure), or in a hot air oven.

One. Sterilization in an autoclave:

The only item required for this process is a properly functioning autoclave.

Procedures for sterilization in an autoclave:

1. Arrange the instruments in such a way that the steam can reach them most easily.
2. Wrap needles and other sharp instruments in gauze to prevent them from becoming dull.
3. Be sure to follow the manufacturer's operating instructions.
4. Wrap instruments in two loose layers of gauze, but without a rubber band so as to allow the steam to penetrate through the gauze.
5. Set the temperature at 121 degrees Centigrade (250 degrees Fahrenheit), and the pressure at 106 degrees and 16 pounds.
6. Leave closed instruments in the autoclave for 30 minutes, and open instruments for 20 minutes.
7. Once the autoclave has been shut off, leave the instruments inside for 20-30 minutes, until the pressure gauge reads zero.
8. Open the autoclave and wait for 30 more minutes until the instruments are completely dry; then remove and store them.

(Note the following: 1) Instruments may be stored for a maximum of one week from the date of sterilization; 2) Open instruments must be used the same day.)

Two. Sterilization with dry heat

The only item required for this process is a properly functioning hot air oven.

Procedures for sterilization in a hot air oven:

1. Arrange the instruments inside the oven in a manner which will facilitate their subsequent use.
2. Wrap the instruments or place them inside a tightly closed container (this protects them from recontamination after they have been sterilized).
3. Place the instruments inside the oven and allow heating to begin.
4. When the temperature gauge reaches 170 degrees Centigrade, begin timing the process, allowing the instruments to remain in the oven for one hour.
5. Be certain to adhere to the manufacturer's operating instructions.
6. Once the instruments have cooled, remove them with a highly sterilized forceps and store them in a securely closed, sterilized container for one week.

Three. Sterilization by the use of chemical substances

For this process, a 2% solution of gluteraldehyde is used.

1. Be certain to follow the manufacturer's operating instructions.
2. Use a deep container with a securely fitting lid in which the instruments can be completely immersed.

3. Prepare another sterilized container filled with boiled water for rinsing the instruments.
4. Open the instruments to allow the solution to come in contact with all parts of them; then allow them to soak for 10 hours.
5. Remove the instruments from the solution with a sterilized forceps.
6. Rinse the instruments thoroughly with boiled water.
7. Allow the instruments to dry in the air.
8. Store the instruments for no longer than one week.

Guide to Infection Prevention Procedures

Criterion	Yes	No	Remarks
1. Staff			
a. Have the medical staff at the center been trained in infection prevention?			
b. Has the center been provided with a copy of the training guide on infection prevention procedures?			
c. Are the skills and techniques contained in the guide, and in which training has been given, being applied?			
d. Is the infection prevention program at the center being evaluated?			
2. Instruments and equipment			
a. Is the center being supplied regularly with sufficient amounts of surgical instruments and equipment?			
b. Is sterilization equipment available at the center?			
c. Is such equipment checked periodically?			
d. Does equipment receive the necessary maintenance?			
e. Are the staff trained in how to deal with such instruments and equipment?			
f. Do the staff follow the instructions relevant to each type of instrument or equipment?			
g. Is a medical supplies request form submitted whenever necessary?			
h. Have the staff been trained in how to protect and maintain instruments and equipment on a daily basis?			
3. Training			
a. Are there ongoing training and education programs related to infection prevention at the health center?			
b. Are the available programs being implemented?			
c. Is there evaluation of such programs?			
4. Other materials and instruments used			
a. Does the health center have a sink or some other area specifically designed for cleaning medical instruments?			
b. Does the health center regularly provide the necessary medical solutions in the required amounts?			

c. Does the center regularly provide the appropriate amounts of the auxiliary supplies required for the process of infection prevention (such as surgical and regular gloves, brushes of various sizes, etc.)?			
d. Does the center provide soap or cleaning liquid for washing hands and instruments?			
e. Is alcohol used to sterilize the hands when soap is not available?			
f. Are containers for the proper disposal of used syringes and waste matter made available?			
g. Are such containers disposed of in the proper manner after they are used?			
h. Does the center regularly provide sufficient numbers of wastebaskets with lids?			
5. The health center building			
a. Does the center have a special room designated for infection prevention procedures?			
b. Is this room supplied with electricity?			
c. Is there a steady supply of water in the room?			
d. Does the room contain a properly functioning sink?			
e. Does the room contain a hot air oven or some other sterilization device which remains in proper working order?			
f. Does the room contain a tightly closed container for storing the available sterilized instruments?			
g. Does the center have bathrooms with washbasins in them for patients' use?			
h. Are there sufficient examination rooms in the center?			
i. Does the center have a hygienic sewer system, and does it receive maintenance when needed?			
j. Does the center have a tightly closed container in which to collect its medical waste?			
k. Is such waste disposed of in the optimal manner?			