

# Unit 22

## INFECTION PREVENTION

### Learning Objectives

By the end of this unit, learners will be able to:

- ❖ Define infection prevention
- ❖ List the family planning methods for which infection prevention practices are particularly important
- ❖ Describe ways to protect oneself and others from infection, focusing on hand washing, use of gloves and other protective gear, injection safety, and proper waste disposal
- ❖ Describe the steps for decontaminating instruments
- ❖ Calculate how to make a 0.5 percent chlorine decontamination solution
- ❖ Describe proper waste management and disposal
- ❖ Describe the steps to take if potentially exposed to HIV.

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## Unit 22: Infection Prevention

### Key Points

- ❖ **Everyone (clinic staff and clients) is potentially infectious AND at risk of infection.**
- ❖ **Hand washing is the single most important practice for preventing infection.**
- ❖ **Physical barriers (gloves and other protective gear) should be worn to avoid exposure to body fluids, soiled items, and contaminated waste.**
- ❖ **When handling and disposing of sharp instruments, use safe methods to avoid accidents.**
- ❖ **Proper waste disposal prevents the spread of infection to the people who handle the waste and to the local community.**
- ❖ **Proper processing of reusable instruments reduces the risk of transmitting infections. The steps are decontamination, cleaning, sterilisation or high-level disinfection and storage.**
- ❖ **In case of potential exposure to HIV, follow guidelines to reduce the risk of transmission.**

**Infection prevention** is a combination of efforts made to prevent transmission of infections between clients, service providers, and the community. Every person (client or staff) is considered potentially infectious.

It is essential that all staff, including providers of family planning, follow infection prevention practices while at work. While the provision of some family planning methods, such as condoms and pills, does not involve exposure to pathogens, the provision of other methods does. These include surgical methods such as female sterilisation and vasectomy, as well as IUCD insertion/removal, implant insertion/removal, and the provision of injectables.

Information about the basic principles of infection prevention practices is available elsewhere. This unit covers the infection prevention practices specific to family planning, based on the 2006 Malawi Ministry of Health publication, Performance and Quality Improvement Process for Infection Prevention in Hospitals.

### 22.1 Hand Washing

**Hand washing is the single most important practice for preventing cross-contamination.**

- Preferably: wash hands with running water and soap for 10–15 seconds. Be sure to clean between the fingers and under fingernails. Dry with an individual clean towel, paper towel, or air-dry, **or**
- **If water and soap are not available:** rub hands with 3–5 ml of an alcohol-based solution until the hands are dry (if hands **are not** visibly soiled).
- Always wash hands:
  - When arriving at work, after using the toilet or latrine, before and after eating, and when leaving work

- Before and after examining or treating each client or giving an injection
- After handling soiled instruments or touching any blood or body fluids, even if gloves are worn
- Before putting on gloves, after removing gloves (the gloves may have very small holes), and whenever hands get dirty.

## 22.2 Physical Barriers to Infection

### Gloves

Wear gloves (both hands) when:

- Performing a procedure that risks touching blood, other body fluids, mucous membranes or broken skin

**Sterile or** high-level disinfected (HLD) surgical gloves should be used when performing invasive medical or surgical procedures such as the insertion of contraceptive implants. Non-sterile examination gloves provide protection to health care workers for procedures that touch intact mucous membranes or generally to avoid exposure to body fluids (e.g., pelvic exam).

- Handling soiled items (e.g., instruments and gloves) or disposing of contaminated waste (clean **utility** or **heavy-duty household gloves**).

Gloves are not needed for activities such as taking a patient's blood pressure; giving injections; or providing pills, condoms, or counselling.

- A separate pair of gloves must be used for each client to avoid cross-contamination.
- Disposable gloves are preferred, but when resources are limited, surgical gloves can be reused. They should be decontaminated by soaking in 0.5 percent chlorine for 10 minutes, washed and rinsed, then examined carefully for any tears or small holes. They should then be sterilised by steam sterilisation or autoclaving. To avoid gloves sticking together, powdering with absorbable powder such as starch may be helpful before sterilisation. Single-use or disposable sterile surgical gloves should not be reused more than three times because invisible tears may occur.

### Protective gear

Use protective goggles, face masks, aprons, and closed protective shoes when cleaning contaminated instruments. Protective gear is not usually necessary for other family planning activities.

## 22.3 Preventing Contact with Infection Agents

### Prevent splashes

- Avoid snapping the gloves when removing, as this may cause contaminants to splash into the eyes, mouth, or on to skin or others.
- Hold instruments and other items under the surface of the water while scrubbing and cleaning to avoid splashing.
- Place items gently into the decontamination bucket to avoid splashes.

### Use antiseptic agents

- Wipe examination tables, bench tops, and other surfaces that come in contact with unbroken skin with 0.5% chlorine solution after each client.

- Cleanse the client’s skin prior to surgery with an alcohol-based antiseptic product.
- When giving an injection, no antiseptic is necessary unless the skin is visibly dirty.
- Prepare antiseptics in small, reusable containers for daily use and label with the type of antiseptic, the concentration, and the date each time they are refilled [e.g., isopropyl alcohol (90%) 9:30 AM/March 10, 2010].
- Wash reusable containers with soap and water, rinse with clean water, and dry before refilling.
- Store instruments, gauze, and cotton wool in dry covered containers without antiseptics.

## 22.4 Handling Sharp Instruments

Do not leave sharp instruments or needles (“sharps”) in places other than “safe” zones:

- Use a tray or basin to carry and pass sharp items during surgical procedures.
- Pass instruments with the handle (not the sharp end) pointing toward the receiver.
- Announce to others before passing any sharp instrument.

### Needles and syringes

- Use each needle and syringe only once.
- Do not take needle and syringe apart after use.
- Do not recap, bend, or break needles before disposal.
- Decontaminate disposable syringes and needles by flushing them three times with a 0.5% chlorine solution before disposal. (The person performing this should be wearing heavy-duty, non-sterile gloves.)
- Dispose of needles and syringes in a puncture-proof container.

## 22.5 Waste Disposal

The purpose of waste disposal is to prevent the spread of infection to people who handle the waste, prevent the spread of infection to the local community, and protect those who handle waste from accidental injury.

In family planning services, medical waste is produced during female sterilisation and vasectomy procedures, IUCD insertion/removal, implant insertion/removal, and the provision of injectables.

### Medical waste (cotton wool, gauze, etc.)

- Place medical waste in a washable container with a leak-proof plastic bag.
- Close and collect bags when three-quarters full, or daily if not three-quarters full.
- Burn and bury bags of waste in a deep pit.
- Pour liquid waste down a drain, a flushable toilet, or pour into a deep pit and bury it.
- Contaminated linens which will not be washed/bleached and re-sterilized should also be burned and buried.
- Wash hands, gloves, and containers after disposal of medical waste.

### Sharps

- Place sharps in a puncture-resistant, single-use container (empty plastic container, metal container with small opening).

- Seal and collect containers when  $\frac{3}{4}$  full and then burn and bury in a deep pit.

### Cleaning equipment

Buckets, brushes, and cleaning cloths should be:

- Decontaminated by soaking for 10 minutes in 0.5% chlorine solution or other approved disinfectant
- Washed in detergent and water
- Rinsed in clean water
- Dried completely before reuse or storage.

## 22.6 The Steps of Processing Instruments

The steps of processing instruments (used during female sterilisation, vasectomy, IUCD insertion/removal, and implant insertion/removal) include first soaking in a 0.5% chlorine solution, physically cleaning any visible contamination with a brush, and putting them through a HLD/sterilisation procedure.

Table 22.1: Benefits of Each Step of Instrument Processing

Processing step	Benefit
<b>Decontaminate</b>	<ul style="list-style-type: none"> <li>• Kills viruses (hepatitis B and C, HIV) and many other germs</li> <li>• Makes items safer to handle during cleaning</li> <li>• Makes items easier to clean</li> <li>• Common decontamination process: soak in 0.5% chlorine solution for 10 minutes immediately after use (extended soaking can cause instruments to rust)</li> </ul>
<b>Clean</b>	<ul style="list-style-type: none"> <li>• Removes blood, other body fluids, tissue, and dirt, making sterilisation or HLD effective</li> <li>• To clean: using a soft brush, gently brush items with soap and water and rinse with clean water</li> </ul>
<b>High-level disinfect (HLD)</b>	<ul style="list-style-type: none"> <li>• Kills all germs except some endospores (dormant, resistant forms of bacteria responsible for tetanus, gangrene, tuberculosis, etc.)</li> <li>• Use for items that have been in contact with broken skin or intact mucous membranes, such as vaginal specula and gloves for pelvic examinations and items which have been in contact with blood</li> <li>• Can be done by boiling or steaming items for 20 minutes or chemical disinfection using 0.1% chlorine solution for 20 minutes</li> </ul>
<b>OR</b>	
<b>Sterilize</b>	<ul style="list-style-type: none"> <li>• Kills all germs including endospores</li> <li>• Used for instruments that touch tissue beneath the skin such as surgical instruments</li> <li>• Can be done by dry (oven) or wet heat (autoclave) or chemically (soak in 2% glutaraldehyde for 20 minutes)</li> </ul>

### Storage

Proper storage is as important as proper processing. If items are stored properly after processing they should not become contaminated. Items that are not being used should be stored in an HLD container, away from clinic traffic, for up to one week after completing the first three processing steps (before sterilisation).

## Making a chlorine solution

Chlorine solutions (0.5% for decontamination or 0.1% for HLD can be made from:

- Liquid household bleach (sodium hypochlorite)
- Bleach powder or chlorine compounds available in powder form (calcium hypochlorite or chlorinated lime).

Chlorine-containing compounds contain a certain percentage of "active" (or available) chlorine. Active chlorine in these products kills microorganisms. Different products may contain different concentrations of available chlorine, and the concentration should be checked before use.

Household bleach preparations can lose some of their chlorine over time. Use newly manufactured bleach if possible. If the bleach does not smell strongly of chlorine it may not be satisfactory for the purpose and should not be used. Chlorine solution should be clear, not cloudy.

### When preparing chlorine solutions for use note that:

- Organic matter destroys chlorine; thus, freshly diluted solutions must be prepared with clear water whenever the solution looks as though it needs to be changed (cloudy or heavily contaminated with blood or other body fluids).
- Chlorine solutions must be prepared daily as they gradually lose strength.
- Use plastic containers for mixing and storing bleach solutions as metal containers corrode rapidly and also affect the bleach.
- Prepare bleach solutions in a well-ventilated area because they give off chlorine.
- Label the container with "(0.1 or 0.5) percent chlorine decontamination or HLD solution" and note the day and time prepared.
- Any bleach solution can be caustic. Avoid direct contact with skin and eyes.

### Calculating the water to liquid bleach ratio

Chlorine content in liquid bleach is available in different concentrations. Any concentration can be used to make a 0.5 percent chlorine solution by using the following formula:

$$\text{Parts clean water} = \frac{\% \text{ chlorine in concentrated solution}}{0.5\% \text{ (desired diluted concentration)}} - 1$$

**Note:** "Parts" can be any unit of measure (e.g., litre, gallon, cup, pitcher, container, etc.).

**For example:** The number of parts water used per part 3.5% liquid chlorine solution to make a 0.5 percent chlorine solution would be:

$$\text{Parts clean water} = \frac{3.5\%}{0.5\%} - 1 = 7 - 1 = 6$$



## Calculating the water to bleach powder ratio

When using bleach powder to make a decontamination solution, calculate the ratio of bleach to water using the following formula to find how many grams of powder to add to each litre of clean water:

$$\text{Grams/litre} = \frac{0.5\% \text{ (desired diluted concentration)}}{\% \text{ chlorine in powder}} \times 1000$$

**For example:** The number of grams of calcium hypochlorite powder containing 35% available chlorine needs to be added to one litre of clean water to make a 0.5 percent chlorine solution would be:

$$\text{Grams/litre} = \frac{0.5\%}{35\%} \times 1000 = 0.0143 \times 1000 = 14.3 \text{ g/l}$$

Therefore, dissolve 14 grams of calcium hypochlorite powder in one litre of clean water in order to get a 0.5% chlorine solution.

## 22.7 Exposure to HIV

Family planning service providers may be exposed to HIV through needle sticks, mucous membranes, or broken skin, but the risk of infection is low:

- Needle sticks or cuts are the most likely causes of the transmission of HIV to providers in family planning clinics. The average risk of HIV infection after a needle stick exposure to HIV-infected blood is 3 infections per 1,000 needle sticks.
- The risk after exposure of the eye, nose, or mouth to HIV-infected blood is estimated to be about 1 infection per 1,000 exposures. Following universal precautions is the best way that providers can avoid workplace exposure to HIV and other fluid-borne infections.

### What a service provider should do if potentially exposed to HIV

If exposure is to:	Do the following:
Intact skin, mouth, or nose	Immediately wash with soap under running water
Cut or punctured skin	Remove gloves Wash with water and soap, preferably antiseptic
Eye	Irrigate with clean water or normal saline

### Post-exposure prophylaxis (PEP)

- Report to the PEP service provider on duty as soon as possible
- Have blood samples (client and provider) taken for HIV testing. If positive for the client and negative for provider start antiretroviral (ARV) therapy. If HIV testing is not available, start PEP while waiting for the client's results
- Follow up HIV testing for the provider at 6 weeks, 3 months, 6 months and 12 months.

## Infection Prevention Case Studies

### Case Study 1

Mrs Banda has two children and has come to the family planning clinic—where you are a provider—to receive a contraceptive method. After counselling, she has chosen DMPA. How will you ensure an infection transmission-free environment before, during, and after administration of the DMPA?

### Case Study 2

You find out that the housekeeper has been leaving the health centre in the evening and, on her way home, has been throwing the clinic's waste in a big waste bin located behind a nearby school. What should you explain to the housekeeper?

### Case Study 3

You are not paying attention while discarding a syringe with a needle into the sharps container, and you accidentally stick yourself. What should you do?



# Infection Prevention Case Studies Answer Key

## Case Study 1

Mrs Banda has two children and has come to the family planning clinic—where you are a provider—to receive a contraceptive method. After counselling, she has chosen DMPA. How will you ensure an infection transmission-free environment before, during, and after administration of the DMPA?

- **Wash hands with soap and water**
- **If injection site is dirty, wash it with soap and water (No need to wipe site with antiseptic)**
- **Use sterile syringe and needle**
- **Dispose the used vial, syringe, and needle in a puncture-proof sharps container**
- **Wash hands after the procedure with soap and water.**

## Case Study 2

You find out that the housekeeper has been leaving the health centre in the evening and, on her way home, has been throwing the clinic's waste in a big waste bin located behind a nearby school. What should you explain to the housekeeper?

**Proper handling of contaminated waste (such as items with blood or body fluids) is required to minimize the spread of infection to her and the community. Proper handling includes:**

- **Wearing heavy-duty gloves**
- **Sealing and either burning or incinerating the puncture-proof sharps container when three-quarters full**
- **Carefully pouring liquid waste down a drain or flushable toilet**
- **Burning and/or burying contaminated solid waste in a deep pit**
- **Washing hands, gloves, and containers after disposal of infectious waste.**

## Case Study 3

You are not paying attention while discarding a syringe with a needle into the sharps container, and you accidentally stick yourself. What should you do?

- **Wash with soap (preferably antiseptic) and water**
- **Report to the PEP service provider on duty as soon as possible**
- **Have blood samples (client and provider) taken for HIV testing. If positive for the client and negative for provider, start ARV therapy**
- **If HIV testing is not available, start PEP while waiting for the client's results**
- **Follow up HIV testing at 6 weeks, 3 months, 6 months and 12 months.**

## Infection Prevention Quiz Questions

**Questions 1–11.** Indicate whether the following statements about infection prevention are **true** or **false** by writing a **“T”** for true or an **“F”** for false in the space provided before each statement.

- \_\_\_ 1. Hand washing is the single most effective practice for preventing cross-contamination in the family planning clinic.
- \_\_\_ 2. Gloves provide a barrier against possible infectious microorganisms that can be found in blood, other body fluids, and waste.
- \_\_\_ 3. Gloves must be worn when administering DMPA.
- \_\_\_ 4. To reduce the risk of a needle stick, recap a needle by holding the syringe in one hand and holding the needle in the other hand.
- \_\_\_ 5. Everyone who handles medical waste—from the point generated until final disposal—is at risk of infections and injury.
- \_\_\_ 6. Liquid medical waste can be disposed down a sink, drain, toilet, or latrine.
- \_\_\_ 7. Decontamination kills all microorganisms on soiled instruments and other item.
- \_\_\_ 8. When preparing a chlorine solution for decontamination, it is important to know the amount of active chlorine in the product used.
- \_\_\_ 9. Cleaning instruments before sterilising them is not necessary if they were soaked in a 0.5 percent chlorine solution for 10 minutes.
- \_\_\_ 10. High-level disinfection kills all microorganisms.
- \_\_\_ 11. Family planning providers are at high risk for exposure to HIV.

**Questions 12–19:** For each practice or situation described below, indicate whether it is an acceptable or unacceptable practice by **writing an “A” for acceptable or a “U” for unacceptable** in the space provided before each statement.

- \_\_\_ 12. A doctor washes her hands by dipping them in a basin of water before examining a patient.
- \_\_\_ 13. Staff members wash their hands for approximately fifteen seconds.
- \_\_\_ 14. A staff member arrives at the family planning clinic to find many people waiting for her, so she immediately begins seeing clients without washing her hands.
- \_\_\_ 15. A service provider keeps her gloves on throughout the morning and is careful to wash them with soap and water in between patients.
- \_\_\_ 16. Break a hypodermic needle before disposal.
- \_\_\_ 17. Wash a needle stick or cut with soap and water.
- \_\_\_ 18. The provider drops instruments into a bucket with decontamination solution to avoid contact with the solution.
- \_\_\_ 19. Irrigate eyes well with water when blood or body fluids splash in them.

**Questions 20–25:** Circle the letter that offers the best response to each question.

20. The primary objective of infection prevention for family planning services is to:
- Minimize the cost of drugs and supplies used in surgery
  - Develop standards for use of prophylactic antibiotics
  - Minimize transmission of infections including hepatitis b (HBV) and HIV/AIDS to clients, providers and other staff
  - All of the above
21. Bacterial endospores which cause tetanus, gangrene and tuberculosis are reliably killed by:
- Soaking in a 0.5% chlorine solution
  - Fumigation
  - Boiling (high-level disinfection)
  - Sterilisation (autoclave or dry heat)
22. Hand washing is indicated before:
- Examining a client (direct contact)
  - Performing a pelvic examination
  - Putting on high-level, disinfected gloves to insert an IUCD
  - All of the above
23. To make a 0.5% solution of chlorine from a concentrated liquid solution containing 5.0% chlorine as sodium hypochlorite, add one part concentrated chlorine solution to:
- 3 parts water
  - 5 parts water
  - 7 parts water
  - 9 parts water
24. If sterile gloves are NOT available, high-level disinfected gloves are the ONLY acceptable alternative for which of the following procedures?
- Performing a pelvic examination
  - Giving an injection
  - Performing a minilaparotomy
  - All of the above
25. When preparing to insert a contraceptive implant, which steps should be taken?
- Wash hands, put on surgical gloves, clean client's skin with an antiseptic
  - Wash hands, put on surgical gloves
  - Put on examination gloves, clean client's skin with an antiseptic
  - Wash hands, put on examination gloves, clean client's skin with an antiseptic

## Infection Prevention Quiz Questions Answer Key

**Questions 1–11.** Indicate whether the following statements about infection prevention are **true** or **false** by writing a “T” for true or an “F” for false in the space provided before each statement.

- T 1. Hand washing is the single most effective practice for preventing cross-contamination in the family planning clinic.
- T 2. Gloves provide a barrier against possible infectious microorganisms that can be found in blood, other body fluids, and waste.
- F 3. Gloves must be worn when administering DMPA. ***Gloves are not required for giving injections.***
- F 4. To reduce the risk of a needle stick, recap a needle by holding the syringe in one hand and holding the needle in the other hand. ***One should avoid recapping needles.***
- T 5. Everyone who handles medical waste—from the point generated until final disposal—is at risk of infections and injury. ***A large percentage of staff report having experienced waste-related injuries and infection.***
- T 6. Liquid medical waste can be disposed down a sink, drain, toilet, or latrine. ***If this is not possible, bury it along with solid medical waste.***
- F 7. Decontamination kills all microorganisms on soiled instruments and other items. Decontamination kills viruses such as HIV and many—but not all—other microorganisms.
- T 8. When preparing a chlorine solution for decontamination, it is important to know the amount of active chlorine in the product used. ***It is important to know the amount of active chlorine in order to make a solution of the correct strength for decontamination.***
- F 9. Cleaning instruments before sterilising them is not necessary if they were soaked in a 0.5 percent chlorine solution for 10 minutes. ***Although decontamination makes items safer to handle, cleaning is still necessary to remove organic material, dirt, and other matter that can interfere with further processing.***
- F 10. Sharps should be put into special containers that are then emptied with other medical waste and washed for reuse. ***Sharps containers should be used once. They should be sealed and burned once three-quarters full.***
- F 11. Family planning providers are at high risk for exposure to HIV. They are at a low risk through needle sticks and contact with mucous and body fluids.

**Questions 12–19:** For each practice or situation described below, indicate whether it is an acceptable or unacceptable practice by writing an “A” for acceptable or a “U” for unacceptable in the space provided before each statement.

- U 12. A doctor washes her hands by dipping them in a basin of water before examining a patient. ***Hands can be contaminated by dipping them in a basin of water. Standing water can easily become contaminated even if antiseptic is added.***
- A 13. Staff members wash their hands for approximately fifteen seconds.

- U** 14. A staff member arrives at the family planning clinic to find many people waiting for her, so she immediately begins seeing clients without washing her hands. **Staff should wash their hands when they arrive and before they leave a health facility.**
- U** 15. A service provider keeps her gloves on throughout the morning and is careful to wash them with soap and water in between patients. **A separate pair of gloves must be used for each client. It is not necessary to wear gloves for activities that do not involve contact with blood or other potentially infectious materials.**
- U** 16. Break a hypodermic needle before disposal. **Providers are at risk if they break a needle after using it and before disposal. Sharps can cause injury and transmission of serious infections, including HIV and hepatitis B.**
- A** 17. Wash a needle stick or cut with soap and water.
- U** 18. The provider drops instruments into a bucket with decontamination solution to avoid contact with the solution. **Place items in the decontamination bucket without splashing the solution.**
- A** 19. Irrigate eyes well with water when blood or body fluids splash in them.
20. The primary objective of infection prevention for family planning services is to:
- c. Minimize transmission of infections including hepatitis b (HBV) and HIV/AIDS to clients, providers, and other staff.**
21. Bacterial endospores that cause tetanus, gangrene and tuberculosis are reliably killed by:
- d. Sterilisation (autoclave or dry heat)**
22. Hand washing is indicated before:
- d. All of the above**
23. To make a 0.5% solution of chlorine from a concentrated liquid solution containing 5.0% chlorine as sodium hypochlorite, add one part concentrated chlorine solution to:
- d. 9 parts water**
24. If sterile gloves are NOT available, high-level disinfected gloves are the ONLY acceptable alternative for which of the following procedures?
- c. Performing a minilaparotomy**
25. When preparing to insert a contraceptive implant, which steps should be taken?
- a. Wash hands, put on surgical gloves, clean client's skin with an antiseptic**

## References

- EngenderHealth. 2004. Infection prevention online course. [www.engenderhealth.org/IP/index.html](http://www.engenderhealth.org/IP/index.html) (accessed March 20, 2010). Online course based on: EngenderHealth. 1999. Infection prevention training curriculum. New York, NY: EngenderHealth.
- Ministry of Health, USAID, and Jhpiego. 2006. Performance and quality improvement process for infection prevention in hospitals. Lilongwe, Malawi: Ministry of Health.
- POPPHI. 2007. *Prevention of postpartum hemorrhage: Implementing active management of the third stage of labor (AMSTL). A reference manual for health care providers*. Additional topic 1: Infection prevention. Seattle: Program for Appropriate Technology in Health (PATH). <http://www.pphprevention.org/AMTSLlearningmaterials.php#IP> (accessed February 26, 2010).
- The World Health Organization and the US Centers for Disease Control and Prevention in partnership with the Francois-Xavier Bagnoud Center at the University of Medicine and Dentistry of New Jersey (UMDNJ) and Jhpiego. 2003. *Infection prevention guidelines for healthcare facilities with limited resources*. Baltimore, MD: Jhpiego. [http://www.reproline.jhu.edu/english/4morerh/4ip/IP\\_manual/ipmanual.htm](http://www.reproline.jhu.edu/english/4morerh/4ip/IP_manual/ipmanual.htm) (accessed April 8, 2010).