Federal Democratic Republic of Ethiopia
Ministry of Health

Communicable Diseases

Part 1 General principles, vaccine-preventable diseases and malaria

Blended Learning Module for the Health Extension Programme

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The Ethiopian Federal Ministry of Health (FMOH) and the Regional Health Bureaus (RHBs) have developed this innovative Blended Learning Programme in partnership with the HEAT Team from The Open University UK and a range of medical experts and health science specialists within Ethiopia. Together, we are producing 13 Modules to upgrade the theoretical knowledge of the country's 33,000 rural Health Extension Workers to that of Health Extension Practitioners and to train new entrants to the service. Every student learning from these Modules is supported by a Tutor and a series of Practical Training Mentors who deliver the parallel Practical Skills Training Programme. This blended approach to work-place learning ensures that students achieve all the required theoretical and practical competencies while they continue to provide health services for their communities.

These Blended Learning Modules cover the full range of health promotion, disease prevention, basic management and essential treatment protocols to improve and protect the health of rural communities in Ethiopia. A strong focus is on enabling Ethiopia to meet the Millennium Development Goals to reduce maternal mortality by three-quarters and under-5 child mortality by two-thirds by the year 2015. The Modules cover antenatal care, labour and delivery, postnatal care, the integrated management of newborn and childhood illness, communicable diseases (including HIV/AIDS, malaria, TB, leprosy and other common infectious diseases), family planning, adolescent and youth reproductive health, nutrition and food safety, hygiene and environmental health, non-communicable diseases, health education and community mobilisation, and health planning and professional ethics.

In time, all the Modules will be accessible from the Ethiopian Federal Ministry of Health website at **www.moh.gov.et**; online versions will also be available to download from the HEAT (Health Education and Training) website at **www.open.ac.uk/africa/heat** as open educational resources, free to other countries across Africa and anywhere in the world to download and adapt for their own training programmes.

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State Minister of Health

Ethiopian Federal Ministry of Health

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WHO (1991) *Basic Malaria Microscopy, Part I: Learner's Guide*, 2nd edition. This document can be found at: http://whqlibdoc.who.int/publications/1991/9241544309.pdf

WHO (1996) *Malaria: A Manual for Community Health Workers*. This document can be found at: http://whqlibdoc.who.int/publications/1996/9241544910_eng.pdf

WHO (1997) *Vector Control Methods for Use by Individuals and Communities*. This document can be found at: http://whqlibdoc.who.int/publications/1997/9241544945_eng.pdf

WHO (2006) *How to use a Malaria Rapid Diagnostic Test (RDT): A guide for training CHWs and other health workers*. The Quality Assurance Project (QAP) and the World Health Organization (WHO), Bethesda, MD, and Geneva. This document can be found at: http://www.wpro.who.int/NR/rdonlyres/A5557149-BB4E-4A26-9CBA-996DA92FC8A4/0/RDTgeneric4bgeneric.pdf

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Contents

Continued in Parts 2, 3 and 4

Introduction to the *Communicable Diseases* Module

Communicable diseases caused by bacteria, viruses, protozoa, fungi and parasites, make a huge contribution to the burden of disease, disability and death in low- and middle-income countries like Ethiopia. The emergence of HIV/AIDS as a global pandemic, the resurgence of tuberculosis co-infection with HIV, and the rapid spread of fatal outbreaks of influenza, have also brought communicable diseases back onto the agenda of health services in high-income countries. The six leading groups of infectious diseases (acute respiratory infections, HIV/AIDS, diarrhoeal diseases, tuberculosis, malaria and measles) together cause over 11 million deaths worldwide every year, and blight the lives of tens of millions more who are living with their chronic or recurrent effects. These high-profile diseases are relatively well publicised across the world, and are subject to major research into vaccines and treatments. By contrast, at least 1 billion people are affected by the so-called 'neglected tropical diseases', including leprosy and schistosomiasis, and/or by intestinal parasites such as tapeworm and hookworm.

Some communicable diseases are easily preventable through simple measures such as vaccination and changes in human behaviour (for example, handwashing with soap). However, the transmission of infectious agents will be difficult to reduce to the levels seen in wealthier nations without significant reductions in the proportion of people living in impoverished social circumstances, with poor nutrition that leaves them more vulnerable to infection, without housing that is secure from disease-carrying pests, and without access to clean drinking water, improved sanitation or the safe disposal of household waste. Strenuous efforts are being made to address these problems in Ethiopia, as elsewhere in Africa and in other developing countries.

To prevent or control the major communicable diseases in Ethiopia, a concerted effort by the nation's health workers, the government, development partners and community members is crucial. Together with the practical skills training associated with this Module, *Communicable Diseases* will help you to acquire the basic skills and knowledge to reduce the burden of mortality and morbidity in your community through the detection, prevention and treatment of common infections.

Communicable Diseases is divided into four Parts. In Part 1 (Study Sessions 1–12), you will first learn the basic concepts in the transmission, prevention and control of communicable diseases, which forms the foundation for all the sessions in later parts of the Module. Next we discuss some important vaccine-preventable diseases (neonatal tetanus, bacterial meningitis, measles, polio and hepatitis B). Part 1 then focuses on malaria and its mosquito vectors: its transmission, its diagnosis based on clinical signs and the malaria rapid diagnostic test (RDT), malaria case management, vector control methods, and the management of epidemics.

Part 2 (Study Sessions 13–19) deal with tuberculosis (TB) and leprosy, which are caused by different *Mycobacteria*. In both diseases the symptoms are due to inflammation and tissue destruction in the infected body parts. The diagnosis, treatment and prevention of these disabling diseases are covered in detail, including the rapid diagnostic test for TB and assessments of disability and nerve damage in people with leprosy.

Part 3 (Study Sessions 20–31) is about the human immunodeficiency virus (HIV) and the spectrum of HIV diseases leading to acquired immune deficiency syndrome (AIDS). It includes opportunistic infections and other sexually-transmitted infections (STIs). The focus is on diagnosis, treatment options and regimens, and prevention of infection and HIV transmission, including from mother to child, and protection from accidental HIV infection in health workers. It also covers positive living for people with HIV and palliative care for those who are dying.

Part 4 (Study Sessions 32–42) completes the Module by discussing the diagnosis, treatment, prevention and control of other communicable diseases of public health importance, including

diarrhoeal diseases, intestinal parasites, acute respiratory infections and otitis media, relapsing fever, typhus, neglected tropical diseases, zoonoses, trachoma and scabies. The Module ends with three study sessions on integrated disease surveillance and response, and epidemic investigation and management.

Study Session 1 Basic Concepts in the Transmission of Communicable Diseases

Introduction

As you will recall from the Module on *Health Education, Advocacy and Community Mobilisation,* **health** is defined as a complete state of physical, mental and social well-being and not the mere absence of disease. The term **disease** refers to a disturbance in the normal functioning of the body and is used interchangeably with 'illness'. Diseases may be classified as communicable or non-communicable. **Communicable diseases** are caused by infectious agents that can be transmitted to other people from an infected person, animal or a source in the environment. Communicable diseases constitute the leading cause of health problems in Ethiopia.

Before we describe each communicable disease relevant to Ethiopia in detail in later study sessions, it is important that you first learn about the basic concepts underlying communicable diseases. Understanding these basic concepts will help you a lot, as they form the basis for this Module.

In this first study session, we introduce you to definitions of important terms used in communicable diseases, the types of infectious agents that cause these diseases, the main factors involved in their transmission, and the stages in their natural development. This will help you to understand how measures for the prevention and control of communicable diseases are put into place at several levels of the health system, including in homes and at your Health Post – which is the focus of Study Session 2.

Learning Outcomes for Study Session 1

When you have studied this session, you should be able to:

1.1 Define and use correctly all of the key terms printed in **bold**. (SAQs 1.1 and 1.5)

1.2 Identify the main types of infectious agents. (SAQs 1.2 and 1.3)

1.3 Describe the main reservoirs of infectious agents. (SAQ 1.3)

1.4 Describe the chain of transmission of communicable diseases and explain how infectious agents are transmitted by direct and indirect modes. (SAQs 1.3 and 1.5)

1.5 Describe the characteristics of susceptible hosts and the main risk factors for development of communicable diseases. (SAQ 1.4)

1.6 Describe the stages in the natural history of communicable diseases. (SAQ 1.5)

1.1 What are communicable diseases?

As described in the introduction, the organisms that cause communicable diseases are called **infectious agents**, and their transmission to new uninfected people is what causes communicable diseases; (note that **infectious diseases** is an interchangeable term). Familiar examples of communicable diseases are malaria and tuberculosis. Diseases such as heart disease, cancer and diabetes mellitus, which are not caused by infectious agents and are not transmitted between people, are called **non-communicable diseases**.

This curriculum includes a Module on *Non-Communicable Diseases, Emergency Care and Mental Health.*

■ Tuberculosis is caused by an organism called *Mycobacterium tuberculosis*, which can be transmitted from one person to another. Is TB a communicable or non-communicable disease?

□ It is a communicable disease because it is caused by an infectious agent and it develops as a result of transmission of the infectious agent.

1.1.1 The burden of communicable diseases in Ethiopia

Outpatient refers to someone who comes to a health facility seeking treatment, but does not stay overnight. An inpatient is someone admitted to a health facility, who has at least one overnight stay.

Communicable diseases are the main cause of health problems in Ethiopia. According to the Ethiopian Federal Ministry of Health, communicable diseases accounted for most of the top ten causes of illness and death in 2008/09. As you can see in Table 1.1, most causes of outpatient visits are due to communicable diseases.

■ Can you identify the communicable diseases in Table 1.1?

□ You may not recognise them all (you will learn about them in later study sessions), but you probably mentioned malaria, respiratory infections, parasitic diseases, pneumonia and diarrhoea.

Table 1.1 Top 10 leading causes of outpatient visits in most regions of Ethiopia, September 2008–August 2009. (From: Federal Ministry of Health (2010) *Health and Health Related Indicators*: *2008/9*, Addis Ababa, Ethiopia)

A **clinical diagnosis** is based on the typical signs and symptoms of the disease, without confirmation from diagnostic tests, e.g. in a laboratory.

Rank	Diagnosis	Percentage of all outpatient visits
1	Malaria (clinical diagnosis without laboratory confirmation)	8.3
2	Acute upper respiratory infections	8.1
3	Dyspepsia (indigestion)	5.9
4	Other or unspecified infectious and parasitic diseases	5.0
5	Pneumonia	4.8
6	Other or unspecified diseases of the respiratory system	4.0
7	Malaria (confirmed with species other than *Plasmodium falciparum*)	3.7
8	Diarrhoea with blood (dysentery)	3.7
9	Helminthiasis (caused by worms)	3.5
10	Diseases of the musculoskeletal system and connective tissue (muscles, bones and joints)	3.0
Total % of all causes of outpatient visits		**47.2**

The naming of infectious agents is discussed in Section 1.2.1.

Table 1.2 shows that most causes of inpatient deaths are due to communicable diseases, including pneumonia, tuberculosis, HIV/AIDS and malaria. These and other communicable diseases will be discussed in detail in later study sessions of this module.

Table 1.2 Top 10 leading causes of inpatient deaths in most regions of Ethiopia, September 2008–August 2009. (Source as Table 1.1)

Rank	Diagnosis	Percentage of all inpatient deaths
1	Pneumonia	12.4
2	Other or unspecified effects of external causes	7.1
3	Tuberculosis	7.0
4	Human immunodeficiency virus (HIV) disease	5.1
5	Anaemias	3.9
6	Other or unspecified diseases of the circulatory system (heart, blood vessels)	3.7
7	Hypertension (high blood pressure) and related diseases	3.5
8	Malaria (clinical diagnosis without laboratory confirmation)	3.1
9	Malaria (confirmed with *Plasmodium falciparum*)	2.5
10	Road traffic injuries	2.3
Total % of all causes of inpatient deaths		**50.8**

1.1.2 Endemic and epidemic diseases

Not all communicable diseases affect a particular group of people, such as a local community, a region, a country or indeed the whole world, in the same way over a period of time. Some communicable diseases persist in a community at a relatively constant level for a very long time and the number of individuals affected remains approximately the same. These communicable diseases are known as **endemic** to that particular group of people; for example, tuberculosis is endemic in the population of Ethiopia and many other African countries.

By contrast, the numbers affected by some communicable diseases can undergo a sudden increase over a few days or weeks, or the rise may continue for months or years. When a communicable disease affects a community in this way, it is referred to as an **epidemic**. Malaria is endemic in some areas of Ethiopia, and it also occurs as epidemics due to an increase in the number of cases suddenly at the beginning or end of the wet season.

A **case** refers to an individual who has a particular disease.

1.1.3 Prevention and control measures

The health problems due to communicable diseases can be tackled by the application of relatively easy measures at different levels of the health system. Here, we will use some examples at the individual and community levels, which are relevant to your work as a Health Extension Practitioner.

Some measures can be applied before the occurrence of a communicable disease to protect a community from getting it, and to reduce the number of cases locally in the future. These are called **prevention measures**. For example, vaccination of children with the measles vaccine is a prevention measure, because the vaccine will protect children from getting measles. **Vaccination** refers to administration of vaccines to increase resistance of a person against infectious diseases.

Once a communicable disease occurs and is identified in an individual, measures can be applied to reduce the severity of the disease in that person, and to prevent transmission of the infectious agent to other members of the community. These are called **control measures**. For example, once a child becomes infected with measles, treatment helps reduce the severity of the disease, and possibly prevents the child's death, but at the same time it decreases the risk of transmission to other children in the community. In this context, treatment of measles is considered a control measure.

- Later in this Module, you will learn that the widespread use of insecticide-treated mosquito nets (ITNs) is recommended as a prevention measure for malaria, which is transmitted to people by mosquitoes. If you promote the effective use of mosquito nets in your community, how would you expect the number of malaria cases to change over time?

- An *increase* in the effective use of mosquito nets should *reduce* the number of cases of malaria.

Next we look at the main ways in which infectious agents are transmitted.

1.2 Factors involved in the transmission of communicable diseases

Transmission is a process in which several events happen one after the other in the form of a chain. Hence, this process is known as a **chain of transmission** (Figure 1.1). Six major factors can be identified: the infectious agent, the reservoir, the route of exit, the mode of transmission, the route of entry and the susceptible host. We will now consider each of these factors in turn.

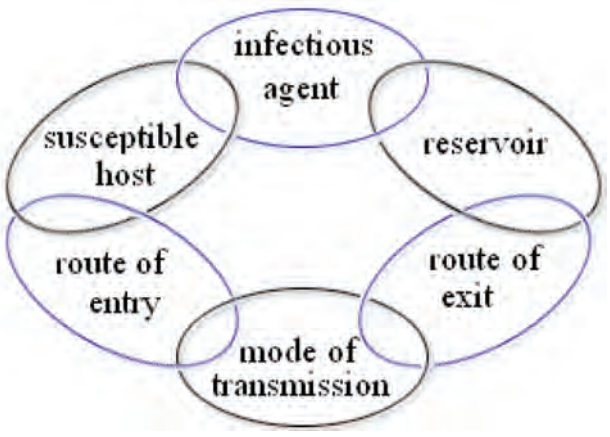


Figure 1.1 Factors involved in the chain of communicable disease transmission.

1.2.1 Infectious agents

Scientific names

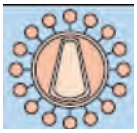
Tables 1.1 and 1.2 referred to *Plasmodium falciparum* as an infectious agent causing malaria. This is an example of how infectious agents are named scientifically, using a combination of two words, the 'genus' and the 'species' names. The genus name is written with its initial letter capitalised, followed by the species name which is not capitalised. In the example above, *Plasmodium* is the genus name and *falciparum* refers to one of the species of

this genus found in Ethiopia. There are other species in this genus, which also cause malaria, e.g. *Plasmodium vivax*.

Sizes and types of infectious agents

Infectious agents can have varying sizes. Some, such as *Plasmodium falciparum* and all bacteria and viruses, are tiny and are called **micro-organisms**, because they can only be seen with the aid of microscopes. Others, such as the ascaris worm (*Ascaris lumbricoides*), can be easily seen with the naked eye. The different types of infectious agents are illustrated in Table 1.3 according to their size, starting with the largest and ending with the smallest, and are then discussed below.

Table 1.3 Different types of infectious agents: their number of cells, visibility and examples. (Adapted from The Open University, 2007, *Water and Health in an Overcrowded World*, Chapter 2)

Type of infectious agent	**Number of cells**	**Visibility**	**Examples**	
Helminths	many	Visible with the naked eye	Ascaris worm causes ascariasisIts length reaches 15–30 cm	
Protozoa	1	Visible with a standard microscope	*Plasmodium falciparum* causes malaria	
Bacteria	1	Visible only with a special microscope; much smaller in size than protozoa	*Vibrio cholerae* causes cholera	
Viruses	0	Visible only with a special microscope; much smaller in size than bacteria	HIV causes AIDS	

Helminths are worms made up of many cells; for example, *Ascaris lumbricoides*.

Protozoa are micro-organisms made up of one cell; for example, *Plasmodium falciparum*.

Bacteria are also micro-organisms made up of one cell, but they are much smaller than protozoa and have a different structure; for example *Vibrio cholerae*, which causes cholera.

Viruses are infectious agents that do not have the structure of a cell. They are more like tiny boxes or particles and are much smaller than bacteria; for example, **HIV** (the Human Immunodeficiency Virus), which can lead to AIDS.

Though not as common as causes of communicable disease in humans, other types of infectious agents include *fungi* (e.g. ringworm is caused by a fungus infection), and *mites* (similar to insects), which cause scabies.

1.2.2 Reservoirs of infectious agents

Many infectious agents can survive in different organisms, or on non-living objects, or in the environment. Some can only persist and multiply inside human beings, whereas others can survive in other animals, or for example in soil or water. The place where the infectious agent is normally present *before* infecting a new human is called a **reservoir**. Without reservoirs, infectious agents could not survive and hence could not be transmitted to other people. Humans and animals which serve as reservoirs for infectious agents are known as **infected hosts**. Two examples are people infected with HIV and with the bacteria that cause tuberculosis; these infectious agents persist and multiply in the infected hosts and can be directly transmitted to new hosts.

Animals can also be reservoirs for the infectious agents of some communicable diseases. For example, dogs are a reservoir for the virus that causes rabies (Figure 1.3). Diseases such as rabies, where the infectious agents can be transmitted from animal hosts to susceptible humans, are called **zoonoses** (singular, zoonosis).

Figure 1.3 Rabies is a zoonosis, which can be transmitted from dogs to humans. (Photo: WHO at http://www.who.int/rabies/animal/en/)

Non-living things like water, food and soil can also be reservoirs for infectious agents, but they are called **vehicles** (not infected hosts) because they are not alive. You will learn more about them later in this study session.

- Bacteria called *Mycobacterium bovis* can be transmitted from cattle to humans in raw milk and cause a type of tuberculosis. In this example, what is the infectious agent and the infected host or hosts?

- The infectious agent is *Mycobacterium bovis* and the infected hosts are cattle and humans.

1.2.3 Route of exit

Before an infectious agent can be transmitted to other people, it must first get out of the infected host. The site on the infected host through which the infectious agent gets out is called the **route of exit**. Some common examples are described below.

Respiratory tract

The routes of exit from the respiratory tract are the nose and the mouth. Some infectious agents get out of the infected host in droplets expelled during coughing, sneezing, spitting or talking, and then get transmitted to others (Figure 1.4). For example, people with tuberculosis in their lungs usually have a persistent cough; *Mycobacterium tuberculosis* uses this as its route of exit.

Figure 1.4 Infectious agents in the respiratory tract can exit from infected hosts during coughing and be transmitted to others.

Gastrointestinal tract

The anus is the route of exit from the gastrointestinal tract (or gut). Some infectious agents leave the human body in the stool or faeces (Figure 1.5). For example, the infectious agents of shigellosis, a disease which can cause bloody diarrhoea, use this route of exit.

Figure 1.5 Infectious agents can get out of the body with faeces and get transmitted to others.

Skin

Some types of infectious agents can exit the body through breaks in the skin. For example, this route of exit is used by *Plasmodium* protozoa, which are present in the blood and get out of the human body when a mosquito bites through the skin to suck blood.

1.2.4 Modes of transmission

Once an infectious agent leaves a reservoir, it must get transmitted to a new host if it is to multiply and cause disease. The route by which an infectious agent is transmitted from a reservoir to another host is called the **mode of transmission**. It is important for you to identify different modes of transmission, because prevention and control measures differ depending on the type. Various *direct* and *indirect* modes of transmission are summarised in Table 1.3 and discussed below it.

Table 1.4 Summary of different modes of transmission.

Mode of transmission	Sub-types of transmission
Direct	Touching
	Sexual intercourse
	Biting
	Direct projection of droplets
	Across the placenta
Indirect	Airborne
	Vehicle-borne
	Vector-borne

Direct modes of transmission

Direct transmission refers to the transfer of an infectious agent from an infected host to a new host, without the need for intermediates such as air, food, water or other animals. Direct modes of transmission can occur in two main ways:

- **Person to person**: The infectious agent is spread by direct contact between people through touching, biting, kissing, sexual intercourse or direct projection of respiratory droplets into another person's nose or mouth during coughing, sneezing or talking. A familiar example is the transmission of HIV from an infected person to others through sexual intercourse.
- **Transplacental transmission**: This refers to the transmission of an infectious agent from a pregnant woman to her fetus through the placenta. An example is mother-to-child transmission (MTCT) of HIV.

Indirect modes of transmission

Indirect transmission is when infectious agents are transmitted to new hosts through intermediates such as air, food, water, objects or substances in the environment, or other animals. Indirect transmission has three subtypes:

- **Airborne transmission**: The infectious agent may be transmitted in dried secretions from the respiratory tract, which can remain suspended in the air for some time. For example, the infectious agent causing tuberculosis can enter a new host through airborne transmission.
- **Vehicle-borne transmission**: A **vehicle** is any non-living substance or object that can be contaminated by an infectious agent, which then transmits it to a new host. **Contamination** refers to the presence of an infectious agent in or on the vehicle.
- **Vector-borne transmission**: A **vector** is an organism, usually an *arthropod*, which transmits an infectious agent to a new host. Arthropods which act as vectors include houseflies, mosquitoes, lice and ticks.

Arthropods are invertebrates (animals without backbones), such as insects, which have segmented bodies and three pairs of jointed legs.

■ Can you suggest some examples of vehicles that could transmit specific infectious agents *indirectly* to new hosts?

□ You may have thought of some of the following:

- Contaminated food, water, milk, or eating and drinking utensils. For example, the infectious agent of cholera can be transmitted to a person who eats food or drinks water contaminated with faeces containing the organism.
- Contaminated objects such as towels, clothes, syringes, needles and other sharp instruments. For example, sharp instruments contaminated with HIV-infected blood can transmit HIV if they penetrate the skin of another person.
- Soil is a vehicle for some bacteria. For example, a person can be infected with bacteria that cause tetanus if contaminated soil gets in through broken skin.

■ Can you think of a vector-borne disease mentioned several times in this study session?

□ Malaria is transmitted by mosquito vectors.

1.2.5 Route of entry

Successful transmission of the infectious agent requires it to enter the host through a specific part of the body before it can cause disease. The site through which an infectious agent enters the host is called the **route of entry**.

■ We have already mentioned all the routes of entry in previous sections. Can you summarise what they are, and give an example of an infectious agent for each of them?

□ The routes of entry are:

- The respiratory tract: some infectious agents enter the body in air breathed into the lungs. Example: *Mycobacterium tuberculosis*.
- The gastrointestinal tract: some infectious agents enter through the mouth. Example: the infectious agents causing diarrhoeal diseases enter through the mouth in contaminated food, water or on unclean hands (Figure 1.6).

- The skin provides a natural barrier against entry of many infectious agents, but some can enter through breaks in the skin. Example: malaria parasites (*Plasmoduim* species) get into the body when an infected mosquito bites through the skin to suck blood.

Figure 1.6 Some infectious agents get into the body with contaminated food, water or on hands. (Photo: Basiro Davey)

■ Can you think of an infectious agent that enters and exits through the *same* body part? Can you think of one where the entry and exit routes are *different* parts of the body?

□ The route of entry and exit for *Mycobacterium tuberculosis* is through the respiratory system. The route of entry for infectious agents of diarrhoeal diseases is the mouth, but the route of exit is the anus with the faeces.

1.2.6 Susceptible hosts and risk factors

After an infectious agent gets inside the body it has to multiply in order to cause the disease. In some hosts, infection leads to the disease developing, but in others it does not. Individuals who are likely to develop a communicable disease after exposure to the infectious agents are called **susceptible hosts**. Different individuals are not equally susceptible to infection, for a variety of reasons.

Factors that increase the susceptibility of a host to the development of a communicable disease are called **risk factors**. Some risk factors arise from outside the individual – for example, poor personal hygiene, or poor control of reservoirs of infection in the environment. Factors such as these increase the *exposure* of susceptible hosts to infectious agents, which makes the disease more likely to develop.

Additionally, some people in a community are more likely to develop the disease than others, even though they all have the *same* exposure to infectious agents. This is due to a low level of immunity within the more susceptible individuals. **Immunity** refers to the resistance of an individual to communicable diseases, because their *white blood cells* and *antibodies* (defensive proteins) are able to fight the infectious agents successfully. Low levels of immunity could be due to:

- diseases like HIV/AIDS which suppress immunity
- poorly developed or immature immunity, as in very young children
- not being vaccinated
- poor nutritional status (e.g. malnourished children)
- pregnancy.

■ In general terms, in what two ways could the risk of developing a communicable disease be reduced?

Vaccination is discussed in detail in the *Immunization* Module in this curriculum.

□ By reducing exposure to infectious agents, or increasing the person's immunity, for example by vaccination or improving their diet.

Finally, look back at Figure 1.2. We can now summarize the chain of transmission as follows:

- the infectious agent gets out of the reservoir through a route of exit
- it gets transmitted to a susceptible host by a direct or indirect mode of transmission and it gets into the susceptible host through a route of entry
- if it multiplies sufficiently in the susceptible host it will cause a communicable disease.

1.3 Natural history of a communicable disease

The natural history of a disease is also referred to as the *course* of the disease, or its *development and progression*; these terms can be used interchangeably.

The **natural history** of a communicable disease refers to the sequence of events that happen one after another, over a period of time, in a person who is not receiving treatment. Recognizing these events helps you understand how particular interventions at different stages could prevent or control the disease. (You will learn about this in detail in Study Session 2.)

Events that occur in the natural history of a communicable disease are grouped into four stages: exposure, infection, infectious disease, and outcome (see Figure 1.6). We will briefly discuss each of them in turn.

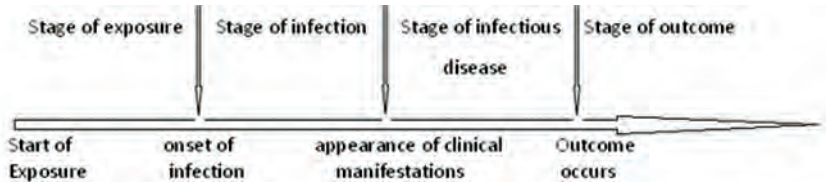


Figure 1.6 Stages in the natural history of communicable diseases.

1.3.1 Stage of exposure

Here a *contact* refers to an association between a susceptible host and a reservoir of infection, which creates an opportunity for the infectious agents to enter the host.

In the **stage of exposure**, the susceptible host has come into close contact with the infectious agent, but it has not yet entered the host's body cells. Examples of an exposed host include:

- a person who shakes hands with someone suffering from a common cold
- a child living in the same room as an adult with tuberculosis
- a person eating contaminated food or drinking contaminated water.

1.3.2 Stage of infection

At this stage the infectious agent has entered the host's body and has begun multiplying. The entry and multiplication of an infectious agent inside the host is known as the **stage of infection**. For instance, a person who has eaten food contaminated with *Salmonella typhii* (the bacteria that cause typhoid fever) is said to be *exposed*; if the bacteria enter the cells lining the intestines and start multiplying, the person is said to be *infected*.

At this stage there are no **clinical manifestations** of the disease, a term referring to the typical symptoms and signs of that illness. **Symptoms** are the

complaints the patient can tell you about (e.g. headache, vomiting, dizziness). **Signs** are the features that would only be detected by a trained health worker (e.g. high temperature, fast pulse rate, enlargement of organs in the abdomen).

1.3.3 Stage of infectious disease

At this stage the clinical manifestations of the disease are present in the infected host. For example, a person infected with *Plasmodium falciparum*, who has fever, vomiting and headache, is in the **stage of infectious disease** – in this case, malaria. The time interval between the onset (start) of infection and the first appearance of clinical manifestations of a disease is called the **incubation period**. For malaria caused by *Plasmodium falciparum* the incubation period ranges from 7 to 14 days.

Remember that not all infected hosts may develop the disease, and among those who do, the severity of the illness may differ, depending on the level of immunity of the host and the type of infectious agent. Infected hosts who have clinical manifestations of the disease are called **active cases**. Individuals who are infected, but who do not have clinical manifestations, are called **carriers**. Carriers and active cases can both transmit the infection to others.

■ To which stage in the natural history of a communicable disease do (a) active cases and (b) carriers belong?

□ (a) Carriers are in the *stage of infection*, as they do not have clinical manifestations of the disease. (b) Active cases are in the *stage of infectious disease*, as they have the manifestations.

Depending on the time course of a disease and how long the clinical manifestations persist, communicable diseases can be classified as acute or chronic. **Acute diseases** are characterized by rapid onset and short duration of illness. For instance, diarrhoea that starts suddenly and lasts less than 14 days is an *acute diarrhoeal disease*. **Chronic diseases** are characterized by prolonged duration of illness; for example, a *chronic diarrhoeal disease* lasts more than 14 days.

1.3.4 Stage of outcome

At this stage the disease may result in recovery, disability or death of the patient. For example, a child who fully recovers from a diarrhoeal disease, or is paralyzed from poliomyelitis, or dies from malaria, is in the **stage of outcome**.

In the next study session you will learn how communicable diseases are classified, and about the main types of prevention and control measures.

Summary of Study Session 1

In Study Session 1 you have learned that:

1 Communicable diseases are caused by infectious agents that can be transmitted to susceptible individuals from an infected person, or from other animals, objects or the environment.

2 Infectious agents include helminths, protozoa, bacteria, viruses and fungi.

3 Six factors are involved in the transmission of communicable diseases: the infectious agent, the reservoir, route of exit, mode of transmission, route of entry, and the susceptible host.

4 A reservoir is a human, another animal, or a non-living thing (such as soil), where the infectious agent normally lives.

5 Modes of transmission of an infectious agent can be *directly* through person-to-person contact, or across the placenta from mother to fetus. *Indirect* transmission can occur through air, vehicles such as water, food and contaminated objects, or via a vector such as a mosquito.

6 A susceptible host is a person or animal who can develop infection if exposed to the infectious agent. Susceptibility is increased if exposure is high, or the host's immunity is low.

7 The natural history of an untreated communicable disease has four stages: stage of exposure, stage of infection, stage of infectious disease, and stage of outcome.

Self-Assessment Questions (SAQs) for Study Session 1

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 1.1 (tests Learning Outcome 1.1)

Consider a disease known as diabetes mellitus, which is characterized by an increase in the blood sugar level. Infectious agents may contribute to the development of the disease in early childhood, but are not the main cause of the disease. Can it be classified as communicable? Explain your reasons.

SAQ 1.2 (tests Learning Outcome 1.2)

Giardiasis is an endemic communicable disease in Ethiopia. Its infectious agent (*Giardia intestinalis*) is a single-celled organism bigger than bacteria, but not visible with the naked eye. To which class of infectious agents listed below is it likely to belong? Explain your reasons.

A Helminths

B Viruses

C Protozoa.

SAQ 1.3 (tests Learning Outcomes 1.2, 1.3 and 1.4)

Hookworm infection is caused by parasites which are common in Ethiopia. The parasites live in the human intestine and lay eggs which are expelled from the body with the faeces into the soil. The eggs grow into worms in the soil, which penetrate the skin of people walking barefooted. Identify each of the following in this example:

A The infectious agent

B The reservoir

C The mode of transmission

D The route of exit and the route of entry.

SAQ 1.4 (tests Learning Outcome 1.4)

Based on the description in SAQ 1.3, what are the risk factors for hookworm infection?

SAQ 1.5 (tests Learning Outcomes 1.1, 1.2 and 1.6)

First read Abebe's story and then answer the questions that follow it.

Case study 1.1 Abebe's story

Typhoid fever is a disease that manifests clinically with high fever and headache. Suppose Abebe is infected with the infectious agent of typhoid fever, but he has no manifestations of the disease. He works in a cafe and among 20 people he served in one day, five got infected, but only three of these developed the disease. Among the three who developed typhoid fever, two recovered and one died.

From the given information:

(a) What are the likely modes of transmission?
(b) Which of the affected persons are active cases and which are carriers?
(c) Can you group the 20 people who were served in the cafe into the four stages of the natural history of a communicable disease?

Study Session 2 Prevention and Control of Communicable Diseases and Community Diagnosis

Introduction

In the first study session, you learned about the basic concepts in the transmission of communicable diseases. The knowledge you gained will help you to understand this study session because they are interlinked. In the first section, you will learn about the different ways of classifying communicable diseases. Following classification you will learn the approaches in prevention and control of communicable disease. This will help you in identifying appropriate measures for the prevention and control of communicable diseases that you, as a Health Extension Practitioner, and other health workers will put into place in your community. This study session forms the basis for study sessions later in this Module on specific diseases such as malaria, tuberculosis and HIV/AIDS. Finally, you will learn how to apply the methods of community diagnosis to assess and prioritise actions to prevent and control the main communicable diseases in your community.

Learning Outcomes for Study Session 2

When you have studied this session, you should be able to:

2.1 Define and use correctly all of the key words printed in **bold**. (SAQs 2.1, 2.2 and 2.4)

2.2 Identify the two main ways of classifying communicable diseases, and illustrate their usefulness. (SAQs 2.1 and 2.2)

2.3 Describe and give examples of prevention and control measures targeting the reservoir of infection. (SAQs 2.3 and 2.4)

2.4 Describe and give examples of prevention and control measures targeting the mode of transmission of communicable diseases. (SAQs 2.3 and 2.4)

2.5 Describe and give examples of prevention and control measures that protect the susceptible host from communicable diseases. (SAQs 2.3 and 2.4)

2.6 Describe the basic processes involved in community diagnosis and give examples of how you would apply these methods. (SAQ 2.5)

2.1 Classification of communicable diseases

Communicable diseases can be classified in different ways into groups with similar characteristics. Classification will help you to select and apply appropriate prevention and control measures that are common to a class of communicable diseases. In this section you will learn the basis for each way of classifying communicable diseases and its relevance to your practice. This will be clarified using examples of communicable diseases that you may already be familiar with.

In Study Session 1 you have learned the types of infectious agents which can be used for classification of communicable diseases. Apart from this, there are two main ways of classifying communicable diseases, which are important for you to know. The classification can be *clinical* or *epidemiologic,* as described in Box 2.1.

Box 2.1 Two ways of classifying communicable diseases

Clinical classification is based on the main clinical manifestations (symptoms and signs) of the disease.

Epidemiologic classification is based on the main mode of transmission of the disease.

Now, we will discuss the details of each type of classification with specific examples.

2.1.1 Clinical classification of communicable diseases

As stated in Box 2.1, this classification is based on the main clinical manifestations of the disease. This way of classification is important in helping you to treat the symptoms and signs that are common to (shared by) individuals who suffer from different diseases. Clinical classification is illustrated by the example given below.

Diarrhoeal diseases

Figure 2.1 Diseases whose main manifestation is diarrhoea are clinically classified as diarrhoeal diseases. The common treatment for this class of disease includes fluid replacement.

Some diseases are classified as **diarrhoeal diseases**. The main clinical symptom is **diarrhoea**, which means passage of loose stool (liquid faeces) three or more times per day. Two examples of diarrhoeal diseases are *shigellosis* and *cholera*. (Further details about these diseases are in Study Session 33 of this Module). People with watery diarrhoeal disease suffer from loss of fluid from their bodies. Therefore, even though the infectious agent might be different, as in the examples of shigellosis and cholera, the common management of patients with diarrhoeal disease includes fluid replacement (Figure 2.1).

Other clinical classifications

Another clinical classification refers to diseases characterised as **febrile illnesses**, because they all have the main symptom of fever, for example, malaria. **Respiratory diseases** are another clinical classification; their main symptoms include cough and shortness of breath, as in pneumonia.

Diseases have many symptoms and signs. As a Health Extension Practitioner, you will need to decide which symptom is the main one for classification. Using the method of clinical classification will help you decide to treat the main symptom. You will be able to identify the main symptoms more easily when you learn about specific diseases later on in this Module. Bear in mind that for most diseases, treatment of the main symptom is only supportive (that is it will not cure the disease). Therefore, you have to give treatment specific to the infectious agent. This will be discussed later in this Module under the specific diseases.

2.1.2 Epidemiologic classification

This classification is based on the main mode of transmission of the infectious agent. The importance of this classification for you is that it enables you to select prevention and control measures which are common to (shared by) communicable diseases in the same class, so as to interrupt the mode of transmission. To clarify the importance of epidemiologic classification, consider the following examples.

Cholera and *typhoid fever* are two different diseases which can be transmitted by drinking contaminated water. Therefore, they are classified as **waterborne diseases**, using the epidemiologic classification. The common prevention measures for the two diseases, despite having different infectious agents, include protecting water sources from contamination and treatment of unsafe water before drinking, for example by boiling (Figure 2.2) or adding chlorine.

The main types of epidemiologic classification are described in Box 2.2.

Figure 2.2 One method of treating unsafe water is boiling before drinking.
(Photo: Wikimedia Commons at http://commons.wikimedia.org/wiki/Category:Boiling_water)

Box 2.2 Epidemiologic classification of communicable diseases

Based on the mode of transmission of the infectious agent, communicable diseases can be classified as:

- **Waterborne diseases:** transmitted by ingestion of contaminated water.
- **Foodborne diseases:** transmitted by the ingestion of contaminated food.
- **Airborne diseases:** transmitted through the air.
- **Vector-borne diseases:** transmitted by vectors, such as mosquitoes and flies.

■ Suppose while you are working in your health facility, a 20 year-old man comes to you complaining of high fever accompanied by violent shivering (rigors), vomiting and headache. A blood examination for malaria found evidence of *Plasmodium falciparum*. Assume that he acquired the parasite after being bitten by infected mosquitoes. How would you classify this man's health problem, using two different classifications?

□ Clinically the disease is classed as a *febrile illness* because fever was the main clinical manifestation. Using epidemiologic classification, the disease is classed as *vector-borne* because it was transmitted by the mosquito.

You will learn how to carry out the rapid blood test for malaria in Study Session 7 of this Module.

When you have studied more about malaria in later study sessions, you will be able to see how the clinical classification as a *febrile illness* can help you in the management of the patient. As he has a high fever, in addition to treatment with anti-malarial drugs, you should take measures to lower the fever by giving him paracetamol. The epidemiologic classification of the disease as *vector-borne* helps you to select measures to prevent and control malaria in the community, for example by advocating protection from mosquito bites by using bed nets, and drainage of small collections of water where mosquitoes breed.

In the next section we will discuss the general approaches to prevention and control of communicable diseases at community level.

2.2 General approaches in the prevention and control of communicable diseases

You now have a working knowledge of factors involved in the *chain of disease transmission* (described in Study Session 1), and how to classify communicable diseases. This knowledge will help you to identify prevention and control measures that can be applied at each link in the chain. When we say **prevention** it refers to measures that are applied to prevent the occurrence of a disease. When we say **control** it refers to measures that are applied to prevent transmission *after* the disease has occurred. Most of the measures for prevention and control of communicable diseases are relatively easy and can be applied using the community's own resources. You have an important role in educating the public to apply these measures effectively.

■ You have learned that prevention and control of communicable diseases involves interventions to break the chain of transmission. Can you recall the six factors involved in the chain?

□ They are the infectious agent, the reservoir, the route of exit, the mode of transmission, the route of entry, and the susceptible host.

We can simplify the discussion of prevention and control measures acting on the chain of transmission by merging these six factors into three groups:

- Infectious agents in the reservoir of infection and the route of exit from the reservoir are discussed under the heading 'reservoir'.
- The 'mode of transmission' is the second category that we will discuss.
- The route of entry and the susceptible host are discussed under the heading 'susceptible host'.

2.2.1 Measures targeting the reservoir of infection

During your community practice, the prevention and control measures you will undertake depend on the type of reservoir. In this section we will discuss measures for tackling human and animal reservoirs. When you encounter an infected person, you should undertake the measures described below.

Diagnosis and treatment

First, you should be able to diagnose and treat cases of the disease, or refer the patient for treatment at a higher health facility. There are two ways to identify an infected individual: when a patient comes to you (Box 2.3, on the next page, describes how you should approach a patient in order to identify a case), and by screening (discussed below). Identifying and treating cases as early as possible, reduces the severity of the disease for the patient, avoiding progression to complications, disability and death; and it also reduces the risk of transmission to others.

Box 2.3 Approaches to the diagnosis of a case

- The first step is to ask about the main complaints of the patient.
- Then ask about the presence of other related symptoms and risk factors.
- Examine the patient physically to detect signs of any diseases you suspect.
- Finally, refer the patient for laboratory examinations if available (e.g. blood examination for malaria).

Screening

Screening refers to the detection of an infection in an individual who does not show any signs or symptoms of the disease. It is carried out using specific tests called *screening tests*. Screening will help you to detect an infection early and organise appropriate treatment so as to reduce complications and prevent transmission to others. An example of screening that may be familiar to you is screening the blood of pregnant women for HIV infection.

Issues related to HIV/AIDS will be further discussed in Study Sessions 20–30 later in this Module.

Isolation

Following detection of an infectious disease, you may need to separate patients from others to prevent transmission to healthy people. This is called **isolation**. It is not indicated for every infection, but it is important to isolate people with highly severe and easily transmitted diseases. For example, an adult case of active pulmonary tuberculosis ('pulmonary' means in the lungs) should be kept in isolation in the first two weeks of the intensive phase of treatment. The isolation period lasts until the risk of transmission from the infected person has reduced or stopped. The period and degree of isolation differs between different diseases, as you will learn in later study sessions.

You will learn further details about tuberculosis in Study Sessions 13–17 of this Module.

Reporting

Cases of communicable diseases should be reported to a nearby health centre or *woreda* Health Office periodically, using the national surveillance guidelines.

How to report communicable diseases will be discussed in Study Session 41 of this Module.

Animal reservoirs

When infected animals are the reservoir involved in the transmission of communicable diseases, different measures can be undertaken against them. The type of action depends on the animal reservoir, and ranges from treatment to destroying the infected animal, depending on the usefulness of the animal and the availability of treatment. For example to prevent and control a rabies outbreak, the measures to be taken are usually to destroy all stray dogs in the area, and vaccinate pet dogs if the owner can afford this protection and the vaccine is available.

2.2.2 Measures targeting the mode of transmission

The detailed discussion of interventions to prevent and control all these modes of transmission can be found in the *Hygiene and Environmental Health* Module.

The measures that can be applied to interrupt transmission of infectious agents in water, food, other vehicles and by vectors, are described below.

Water

Measures to prevent transmission of infection due to contaminated water include boiling the water, or adding chemicals like chlorine. **Disinfection** is the procedure of killing most, but not all, infectious agents outside the body by direct exposure to chemicals. Adding chlorine is one method of disinfecting water. Physical agents can also be used, for example filtering water through a box of sand, or pouring it through several layers of fine cloth. Faecal contamination of water should also be prevented by protecting water sources and through proper use of latrines (Figure 2.3).

Figure 2.3 Proper use of latrines can help prevent breeding of vectors, and contamination of hands, food and water.
(Photos: left, WaterAid, right, Pam Furniss)

Food

Measures to prevent transmission in contaminated food include washing raw vegetables and fruits, boiling milk, and cooking meat and other food items thoroughly before eating. Contamination with faeces can be prevented by hand washing and proper use of latrines.

Other vehicles

Measures to tackle transmission in or on vehicles other than water and food include:

- *Contaminated objects* like household utensils for cooking, eating and drinking should be washed with soap and water.
- *Contaminated medical instruments and clothing* can be sterilized, disinfected or properly disposed of.

Sterilisation involves destruction of all forms of micro-organisms by physical heat, irradiation, gas or chemical treatment. The difference between disinfection and sterilisation is that disinfection kills most, but not all, micro-organisms. Disinfection can be done using alcohol, chlorine, iodine or heating at the domestic level; whereas sterilisation has to use extreme heating, irradiation or strong chemicals like a high concentration of chlorine.

Vectors

Measures against vectors include preventing breeding of vectors, through proper disposal of faeces and other wastes, eradication of breeding sites, and disinfestation. **Disinfestation** is the procedure of destroying or removing small animal pests, particularly arthropods and rodents, present upon the person, the clothing, or in the environment of an individual, or on domestic animals. Disinfestation is usually achieved by using chemical or physical agents, e.g. spraying insecticides to destroy mosquitoes, and removing lice from the body and clothing.

2.2.3 Measures targeting the susceptible host

The measures described below help to protect the susceptible host either from becoming infected, or from developing the stage of infectious disease if they are exposed to the infectious agents.

Vaccination

As you already know from Study Session 1, **vaccination** refers to administration of vaccines to increase the resistance of the susceptible host against specific vaccine-preventable infections. For example, measles vaccination helps to protect the child from measles infection, and BCG vaccination gives some protection from tuberculosis (Figure 2.4).

You will learn more about vaccine-preventable diseases in Study Sessions 3 and 4 of this Module.

Figure 2.4 Vaccination can help to prevent transmission of communicable diseases by increasing the resistance of susceptible hosts. (Photo: AMREF, Ethiopia/ Demissew Bezuwork)

Chemoprophylaxis

Chemoprophylaxis refers to the drugs given to exposed and susceptible hosts to prevent them from developing an infection. For example, individuals from non-malarial areas who are going to a malaria endemic area can take a prophylactic drug to prevent them from developing the disease if they become infected with malaria parasites from a mosquito bite.

Chemoprophylaxis is pronounced 'keem-oh-proff-ill-axe-sis'; ('chemo' refers to medical drugs, and 'prophylaxis' means 'an action taken to prevent a disease').

Maintaining a healthy lifestyle

Proper nutrition and exercise improves a person's health status, supports the effective functioning of their immune system, and increases resistance to infection.

Limiting exposure to reservoirs of infection

Measures taken to decrease contact with reservoirs of infection include:

- Condom use to prevent transmission of HIV and other sexually transmitted infections (STIs).
- Use of insecticide treated nets (ITNs) over the bed at night, insect repellants and wearing protective clothing to prevent diseases transmitted by insect vectors.
- Wearing surgical or very clean gloves and clean protective clothing while examining patients, particularly if they have wounds, or the examination involves the genital area.
- Keeping personal hygiene, like taking a daily bath and washing your hands frequently. Hand washing with soap and water is the simplest and one of the most effective ways to prevent transmission of many communicable diseases (Figure 2.5). The times when hands must be washed are indicated in Box 2.4.

Figure 2.5 Hand washing with soap and water is the simplest and most effective way to prevent transmission of communicable diseases. (Photo: Basiro Davey)

Box 2.4 When to wash hands with soap and clean water?

- After using the toilet
- After handling animals or animal waste
- After changing a diaper (nappy) or cleaning a child's bottom
- Before and after preparing food
- Before eating
- After blowing the nose, coughing, or sneezing
- Before and after caring for a sick person
- After handling waste material.

Now you have many good ideas on what measures can be undertaken to prevent and control communicable diseases. However, you have to apply these methods effectively in order to prevent and control the most important communicable diseases in your community. But how do you identify these diseases? In the next section we will answer this question.

2.3 Community diagnosis

In order to select and apply effective prevention and control measures, you first have to determine which type of diseases are common in the community you are working with. How do you do that? The method is called **community diagnosis** and it involves the following four steps:

- Data collection
- Data analysis
- Prioritising problems
- Developing an action plan.

Data collection methods and data analysis are described in the Module on *Health Management, Ethics and Research*.

Let's start with data collection and proceed to the others step by step.

2.3.1 Data collection

Data collection refers to gathering data about the health problems present in the community. This is important as it will help you to have good ideas about the type of problems present in the area where you work. Where do you get useful data concerning the health problems in your community? The following sources of data can be used:

- Discussion with community members about their main health problems
- Reviewing records of the health services utilized by the community
- Undertaking a community survey or a small-scale project
- Observing the risks to health present in the community.

After collecting data it should be analysed to make meaning out of it.

2.3.2 Data analysis

Data analysis refers to categorising the whole of the data you collected into groups so as to make meaning out of it. For instance you can assess the magnitude of a disease by calculating its *prevalence* and its *incidence* from the numbers of cases you recorded and the number of people in the population in your community.

Prevalence refers to the total number of cases existing in the population at a point in time, or during a given period (e.g. a particular month or year). The number of cases can be more usefully analysed by calculating the **prevalence rate** in the community: to do this you divide the total number of cases you recorded in a given period into the total number of people in the population. The result is expressed 'per 1,000 population' in a community as small as a *kebele*. For example, suppose that in one year you record 100 cases of malaria in a *kebele* of 5,000 people: for every 1,000 people in the *kebele*, there were 20 malaria cases in that year. So the prevalence rate of malaria in that *kebele* is expressed as 20 cases per 1,000 people in that year.

Prevalence rates and incidence rates can also be expressed as 'per 10,000' or 'per 100,000' in much larger populations, e.g. of a region or a whole country.

Calculating the prevalence *rate* is more useful than just counting the number of cases, because the population size in your *kebele* can change over time. The prevalence rate takes account of changes in the number of people, so you

can compare the prevalence rates from different years, or compare the rate in your *kebele* with the rate in another one.

Incidence refers only to the number of *new* cases of a disease occurring in a given period. The **incidence rate** is calculated by dividing the total number of new cases of the disease in a certain period of time into the total number of people in the population, and is expressed as 'per 1,000 population'.

■ If there were 10 new cases of cholera in a *kebele* of 5,000 people in one month, what is the incidence rate of cholera per 1,000 population in that period?

□ The incidence rate in this example is two new cholera cases per 1,000 population.

As a health professional working in a community affected by several health problems at the same time it is difficult to address all the problems at once. Therefore, you should give priority to the most important ones first. But how do you prioritise? You are going to see how to do that next.

2.3.3 Prioritising health problems

Prioritising refers to putting health problems in order of their importance. The factors that you should consider in prioritising are:

- the *magnitude* of the problem: e.g. how many cases are occurring over what period of time?
- the *severity* of the problem: how high is the risk of serious illness, disability or death?
- the *feasibility* of addressing the problem: are the prevention and control measures effective, available and affordable by the community?
- the *level of concern* of the community and the government about the problem.

Health problems which have a high magnitude and severity, which can be easily solved, and are major concerns of the community and the government, are given the highest priority. After prioritising which disease (or diseases) you will give most urgent attention to, the next step is to develop an action plan.

2.3.4 Action plan

An **action plan** sets out the ways in which you will implement the interventions required to prevent and control the disease. It contains a list of the objectives and corresponding interventions to be carried out, and specifies the responsible bodies who will be involved. It also identifies the time and any equipment needed to implement the interventions. Once you have prepared an action plan you should submit it for discussion with your supervisor and other officials in the *woreda* Health Office to get their approval. Then implement the work according to your plan.

Now that you have learned the basic concepts and methods relating to communicable diseases in general, it is time for you to move on to consider the diagnosis, treatment, prevention and control of specific diseases. In the next two study sessions, you will learn about the bacterial and viral diseases that can be prevented by vaccination.

Summary of Study Session 2

In Study Session 2, you have learned that:

1 Communicable diseases can be classified based on their clinical or epidemiologic features.

2 Clinical classification is based on the main clinical manifestations of the disease (e.g. diseases characterised by diarrhoea are classified as diarrheal diseases; diseases characterised by fever are febrile diseases).

3 Epidemiologic classifications are based on the mode of transmission and include foodborne, waterborne, airborne and vector-borne diseases.

4 Prevention and control measures for communicable diseases may target the reservoir of infection, the mode of transmission, or the susceptible host.

5 Measures against a human reservoir include treatment and isolation. Measures against animal reservoirs can be treatment or destroying the animal.

6 Measures against transmitters like food, water, other vehicles, and vectors, include hand washing with soap, effective use of latrines, destruction of breeding sites, disinfection, sterilisation and disinfestation.

7 Measures to protect susceptible hosts include vaccination, keeping personal hygiene, use of bed nets and use of condoms.

8 Community diagnosis of health problems involves data collection; data analysis; prioritising interventions based on the magnitude and severity of the problem, the feasibility of addressing it, and the level of concern; and making and implementing an effective action plan.

Self-Assessment Questions (SAQs) for Study Session 2

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 2.1 (tests Learning Outcomes 2.1 and 2.2)

Tuberculosis (TB) is common in Ethiopia. Its main clinical manifestations include chronic cough and shortness of breath. Using this information, which classification of communicable diseases can you apply to TB and to which class does TB belong?

SAQ 2.2 (tests Learning Outcomes 2.1 and 2.2)

How would you classify pulmonary tuberculosis using the epidemiologic method? What is the main importance of such classification?

SAQ 2.3 (tests Learning Outcomes 2.3, 2.4 and 2.5)

Suppose in a certain rainy season you diagnosed malaria in several people who came to you seeking treatment. Then, you undertook the following measures:

(a) You treated each patient with the appropriate drug.
(b) You mobilised the community to eradicate breeding sites of mosquitoes.
(c) You gave health education on the proper use of bed nets.

Which factor in the chain of disease transmission are you targeting with each of the above measures?

SAQ 2.4 (tests Learning Outcomes 2.1, 2.3, 2.4 and 2.5)

Which of the following statements are *true* and which are *false*? In each case, explain your reasoning.

A Isolation of the susceptible host is advised for the duration of the incubation period of a severe and easily transmitted disease.
B Sterilisation refers to the destruction of all forms of micro-organisms by physical or chemical agents such as alcohol and chlorine.
C Vaccination and vector control target the infected host so as to prevent transmission of infection.

SAQ 2.5 (tests Learning Outcome 2.6)

Suppose among the diseases you have identified in your community, two are malaria and ascariasis (infection by ascaris worms). Let's say the prevalence rate of malaria is 90 per 1,000 population and the prevalence rate of ascariasis is 200 per 1,000 population.

(a) If you need to prioritise activities to control one of these diseases, what other criteria should you consider?
(b) Malaria is a more severe disease than ascariasis. Let's say that interventions for both diseases are equally feasible, but the community and government are more concerned about malaria. So, considering all the factors, to which disease do you give higher priority for prevention and control?

Study Session 3
Bacterial Vaccine-Preventable Diseases

Introduction

This study session and the next one focus on the communicable diseases that can be prevented by immunization with vaccines. Together they are known as **vaccine-preventable diseases**. In this study session you will learn about vaccine-preventable diseases caused by bacteria. In Study Session 4 we will describe those that are caused by viruses. Greater understanding of these diseases will help you to identify the ones that are common in your community, so that you can provide effective vaccination programmes, and identify and refer infected people for specialised treatment at a higher health facility.

In this study session, you will learn some basic facts about bacterial vaccine-preventable diseases, particularly how these diseases are transmitted, and how they can be treated and prevented. Our focus will be on tetanus and meningitis, because tuberculosis (TB), which is a bacterial vaccine-preventable disease, will be discussed in much more detail in Study Sessions 13–17 of this Module. Bacterial pneumonia (infection of the lungs), caused by bacteria called *Streptococcus pneumoniae* and *Haemophilus influenzae*, is also discussed in detail later, in Study Session 35. A vaccine against *Haemophilus influenzae* is already being given to children in Ethiopia. A new vaccine against *Streptococcus pneumoniae* is planned to be introduced in Ethiopia, probably in 2011/2012.

You will learn about vaccines in detail in the *Immunization* Module.

Learning Outcomes for Study Session 3

When you have studied this session, you should be able to:

3.1 Define and use correctly all of the key words printed in **bold**. (SAQs 3.1, 3.2 and 3.3)

3.2 Describe what causes common bacterial vaccine-preventable diseases, how the infectious agents are transmitted, and the characteristic symptoms of an affected person. (SAQs 3.1 and 3.4)

3.3 Describe how the bacterial vaccine-preventable diseases tetanus and meningococcal meningitis can be treated, controlled and prevented in rural communities. (SAQs 3.2, 3.3 and 3.4)

3.1 Vaccines, immunity and vaccination

Before we can tell you about the vaccine-preventable diseases, you need to understand what is meant by a vaccine. **Vaccines** are medical products prepared from whole or parts of bacteria, viruses, or the toxins (poisonous substances) that some bacteria produce. The contents of the vaccine have first been treated, weakened or killed to make them safe. If a vaccine is injected into a person, or given orally by drops into the mouth, it should not cause the disease it is meant to prevent, even though it contains material from the infectious agent. Vaccines are given to susceptible persons, particularly children, so that they can develop immunity against the infectious agent (Figure 3.1).

Figure 3.1 Vaccination may hurt for a moment but the BCG vaccine given to this baby will help to protect him against tuberculosis. (Photo: AMREF Ethiopia/Demissew Bizuwerk)

As you will recall from Study Session 1, **immunity** refers to the ability of an individual to resist a communicable disease. When a dead or weakened micro-organism is given in the form of a vaccine, this process is called **vaccination** or **immunization**. For simplicity, in this Module we will refer to 'vaccination', but you should be aware that these two terms are used interchangeably.

The vaccine circulates in the body and stimulates white blood cells called **lymphocytes** to begin producing special defensive proteins known as **antibodies**. Antibodies are also normally produced whenever a person is infected with active bacteria or viruses transmitted from a reservoir in the community. Antibodies and white blood cells are very important natural defences against the spread of infection in our bodies, because they can destroy infectious agents before the disease develops. What vaccination does is to stimulate this normal response, by introducing a weakened or killed form of infection, which the white blood cells and antibodies attack.

This defensive response against the harmless vaccine increases the person's level of immunity against the active infectious agents, if the same type that was in the vaccine gets into the body. The protective effect of vaccination lasts for months or years afterwards, and if several vaccinations are given with the same vaccine, the person may be protected from that infection for their lifetime. The Module on *Immunization* will teach you all about the vaccines available in Ethiopia in the Expanded Programme on Immunisation (EPI), and how they are stored and administered in vaccination programmes.

3.2 Overview of bacterial vaccine-preventable diseases

Vaccine-preventable diseases are important causes of death in children. The causes, infectious agents, modes of transmission, symptoms, and methods of prevention, treatment and control of the most important bacterial vaccine-preventable diseases are summarized in Table 3.1. Note that some of the diseases shown in Table 3.1, such as diphtheria and pertussis, are no longer common in Ethiopia, or in other countries where vaccination in childhood against their infectious agents is widespread. Tuberculosis and bacterial pneumonia are discussed in detail in later study sessions.

In this study session, we will describe *tetanus* and bacterial *meningitis*, so that you will be able to identify and refer cases of these diseases, and also know how you might help to prevent them in your community.

Table 3.1 Causes, transmission, symptoms, prevention and control methods for common bacterial vaccine-preventable diseases.

Disease	Bacterial cause *(scientific name)*	Mode of transmission	Symptoms	Prevention and control methods
Tuberculosis	*Mycobacterium tuberculosis*	Respiratory by coughing or sneezing	Chronic cough, weight loss, fever, decreased appetite (more details are given in Study Session 13)	BCG vaccine, chemoprophylaxis, early diagnosis and treatment
Diphtheria	*Corynebacterium diphtheriae* and its toxin	Respiratory by coughing or sneezing	Sore throat, loss of appetite, and slight fever	Diphtheria vaccine, combined with two or four other vaccines against pertussis, tetanus, BCG, etc.
Pertussis	*Bordetella pertussis*	Respiratory by coughing or sneezing	Runny nose, watery eyes, sneezing, fever, and continuous cough, followed by vomiting	Pertussis vaccine, combined with two or four other vaccines against diphtheria, tetanus, BCG, etc.
Tetanus	*Clostridium tetani*	From soil into a wound or broken skin, through direct contact	Stiffness in the jaw and neck, with stomach and muscle spasms	Tetanus vaccine for children, combined with other vaccines, or given alone for women of childbearing age
Meningitis (infection of the brain or spinal cord)	*Neisseria meningitidis*	Respiratory by coughing or sneezing	Fever, headache, neck stiffness, coma	Meningococcal vaccine and treatment by antibiotics
	Streptococcus pneumoniae	Respiratory by coughing or sneezing	Fever, headache, neck stiffness, coma	Treatment by antibiotics; a pneumococcal conjugate vaccine (PCV) will be introduced to Ethiopia soon
Pneumonia (infection of the lungs)	*Streptococcus pneumoniae*	Respiratory by coughing or sneezing	Cough, fast breathing/ difficult breathing (more details are given in Study Session 35)	Treatment by antibiotics; a pneumococcal conjugate vaccine (PCV) will be introduced to Ethiopia soon
	Haemophilus influenzae	Respiratory by coughing or sneezing	Cough, fast breathing/ difficult breathing (more details are given in Study Session 35)	Treatment by antibiotics; Hib is part of the pentavalent vaccine

3.3 Tetanus

In this section, you will learn about what tetanus is, how it is transmitted, what its clinical symptoms are, and how it can be treated and prevented. Having this information will help you to identify cases of tetanus and refer them to the nearby hospital or health centre for further treatment. All cases should be reported to the District Health Office. After reading this section, you should also be able to educate your community about the causes of tetanus, and how to prevent it. You will learn how to give the tetanus toxoid vaccine to children, and to women of reproductive age, in the Module on *Immunization*.

3.3.1 Definition, cause and occurrence of tetanus

Tetanus is a neurological disorder, that is, a disorder of the nervous system. Symptoms of tetanus are tight muscles that are difficult to relax, and muscle *spasms* (muscle contractions that occur without the person wanting them to). These problems with the muscles are caused by a toxin (poison) produced by the bacteria called *Clostridium tetani*.

Tetanus is among the top ten causes of illness and death in newborns in Ethiopia. Tetanus in newborns is called **neonatal tetanus**. Nine out of every 1,000 newborns in Ethiopia have neonatal tetanus. More than 72% of the newborns who have tetanus will die.

Tetanus is also common among older children and adults who are susceptible to the infection. Unvaccinated persons are at risk of the disease, and people who have a dirty wound which favours the growth of the bacteria that cause tetanus are especially vulnerable.

3.3.2 Mode of transmission of tetanus

People can get tetanus through exposure to tetanus bacteria (*Clostridium tetani*) which are always present in the soil. The bacteria can be transmitted directly from the soil, or through dirty nails, dirty knives and tools, which contaminate wounds or cuts. A newborn baby can become infected if the knife, razor, or other instrument used to cut its umbilical cord is dirty, if dirty material is used to dress the cord, or if the hands of the person delivering the baby are not clean. Unclean delivery is common when mothers give birth at home in poor communities, but it can be prevented by skilled birth attendants (Figure 3.2).

Figure 3.2 Skilled birth attendants can reduce the risk of tetanus infecting babies born at home in rural communities. (Photo: AMREF/Sven Torfinn)

The disease is caused by the action of a toxin produced by the bacteria, which damages the nerves of the infected host. This toxin is produced during the growth of the tetanus bacteria in dead tissues, in dirty wounds, or in the umbilicus following unclean delivery of the newborn.

3.3.3 Clinical manifestations of tetanus

The time between becoming infected with *Clostridium tetani* bacteria and the person showing symptoms of tetanus disease is usually between three and 10 days, but it may be as long as three weeks.

- What is the name given to the gap in time between infectious agents entering the body, and the first appearance of the disease they cause? (You learned this in Study Session 1.)

- It is called the **incubation period**.

In cases of tetanus, the shorter the incubation period, the higher the risk of death. In children and adults, muscular stiffness in the jaw, which makes it difficult or impossible to open the mouth (called 'locked jaw') is a common first sign of tetanus. This symptom is followed by neck stiffness (so the neck cannot be bent), difficulty in swallowing, sweating, fever, stiffness in the stomach muscles, and muscular spasms (involuntary contraction of the muscles).

Babies infected with tetanus during delivery appear normal at birth, but they become unable to feed by suckling from the breast at between three and 28 days of age. Their bodies become stiff, while severe muscle contractions and spasms occur (Figure 3.3). Death follows in most cases.

Figure 3.3 A baby who has rigidity and arching of the whole body due to tetanus. (Photo: WHO, 2000, at www.who.int/vaccines-documents/)

- A newborn baby (10 days old) who was born in a village with the assistance of traditional birth attendants, is brought to you with fever, stiffness in the stomach muscles and difficulty in opening his mouth, so he is unable to breastfeed. What is the possible cause of this baby's symptoms, and why do you make this diagnosis? What action will you take?

- The newborn may have tetanus since he was born at home without the care of a skilled birth attendant. The umbilical cord could be infected by tetanus. You should refer this child urgently to the nearest health centre or hospital.

3.3.4 Treatment, prevention and control of tetanus

Once a person has tetanus, he or she will be treated by an antibiotic drug. **Antibiotics** are medicines that destroy bacteria, or stop them from multiplying in the body. However, many people who have tetanus die despite the treatment. Hence, prevention is the best strategy, and vaccination is the best way to prevent tetanus.

Tetanus toxoid (TT) vaccination

The tetanus vaccine contains inactivated tetanus toxoid (poison), which is why it is often called TT vaccine. Tetanus toxoid vaccination is given routinely to newborns and infants as part of the threefold DPT vaccine (with diphtheria and pertussis vaccines), or the pentavalent (fivefold) vaccine, which includes vaccines for diphtheria, tetanus, pertussis, Hepatitis B (a virus), and a bacterium called *Haemophilus influenzae* type B (Hib). Neonatal tetanus can also be prevented by vaccinating women of childbearing age with tetanus toxoid vaccine, either during pregnancy or before pregnancy. This protects the mother and enables anti-tetanus antibodies to be transferred to the growing fetus in her uterus.

■ What is the name given to this mode of transmission? (You learned about it in Study Session 1 in reference to infectious agents being transferred from mother to baby).

□ The transmission from mother to fetus is called *transplacental transmission* because the mother's antibodies pass across the placenta and into the baby.

Cleanliness is also very important, especially when a mother is delivering a baby, even if she has been vaccinated with TT vaccine.

People who recover from tetanus do not have increased natural immunity and so they can be infected again. Therefore they will need to be vaccinated.

The World Health Organization (WHO) and UNICEF set a goal to eliminate neonatal tetanus by 2005. **Elimination** in this case would mean that the number of neonatal tetanus cases would have to be reduced to below one case per 1,000 live births per year in every district. Notice that elimination of a communicable disease does not mean there are *no* cases — just very few right across a country or region. **Eradication** means the total and sustained disappearance of the disease from the population.

■ Do you think that tetanus can ever be eradicated? Explain why, or why not.

□ Because tetanus bacteria survive in soil in the environment, eradication of the disease is not possible.

To achieve the elimination goal, countries like Ethiopia, with a high number of tetanus cases every year, need to implement a series of prevention strategies, which include those listed in Box 3.1.

Box 3.1 Strategies to prevent and control tetanus

- *Vaccinating* a higher percentage of pregnant women against tetanus with vaccines containing tetanus toxoid (TT).
- *Vaccinating* all females of childbearing age (approximately 15–45 years) with TT vaccine in high-risk areas where vaccination coverage is currently low.
- *Outreach vaccination campaigns* where health workers go to rural villages and give TT vaccine, usually three times at intervals (known as a 'three-round' vaccination campaign).
- *Promoting clean delivery and childcare practices*, through better hygiene and care of the newborn's umbilicus.
- *Improving surveillance and reporting* of cases of neonatal tetanus. The case finding and reporting will help us to give appropriate treatment and vaccination to children.

Clean delivery practices are described in the *Labour and Delivery Care* Module.

3.4 Meningococcal meningitis

In this section, we will describe what meningococcal meningitis is, how it is transmitted, what its clinical symptoms are, and also how it can be treated and prevented. With this information, we hope you will be able to identify a person with meningitis and refer him or her *urgently* to the nearest health centre or hospital for further diagnosis and treatment. You should also be able to detect meningococcal meningitis epidemics in the community.

Cases of meningitis must be referred *urgently* for medical treatment.

3.4.1 Definition and cause of meningococcal meningitis

Meningococcal meningitis is an infection of the brain and spinal cord by the bacterium *Neisseria meningitidis* (also known as the meningococcus bacterium). The disease is caused by several groups of meningococcus bacteria, which are given distinguishing codes such as type A, B, C, Y and W135.

The disease occurs globally, but in sub-Saharan Africa, meningitis epidemics occur every two to three years. An **epidemic** is a sudden and significant increase in the number of cases of a communicable disease, which may go on rising for weeks, months or years. Meningitis epidemics are common in many countries of Sub-Saharan Africa, including Ethiopia. In Ethiopia, these epidemics are usually caused by group A and C type meningococcus bacteria, and are more common in western Ethiopia. The disease is most common in young children, but it also can affect young adults living in crowded conditions, in institutions, schools and refugee camps.

In populations over 30,000 people, a meningitis epidemic is defined as 15 cases per 100,000 inhabitants per week; or in smaller populations, five cases in one week or an increase in the number compared to the same period in previous years.

3.4.2 Mode of transmission and clinical symptoms

Meningococcal meningitis is transmitted to a healthy person by airborne droplets from the nose and throat of infected people when they sneeze or cough. The disease is marked by the sudden onset of intense headache, fever, nausea, vomiting, sensitivity to light and stiffness of the neck. Other signs include lethargy (extreme lack of energy), coma (loss of consciousness), and convulsions (uncontrollable shaking, seizures). Box 3.2 summarises the *general* signs of meningitis, which may also be caused by some other serious conditions, and the more *specific* signs which are characteristic of meningitis.

Box 3.2 General and more specific signs of meningitis in infants

General signs of meningitis:

- Drowsy, lethargic or unconscious
- Reduced feeding
- Irritable
- High pitched cry.

More specific signs of meningitis:

- Convulsion (fits)
- Bulging fontanelle in infants.

A child with typical signs of meningitis such as neck stiffness, bulging fontanelle and convulsion, should be immediately referred to the nearest hospital or health centre.

During examination of a baby with meningitis, you will notice stiffness of the neck, or bulging of the **fontanelle** – the soft spot on top of the head of infants (see Figure 3.4). The fontanelle bulges because the infection causes fluid to build up around the brain, raising the pressure inside the skull. A bulging fontanelle due to meningitis is observed in infants since the bones of the skull are not yet fused together.

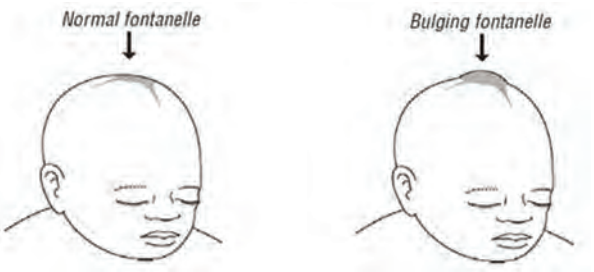


Figure 3.4 Bulging of the fontanelle in infants is a sign of meningitis. (Source: WHO, 2005, *Pocket Book of Hospital Care for Children*, p.50)

Children may also show rigid posture due to irritation of the covering part of the brain or spinal cord. To check the presence of neck stiffness, ask the parents to lay the child in his/her back in the bed and try to flex the neck of the child (Figure 3.5).

Figure 3.5 Neck stiffness is a danger sign of meningitis.

If meningitis is not treated, mortality is 50% in children. This means that half of all cases end in death. However, with early treatment, mortality is reduced to between 5 to 10%. But about 10 to 15% of those surviving meningococcal meningitis will suffer from serious complications afterwards, including mental disorders, deafness and seizures.

3.4.3 Diagnosis and treatment of meningitis

Meningitis is diagnosed by physical examination of the person, and by laboratory testing of the fluid from their spinal cord, where the meningococcal bacteria can be found. In the hospital or health centre, the meningitis is treated using antibiotics given intravenously (IV), that is, liquid antibiotics given directly into the bloodstream through a vein.

■ Tetanus and meningitis are both diseases in which fever and stiffness of the neck are important symptoms. How could you tell these diseases apart in babies by examining them yourself?

□ Tetanus and meningitis can both be manifested by fever and neck stiffness, but there are other specific signs of each disease which help in differentiation. For instance, people with tetanus may have tightness of the abdominal muscles and may be unable to open their mouths. By contrast, the bulging fontanelle is a typical sign of meningitis in young babies, which would not be found in cases of tetanus. However, these diseases are very difficult to distinguish on the basis of clinical examination alone.

3.4.4 Prevention and control of meningococcal meningitis

Next we describe how to prevent meningococcal meningitis from spreading in a community. The most important preventive and control methods are summarized in Box 3.3.

Box 3.3 Strategies to prevent and control meningitis

- *Early identification* and *prompt treatment* of cases in the health facility and in the community.
- *Education* of people in the community on the symptoms of meningitis, the mode of transmission and the treatment of the disease.
- *Reporting* any cases of meningitis to the District Health Office; and avoiding close contact with the sick persons. Your health education messages should tell everyone about this.
- *Vaccination* against meningococcus bacteria of types A, C, Y and W135, as described in the *Immunization* Module.

A mass immunization campaign that reaches at least 80% of the entire population with meningococcus vaccines can prevent an epidemic. However, these vaccines are not effective in young children and infants, and they only provide protection for a limited time, especially in children younger than two years old. A single case of meningitis could be a warning sign for the start of an epidemic. As a community Health Extension Practitioner, you will need to educate your community about the symptoms of meningitis and how it is transmitted. All cases should be reported to the District Health Office.

The next study session is also about vaccine-preventable diseases, but we turn your attention to those common diseases of this type that are caused by viruses.

Summary of Study Session 3

In Study Session 3, you have learned that:

1 Vaccine-preventable diseases are communicable diseases that can be prevented by immunization with vaccines containing weakened or killed infectious organisms or their toxins.

2 Vaccination increases the level of immunity in the body to the infectious agents that were used to make the harmless vaccine.

3 Tuberculosis, diphtheria, pertussis, tetanus, meningococcal meningitis and streptococcal pneumonia are the commonest and the most important bacterial vaccine-preventable diseases.

4 Tetanus and meningococcal meningitis are bacterial vaccine-preventable diseases that cause many deaths of children and adults in developing countries.

5 Tetanus bacteria (*Clostridium tetani*) live in the soil and enter the body through wounds, breaks in the skin and, in the newborn, in the umbilical cord after it has been cut.

6 The symptoms and signs of tetanus include rigid posture, stiffness in the jaw and neck, difficulty in swallowing, sweating, fever, stiffness in the stomach muscles and muscular spasms.

7 Clean delivery of babies by trained health professionals, and vaccination of children and women in the reproductive age groups with tetanus toxoid (TT) vaccine, are the most important strategies for preventing neonatal tetanus.

8 Meningococcal meningitis is caused by *Neisseria meningitidis* (or the meningococcus bacteria); they are passed from person to person in airborne droplets when the infected host coughs or sneezes, sometimes causing epidemics.

9 A person who has signs of meningitis, such as high fever, neck stiffness, lethargy and loss of consciousness, or bulging of the fontanelle in babies, should be referred immediately to the nearest hospital or health centre.

10 Cases of tetanus or meningococcal meningitis in the community should be reported to the District Health Office.

Self-Assessment Questions (SAQs) for Study Session 3

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 3.1 (tests Learning Outcomes 3.1 and 3.2)

Mention two or more bacterial vaccine-preventable diseases that have the same modes of transmission.

SAQ 3.2 (tests Learning Outcomes 3.1 and 3.3)

What are the methods for preventing bacterial meningitis?

SAQ 3.3 (tests Learning Outcomes 3.1 and 3.3)

If you observe a child who has a fever, neck stiffness and a rigid posture, as shown in Figure 3.6, what is the likely cause? What action will you take and why?

Figure 3.6 Rigid posture of a sick child. (Source: WHO, 2005, *Pocket Book of Hospital Care for Children* p.149)

SAQ 3.4 (tests Learning Outcomes 3.2 and 3.3)

Mention two major bacteria that commonly cause meningitis. Can you differentiate between the symptoms caused by these bacteria? What would you do if you encounter a person with these symptoms?

Study Session 4 Viral Vaccine-Preventable Diseases

Introduction

In Study Session 3 we gave an overview of vaccine-preventable diseases, and then focused on two of the main diseases in this category that are caused by bacteria. In this study session, you will learn about the major vaccine-preventable diseases that are caused by viruses, how they are transmitted, and how they can be prevented and controlled. Knowing the signs and symptoms of these viral diseases will help you to identify them in your community, so that you can refer infected people quickly for treatment at a nearby health centre. Greater understanding of viral vaccine-preventable diseases will also enable you to explain to parents why they should have their children vaccinated to prevent them from susceptibility to these viruses. How to give vaccines to children is described in the *Immunization* Module.

Learning Outcomes for Study Session 4

When you have studied this session, you should be able to:

4.1 Define and use correctly all of the key words printed in **bold**. (SAQs 4.1 and 4.3)

4.2 Describe what causes the common viral vaccine-preventable diseases, how the infectious agents are transmitted, and the characteristic signs and symptoms of an affected person. (SAQs 4.2 and 4.3)

4.3 Describe the treatment in the community of children who have measles. (SAQ 4.2)

4.4 Describe how measles, polio and hepatitis B can be controlled and prevented in rural communities. (SAQ 4.3)

4.1 Overview of viral vaccine-preventable diseases

As you know from Study Session 1 of this Module, **viruses** are microscopic infectious agents that do not have the structure of a cell; they are more like tiny boxes or particles. They are much smaller than bacteria and can only be seen with the most powerful microscopes. Some of the diseases caused by viruses can be prevented by vaccination, as you will learn in this study session.

■ Do you know of any human communicable diseases caused by a virus?

□ HIV disease and AIDS are caused by the human immunodeficiency virus (HIV). You may also have thought of measles, polio or hepatitis.

HIV cannot be prevented by vaccination at the present time, but the other three viral diseases mentioned above are part of the Expanded Programme of Immunization (EPI) in Ethiopia and many other countries around the world (see Table 4.1, on the next page). The composition of the vaccines, which contain dead or weakened viruses or fragments of their structure, and the routes of administration, are described in detail in the *Immunization* Module. In the following sections, we will look at each of these diseases in turn.

Table 4.1 Causes, transmission, symptoms, prevention and control methods for common viral vaccine-preventable diseases.

Disease	Cause	Mode of transmission	Symptoms	Prevention methods
Measles	measles virus	Respiratory by coughing or sneezing	Cough, rash and fever	measles vaccination
Poliomyelitis	polio virus	Ingesting (faeco-orally)	A few children have paralysis of the legs or hands; many will not show symptoms	oral polio vaccination (OPV)
Hepatitis	hepatitis B virus	Direct contact with body fluids or blood, or sexually transmitted	Fever, yellow colouring of the white part of the eye; many children will not show symptoms	hepatitis B vaccination

4.2 Measles

In this section, you will learn about what measles is, how it is transmitted, what its signs and symptoms are, and how it can be treated and prevented. Having this information will help you to identify a child with measles and give necessary treatment. After reading this section, you should also be able to identify an epidemic of measles in the community if it occurs, so you will be able to report it to the District Health Office.

4.2.1 Definition, cause and occurrence of measles

Note that (unlike bacteria, which have two-part *species* names) the names of most viruses are simply the disease it causes followed by the word 'virus', as in 'measles virus'.

Measles is a highly transmissible infectious disease caused by the measles virus. Globally, measles kills more children than any other vaccine-preventable disease. In 2008, there were around 165,000 deaths from measles worldwide – most of them in young children and almost all of them in low-income countries. Because the virus is so easily transmitted, you should be aware that it usually causes an epidemic and may cause many deaths, especially among malnourished children. In Ethiopia, measles occasionally causes epidemics. Almost 5,000 children suffered from measles in 2009 and 2,726 cases had already been confirmed in 2010 by early July of that year. However, it is estimated that deaths from measles can be reduced by more than 60% through effective vaccination programmes.

Figure 4.1 Transmission of measles by airborne droplets occurs easily in schools. (Photo: Ali Wyllie)

4.2.2 Mode of transmission of measles

Measles is spread through contact with the nose and throat secretions of infected people, and in *airborne droplets* released when an infected person sneezes or coughs. A person with measles can infect others for several days before and after he or she develops symptoms. The disease spreads easily in areas where infants and children gather, for example in health centres, homes and schools (Figure 4.1).

4.2.3 Clinical manifestations of measles

The first sign of infection with measles is a high fever, which begins approximately 10–12 days after exposure to the virus and lasts for several

days. During this period, the child may develop a runny nose, a cough, red and watery eyes (Figure 4.2), and small white spots inside his or her cheeks.

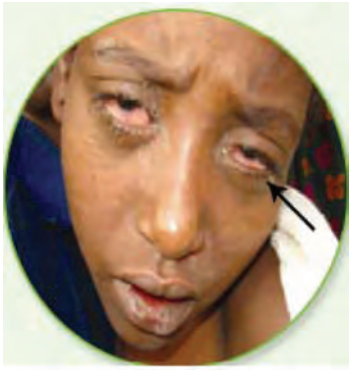


Figure 4.2 Red eyes (conjunctivitis) due to measles. (Source: WHO and Ethiopian Federal Ministry of Health, 2005, *Case Definition of Measles*)

Conjunctivitis is pronounced 'con-junk-tiv-eye-tiss'.

After several days, a slightly raised **rash** (appearance of small pigmentations or red spots on the skin, or '*shifta*' in Amharic), develops, usually on the face and upper neck. Over a period of about three days, the rash spreads to the body (Figure 4.3) and then to the hands and feet. It lasts for five or six days and then gradually fades. The incubation period from exposure to the onset of the rash averages 14 days.

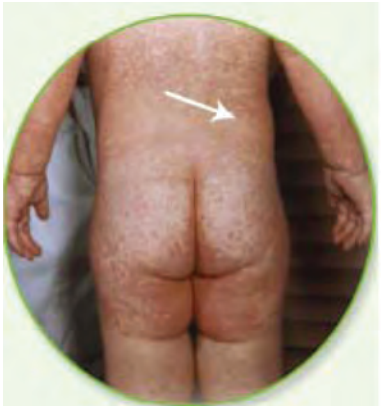


Figure 4.3 Measles rash covering the whole body of a child. (Source: WHO and Ethiopian Federal Ministry of Health, 2005, *Case Definition of Measles*)

To identify cases of measles, you need to confirm the presence of fever and rash, with cough or running nose, or conjunctivitis (red eyes).

Measles may be severe, causing several complications that can lead to permanent disability or death, including pneumonia (infection of the lower respiratory tract), encephalitis (infection in the brain), otitis media (infection of the middle ear), corneal clouding and blindness (Figure 4.4), and diarrhoea with dehydration. You will learn about pneumonia and acute otitis media in more detail in Study Session 35.

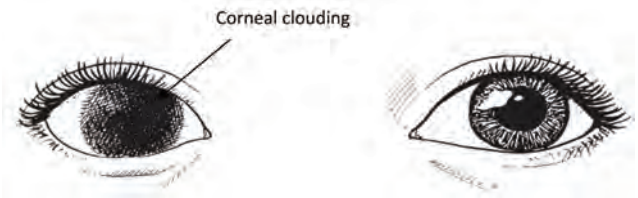


Figure 4.4 Corneal clouding in a child with measles and vitamin A deficiency. (Source: WHO, 2005, *Pocket Book of Hospital Care for Children*)

The structure of the eye and the main causes of blindness are covered in the Module on *Non-Communicable Diseases, Emergency Care and Mental Health.*

Severe measles, manifested by complications such as pneumonia, and clouding of the eyes or blindness, is particularly likely in poorly nourished children, especially those who do not receive sufficient vitamin A in their diet. Vitamin A, which is found in yellow vegetables like carrots and yellow fruits like mangoes, is essential for good eyesight and it also strengthens the immune system of children. If measles develops in a child with a shortage of vitamin A, this makes the disease more severe and damage to eyesight is more likely. Measles and vitamin A deficiency together are a major cause of blindness among children in Africa and in other areas of the world where measles is common. Children who live in crowded conditions and whose immune systems have been weakened by HIV/AIDS, or other diseases, are also more likely to develop severe measles.

■ Give a reason why malnourished children are more likely to develop severe measles.

□ Children with malnutrition, particularly those who lack vitamin A, have weak immunity and cannot fight the measles virus, which causes severe clinical symptoms and may even kill them.

4.2.4 Treatment, prevention and control of measles

Cases of severe measles with pneumonia or clouding of the cornea should be referred immediately to the nearest health facility.

It is very important to encourage children with measles to eat and drink. Advise the parents to help their child as much as possible with nutrition and intake of fluids; treat any dehydration with oral rehydration salts (ORS) as necessary. Antibiotics should only be prescribed for ear infections and pneumonia caused by bacteria, which are able to develop in the person weakened by measles. Remember that antibiotics only attack bacteria – they have no activity against any viruses, including the measles virus.

Vitamin A supplementation

As lack of vitamin A is such a problem associated with measles, all children in developing countries who are diagnosed with measles should receive *two doses of vitamin A supplements given 24 hours apart*, at a dosage appropriate to their age (see Table 4.2). For instance, a 7 month-old infant with measles should receive one dose of vitamin A, which contains 100,000 International Units (IU) on the day of diagnosis (day 1) and also on the next day (day 2). Giving Vitamin A can help prevent eye damage and blindness and reduce the number of deaths from measles by 50%, so this is a very important and effective part of the treatment.

IU stands for International Unit; this is the internationally agreed measurement of vitamin dosages

Table 4.2 Dosage of vitamin A for children with measles.

Age	Immediately on diagnosis	Next day	Follow-up
Infants less than 6 months old	50,000 IU	50,000 IU	Third dose 2–4 weeks later if there are signs of eye problems
Infants aged 6–11 months	100,000 IU	100,000 IU	
Children aged 12 months and over	200,000 IU	200,000 IU	

Measles vaccination

Measles is prevented by vaccination with measles vaccine. By the year 2008, successful vaccination campaigns all over the world had succeeded in reducing measles deaths by around 75% — a huge drop from the 750,000 deaths in the year 2000. The World Health Organization (WHO) estimated that in 2008 around 83% of the world's children were receiving one dose of measles vaccine by their first birthday.

How to administer the measles vaccine to children is described in the *Immunization* Module.

All infants at *nine months* of age or shortly thereafter should be vaccinated through routine immunization services. This is the foundation of the sustainable measles death-reduction strategy. It is also possible to reduce infections with measles by giving vaccination to vulnerable children. For example, to reduce the risk of measles infection in hospitals, all children between the ages of six and nine months, who have not received measles vaccine and who are admitted to a hospital, should be vaccinated against measles. If the children's parents do not remember or know whether they have received measles vaccine, the child should still be vaccinated. If a hospitalised child has received measles vaccine before nine months of age, a second dose should be administered at nine months, or as soon as possible after nine months.

All children should be provided with a second opportunity for measles vaccination. This is to make sure that children who did not receive a previous dose of measles vaccine, or children who were vaccinated earlier but did not develop immunity, have another chance to develop immunity. The second opportunity may be delivered either through routine immunization services or through periodic mass campaigns of vaccination.

Measles surveillance

Measles surveillance (looking for cases of measles in the community) should be strengthened at community level, so that there is early warning of any possible epidemics. Try to persuade parents that a child with measles should be kept isolated from other children who have not previously had measles or been vaccinated, to avoid the disease from spreading. As a health worker, you should report any cases of measles in your community to the District Health Office. As well as this, of course, you have the important task of vaccinating all children who are around nine months old against measles.

Next, we would like you to read Case Study 4.1 and then answer the questions that follow it.

Case Study 4.1 Alemu's parents want to cure his rash by prayer

During a house-to-house visit in a remote village, you see a one year-old boy called Alemu, who has a high fever, a cough and small rashes (the spots look like *teff*) on his forehead and neck. Alemu's parents call this illness *'ankelis'* or *'wotetie'* in the local language. The treatment they believe will cure their son is to prepare a coffee ceremony to the gods who they believe to have spiritual power. They informed you that their two older children were cured by the same treatment and they will continue acting the same way for Alemu.

- What should you advise Alemu's parents? What actions should you take to help the child? And what else should you do?

- Advise the parents that the child may have a disease called measles, which is caused by a virus. Measles is prevented by vaccination, and children who recover from measles naturally will never get it again (they develop lifelong immunity). If the disease is severe, children may die. Inform the parents that for a very sick child like Alemu, complications such as pneumonia and death can be prevented by giving vitamin A and fluids such as oral rehydration salts. Give vitamin A (200,000 IU) on the first and second day to Alemu. After convincing the parents, refer the child to the health centre and report the case to the District Health Office. Search for other similar cases in the village.

4.3 Poliomyelitis (polio)

In this section, we will describe what polio is and how it is transmitted, its clinical symptoms, how it is treated and how it can be prevented and controlled. This will help you to identify cases of polio and refer them for further diagnosis and treatment. It will also help you to give health education in your community about how to prevent polio in children through the administration of oral polio vaccine in drops into the mouth.

4.3.1 Definition, cause and occurrence of polio

Poliomyelitis (usually called **polio**) is a viral disease that causes **paralysis** (weakness or inability to use the muscles) of the legs, arms or hands. Polio is caused by three types of viruses, namely, poliovirus types 1, 2 or 3; (note that 'poliovirus' is all one word). Many countries agreed in 1988 to try to *eradicate* polio completely from the world. The Ethiopian government has a plan to eradicate the disease in the near future. As a result of a continuing vaccination programme, polio is fortunately becoming a rare disease in Ethiopia. However, there are sometimes cases among people who come to Ethiopia from neighbouring countries such as Sudan.

4.3.2 Mode of transmission and clinical manifestation of polio

Polioviruses are transmitted when people drink water or eat food contaminated by faeces (or stools) which carry the virus (faeco-oral transmission). However, most children infected by polioviruses never feel ill. Less than 5% of those infected may have general flu-like symptoms such as fever, loose stools, sore throat, headache, or stomach ache. Most children who get a poliovirus infection without symptoms develop immunity and have lifelong protection against polio. A few children may develop a kind of paralysis called **acute flaccid paralysis (AFP)**, which is characterized by acute (rapidly developing, severe) loss of movement or weakness of the legs, arms or hands.

Paralytic polio begins with mild symptoms and fever, followed by severe muscle pain and paralysis, which usually develops during the first week of illness. Patients may lose the use of one or both arms or legs. Some patients may not be able to breathe because of the paralysis of respiratory muscles in the chest, which can lead to death. Some patients who develop paralysis due to polio recover the ability to move the affected limbs to some degree over time, but the degree of recovery varies greatly from person to person. A diagnosis of polio is confirmed by laboratory testing of stool samples.

4.3.3 Treatment and prevention of polio

While the initial symptoms of acute polio such as muscle pain and fever can be relieved, there is no treatment that can cure the weakness and paralysis if AFP develops. Regular physical exercise can help paralysed children to resume some activity. Prevention of polio by vaccination is the best method to eradicate the disease. Three doses of oral polio vaccine (OPV) are given during routine vaccinations for other communicable diseases, and/or during campaigns for polio eradication. A detailed description of the vaccination procedure is given in the *Immunization* Module.

An initial dose of OPV can also be given at birth or before 2 weeks of age.

Polio surveillance and reporting

You should immediately report a case of AFP to the District Health Office and take stool samples from the patient. The stool sample should be sent to Addis Ababa to identify the virus. Stool specimens must be collected within 14 days of paralysis onset in order to have the greatest chance of isolating the virus. Try to collect the first specimen at the time of the case investigation. If the patient is not able to produce a stool, leave a cup, cold box and frozen ice packs with the family so that they can collect it from the patient later.

To collect faeces from the child, ask him or her to defaecate onto clean paper. Use a spatula or very clean spoon to put the stool specimen in a clean container and label it and write the date. After collection, the specimens must be placed immediately in a refrigerator for shipment, or in a cold box between frozen ice packs at 4–8°C. The specimens must reach the laboratory in Addis Ababa within 72 hours of collection.

- Gemechis is a two-year-old boy who has had weakness in his legs for the last two days. His mother has told you that he has mild fever and diarrhoea. What should you do?

- The boy may have AFP due to poliovirus infection. You should collect a stool sample from Gemechis and immediately report to the District Health Office and have the sample sent to Addis Ababa for laboratory analysis. For further evaluation and treatment, refer the child to the nearest health centre.

As a Health Extension Practitioner, if you identify a case of AFP you must report it immediately. You will also routinely need to give the oral polio vaccine (OPV) to all eligible children in your community.

4.4 Hepatitis B

In this section, we describe what hepatitis B is and how it is transmitted, its clinical symptoms, and how it can be treated and prevented. This will help you to identify cases of hepatitis and refer them for further investigation and treatment, and also to educate your community about what causes hepatitis B and how it can be prevented by vaccination and safer sexual practices.

4.4.1 Definition, cause and occurrence of hepatitis B

Hepatitis is a term referring to a serious inflammation of the liver. Several viruses can cause hepatitis, but the hepatitis B virus (or HBV) is the most important one. Hepatitis B disease is a major global health problem and the most serious type of viral hepatitis. The WHO estimates that an estimated two billion people have been infected with HBV worldwide, and more than 350 million have chronic (long-term) liver infections. About 600,000 people die

every year as a result either of acute liver infection, or of chronic liver damage or liver cancer, which develops slowly over decades and eventually leads to their death.

4.4.2 Mode of transmission and clinical manifestation of HBV

HBV is carried in the blood and other body fluids of people who are infected. It is usually spread by contact with infected blood or body fluids in the following ways:

- *Injury or injection*: with contaminated sharp unsterile objects or instruments.
- *From a pregnant mother to her baby*: During birth, the virus which exists in the blood or body fluid of the mother may be transmitted to the baby.
- *Unprotected sexual intercourse*: During sexual intercourse without a condom, the virus which exists in the blood of the infected person may be transmitted to the other partner through scratches or wounds, or through small breaks in the delicate membranes covering the sexual organs.

The incubation period of hepatitis B averages six weeks, but may be as long as six months. Young children who are infected (usually at birth) often show no symptoms. Also, a larger proportion of children become chronic carriers of HBV, compared with infected adults.

■ Do you remember what a 'chronic carrier' means?

□ It is a person who carries the infection for a long period of time and can transmit the infectious agent to others, but without showing any symptoms of the disease themselves.

People who show symptoms of hepatitis B disease may feel weak and experience stomach upsets and other flu-like symptoms, which may last several weeks or months. They may also have very dark urine or very pale stools. **Jaundice**, which presents with yellowing of the skin or a yellow colour in the whites of the eyes (Figure 4.5), is common. Jaundice results when the liver is unable to deal with a yellow substance called bilirubin, which is formed when old red blood cells are broken up and their constituents are recycled to make new red blood cells. If the liver is damaged, it can't deal with the bilirubin, which builds up in the body causing the yellow discoloration.

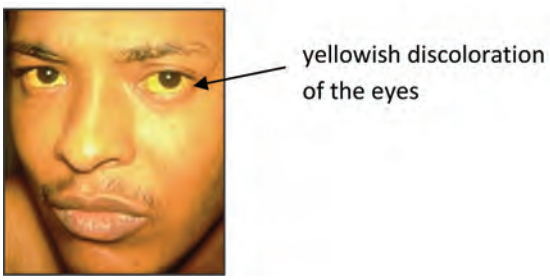


Figure 4.5 Yellowish colour in the white part of the eye due to hepatitis B. (Photo: CDC, accessed from **www.vaccineinformation.org/hepa/photos.asp**)

A laboratory blood test is required for confirmation of hepatitis B infection. Most HBV infections in adults are followed by complete recovery and 90% of adults will be completely rid of the virus within six months. Recovery also means that they are naturally protected from further infection with HBV for the rest of their lives. However, 30–90% of infants and children who become infected with HBV become chronic carriers of the virus, and they have a much increased risk of developing chronic, life-threatening liver damage or liver cancer much later in life.

4.4.3 Treatment, prevention and control of hepatitis B

You should be aware that there is no curative treatment for acute hepatitis B disease. Advise patients or the parents of affected children to try to keep eating and drinking; replacement of fluids lost through vomiting or diarrhoea is essential, and giving ORS is recommended if dehydration is a concern. In chronic hepatitis B infection, the disease can sometimes be halted with medication, but the drugs cost thousands of dollars and are rarely available in developing countries.

Prevention of hepatitis B disease is by vaccination, which is 95% effective. All infants should get three or four doses of hepatitis B vaccine during the first year of life, as part of routine vaccination schedules. In Ethiopia, it is usually given in the *pentavalent vaccine*, which protects against HBV and four bacterial diseases. Your role is to educate your community about how hepatitis B is transmitted and how transmission can be avoided, and you will need to give the pentavalent vaccine to infants.

The pentavalent vaccine and its administration is described in the *Immunization* Module.

■ Do you know another viral disease which has the same modes of transmission as hepatitis B? What health education messages can you give to people to protect themselves from both diseases?

□ HIV has the same modes of transmission as HBV. The advice on protection from acquiring both these viruses is to avoid contact with another person's blood or body fluids, particularly during sexual intercourse.

Ways to prevent transmission of HIV are described in detail in Study Session 26 of this Module; they also apply to prevention of HBV transmission.

In the rest of Part 1 of this *Communicable Diseases* Module (Study Sessions 5–12), you will be learning about a disease that cannot (at the present time) be prevented by vaccination, which is not caused by either bacteria or viruses. It is the vector-borne disease *malaria*, caused by a protozoan and transmitted by mosquitoes.

Summary of Study Session 4

In Study Session 4, you have learned that:

1 Measles, polio and hepatitis B are viral vaccine-preventable diseases; most infants and children are protected from these infections in Ethiopia and most other countries by routine vaccinations.

2 Measles virus is easily transmitted from person to person by the respiratory route. Typical symptoms include fever, cough, running nose, red eyes, diarrhoea and a widespread rash. Severe measles may lead to complications such as ear infections, loss of eyesight and pneumonia.

3 Vitamin A should be given to children with measles to prevent damage to the eyes, which may lead to blindness.

4 Poliomyelitis (caused by poliovirus) is transmitted from person to person through the faeco-oral route. Most children with polio infection do not show symptoms, but a few may develop acute flaccid paralysis (AFP).

5 Hepatitis B virus (HBV) has several routes of transmission, such as contact with infected blood or other body fluids, through wounds, from mother to child at birth, or during unprotected sexual intercourse.

6 People with hepatitis B present with fever, weakness and jaundice. Children infected with HBV may become chronic carriers; long-term complications such as permanent liver damage or liver cancer can develop in later life.

7 Cases of measles, AFP and hepatitis should be actively searched in the community and reported to the District Health Office. Diagnosis can only be confirmed by laboratory isolation of the viruses.

8 Patients with severe complications of measles, AFP or signs of hepatitis, should be referred to the nearest health centre.

9 There is no curative treatment for measles, polio or hepatitis B disease. Supportive treatment for reduction of symptoms of measles and hepatitis includes maintaining intake of nutrients and fluids. Exercise therapy may help to improve mobility in people with AFP.

Self-Assessment Questions (SAQs) for Study Session 4

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 4.1 (tests Learning Outcomes 4.1, 4.2 and 4.4)

Which of the following statements is *false*? In each case, explain what is incorrect.

A Pneumonia and clouding of the cornea are two of the common complications of severe measles.

B Measles is very rarely fatal.

C The transmission of poliovirus cannot be prevented at the present time.

D Acute flaccid paralysis (AFP) is a rare complication of polio; most children infected with poliovirus show no symptoms.

E Almost all adults infected with hepatitis B virus (HBV) become virus carriers for the rest of their lives.

F Jaundice is a common complication of hepatitis B disease.

SAQ 4.2 (tests Learning Outcomes 4.2 and 4.3)

You see a child in your village who has a rash all over his body, which developed three days ago; before that he was ill with fever and diarrhoea, his nose was running and his eyes were red. Now he has an ear infection, with pus coming out of his ear. What is the most likely cause of his illness? What do you do in response?

SAQ 4.3 (tests Learning Outcome 4.2)

In Table 4.2 below, write the mode of transmission and the method of prevention against each of the viral diseases in the first column.

Table 4.2 Modes of transmission and prevention of three common viral diseases.

Disease	Mode of transmission	Prevention
measles		
polio		
hepatitis B		

Study Session 5 Malaria Epidemiology and Transmission

Introduction

In this study session you will learn about the burden of malaria worldwide, in Africa and in Ethiopia. As malaria is a vector-borne disease you will learn about the vectors, which in the case of malaria are the mosquitoes that carry the malaria parasite from person to person. You will learn where mosquitoes lay their eggs and the stages of development leading up to a new flying adult. Information about the **breeding habitats** (water collections where mosquitoes lay eggs and develop), and the life cycle of mosquitoes, is essential for you to target anti-vector interventions in the right way. A clear understanding of the life cycle of the malaria parasite and of the mosquito, the vector which transmits it from person to person, will help you carry out your responsibility of protecting people in your community from getting malaria and of treating people who do get malaria.

Learning Outcomes for Study Session 5

When you have studied this session, you should be able to:

5.1 Define and use correctly all of the key words printed in **bold**. (SAQ 5.1)

5.2 Describe the burden of malaria globally, in Africa and Ethiopia. (SAQs 5.2 and 5.3)

5.3 Describe the life cycle of the malaria parasite. (SAQ 5.4)

5.4 Describe the life cycle of the mosquito vector. (SAQ 5.5)

5.5 Explain how to identify the potential vector of malaria and tell it from other mosquitoes. (SAQ 5.6)

5.6 Describe the behaviour of vector mosquitoes. (SAQ 5.7)

5.1 The burden of malaria

Malaria is one of the most serious diseases to affect people in developing countries with tropical and subtropical climates. It is particularly dangerous for young children and for pregnant women and their unborn babies, although others may also be seriously affected in some circumstances. Malaria is endemic in 109 countries and more than three billion of the world's population lives in malaria risk regions. Globally, 300–500 million episodes of malaria illness occur each year, resulting in over one million deaths. As Figure 5.1 (on the next page) shows, changes in socio-economic conditions and anti-malaria interventions have gradually reduced the areas of the world where malaria is endemic, but it is still widespread as a major global disease. A communicable disease is said to be **endemic** in a region or country if it is always present there. In areas where many cases occur throughout the year, the disease is said to be highly endemic, or (to say it another way) it has high endemicity.

Endemic is pronounced 'end-em-ik', and endemicity is pronounced 'end-em-iss-it-ee'.

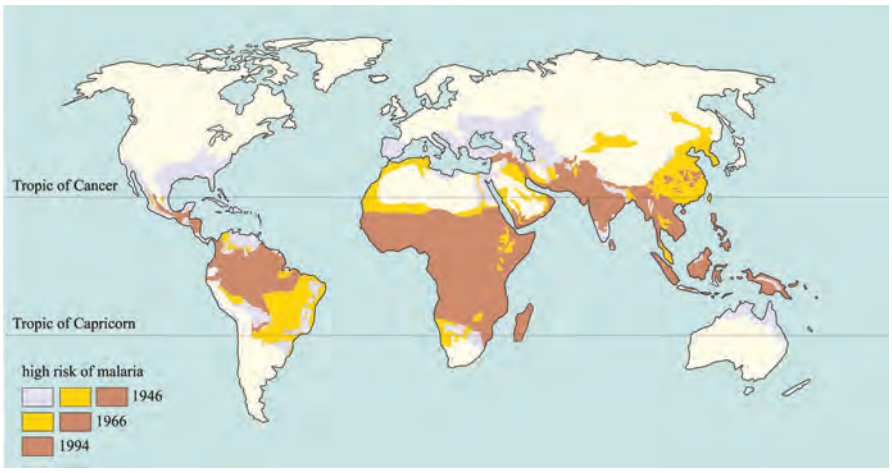


Figure 5.1 Changing geographical range of malaria. In 1946, the high risk range was all three coloured areas; by 1966, it was down to the yellow and brown areas; and by 1994 it was only the brown areas. (Source: The Open University, 2003, *Infectious Disease*, Book 5: *Evolving Infections*, Figure 3.1)

More than 90% of the worldwide deaths from malaria occur in sub-Saharan Africa and most of these deaths are in children. Malaria risk is highest in tropical Africa where conditions (which will be considered further below) are very favourable for malaria transmission (Figure 5.2).

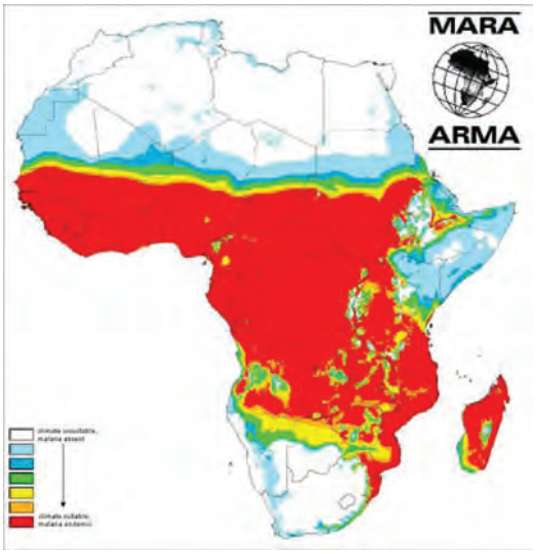


Figure 5.2 Distribution of malaria in Africa (WHO data).

- Look at Figure 5.2 and describe what it shows about the incidence of malaria in Africa.

- Figure 5.2 shows that the highest incidence of malaria (as shown in red) is around the equator and in the tropics. Malaria is much less common in the northern and southern part of the continent.

The intricate interactions between host, parasite, vector and the environment are the major factors in the distribution of malaria. Different areas can experience different levels of incidence rates.

Malaria can be viewed in terms of being *stable* or *unstable*. Malaria is said to be **stable** (and therefore endemic) when malaria infections occur for many months in a year, over many years. People living in highly endemic areas usually exhibit a high level of *immunity* and tolerate the infection well.

Immunity against malaria is the ability to fight the infection, which is developed by people with repeated episodes of malaria. Under endemic conditions, children under the age of five years, and pregnant mothers, are most likely to be infected as they have weaker immunity.

Unstable (epidemic) malaria refers to a seasonal type of transmission seen in areas of low endemicity, or to outbreaks in areas previously without malaria, or among non-immune persons. Epidemics can be due to changes in human behaviour, environmental and climate factors. For example, human migration and resettlement can introduce malaria into an area that did not have it previously, and this can expose a population to the disease that was not immune to malaria. Malaria epidemics generally occur when the population in an area has weak immunity to the disease, because so many people in the population will be vulnerable to malaria, not just children under five years of age and pregnant women.

However, it is important to remember that children and mothers are always more at risk, so they will need particular attention.

5.2 Epidemiology and distribution of malaria in Ethiopia

About 75% of the landmass of Ethiopia is malarious and 68% of the Ethiopian population, estimated at about 54 million in 2010, live in malaria risk areas. As you can see from Figure 5.3, malaria is a risk in the western and eastern lowlands and central midlands. However, it is absent or the risk is low in the central highlands, where the altitude (or elevation) is 2,000 metres or more above sea level, as Figure 5.3 shows. As you will see later, the reason is the effects of altitude on the habitat of the mosquito vector, and the development of the parasite inside the mosquito.

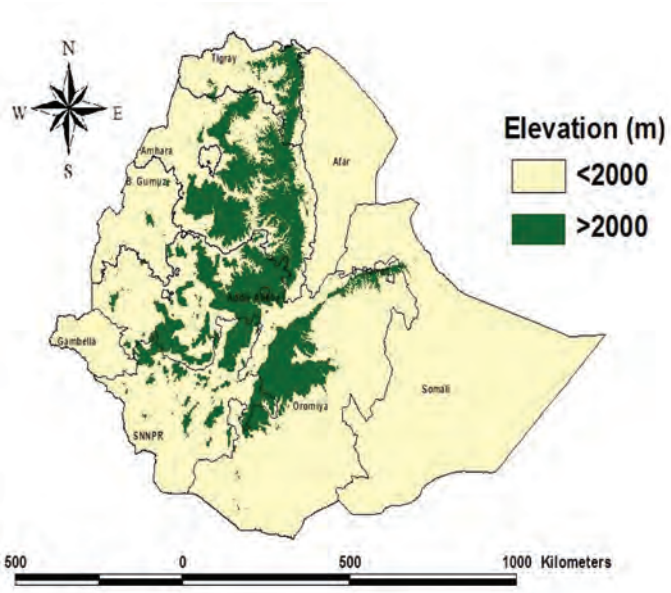


Figure 5.3 Malarious areas (below 2,000 metres elevation) and malaria-free areas (above 2,000 metres elevation) of Ethiopia. (Source: Ethiopian Federal Ministry of Health)

The exact number of people getting sick and dying of malaria every year in Ethiopia is not known. However, it is known that millions of people get sick and tens of thousands of people die due to malaria every year, and that rates of mortality (death) and morbidity (illness) dramatically increase during epidemics. The distribution of malaria in Ethiopia is not uniform. There are areas where the risk of malaria is high and there are areas where the risk is low. There are even areas, 25% of the country, that are malaria free.

You learned in Section 5.1 above that malaria transmission is classified as stable or unstable. The three most important factors that affect the distribution of malaria and its severity in Ethiopia are:

- Temperature
- **Humidity** (the amount of moisture in the air)
- The availability of water collections in which the mosquito vectors can breed.

Altitude, vegetation and rainfall have indirect effects because of their impact on temperature, humidity and availability of water collections for vector breeding.

The distribution of malaria in Ethiopia varies from place to place due to the above factors directly or indirectly affecting the pattern of malaria transmission. For example, the distribution of malaria in Ethiopia is largely determined by altitude. Altitude affects the pattern of malaria distribution in Ethiopia through its effect on temperature. Risk of malaria is highest in the western lowlands of Oromia, Amhara, Tigray and almost the entire regions of Gambella and Benishangul Gumuz. The midlands of Ethiopia between 1,000 and 2,200 metres altitude experience seasonal transmission of malaria with sporadic epidemics every few years. In the eastern lowlands of Ethiopia (primarily Afar and Somali), malaria is endemic only along the rivers, as this part of the country is largely dry away from rivers. Transmission is limited by the lack of water collections for mosquito breeding and low humidity due to low rainfall and sparse vegetation. The central highlands of Ethiopia are free of malaria mainly due to the low temperatures, which slows the development of the vector and the parasite.

5.3 Malaria parasites

Malaria is caused by *Plasmodium* parasites. *Plasmodium* parasites infect people and attack the red blood cells, which often leads to severe illness and death. The parasites are spread to people through the bites of infected *Anopheles* mosquitoes, which are the malaria vectors and which bite mainly between dusk and dawn.

The species names of malaria parasites are frequently abbreviated to *P. falciparum*, *P. vivax*, etc.

There are four types of human malaria, each due to one of the parasites with the following specific names:

- *Plasmodium falciparum*
- *Plasmodium vivax*
- *Plasmodium malariae*
- *Plasmodium ovale.*

Plasmodium falciparum and *Plasmodium vivax* are the most common malaria parasites in Ethiopia. 60% of malaria infections in Ethiopia are due to *P. falciparum* and 40% are due to *P. vivax*. *P. falciparum* is the most deadly and requires special attention.

Although both parasites are widely distributed, some communities will have more *falciparum* malaria while others will have more *vivax* malaria. Do you know which type of infection is more common in your community?

5.3.1 Life cycle of the malaria parasite

Human malaria (*Plasmodium* parasite) is transmitted from an infected person to another person by *Anopheles* mosquitoes, as shown in Figure 5.4. The parasite spreads by infecting two types of hosts: humans and female *Anopheles* mosquitoes. The mosquitoes then act as the vector for the parasite. Malaria is a human parasite that is transmitted only between people; malaria is not transmitted from animals to humans, or from humans to animals.

Figure 5.4 How malaria is transmitted from one person to another. (WHO, 1996, *Malaria: A Manual for Community Health Workers*)

Now you are going to learn about the life cycle of the parasite. Please study Figure 5.5 (on the next page) very carefully as it is going to help you understand about the pathology, signs, symptoms and treatment of malaria in the subsequent study sessions.

Malaria in humans develops via two stages: a liver and red blood cell stage. When an infected mosquito pierces a person's skin to take a blood meal, malaria parasites in the mosquito's saliva enter the bloodstream and migrate to the person's liver. Within 30 minutes of being introduced into the human body, they infect liver cells, multiplying in the liver cells for a period of 6–15 days. In the process they become thousands of parasites which,

following rupture of the liver cells, escape into the blood and infect red blood cells, thus beginning the red blood cell stage of its life cycle.

Within the red blood cells, the parasites multiply further, periodically breaking out of their host cells to invade fresh red blood cells. Several replication cycles occur. The pathology and clinical manifestations associated with malaria are almost exclusively due to the red blood cell stage parasites (Figure 5.5). The blood stage parasites are those that cause the symptoms of malaria.

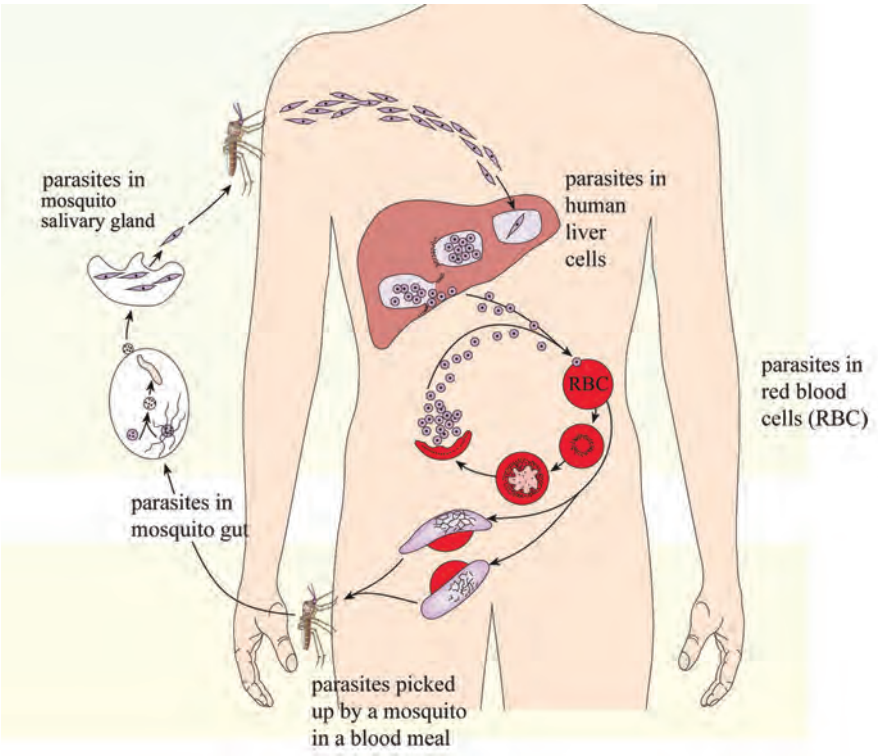


Figure 5.5 Life cycle of the malaria parasite. (Adapted from: The Open University, 2003, *Infectious Disease*, Book 5: *Evolving Infections*, Figure 3.4)

When certain forms of blood stage parasites, called *gametocytes*, are picked up by a female *Anopheles* mosquito during a blood meal, they start another, different cycle of growth and multiplication in the mosquito. After 10–18 days, the parasites are found in the mosquito's salivary glands. When the *Anopheles* mosquito takes a blood meal from another human, the parasites are injected with the mosquito's saliva and start another human infection when they enter the new person's liver cells. Thus the mosquito carries the disease from one human to another, acting as a vector. Unlike the infected human, the mosquito vector does not suffer from the presence of the parasites.

The most common way to be infected with malaria is through the natural transmission by mosquitoes, as already described. However, malaria can also be transmitted via blood transfusions or sharing syringes. Mother to child transmission during pregnancy has also been documented, but all the modes of transmission other than via the mosquito are believed to be very rare and unimportant.

5.3.2 Incubation period of malaria

When a person becomes infected with one of the *Plasmodium* parasites that cause malaria, he or she will not feel sick immediately. The period between infection with the parasites that cause the disease and the beginning of malaria symptoms is called the **malaria incubation period**. The infected person may feel normal from 7 to 21 days when infected with *Plasmodium* parasites. *P. falciparum* has a shorter incubation period (7 to 14 days) than *P. vivax* (12 to 18 days). *Plasmodium malariae* tends to have a much longer incubation period, as you can see from Table 5.1.

Table 5.1 Incubation period of malaria parasites.

Malaria parasites	Incubation period in days
P. falciparum	7–14
P. vivax	12–18
P. ovale	12–18
P. malariae	18–40

As you will learn in Study Session 7, *Plasmodium* infection causes fever in cycles or episodes which occur at either 48 or 72 hour intervals. Episodes of fever occur when the parasites are released into the blood and infect new red blood cells (see Figure 5.5).

5.3.3 Partial immunity to malaria

The severity of the attack depends on the *Plasmodium* species, as well as other circumstances, such as the state of immunity and the general health and nutritional status of the infected individual.

Following several attacks of malaria, people living in highly endemic regions can develop partial immunity that can protect them from severe attacks and death. But no-one develops complete immunity against malaria that can fully protect the person from infection. Pregnant women and children under five years of age are more susceptible to severe forms of the disease and death due to their weak immune system.

5.4 Life cycle of the mosquito vector

Now you will learn about the life cycle of the vector of the malaria parasite, the mosquito. Mosquitoes have four different stages in their life cycle: the egg, larva, pupa and adult (see Figure 5.6 on the next page). The first three stages are immature and are found in water collections. The adult is a flying insect. The time taken for the different stages to develop depends on temperature and nutritional factors in their environment. Development takes a shorter time at higher temperatures.

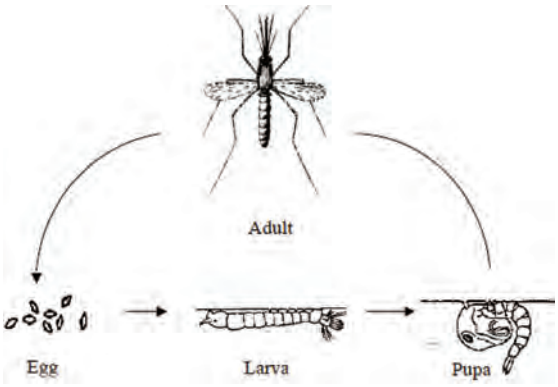


Figure 5.6 Life cycle of the malaria vector mosquitoes (*Anopheles* species). (WHO, 1997, *Vector Control Methods for Use by Individuals and Communities*)

5.4.1 Eggs

A female *Anopheles* mosquito normally mates only once in her lifetime. It usually requires a blood meal after mating before her eggs can develop. While the blood meal is not essential for the survival of female mosquitoes, it is crucial for successful egg production and egg laying. Blood meals are generally taken every two to three days, before the next batch of eggs is laid. About 100 to 150 eggs are laid on the water surface during oviposition (egg laying). Oviposition sites vary from small hoof prints and rain pools to streams, swamps, canals, river beds, ponds, lakes and crop fields. Each species of mosquito prefers different types of habitats to lay eggs. Under the best conditions in the tropics, the average lifespan of female *Anopheles* mosquitoes is about three to four weeks.

5.4.2 Larvae

Larvae (pronounced 'lah-vee') is the plural of larva ('lah-vah'); this stage of the life cycle is called the larval stage ('lah-val'). Pupae (pronounced 'pyoo-pee') is the plural of pupa ('pyoo-pah'); this stage of the life cycle is called the pupal stage ('pyoo-pal').

A larva hatches from the egg after one or two days and generally floats parallel under the water surface, since it needs to breathe air. It feeds by taking up food from the water. When disturbed, the larva quickly swims towards the bottom, but it soon needs to return to the surface to breathe. There are four larval stages or *instars*. The small larva emerging from the egg is called the first instar. After one or two days it sheds its skin and becomes the second instar, followed by the third and fourth instars at further intervals of about two days each. The larva remains in the fourth instar stage for three or four more days before changing into a pupa. The total time spent in the larval stage is generally eight to ten days at normal tropical water temperatures. At lower temperatures, the larval stages take longer to develop.

5.4.3 Pupae

The pupa is the stage during which a major transformation takes place, from living in water to becoming a flying adult mosquito. The pupa is shaped like a comma. It stays under the surface and swims down when disturbed, but it does not feed. The pupal stage lasts for two to three days, after which the skin of the pupa splits. Then the adult mosquito emerges and rests temporarily on the water's surface until it is able to fly.

5.4.4 Adult mosquitoes

Mating takes place soon after the adult emerges from the pupa. The female usually mates only once because it receives sufficient sperm from a single mating for all subsequent egg batches. Normally the female takes her first blood meal only after mating, but sometimes the first blood meal can be taken by young virgin females. The first batch of eggs develops after one or two blood meals (depending on the species); while successive batches usually require only one blood meal. The process of blood-feeding, egg maturation and egg laying is repeated several times throughout the life of the mosquito. The length of time between two feeding cycles depends on the external temperature. In *Anopheles arabiensis*, for example, the cycle takes 48 hours when the average day-night temperature is 23°C.

5.5 Malaria transmitting vectors in Ethiopia

You have now learned that malaria is transmitted from an infected person to another person by mosquitoes. However, not all mosquitoes carry malaria. There might be mosquitoes biting people in your village, but they may not be the ones that transmit the infection. The mosquitoes that transmit malaria belong to a group of mosquitoes called *Anopheles*. However, not all *Anopheles* mosquitoes are vectors of malaria. For example there are more than 40 species of *Anopheles* mosquitoes in Ethiopia, but only four species of *Anopheles* mosquitoes carry malaria. The scientific names of these mosquitoes are:

The scientific names of the mosquitoes that transmit malaria parasites are often abbreviated to *An. arabiensis, An. pharoensis,* etc.

- *Anopheles arabiensis*
- *Anopheles pharoensis*
- *Anopheles funestus*
- *Anopheles nili.*

An. arabiensis is the most important transmitter of malaria in Ethiopia and is responsible for more than 95% of transmissions. It is found everywhere in Ethiopia. The other three are secondary vectors of very minor importance.

Distinguishing the above four species of *Anopheles* from other *Anopheles* mosquitoes is not your responsibility and will not be part of this training. However, it is important for you to distinguish *Anopheles* mosquitoes in general from other mosquitoes at their larval stage. You will see the importance of this knowledge when you learn about vector control in Study Session 9.

5.6 Distinguishing *Anopheles* mosquitoes from other types

The terms ‘anophelines’ and ‘culicines’ refer to all species of these mosquito types.

There are two common types of mosquitoes that lay their eggs in water: anophelines, which can be vectors of malaria, and culicines, which do not carry malaria. It is very important that you know the difference in the morphology (structure and shape) of these mosquitoes to identify the exact breeding habitats that support the development of the potential vectors.

Now study the differences in the body structure and resting position in water collections of the anopheline and culicine larvae, as illustrated in Figure 5.7. You don't need magnifying or other equipment to distinguish anopheline and culicine larvae. You can tell the difference by looking at the larvae in the vector breeding waters. Your mentor will show you the difference between the two during your practical training. This will be a very important part of your task as a Health Extension Practitioner: identifying water collections that shelter anopheline larvae and taking action to eliminate such breeding grounds or kill the larvae. You will learn more about the action against mosquito larvae in Study Session 8.

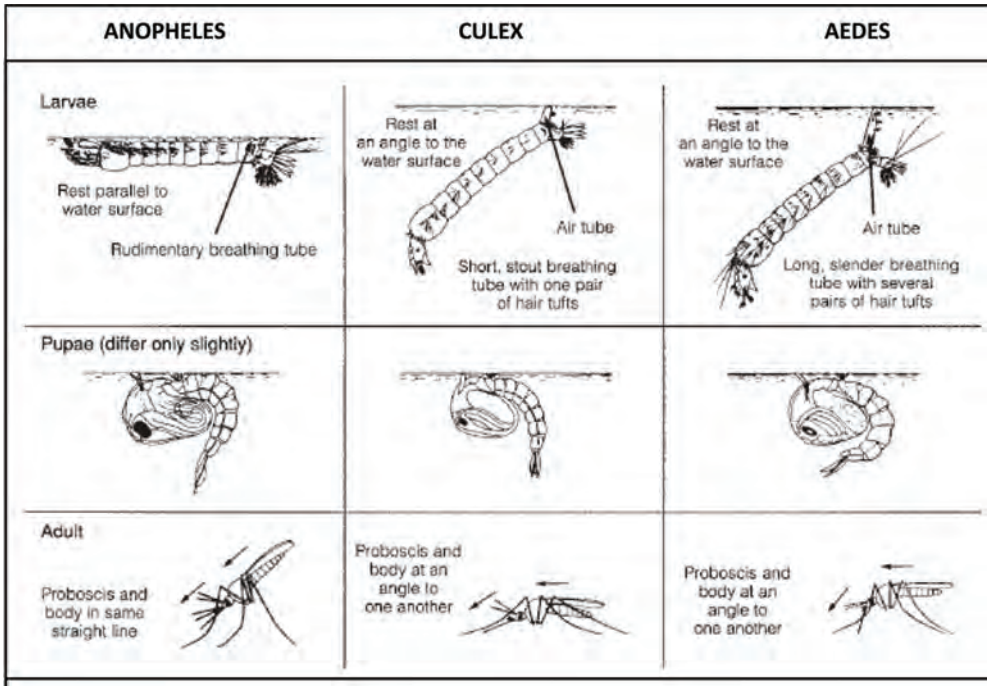


Figure 5.7 Distinguishing features of anopheline mosquitoes (potential malaria vectors) and culicine and aedes mosquitoes (which don't transmit malaria). (WHO, 1997; source as in Figure 9.2)

There are four stages in the mosquito life cycle, and three of them — eggs, larvae and pupae — are to be found in water.

5.6.1 Eggs

Mosquito eggs either clump together in a 'raft' (*Culex*) or float separately (*Aedes*); anopheline eggs float separately and each of them has 'floats'.

5.6.2 Larvae

The culicine larva has a breathing tube (siphon) which it also uses to hang down from the water surface, whereas the anopheline larva has no siphon and rests parallel to and immediately below the surface.

5.6.3 Pupae

Pupae of both anophelines and culicines are comma-shaped and hang just below the water surface. They swim when disturbed. The breathing trumpet of the anopheline pupa is short and has a wide opening, whereas that of the culicine pupa is long and slender with a narrow opening. However, it is difficult to distinguish anopheline from culicine pupae in the field.

5.6.4 Adults

With live mosquitoes, you can distinguish between adult anopheline and culicine mosquitoes by observing their resting postures. Anophelines rest at an angle between 50° and 90° to the surface, whereas culicines rest more or less parallel to the surface.

5.7 Behaviour of mosquitoes that transmit malaria

To help you work effectively to prevent malaria transmission, you need to learn about the most important behaviours of a malaria-transmitting mosquito.

Female mosquitoes can feed on animals and humans. Most species show a preference for certain animals or for humans. They are attracted by the body odours, carbon dioxide and heat emitted from the animal or person. Species of mosquitoes that prefer to feed on animals are usually not very effective in transmitting diseases from person to person. Those who prefer to take human blood are the most dangerous as they are more likely to transmit diseases between people. One of the reasons why *An. arabiensis* mosquitoes are better vectors of malaria than other mosquitoes is that they feed mostly on humans and very little on cattle.

Most anopheline mosquitoes bite at night. Some species bite just after sunset while others bite later, around midnight or in the early morning. Those that bite in the early evening may be more difficult to avoid than species that feed at night.

Some species prefer to feed in forests, some outside houses and others indoors. Mosquitoes that enter a house usually rest on a wall, under furniture or on clothes hanging in the house. Mosquitoes that bite outside usually rest on plants, in holes, in trees, or on the ground, or in other cool dark places. Mosquitoes that rest indoors are the easiest to control, as you will learn in Study Session 6.

Because digestion of the blood-meal and development of the eggs takes 2–3 days, a blood-fed mosquito looks for a safe resting place that is shaded and offers protection from drying out. Some species prefer to rest in houses or cattle sheds, while others prefer to rest outdoors, on vegetation or at other natural sites. After the mosquito takes a blood meal indoors, it usually rests inside the house, some for a short period and some for days. Mosquitoes do not usually bite while eggs are developing.

Adult females can normally live between 20 days and one month. The average survival is much shorter at 6–9 days. The average life-span of the female has direct relevance to its efficiency as a malaria vector, because it has to live long enough to transmit malaria (i.e. long enough for the parasite to complete its life cycle in the mosquito host, approximately 10 days).

On average, the flight range of adult *Anopheles* is between a few hundred metres and 2 kilometres. Therefore water collections very close to houses are more important sources of vectors than those located far away from houses. As you will see in Study Session 9, this is something that could be important when considering vector control measures to prevent vectors from breeding in water collections.

Summary of Study Session 5

In Study Session 5, you have learned that:

1 Malaria is a major public health problem in the world, Africa and Ethiopia, affecting millions of people each year.

2 The malaria parasite is transmitted from person to person by the bite of female mosquitoes.

3 The parasite is taken by the mosquito when feeding on an infected person.

4 The parasite develops and multiplies in the mosquito body and the cycle takes about 10 days, depending on the temperature.

5 The parasites are injected into humans when the mosquito bites.

6 Studying the life cycle of the malaria parasite that causes human malaria makes understanding the pathology, signs, symptoms and treatment of the disease easier.

7 Water collections are important for vector breeding.

8 Malaria is transmitted by *Anopheles* mosquitoes only; the larvae of *Anopheles* mosquitoes can be easily distinguished from other non-vector mosquitoes.

9 A female *Anopheles* mosquito needs to feed on blood to develop its eggs and reproduce.

10 The life cycle of the malaria vector from egg to adult takes 8 to 12 days, depending on temperature.

11 The vectors bite people from dusk to dawn.

12 The vectors can bite people indoors or outdoors.

13 The vectors feeding indoors are likely to spend some time resting inside houses after taking a blood meal.

14 Understanding the behaviour of the vector is important to plan preventive measures.

Self-Assessment Questions (SAQs) for Study Session 5

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 5.1 (tests Learning Outcome 5.1)

A person from a malaria-free place visiting a high malaria risk area shows signs and symptoms of malaria after 8 days of his stay in the area. Which of the following types of malaria parasites is the person most likely to be infected with: *P. falciparum, P. vivax, P. ovale* or *P. malariae*? Explain how you reached your answer.

SAQ 5.2 (tests Learning Outcome 5.2)

You have learned that the burden of malaria in Africa is higher than other parts of the world, and also that the malaria incidence varies in different regions of Africa. Where in Africa is the incidence of malaria highest? Where is malaria incidence low?

SAQ 5.3 (tests Learning Outcome 5.2)

The distribution of malaria in Ethiopia is not uniform. What are the possible explanations for the difference in malaria incidence in different areas of Ethiopia?

SAQ 5.4 (tests Learning Outcome 5.3)

Carefully study the life cycle of the parasite in the human body and the mosquito (see Figure 5.5). List the body parts of the mosquito and the body parts of humans that are directly associated with parasite development and reproduction.

SAQ 5.5 (tests Learning Outcome 5.4)

The following are statements about the life cycle of the malaria vector mosquito. Which of these statements is *false*? In each case, explain what is incorrect.

A The malaria vector mosquito lays its eggs on grass.
B The malaria vector mosquito life cycle has four stages.
C The malaria vector mosquito needs to feed on blood to develop its eggs.
D The adult female mosquito lays eggs only once in its life time.
E The stage that hatches from the eggs is the *pupae.*

SAQ 5.6 (tests Learning Outcome 5.5)

List two characteristics that illustrate how the *Anopheles* larvae are different from other mosquito larvae.

SAQ 5.7 (tests Learning Outcome 5.6)

You know that the parasite needs 10 days to develop inside the mosquito body. Therefore the mosquito needs to live at least 10 days to be able to transmit the infection. 10% of the mosquitoes live more than 10 days in February and more than 20% of them live more than 10 days in September.

(a) Do you expect malaria transmission to occur during these two periods?
(b) During which period will the incidence of malaria be higher?

Study Session 6 Factors that Affect Malaria Transmission

Introduction

As you learned in Study Session 5, the incidence of malaria varies from place to place and at different times. Such variations are very common in Ethiopia. There are areas where the incidence of malaria is high and other areas where the incidence is low, and some areas are malaria free. In some communities, malaria transmission lasts for several months or happens throughout the year, and in other areas it is very brief.

In this study session you will learn about the factors that affect the transmission and incidence of malaria. Climate affects the natural distribution of malaria in Ethiopia and elsewhere in the world. The three main climatic factors that directly affect malaria transmission are *temperature, rainfall* and *relative humidity* (the amount of moisture in the air). Several non-climatic factors, including differences between human hosts, human migration, and development projects, can also affect the pattern of malaria transmission and the severity of the problem.

Climatic means 'relating to the climate'.

Understanding the climatic and non-climatic factors that affect malaria transmission will help you to understand the risk of malaria in your village better. This kind of understanding will also be useful to you in monitoring, preventing, or controlling local malaria epidemics (Study Session 12).

Learning Outcomes for Study Session 6

When you have studied this session, you should be able to:

6.1 Define and use correctly all of the key words printed in **bold**. (SAQ 6.1)

6.2 Describe how temperature affects the development of the parasite and the vector, and explain the association between temperature and the distribution of malaria in Ethiopia. (SAQs 6.2 and 6.3)

6.3 Explain how humidity influences malaria transmission. (SAQs 6.1 and 6.3)

6.4 Explain the relationship between rainfall and malaria transmission. (SAQ 6.4)

6.5 Describe how important non-climatic factors influence the pattern and severity of malaria transmission. (SAQs 6.5 and 6.6)

6.1 Climatic factors

Climatic factors greatly influence the pattern and level of malaria transmission in Ethiopia, in Africa and the world. The most important **climatic factors** that directly affect malaria transmission are temperature, rainfall and humidity. We will consider these in turn. You may find it useful first to look back at Figure 5.5 to remind yourself of the lifecycle of the malaria parasite.

6.1.1 Temperature

The ranges of minimum and maximum temperature greatly affect the development of the malaria parasite and its mosquito vector, which determines malaria transmission.

Temperature and parasite development

Temperature affects the life cycle of the malaria parasite. The time required for the parasite to complete its development in the gut of the mosquito is about 10 days, but it can be shorter or longer than that depending on the temperature. As the temperature *decreases*, the number of days necessary to complete the development *increases* for a given *Plasmodium* species. *P. vivax* and *P. falciparum* have the shortest development cycles and are therefore more common than *P. ovale* and *P. malariae*.

The time needed for the parasite to complete its development in the mosquito, decreases to less than 10 days as temperature increases from 21°C to 27°C, with 27°C being the optimum. The maximum temperature for parasite development is 40°C. Below 18°C, the life cycle of *P. falciparum* in the mosquito body is limited. The minimum temperatures are between 14–19°C, with *P. vivax* surviving at lower temperatures than *P. falciparum*. Malaria transmission in areas colder than 18°C can sometimes occur because the *Anopheles* often live in houses, which tend to be warmer than the outside temperature.

Temperature and mosquito development

Development of the mosquito larva also depends on temperature – it develops more quickly at higher temperatures. Higher temperatures also increase the number of blood meals taken and the number of eggs laid by the mosquitoes, which increases the number of mosquitoes in a given area.

The minimum temperature for mosquito development is between 8–10°C; the optimum temperature is 25–27°C, and the maximum temperature for is 40°C.

Altitude and temperature

As you saw in Figure 5.3 in the previous study session, **altitude** (elevation above sea level) is one of the most important factors that determines the pattern of malaria transmission in Ethiopia. Altitude in Ethiopia varies from 100 metres below sea level to more than 4,000 metres above sea level. Altitude influences the distribution and transmission of malaria indirectly, through its effect on temperature. As altitude increases, temperature decreases, so highlands are colder and lowlands are warmer.

In the Ethiopian highlands, with altitudes between 2,000 and 2,400 metres, malaria transmission occurs for short periods only when temperatures rise unusually high.

- Can you explain why transmission occurs during these periods?

- The increased temperature allows the development of parasites to occur in the mosquitoes, and the mosquito population also increases as the temperature rises.

Beyond 2,400 metres, the temperature does not go high enough to support malaria transmission and these areas are free of malaria.

Addis Ababa is free of malaria, and most of the Ethiopian highlands above 2,000 metres have little or no locally transmitted malaria (Figure 6.1). The most important reason for this is that it is generally too cold in the highlands for mosquitoes to develop in large numbers, or for the malaria parasite to develop inside the vector.

Figure 6.1 The temperature above 2,400 metres in the Ethiopian highlands is too low for malaria transmission to occur. (Photo: Basiro Davey)

Equatorial Africa

Now look back at the map showing the distribution of malaria in Africa (Figure 5.2 in the previous study session). From your school geography education, you may remember that temperatures are higher around the equator and do not vary much through the year. Temperatures decrease progressively as you move north or south of the equator. The red part of the map shows a very high level of transmission around the equator and the light blue colour represents lower malaria transmission further north and south of the equator. One of the reasons for high levels of transmission near the equator is the warm and relatively constant temperature in tropical Africa.

6.1.2 Rainfall

As you learned in Study Session 5, anopheline mosquitoes breed in water. So the right amount of rainfall is often important for them to breed. Different anopheline mosquitoes prefer different types of water bodies in which to breed. In Ethiopia, water collections that support vector breeding appear mainly after the rains, and therefore malaria transmission is highest following the rainy season.

Of course, too much rainfall can flush away breeding habitats temporarily, but mosquitoes start breeding as soon as the rain stops. In most cases, flushing has a bigger impact on vector breeding habitats in the highlands and hilly areas than in the lowland plains. Not all water collections are suitable for the mosquito life cycle. In Ethiopia, rain water collections are the most important breeding ground, as the anopheline mosquitoes prefer to breed in fresh water collections created after the rainy season. Such water bodies may be clear or muddy (Figure 6.2 on the next page) but they are not polluted.

Note that the anopheline mosquitoes that transmit malaria do not breed in foul-smelling polluted water.

Figure 6.2 A muddy rainwater collection can support mosquito breeding if it is not polluted. (Photo: Dr Daddi Jima)

There are also places where *less* rainfall and drought can favour mosquito breeding and malaria transmission. Such places are usually covered by vegetation throughout the year and streams and rivers often flow rapidly. When the rains fail or are delayed, the flow of streams is interrupted and pooling occurs along the stream. Pooling creates a favourable environment for mosquito breeding. Malaria vectors mainly breed in stagnant water collections, rarely in slightly moving waters and never in rapidly flowing rivers and streams.

In drier areas, rainfall can also affect malaria transmission indirectly through its effect on humidity. Vegetation cover increases after rainfall, which in turn increases the relative humidity of the environment. The effect of humidity on malaria transmission is considered below.

6.1.3 Relative humidity

Relative humidity refers to the amount of moisture in the air, expressed as a percentage; (0% humidity would mean the air is completely free of moisture and 100% humidity would mean the air is completely saturated with moisture). Relative humidity affects malaria transmission through its effect on the activity and survival of mosquitoes. You may recall that mosquitoes need to live at least 8–10 days to be able to transmit malaria.

- Why is it important that mosquitoes should live this long, for the transmission of malaria?

- This is the length of time required for the parasite to develop inside the mosquito host. If the mosquito dies before the parasite has developed, then transmission of the parasite cannot occur.

Mosquitoes survive better under conditions of high humidity. They also become more active when humidity rises. This is why they are more active and prefer feeding during the night – the relative humidity of the environment is higher at night. If the average monthly relative humidity is below 60%, it is believed that the life of the mosquito is so short that very little or no malaria transmission is possible.

6.1.4 Combining the effects of climatic factors

Now think of your village in terms of its suitability for malaria transmission. How many (if any) malaria cases occur each month? Does the number vary between months? When do you see the highest number? Write down the

reasons you think are responsible for the variation in the number of malaria cases in your community. Then answer the following questions.

- What factors do you think are responsible for the high malaria incidence in some months? Consider the following factors and decide which of them would apply to your village

  (a) Immediately following the rains; if so, why?
  (b) When the temperature is hot; if so, why?
  (c) When the rains fail and there is drought; if so, why?
  (d) When the fields are covered with vegetation; if so, why?

- Of course, we don't know the climatic pattern in your village, but malaria transmission could be high:

  (a) *Immediately following the rains,* because there will be plenty of water collections for vector breeding after the rainy season.
  (b) W*hen the temperature is hot,* because temperature speeds up vector and parasite development.
  (c) *When the rains fail and there is drought,* because rivers and small streams slow down into pools, creating stagnant water collections for vector breeding.
  (d) *When the fields are covered with vegetation,* because when the vegetation cover is high the humidity increases; higher humidity helps the mosquito to live longer and transmit malaria.

6.2 Non-climatic factors

Factors that affect malaria transmission, but which are not related to the climate, are called **non-climatic factors**. The type of vector, the type of parasite, environmental development and urbanisation, population movement and migration, the level of immunity to malaria in the human hosts, insecticide resistance in mosquitoes, and drug resistance in parasites, all have a role in affecting the severity and incidence of malaria. We will look at each of these in turn.

6.2.1 Malaria vectors

As you learned in the Study Session 5, not all mosquitoes transmit malaria – only *Anopheles* mosquitoes (Figure 6.3) can carry the malaria parasite. In Ethiopia there are about 40 different species of *Anopheles* mosquitoes, but only four of them are known to transmit malaria parasites, and just one of them, *Anopheles arabiensis*, is responsible for more than 95% of malaria transmissions.

Figure 6.3 The *Anopheles* mosquito – the malaria vector.

Different species of *Anopheles* mosquitoes differ in their capacity to transmit malaria. This depends on the biology and behaviour of the mosquitoes. Mosquitoes in the *Anopheles gambiae* group (which includes *A. arabiensis)*, are the most efficient malaria vectors in the world. These mosquitoes are found only in Africa. In fact, the higher incidence of malaria in Africa compared to other parts of the world is mainly due the efficiency of these mosquitoes in transmitting the parasites.

Mosquitoes need a blood meal to develop and reproduce. They can take their blood meal either from humans or animals. Mosquitoes that mainly feed on humans are more efficient carriers of malaria than those that feed on animals.

One reason why mosquitoes in the *A. gambiae* group are very good vectors of malaria is that they prefer to bite humans more than animals. Mosquitoes that feed on humans and animals equally are much weaker vectors of malaria. Others feed exclusively on animals and are not malaria vectors. Therefore, the type of *Anopheles* mosquitoes and their feeding behaviour influence the intensity of transmission in an area.

Your knowledge and practical skills in identification of important breeding habitats in your village will be very helpful in your malaria prevention activities.

Mosquitoes adapted to breeding close to human settlements, and able to breed in a wide range of environments, are also better vectors of malaria than mosquitoes that breed away from human habitation. Some mosquitoes breed in small pools that are partially or completely exposed to the sun, while others prefer to breed in shaded stagnant pools. *A. gambiae* mosquitoes breed in a wide range of habitats, including small water collections such as hoof-prints, water-filled holes in rocks and trees, as well as dams, river beds and lake shores. Because *A. gambiae* vectors can breed in so many different habitats, they are responsible for much of the malaria transmission in Africa.

The main vector of malaria in Ethiopia, *A. arabiensis*, can be found in a variety of water collections, mainly closer to human habitations. However, stagnant water collections in borrow pits, ponds, micro-dams, pools in small rivers, and streams created immediately after the rainy season, are the most important breeding habitats for this vector.

6.2.2 Malaria parasites

You learned in Study Session 5 that there are four types of malaria parasite that can infect people. They are single-celled protozoa that can only be seen if viewed under a microscope (Figure 6.4).

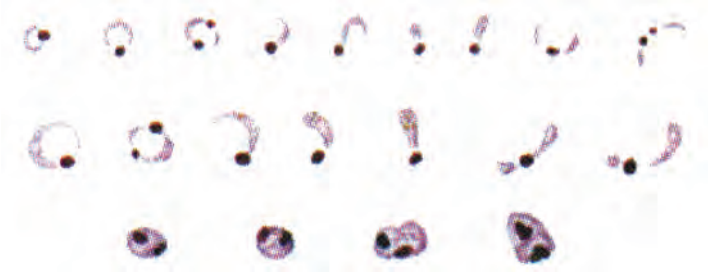


Figure 6.4 Developmental stages of malaria parasites (*Plasmodium* species) in the blood, stained to make them visible when magnified by a microscope. (Source: WHO, 1991, *Basic Malaria Microscopy, Part 1: Learner's Guide*, 2nd edition)

■ Can you recall the two forms of malaria that are most common in Ethiopia, and which one of them is more dangerous?

□ *P. vivax* is responsible for around 40% of cases and *P. falciparum* is responsible for around 60% of cases of malaria in Ethiopia. *P. falciparum* causes the most dangerous type of malaria and often kills untreated patients. *P. vivax* (and the other two rare forms) can make people very sick, but are not usually killers.

In some areas of Ethiopia *falciparum* malaria is more common, while in other areas *vivax* malaria is more common. *Falciparum* malaria is more common in Africa than in other parts of the world, and this is one reason why there are more deaths from malaria in Africa than elsewhere.

6.2.3 Water development projects

Big and small water-related development projects, such as irrigation channels, dams and ponds, can increase the incidence of malaria in villages that are located near such projects.

■ How can water development projects affect malaria transmission?

□ They create more vector breeding habitats; more vectors mean more malaria transmission.

Agricultural development, particularly with the use of irrigation, creates breeding sites for malaria mosquitoes, leading to increased malaria transmission. For instance, the use of irrigation to flood agricultural land during rice cultivation has long been associated with an increase in the number of vectors and a corresponding increase in the burden of malaria. Irrigated farming and rice agriculture is becoming more common in the lowlands of Ethiopia.

You will learn about environmental management to reduce the breeding sites for mosquitoes in Study Session 9 of this Module.

6.2.4 Urbanisation

The incidence of malaria is generally lower in urban areas than in rural areas. There are a number of reasons for this:

- While there is plenty of space for vector breeding in rural villages, mosquito breeding sites in urban areas are limited because more space is covered by houses.
- The main vectors of malaria in Ethiopia and elsewhere in Africa, are mosquitoes in the *A. gambiae* group, which breed in clean water; most water collections in urban settlements are polluted and unfavourable for mosquito breeding.
- People in urban areas may have more access to health care and malaria prevention strategies than people in rural villages.

However, rapid urbanisation of areas within or on the outskirts of urban centres is commonly done in an uncontrolled fashion without thought or planning (Figure 6.5). The settlers are mainly migrant workers from rural villages. Conditions are crowded; housing is often of poor quality or is of temporary construction; and the provision of health care and sanitation is often inadequate.

Figure 6.5 Rapid unplanned urban development can create many new breeding grounds for malaria vectors. (Photo: Basiro Davey)

Settlers tend to dig several pits to extract stone and soil for house construction, creating numerous breeding grounds for mosquitoes. This can lead to explosive growth of mosquito vectors, increased exposure of the population to vectors due to poor housing, and amplification of disease to epidemic proportions through lack of effective treatment.

Your main responsibility as a rural Health Extension Practitioner is mainly to provide care and set up preventive measures in rural communities. However, some semi-urban settlements at the periphery of urban centres could fall under the rural classification and be part of your catchment area. Remember that people living in such semi-urban centres can be at a higher risk of malaria than typical rural communities.

6.2.5 Population movement and migration

Population movements have significant implications for malaria transmission. The majority of the population movements in Ethiopia involve people moving from the highlands to the malaria-endemic lowlands as seasonal labourers. These people are often employed as daily labourers in the crop fields during the planting and harvesting seasons (Figure 6.6), when malaria transmission is at its peak. The poor living conditions and inadequate health care in such agricultural projects often worsen the problem of malaria. Migrants from malaria-free highlands lack immunity against the disease, as well as the appropriate knowledge of the transmission process and how to avoid being bitten by mosquitoes.

Figure 6.6 Migrant labourers from malaria-free areas are at increased risk of malaria during harvesting in lowland malaria-endemic areas.
(Photo: Basiro Davey)

Migration for the purpose of permanent settlement in a new area is also common in Ethiopia and is a major factor associated with malaria transmission. Migration is often from densely populated highlands to malaria-endemic lowlands, where the population density is low and the soil is more fertile. Major environmental transformations like deforestation, and new construction etc, take place during resettlement, enhancing the proliferation of mosquito breeding sites, and resulting in major malaria outbreaks.

Population movements and migration also make the malaria problem worse in the areas from which the migrants came. Temporary migrant workers often bring the parasites back to the malaria-free highlands and local transmission can be readily established as many of these communities could support vector breeding. Such sporadic epidemics could affect a large number of people, as the population in malaria-free areas is generally non-immune.

Large population displacements can also occur rapidly due to causes like war and civil unrest, or natural causes like drought and famine, flooding and earthquakes, etc. Displaced people from areas with malaria can introduce or reintroduce malaria into areas that are malaria free, and in some cases spread drug-resistant malaria. Displaced populations can in some cases be at a higher risk of getting sick or dying from malaria because:

- Displaced people may not have proper housing.
- They often camp near water bodies that serve as mosquito breeding sites.
- They could be non-immune, if moving from malaria-free to malaria-endemic areas.
- Malnutrition can worsen the malaria problem.
- The health care system can be overburdened, so there may be very limited malaria care and preventive measures.

You will learn about drug-resistance when we describe malaria case management in Study Session 8.

Though the chance of large scale population displacement due to social and natural disasters is rare in Ethiopia, it is important for you to keep in mind that displacement can worsen the problem of malaria.

6.2.6 Human host factors

Differences in human hosts also affect the pattern of malaria transmission and the severity of the disease. When it comes to malaria, people are either immune, or non-immune. Immune people often have a better chance of tolerating the effects of malaria and surviving the disease than non-immune people. In highly endemic areas, children under five years of age and pregnant women are the most at risk (Figure 6.7), because they have weak immunity to malaria infection. Immunity to malaria develops slowly after several infections and children need at least five years to develop their immunity. Pregnant women have less immunity to malaria due to their pregnancy.

Figure 6.7 Pregnant women and children under five years of age are most at risk of malaria due to their weakened immunity.
(Photo: UNICEF Ethiopia/Indrias Getachew)

Certain population groups can be infected by some types of malaria parasites, but not by others. For example most Africans south of the Sahara can get infected by *falciparum* malaria, but not by *vivax* malaria. This is another reason why most of the disease and deaths due to malaria occur in Africa, because *falciparum* malaria is the deadliest form of malaria and is highly prevalent in the continent.

6.2.7 Insecticide resistance in vectors

In Study Sessions 9, 10 and 11, you will learn how some insect-killing chemicals (**insecticides**) are used to kill mosquitoes and protect communities from mosquito bites. No (or low numbers of) mosquito bites mean no or less risk of malaria. However, after repeated application of these chemicals, the mosquitoes develop **insecticide resistance**, which means that they are no longer killed by the insecticides. This means a large number of mosquitoes will survive in the community, and the risk of malaria infections rises and many people can be affected.

6.2.8 Drug resistance in malaria parasites

You will learn about the medicines used to treat malaria in Study Session 8. These drugs kill the malaria parasite inside the human body. However, similar to the insecticide resistance mentioned above, after repeated use of an anti-malaria medicine, the parasite can develop resistance to that particular drug or to similar medicines. As a result, the parasites inside the human body can no longer be killed and patients cannot be cured unless new drugs are developed for treatments. If **drug-resistant malaria parasites** are not cleared by treatment from infected individuals, they are easily picked up by vector mosquitoes, and transmitted to new susceptible individuals who then develop drug-resistant malaria. Moreover, more people who are not getting cured by drug treatment means that more will die of malaria.

6.2.9 Interruption of control and prevention measures

Malaria is a curable disease if the parasites remain susceptible to available treatments, and it can be prevented by using several methods. However, long-term and sustained implementation of prevention and control measures is necessary to significantly reduce or eliminate the problem from a country or a specific geographic area. As a result of long-term successful interventions, a local population can lose their immunity to malaria in an area where it has been reduced to a low level for some time. Remember that repeated infections are necessary to develop immunity to malaria. Immunity gets lower or is lost if a person moves out of a malaria endemic area, or is protected from infection for several years. Therefore, if control and preventive measures are stopped before the disease is eliminated, malaria can surge back and affect more people, and affect them more severely than before.

Summary of Study Session 6

In Study Session 6, you have learned that:

1 Malaria transmission is directly affected by different climatic factors.

2 There is an optimal range of temperature that is best for the development of the vector and the parasite.

3 Temperature greatly influences the distribution of malaria in Ethiopia; most highlands in Ethiopia have very little or no malaria due to low temperature.

4 Altitude is the most important factor that determines the distribution of malaria. Altitude and temperature are closely related in Ethiopia. Lowlands are warm (good for malaria transmission), highlands are too cold for malaria parasites and vectors to develop.

5 Higher humidity makes the vector live longer; malaria is transmitted by vectors that live 8–10 days so the parasites have time to develop.

6 The main malaria transmission in Ethiopia is after the rainy season because rainfall creates many vector breeding grounds.

7 Several non-climatic factors affect the severity and incidence of malaria transmission, including the type of vectors and parasites, environmental developments and urbanisation, population movement and migration, the level of immunity in the human hosts, insecticide resistance in mosquitoes, and drug resistance in parasites.

Self-Assessment Questions (SAQs) for Study Session 6

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 6.1 (tests Learning Outcomes 6.1 and 6.3)

Imagine that the relative humidity of your village is 40% in February and 80% in September. Describe how this could affect malaria transmission in your village. Start by explaining the effect of humidity on the vector.

SAQ 6.2 (tests Learning Outcome 6.2)

Imagine that the average daily temperature in your village is 12°C and you rarely see malaria cases. Describe the reason why there is no malaria transmission in your village.

SAQ 6.3 (tests Learning Outcomes 6.2 and 6.3)

Imagine that your village is located at 1,000 metres above sea level and is covered with vegetation throughout the year. Several new malaria cases are occurring every month. What could be the factors causing the high malaria rate in your village?

SAQ 6.4 (tests Learning Outcome 6.4)

Most of the malaria cases in your village come in the two months following the rainy season. Very few cases occur in the dry season. Explain the reason why so many cases occur after the rainy season.

SAQ 6.5 (tests Learning Outcome 6.5)

Anopheles arabiensis prefers to bite humans more than animals. Another *Anopheles* mosquito, *An. pharoensis*, feeds more on animals than humans. Which one of them will be a better vector of malaria and why?

SAQ 6.6 (tests Learning Outcome 6.5)

In village A, most of the malaria cases are due to *falciparum* malaria. In village B, *vivax* malaria is more common than *falciparum* malaria. Which village will have more deaths due to malaria and why?

Study Session 7 Diagnosis of Malaria

Introduction

In this study session you will learn about two different methods used to identify malaria parasites in patients (parasite-based tests). But first you will need to make a clinical or 'presumptive' diagnosis of malaria, based on recognising the most common signs and symptoms of the disease, including severe malaria.

The most important malaria diagnostic method used at the community level is the **rapid diagnostic test (RDT)** for malaria. RDTs provide a quick way to tell whether a person with malaria-like symptoms actually has malaria, as the test takes only 15–20 minutes. The RDT detects certain chemicals in the blood that are produced by malaria parasites if they are present. In this study session you will learn how to use the RDT kit for malaria, including the precautions you must take when performing an RDT, and how to interpret the results.

Finally, we will briefly describe how malaria can be diagnosed using microscopic techniques to detect the presence of parasites in blood smears. You are not expected to use a microscope for diagnosis, but it is useful for you to know what is involved in microscopic diagnosis, which is done at health centres and hospitals.

Learning Outcomes for Study Session 7

When you have studied this session, you should be able to:

7.1 Define and use correctly all of the key words printed in **bold**. (SAQ 7.1)

7.2 Describe how to diagnose malaria and assess the severity of cases, based on clinical signs and symptoms. (SAQs 7.2 and 7.3)

7.3 List the advantages and limitations of rapid diagnostic tests (RDTs) for malaria. (SAQ 7.4)

7.4 Explain how to perform RDTs for malaria safely and effectively, and record the results accurately. (SAQs 7.5 and 7.6)

7.5 Explain how microscopic examination is used to diagnose malaria and state its advantages over RDTs. (SAQ 7.7)

7.1 Clinical diagnosis

In Study Session 2, you learned how to classify and diagnose communicable diseases according to their clinical symptoms. In this section, you will be able to apply those principles to the clinical diagnosis of malaria. In Study Session 5 you learned that some members of the population, such as children under the age of five years and pregnant women, are at a higher risk of getting malaria due to their weaker immunity. By learning how to identify malaria with clinical diagnosis (and confirm it with RDTs) you will be able to provide effective and prompt treatment of malaria to patients at the community level. By identifying signs and symptoms of severe malaria, you will also be able to refer patients that need higher medical care to the health centre or hospital. In this way your knowledge and actions could save many lives, as poorly diagnosed and managed malaria could kill many people in your community.

7.1.1 The symptoms and signs of malaria

The clinical symptoms of malaria vary from very mild to very severe, depending on several factors. In areas where malaria is very common, adults with the disease may show just a slight increase in body temperature. However, pregnant women, and in particular, young children, often have a severe illness with many symptoms. The most important symptom of malaria is fever (or a history of fever within the last two to three days). An attack often begins with shivering (body shaking). This is followed by a period of fever, and finally there is profuse sweating. During an attack the patient often complains of headache and pains in the back, joints, and all over the body (Figure 7.1).

Figure 7.1 An adult with malaria, Ethiopia.

There may also be loss of appetite, vomiting, and diarrhoea. The patient may feel better the next day, but may have another attack the day after that, and so on. If untreated (or inadequately treated), malaria can cause several weeks or months of poor health because of repeated attacks of fever, **anaemia** (see Box 7.1) and general weakness. Some patients rapidly become very ill and may die within a few days.

Box 7.1 Anaemia

Anaemia means not enough haemoglobin in the blood. Haemoglobin is the red substance in the red blood cells which carries oxygen. Malaria parasites destroy the red blood cells and so malaria may cause anaemia. Anaemia may also have other causes (for example, not enough iron in the food). You can recognise anaemia by looking at the patient's hands: the palms of a person with anaemia do not have the redness of a healthy person's palms. If the red colour of the inner eyelid or mouth is paler than in a healthy person, the patient has anaemia. Breathlessness and a fast pulse may also be present, because the person's blood cannot carry enough oxygen for their needs.

A critical feature that may help you to recognise if a fever is due to malaria or not is that **malarial fever** occurs in *cycles* – periods of fever alternate with periods in which the patient shows normal body temperature (below 37.5°C) and no symptoms. The stages of malarial fever attacks are shown in Table 7.1. (You will learn more about how to identify malaria cases in Section 7.2.3).

Table 7.1 Clinical symptoms of a typical malarial fever attack.

Stage of malarial fever attack			
Stage name	**Cold stage**	**Hot stage**	**Sweating stage**
Main clinical symptoms	• Feeling very cold • Vigorous shivering	• Feeling very hot – higher than normal temperature • Dry burning skin • Headache	• A lot of sweating • Fall in temperature • Feeling exhausted and weak • Tendency to fall asleep
How long symptoms last	15–60 minutes	2–6 hours	2–4 hours

■ A four-year-old patient is presented to you with fever of 38°C. The child also has poor appetite, is weak and has yellowish eyes. What other questions should you ask his mother or guardian to try and find out if the child is suffering from malaria? Give reasons for your answer.

□ You should try to find out how long the child has had fever. You should also find out whether the fever has alternated with a stage of sweating, followed by a cold, shivering stage. A child with a fever could have malaria, but fever can also be a symptom of other diseases. However, a child who has gone through stages of fever, sweating and shivering is much more likely to be suffering from malaria, as this is the typical pattern of malarial fever attacks.

Malarial fever attacks usually repeat every 48 hours, for patients infected with the two most common species of plasmodium in Ethiopia, *P. vivax* and *P. falciparum*.

7.1.2 Course of malarial disease

Symptoms of malaria usually start to appear 7 to 21 days after the bite of an infected mosquito. However, the normal *incubation period* is different for different species of *Plasmodium,* as described in Study Session 5. Remember that the **incubation period** is the time between the parasite getting into the blood of a person and the onset of symptoms.

■ Can you recall, from what you learned in Study Session 5, which of the following malaria parasites has the shortest incubation period? Which has the longest?

- *Plasmodium falciparum*
- *Plasmodium vivax*
- *Plasmodium malariae*
- *Plasmodium ovale.*

□ *P. falciparum* has the shortest and *P. malariae* has the longest incubation period.

A patient who is not treated may develop severe complications and may die, or may continue to have cycles of fever alternating with symptom-free periods. In general, the more *Plasmodium* parasites there are in the blood, the more severe the disease will be.

Disease progression varies with the parasite species

Disease progression varies according to the species of *Plasmodium* that has infected the patient. Patients infected with *P. vivax*, especially for the first time, can be quite ill. However, *P. vivax* rarely causes complications or results in death. **Relapses** (return of malaria symptoms due to activation of an old infection) due to *P. vivax* can occur for several years.

Patients with serious complications are generally referred to a health centre; you will learn how to refer such patients in Study Session 8.

By contrast, *P. falciparum* is the most lethal form of malaria infection. It causes the most serious complications, which are anaemia (Box 7.1 above) and **cerebral malaria**. In cerebral malaria, red blood cells infected by the parasite stick to small blood vessels in the brain. This reduces the flow of blood and the supply of oxygen and nutrients to the brain. If untreated, cerebral malaria can kill the patient in 24–48 hours. It most commonly affects young children (Figure 7.2).

Figure 7.2 A mother with a child suffering a malaria attack. (Photo: UNICEF Ethiopia)

7.1.3 How you can identify cases of malaria

The most important element in the clinical diagnosis of malaria is for you to be alert and to suspect malaria in all patients with fever, whether your catchment area is located in a malarious area or not. Because the distribution of malaria in Ethiopia is patchy, it is also very important for you to find out the geographical and travel history of a patient who shows signs and symptoms of malaria, most importantly fever.

In non-malarious areas, you should suspect malaria in a patient who has high fever, or has had fever in the last 48 hours, if the person has travelled to a malarious area or country in the previous two weeks. In malarious areas, fever, or a history of fever in the last 48 hours, should be enough for you to suspect malaria in a patient. You should pay particular attention to children under the age of five years and pregnant mothers, as these groups are at a higher risk than others.

■ Why do you think children are at higher risk of getting severely ill or dying of malaria than adults?

□ Children have a much weaker immunity against malaria. Immunity develops after repeated exposures to the malaria parasite and this takes time.

You can recognise malaria by *asking the right questions* and *looking for the important signs* (see Box 7.2):

Box 7.2 How to approach a clinical diagnosis of malaria

- *Ask:* Ask questions and listen to what the patient has to say (if the patient is a young child, listen to the parent or guardian). If the patient (or parent) does not mention fever, ask whether there has been a fever at any time during the past 2–3 days. *Patients who have had fever during the last 2–3 days may have malaria.*
- *Look:* Examine the patient for symptoms of malaria. Measure the temperature with a thermometer. If the temperature is more than 37°C, the patient has a fever. (If you do not have a thermometer with you, feel the forehead with the back of your hand. If the forehead feels hot, the patient probably has a fever).
- *Check:* In addition to fever, malaria patients can show the following signs and symptoms: loss of appetite, refusal to breastfeed (child), weakness, nausea, vomiting, headache, joint pains, muscle aches. If you see any of these features you should think about malaria and act immediately. If there is no fever and no history of fever during the past 2–3 days, the patient does *not* have malaria.

7.1.4 Danger signs of severe malaria

If the patient has had fever during the past 2–3 days, first *ask* about and then *look* for danger signs:

Ask:

- Is the patient unable to drink?
- Has the patient had convulsions (fits)?
- Does the patient vomit repeatedly?
- How much urine does the patient pass? Very little? None at all? Is it dark?
- Is the patient breathing fast, or having difficulty breathing?
- Does the patient have yellowish eyes, mouth or palms?

Look:

- Is the patient abnormally sleepy, difficult to wake, or confused?
- Does the patient have anaemia?
- Does the patient have severe dehydration? (Look for sudden weight loss, loose skin, sunken eyes, dry mouth)
- Is the patient unable to stand or sit?
- Is the patient breathing fast, or having difficulty breathing?
- Does the patient have yellowish eyes, mouth or palms?

If the answer to any of these questions is *yes*, the patient has severe malaria. The patient's life is in danger. Urgent treatment is needed to save the patient's life so refer immediately to the nearest health centre.

7.2 Parasitological diagnosis of malaria

If you suspect that a patient may have malaria, you will need to confirm the clinical diagnosis using specific tests to identify the presence of the malaria parasite or its products in the blood. This process is called **parasitological** or **parasite-based diagnosis**. In areas with a risk of malaria, or in patients who have travelled back from malaria-endemic areas, fever should be enough to make you suspect malaria and do a confirmatory test. The parasitological diagnosis of malaria can be divided into microscopic and non-microscopic tests. Microscopic tests involve the use of a microscope to see the parasite in the blood of a patient. At health post level you will not be able to carry out microscope tests, but they will be discussed briefly in Section 7.2.3. First we describe the non-microscopic tests, also known as rapid diagnostic tests (RDTs).

7.2.1 Introduction to rapid diagnostic tests (RDTs) for malaria

The national malaria diagnosis policy in Ethiopia is that Health Extension Workers and Practitioners must test anyone suspected of having malaria by using the RDT for malaria. RDTs are now available in all health posts in areas where malaria is a risk and you will receive some practical training in how to use them.

The Ethiopian national guidelines state that malaria treatment at health post level, or referral from the health post to the health centre, should be based on RDT test results, so knowing how to use the RDT properly is a very important part of your job. In this section you will learn how to use the RDTs more effectively. You will also learn about the precautions you have to take to protect yourself and other patients when working with blood.

How RDTs work

RDTs test whether a person with malaria-like symptoms actually has malaria by testing the blood of the patient for chemical substances produced by malaria parasites. Malaria parasites produce proteins called *antigens.* RDTs detect *malaria antigens*, so if they are present, the person will test positive. If malaria antigens are not present, the person will test negative.

The reason for using RDTs

RDTs enable you to find out if a fever is really caused by malaria rather than by other illnesses. You can also get information about which malaria parasites may be causing the infection. The information provided by RDTs is important for three main reasons:

- First, being able to tell quickly whether a patient with fever has malaria or not ensures that the patient can receive the correct treatment.
- Second, if a patient does have malaria, knowing which parasite may be involved is important, as some malaria parasites are more dangerous than others and require more urgent treatment.

■ Can you remember which malaria parasite causes the most serious malaria in Ethiopia?

□ *P. falciparum* can kill a person in 24–48 hours, for example by causing cerebral malaria. *P. vivax* is less likely to cause complications and is rarely fatal.

- Third, *falciparum* malaria treatment in Ethiopia is based on **artemisinin combination therapy** (**ACT**), which is more expensive than older anti-malarial drugs such as chloroquine (CQ) and sulfadoxine-pyrimethamine (SP). *Vivax* malaria accounts for 40% of the malaria cases in Ethiopia, but it does not need treatment with ACT. By identifying which patients have *falciparum* malaria, RDTs can save money, as ACTs will then only be given to patients with *falciparum* malaria.

You will learn about malaria case management with these drugs in Study Session 8.

By using the RDT you will be able to test for malaria parasites in a patient's blood, and in this way to provide a more accurate diagnosis than a clinical or presumptive diagnosis. RDTs give results in about 15–20 minutes, so a patient with malaria can begin treatment right away. RDTs do not require any expensive or complicated equipment and can be used by you in the patient's home. You should be able to learn to use RDTs in just a few hours in your practical training programme.

Limitations of RDTs

RDTs are very effective for diagnosing malaria, but there are some things they cannot do.

First, RDTs cannot test how *many* malaria parasites there are in the blood – they can only test whether parasites are present or absent. In fact, RDTs do not detect actual parasites; they detect parasite *antigens*, as mentioned above. Some parasite *antigens* can remain in the blood for at least two weeks after the parasites have been killed by drugs.

■ What will be the result if an RDT is used on a person within two weeks of taking anti-malarial drugs, and should you trust the result? Explain your answer.

□ An RDT used within two weeks of drug treatment may still detect parasite antigens and so give a positive result for malaria infection, even if the person no longer has parasites, because the parasites have been killed by the drugs. This is why this positive result cannot be trusted.

Second, RDTs can be damaged by heat and humidity, so the RDT should not be removed from its sealed package before you are ready to use it. If a package has been open for some time before the RDT is used, the RDT may be damaged and can give an invalid (false) result. You should discard this package and use another, unopened, package.

Actions following positive and negative results from RDTs

The national malaria treatment guidelines now recommend the use of parasite-based diagnosis using RDTs for malaria by community health workers for all age groups, except when the RDT is not available due to logistics problems.

- Before using the RDT, ask the patient if he or she has recently taken anti-malaria medication. If the patient has taken a complete course of anti-malaria medication in the last 5–14 days, a positive RDT result may be

misleading (see above). It may be necessary to refer the patient to a health centre with a laboratory for further testing using a microscope.

- If fever persists a few days after a negative RDT result and other appropriate management has been applied, you should re-test the patient with another RDT, as RDTs can sometimes miss early malaria infections.

Otherwise:

- If the patient has not recently taken anti-malarial medication and the test result is *positive,* treat the person for malaria according to national guidelines (see Study Session 8).
- If a patient has fever and the second test result is still *negative,* refer them to a higher level health centre.

We now explain how to use an RDT, and how to interpret the results.

7.2.2 How to use an RDT to get a malaria test result

Here is the checklist that you must follow when you are using an RDT for malaria diagnosis.

(i) *Check the expiry date on the package.* Do not use RDTs that have expired.

(ii) *Put on gloves before beginning* (Figure 7.3). Use a new pair of gloves for each patient. Do not re-use gloves.

Figures 7.3 to 7.10 are from WHO, 2006, *How to Use a Malaria Rapid Diagnostic Test (RDT): A Guide for Training CHWs and Other Health Workers.*

Figure 7.3 Put on new gloves before starting each RDT. (Source: WHO, 2006, see marginal note)

(iii) *Open the RDT package and remove the contents.* The blood-transfer device — it could be a capillary tube, straw, loop, pipette or other device — is used to collect blood and transfer it to the test cassette. (Once the packet is opened, the 'desiccant' sachet which absorbs moisture from the atmosphere in the package should be discarded.) The test cassette (shown later, in Figure 7.8) is used to conduct the test. The square hole labeled 'A' is where you add the blood. The round hole labeled 'B' is where you add the buffer.

(iv) *Write the patient's name on the cassette* (Figure 7.4).

Figure 7.4 Write the patient's name on the cassette.

(v) *Open the alcohol swab and clean the patient's third or fourth finger with alcohol* (Figure 7.5). This is to prevent infection. Other fingers may be used if necessary. Ask the patient: 'Are you right-handed or left-handed?' If the patient is right-handed, choose a finger on their left hand. If the patient is left-handed, choose a finger on their right hand.

Figure 7.5 Clean the patient's finger with alcohol.

(vi) After cleaning the finger with the alcohol swab, the finger must be allowed to *air dry.* After using the alcohol swab, place it on its wrapper and set it aside on the table. You will use it again to stop the bleeding after you collect the patient's blood.

(vii) *Once the patient's finger is dry, open the lancet.* Prick the patient's finger, preferably towards the side of the pulp (ball) of the finger. Discard the lancet in a sharps-only container immediately after using it (Figure 7.6).

Figure 7.6 The lancet used in the RDT must be put in a 'sharps only' safety box.

(viii) Turn the 'patient's' arm so their palm is facing downward. *Squeeze the pricked finger and allow a drop to well up below the finger tip* as in Figure 7.7. Use the loop or capillary tube or straw or the pipette to collect the drop from underneath. Once you have collected a sufficient amount of blood, you may hand the alcohol swab back to the patient and show him or her how to use it to stop the bleeding.

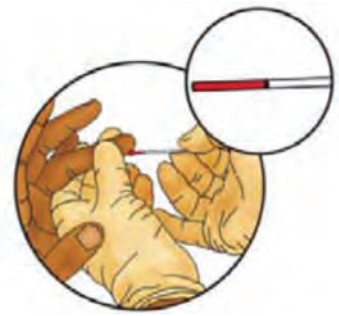


Figure 7.7 Drawing blood with a capillary tube.

Never put the lancet down before discarding it. Never discard the lancet in a non-sharps container. Never use a lancet on more than one person.

(ix) *Use the device (capillary tube, straw, loop, pipette or other) to add the drop of blood to the sample window* (square hole labeled with the letter A, see Figure 7.8). The blood needs to reach and be absorbed by the pad at the base of the square hole. If the blood is mostly deposited on the plastic edges of the well, but does not reach the pad, the test will not work correctly. Deposit the blood in the correct place using the capillary tube, straw, loop, pipette or other. Adding too much or too little blood can cause the test to give an invalid result or be difficult to read.

Figure 7.8 Adding blood to the RDT cassette.

(x) *Add the buffer solution to the round hole labeled B.* Hold the bottle vertically when adding the buffer solution, as in Figure 7.9. This ensures the correct drop size.

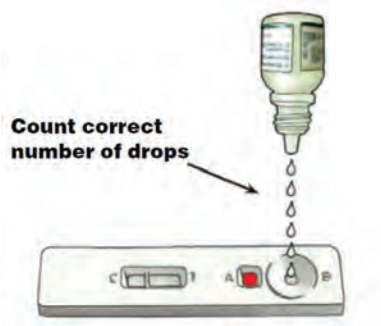


Figure 7.9 Adding the buffer solution.

(xi) *Wait for the correct duration of time (15 or 20 minutes) after adding buffer before reading the test results.*

(xii) *Discard the blood-collection device (e.g. capillary tube) safely after use.*

(xiii) *Remove and discard your gloves at this time.* To avoid possible contamination, the used gloves should be discarded in the non-sharps container before you do anything else.

7.2.3 How to read and interpret an RDT test result

The different possible results and what they mean are illustrated in Figure 7.10 and summarised in Table 7.2 (on the next page).

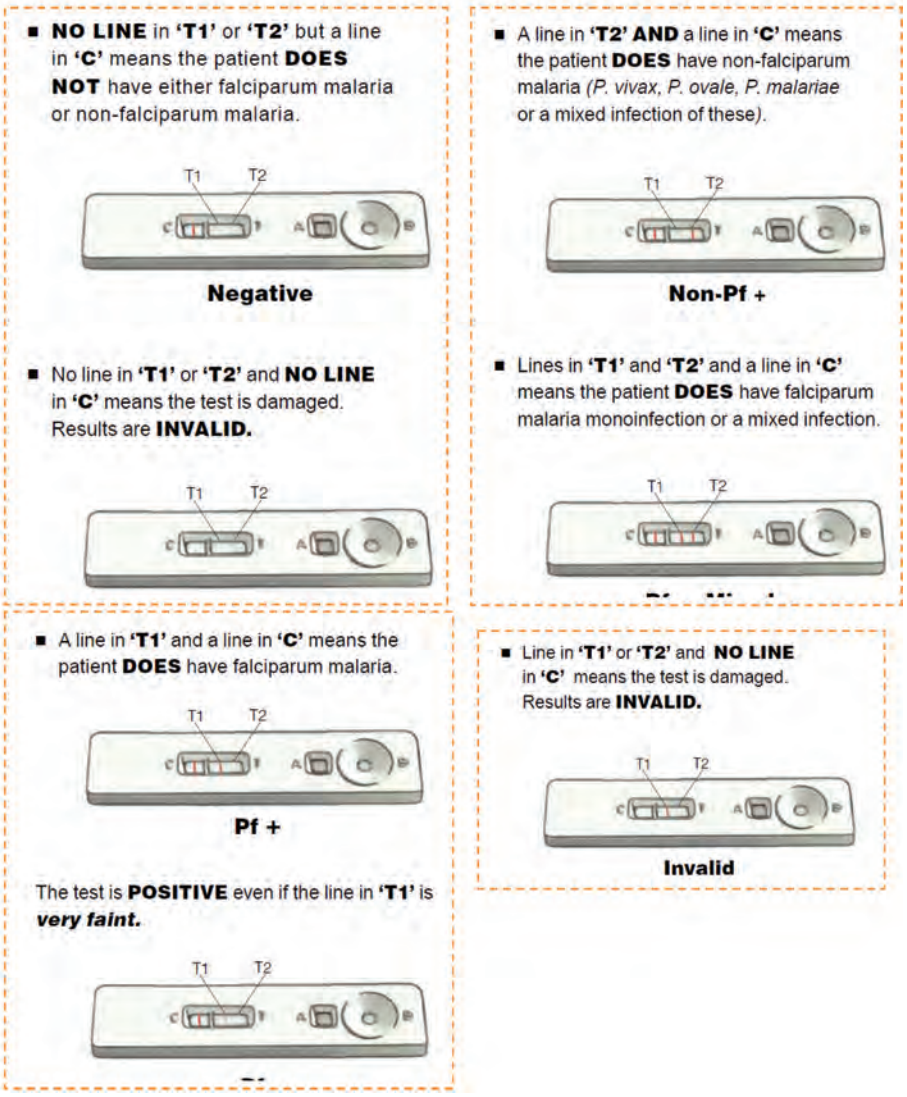


Figure 7.10 The different possible test results of a malaria RDT. 'C' is the control line; 'T1' and 'T2' are the test lines.

Table 7.2 Malaria RDT interpretation chart.

Results	Control Line C	Test lines T1	Test lines T2
		P. falciparum	*P. vivax*
Negative			
Positive: *P. falciparum* only			
Positive: *P. falciparum* only or mixed with other species			
Positive : non-*P. falciparum* (*P. vivax*)			
Invalid			
Invalid			
Invalid			

As you can see from Figure 7.10 and Table 7.2, sometimes the result can be *invalid*, that is, it could be incorrect.

- What should you do if the test result is invalid?
- Discard the RDT cassette. Open a new cassette and repeat the test using the new cassette.

7.2.4 Microscopic test for malaria

Figure 7.11 Malaria parasites being viewed under a microscope. (Photo: I-TECH/ Julia Sherburne)

Microscopic diagnosis of malaria is done by a trained laboratory technician at health centre or hospital level. It is not your responsibility to do a microscope test, but this section will briefly explain it so you understand the technique.

Microscopic diagnosis involves taking a small amount of blood from the patient, staining it and looking at it under a microscope to check for malaria parasites. In most cases of malaria, microscopic examination of thick and thin films of finger-prick blood will reveal malaria parasites. Thick films are 20–40 times more sensitive than thin films for detecting *Plasmodium* parasites, and are particularly useful if the number of parasites is low. Thin smears are also useful as they can allow identification of particular *Plasmodium* species (Figure 7.11). The diagnostic accuracy relies on the quality of the blood smear and the experience of laboratory personnel.

Summary of Study Session 7

In Study Session 7, you have learned that:

1 Knowledge of the signs and symptoms of malaria is important for its clinical diagnosis.

2 Different species of the malaria parasite can cause malaria of different severity. Of the two species present in Ethiopia, *P. falciparum* is more likely to cause a severe and fatal disease. Young children and pregnant women are more at risk of serious infection as they have weaker immunity.

3 The most important clinical symptom of malaria is fever (or a history of fever within the last 2–3 days), typically with regular attacks every 2–3 days lasting several hours. Attacks often begin with shivering, followed by fever, then profuse sweating.

4 In areas where malaria incidence is low, always ask those who have a fever about their travel history to malaria endemic areas in the last two weeks.

5 Carefully observe all suspected or confirmed malaria cases for any signs of severe malaria, which include convulsions, anaemia, repeated vomiting, high fever (above 39°C), severe dehydration, drowsiness or confusion, and reduced urine output.

6 Refer severe cases immediately.

7 Whenever possible malaria treatment should be based on parasitological diagnosis of malaria rather than on a clinical diagnosis based on symptoms.

8 Rapid diagnostic tests (RDTs) for malaria are available at health post level and are effective in diagnosing malaria if correctly used. RDTs cannot distinguish between species of malaria parasites or estimate the number present in the patient's blood sample.

9 In the absence of RDTs, you will need to use clinical symptoms to diagnose malaria. In some cases you may need to refer patients to the health centre or hospital, so a microscopic diagnosis of malaria can be carried out to confirm malarial infection.

Self-Assessment Questions (SAQs) for Study Session 7

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 7.1 (tests Learning Outcome 7.1)

What method is available to you at health post level to allow you to make a parasite-based diagnosis of malaria?

SAQ 7.2 (tests Learning Outcome 7.2)

Malaria is rare in your village. However, a 25 year-old male comes to your health post complaining of loss of appetite and muscle aches. You suspect malaria, but you don't have an RDT kit to confirm your diagnosis. What questions should you ask him to either *exclude* malaria as a possible diagnosis, or decide that you should *treat* him for malaria?

SAQ 7.3 (tests Learning Outcome 7.2)

A five-year-old child comes to your health post with fever. He was tested with an RDT and the result was positive for *falciparum* malaria. Before treating and sending him home, you have to check for signs of severe malaria in case he needs a referral. What are the signs and symptoms you would look for?

SAQ 7.4 (tests Learning Outcome 7.3)

You have learned that RDT and microscopy are two simple and useful methods to diagnose malaria. List two important advantages of RDT over microscopy.

SAQ 7.5 (tests Learning Outcome 7.4)

You are confronted with more than 20 fever cases in the community around your health post at the same time. You will test all patients with RDTs for malaria. What do you do to avoid any mix-up of results?

SAQ 7.6 (tests Learning Outcome 7.4)

List the precautions you need to take to avoid contaminating yourself and your patients with another person's blood, when performing an RDT for malaria.

SAQ 7.7 (tests Learning Outcome 7.5)

You treated the five-year-old child positive for *falciparum* malaria in SAQ 7.3, according to the national guideline. The child comes back after three days with fever and you again test him with an RDT. The patient was again positive for *falciparum* malaria.

(a) What will be your next action?
(b) What are the advantages of microscopy over RDTs?

Study Session 8
Malaria Case Management

Introduction

You have now learned how the malaria parasite is transmitted, the life cycle of the parasite, the symptoms and signs of the disease and the diagnosis of malaria. The objective of this study session is to give you the required knowledge and skills to provide effective and prompt treatment for malaria cases. You are going to learn:

- How to treat uncomplicated (non-severe) malaria in adults, in children and pregnant mothers.
- The pre-referral treatment of severe malaria cases.
- How to educate people about the benefits of early treatment of cases and adherence to the treatment course.

This study session will describe the procedures of malaria treatment, the anti-malaria medicines used under different situations, and the procedure of providing pre-referral care to patients that cannot be managed at your Health Post level. Providing early and effective treatment is one of the most important interventions of any malaria control programme. In fact, the most important indicator used to measure the success of malaria interventions is the proportion of people with malaria getting anti-malaria treatment within 24 hours after the onset of fever.

Unlike many communicable diseases, malaria is an *acute* infection that requires immediate attention after the onset of symptoms. The disease can quickly progress to a severe form, and death can occur within 48 hours of the onset of signs and symptoms. As a Health Extension Practitioner deployed within a village, you are the most important person, and probably the *only* person, who can provide early and effective treatment for malaria cases, within 24 hours. This is probably one of the most satisfying parts of your job because it is directly linked to saving lives.

Learning Outcomes for Study Session 8

When you have studied this session, you should be able to:

8.1 Define and use correctly all of the key words printed in **bold**. (SAQs 8.1 to 8.6)

8.2 List the different anti-malaria drugs and the dosage given to uncomplicated and severe cases of malaria. (SAQs 8.2, 8.4 and 8.6)

8.3 Describe the procedure for treating uncomplicated malaria and giving supportive treatment in different age groups and in pregnant mothers. (SAQs 8.1, 8.2 and 8.6)

8.4 Describe the procedure for the pre-referral treatment of cases of severe malaria and when to refer them to the health centre. (SAQs 8.3, 8.4 and 8.6)

8.5 Explain how you would identify and address the challenges in malaria case management. (SAQs 8.5 and 8.6)

8.1 Treatment of uncomplicated malaria

In Study Session 7 you learned the different methods for diagnosing malaria and how the clinical diagnosis and Rapid Diagnostic Test (RDT) methods are applied at the Health Post level. In this section you will learn about the treatment of uncomplicated (non-severe) malaria cases.

In order to prescribe an anti-malaria treatment for malaria-suspected fever cases, you should make a confirmed diagnosis using a **multi-species RDT**. This is an RDT that can test for different species of the malaria parasite. However, if you do not have this RDT at your Health Post, you can still make a malaria diagnosis based on the patient's history and based on findings of physical examination. The summary of the steps you follow to make a diagnosis and prescribe treatment for malaria is indicated in Box 8.1 below.

Box 8.1 Steps to follow to treat malaria cases

- Take history of the patient, including history of travel to malarious areas. Take enough time to pay proper attention to what the patient has to say.
- Do a physical examination, measure temperature, blood pressure and count the pulse rate.
- Consider if there is another obvious cause of fever other than malaria.
- Test for malaria parasites using multi-species RDTs (if you have the test kits and have been trained to use them).
- Treat the patient based on the result of the RDT.
- If you do not have RDTs in your Health Post, diagnose malaria based on the clinical findings from the patient's history and the physical examination.

In the next section you will learn the course of action to take when you use either an RDT, *or* clinical diagnosis, to determine the treatment of malaria. Carefully note the slight differences between the two approaches.

8.1.1 Treatment of uncomplicated malaria based on RDT confirmation

Scenario 1

If RDT indicates *P. falciparum* infection then treat the patient with appropriate doses of Coartem (one of the artemisinin-based combination drugs), or artemisinin combination therapy with chemical ingredients of artemether-lumefantrine. Before you give the patient Coartem, make sure that the patient is able to swallow the medication, and is not vomiting. (See the treatment doses of Coartem in Table 8.1 on the next page.) Coartem tablets are given according to the body weight or age of the patient, in six doses to be taken over three days. Give the first dose to the patient in front of you. Advise your patient to take fatty foods if available. If fatty food is not available, advise the patient to take any foods or fluids after swallowing Coartem. Explain that a fatty meal or milk improves absorption of Coartem, hence the patient can recover faster.

One tablet of Coartem contains 120 mg artemether, plus 20 mg lumefantrine, in a fixed dose.

Table 8.1 Coartem treatment doses and schedules by body weight and age.

Weight (kg)	Age	Day 1		Day 2		Day 3	
		Morning	Evening	Morning	Evening	Morning	Evening
5–14	4 months–2 years	1 tablet	1 tablet	1 tablet	1 tablet	1 tablet	1 tablet
15–24	3–7 years	2 tablets	2 tablets	2 tablets	2 tablets	2 tablets	2 tablets
25–34	8–10 years	3 tablets	3 tablets	3 tablets	3 tablets	3 tablets	3 tablets
35+	10 + years	4 tablets	4 tablets	4 tablets	4 tablets	4 tablets	4 tablets

Scenario 2

If the RDT indicates mixed infection of *P. falciparum* and *P. vivax*, then treat the patient with appropriate doses of Coartem, as in Table 8.1.

Scenario 3

If the RDT reveals *P. vivax* only, then treat the patient with Chloroquine (see the treatment doses in Table 8.2). Chloroquine is prepared in tablet or in syrup form. Chloroquine dose is 10 mg/kg of the patient's body weight, taken orally immediately (day 1), followed by 10 mg/kg at 24 hours (day 2), and 5mg/kg at 48 hours (day 3).

Chloroquine tablets are 150 mg base, and the syrup is 50 mg base per 5 ml dose.

- How many tablets of Chloroquine to take home do you give to a woman aged 36 years who is diagnosed with *P.vivax* malaria? *Note that you give her the first dose, i.e. 4 tablets, while she is in front of you.*
- You give her the remaining 6 tablets to take home. She will swallow 4 tablets on the second day and 2 tablets on the third day.

Table 8.2 Chloroquine treatment doses (tablets or syrup) and schedules by body weight and age.

Weight (kg)	Age	Day 1	Day 2	Day 3
5–6	less than 4 months	½ tablet *OR* 5 ml syrup	¼ tablet *OR* 5 ml syrup	¼ tablet *OR* 2.5 ml syrup
7–10	4–11 months	½ tablet *OR* 7.5 ml syrup	½ tablet *OR* 7.5 ml syrup	½ tablet *OR* 5 ml syrup
11–14	1–2 years	1 tablet *OR* 12.5 ml syrup	1 tablet *OR* 12.5 ml syrup	½ tablet *OR* 7.5 ml syrup
15–18	3–4 years	1 tablet *OR* 15 ml syrup	1 tablet *OR* 15 ml syrup	1 tablet *OR* 15 ml syrup
19–24	5–7 years	1½ tablets *OR* 20 ml syrup	1½ tablets *OR* 20 ml syrup	1 tablet *OR* 15 ml syrup
25–35	8–11 years	2 tablets	2 tablets	1 tablet
36–50	12–14 years	3 tablets	3 tablets	2 tablets
51+	15 + years	4 tablets	4 tablets	2 tablets

Scenario 4

If the RDT is positive for *P. falciparum* in:

- women who are less than 3 months pregnant,
- children whose weight is less than 5 kg or whose age is less than 4 months,

give quinine oral treatment. (See the treatment doses of quinine tablets in Table 8.3 below).

Quinine tablets may contain 200 mg or 300 mg. Check carefully when you calculate the dose.

Table 8.3 Quinine treatment doses by body weight and age.

Weight (kg)	Age	Dosage to be given daily	
		200 mg tablets	300 mg tablets
4–6	2–4 months	¼	-
6–10	4–12 months	⅓	¼
10–12	1–2 years	½	⅓
12–14	2–3 years	¾	½
14–19	3–5 years	¾	½
20–24	5–7 years	1	¾
25–35	8–10 years	1½	1
36–50	11–13 years	2	1½
50+	14 years and above	3	2

For all of Scenarios 1 to 4, if the patient vomits within 30 minutes after swallowing the drug, the medicine will not work. So give the patient the same dose again from your own stock (not from the tablets you give to the patient or the mother/caregiver to take home) and let the patient swallow it.

If a child vomits within 30 minutes of taking drugs at home, advise the patient/caregiver to take another dose, and to come back to the Health Post to collect another replacement dose from you so that the patient still takes the complete course of treatment.

To ensure appropriate intake of prescribed drugs, patients/ caregivers should be well informed on the treatment schedule to ensure intake of the complete dose.

Advise the patient/caregiver to come back if the patient does not show any improvement after three days of treatment with anti-malaria drugs, or if the signs and symptoms get worse at any time.

Whenever you encounter a suspected malaria case, use Figure 8.1 to guide you on the details of the procedures and steps that you need to follow to identify uncomplicated and severe malaria cases using RDTs, and manage them appropriately.

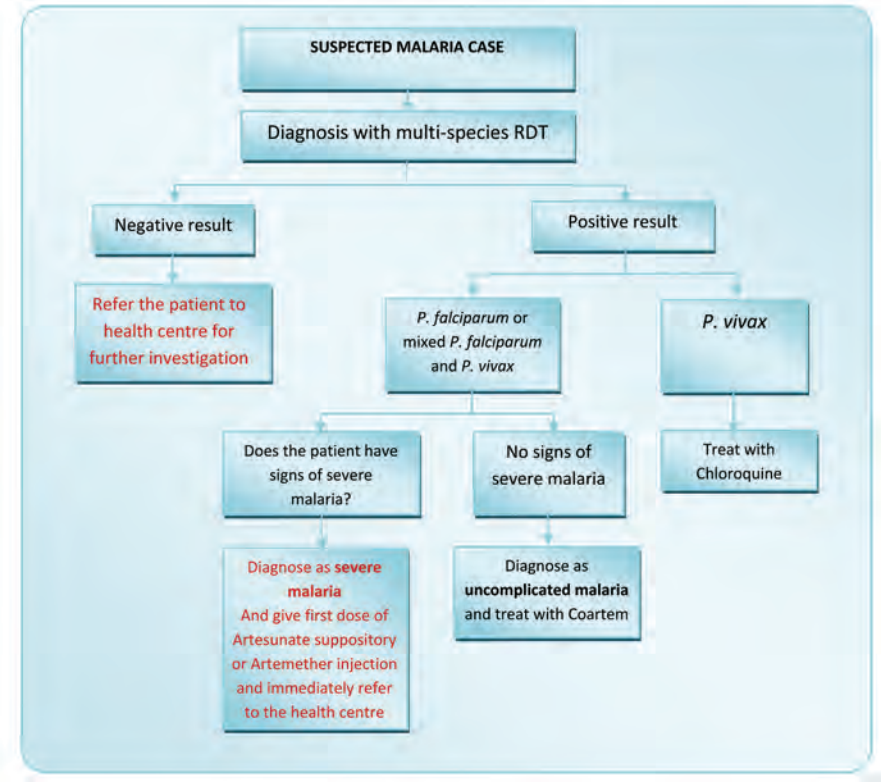


Figure 8.1 Flow chart for RDT diagnosis and treatment of malaria at Health Post level. (Adapted from Ethiopian Federal Ministry of Health, *Malaria Diagnosis and Treatment Guideline for Health Workers in Ethiopia*, 3rd edition, 2010).

- If the RDT result of Bekele, who is a 7-year-old child, shows *P. falciparum* infection, what anti-malaria drug would you give him? How many tablets will be a complete course of treatment? If Bekele vomited 25 minutes after swallowing the first dose you gave him, what should you do next?

- The appropriate anti-malaria drug to give Bekele is Coartem.

  The total number of tablets you give a 7-year-old child is 12 (go back to see the doses in Table 8.1 above). The Coartem strip that contains 12 tablets is shown in Figure 8.2. Bekele should be given 2 tablets in the morning and 2 tablets in the evening for 3 days.

  To replace the vomited dose, which is 2 tablets, give the child another 2 tablets to swallow again from your own stock — not from the tablets you gave to the mother/caregiver. The mother/caregiver must have 10 tablets to take home to continue the treatment.

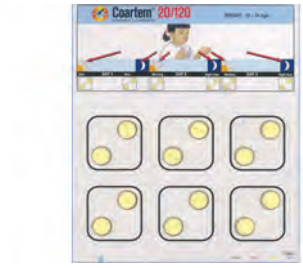


Figure 8.2 Coartem strip for patients who are 3 to 7 years old, or body weight of 15 to 24 kg.

Note that if the strip in Figure 8.2 (which is appropriate for Bekele) is not available, you can still cut out 12 tablets from the strip of adult doses as shown in Figure 8.3. While cutting the strips be careful not to cut the plastic or the blisters that contain individual tablets.

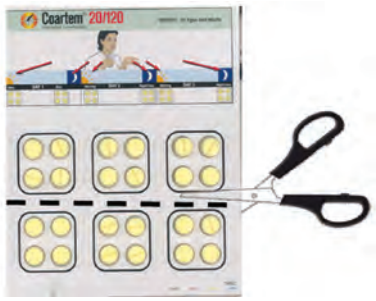


Figure 8.3 Cutting an adult Coartem strip with scissors into two to give to children.

Coartem shelf life and contraindications

Coartem has a short shelf life of two years only. So use those packages which are closer to the expiry date first. Do not expose Coartem to moisture and high temperature. Store it at temperatures of below 30°C in dry and cool places.

Coartem absorbs moisture from the surrounding environment very fast. To protect the drug from absorbing the moisture it is covered by plastic blisters. Therefore, do not remove the tablet from the blister if it is not going to be used immediately.

Coartem is **contraindicated** (not given) for some people. Box 8.2 gives you specific warnings on the groups who should not get Coartem.

Box 8.2 Contraindications of Coartem

Do not give Coartem for the following groups of people:

- For use as **prophylaxis**, that is for a healthy person who wants to swallow the drug in order to protect himself or herself from getting malaria
- Pregnant women in the first trimester (three months of pregnancy) and infants less than 5 kg or less than 4 months old
- Persons with a previous history of reaction after using the drug.

Previously, Coartem was contraindicated for breastfeeding mothers of infants less than 5 kg or under 4 months old. *WHO Malaria Treatment Guidelines*, 2010, now state that Coartem should be given to these patients.

8.1.2 Treatment of uncomplicated malaria based on clinical diagnosis

If you do not have the RDT in your Health Post, then use clinical methods (as described in Study Session 7) to diagnose suspected malaria in people seeking your help. If the diagnosis is clinical rather than parasite-based, treat uncomplicated malaria cases as follows:

- If the person does not have signs of severe malaria, then treat the patient with Coartem. After three days, check the patient again. If fever is still present refer the patient to the health centre.
- If the person has signs of *severe* malaria (as described in Section 8.2) then diagnose him/her as having severe malaria. Give first dose of Artesunate suppository or Artemether injection and immediately refer the patient to the nearest health centre.
- Advise the patient/caregiver to come back if the patient does not show any improvement after three days of treatment with anti-malaria drugs, or if the signs and symptoms get worse at any time.

Whenever you encounter a suspected malaria case and you do not have RDTs, Figure 8.4 will guide you in the details of the procedures and steps that you need to follow for the treatment and referral of patients diagnosed clinically.

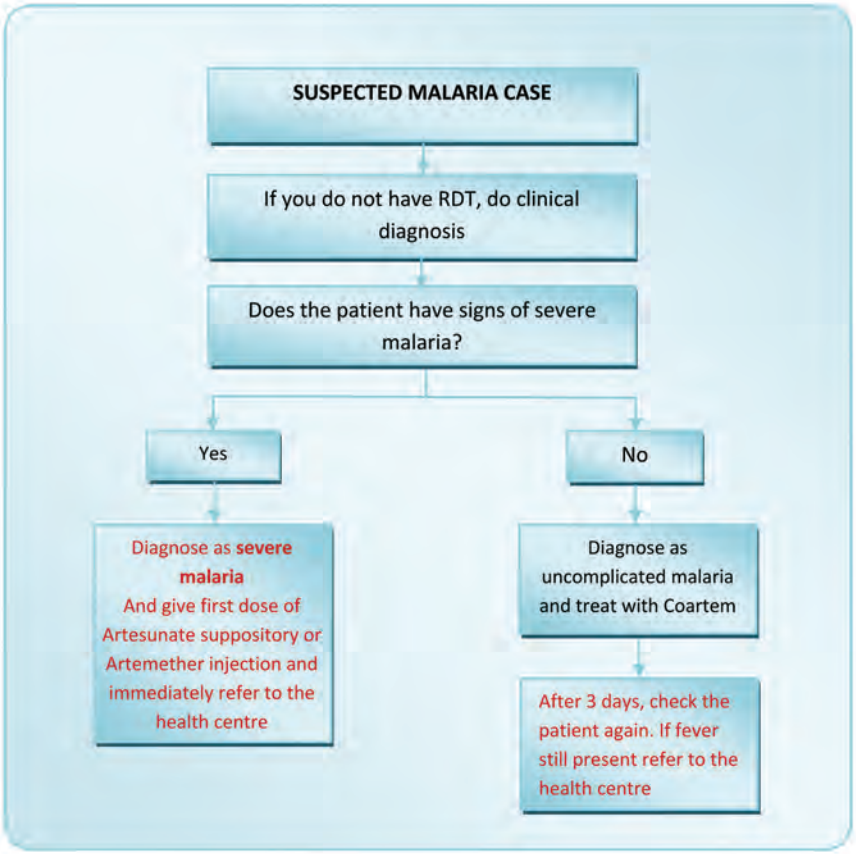


Figure 8.4 Flow chart for clinical diagnosis and treatment of malaria at Health Post level. (Adapted from Ethiopian Federal Ministry of Health, *Malaria Diagnosis and Treatment Guidelines for Health Workers in Ethiopia*, 3rd edition, 2010).

8.1.3 Supportive treatment of uncomplicated malaria cases

Many malaria patients have other clinical problems associated with malaria infection. While most of these problems get resolved when the patients are treated for malaria, some conditions need treatment at the same time as the malaria, that is, **supportive treatment**. Some of the supportive treatments that you should give the patient are as follows:

- If high fever is present, give the patient paracetamol tablets. Also advise the patient or caregivers to cool the fever by wetting the body of the patient with clean pieces of cloth dipped in slightly warm water, or by fanning.
- For patients with moderate dehydration, give oral rehydration salts (ORS) and advise them to drink more clean water or other fluids. In the case of breastfed infants, encourage mothers to provide extra breastfeeding.
- If you suspect mild or moderate anaemia is present, give ferrous sulphate (iron tablets), 200 mg once daily for two months, and advise the patient to return for a recheck in two months.

In addition to the diagnosis and treatment services you give to the patient with uncomplicated malaria, advise or educate the patient or the caregiver on the following issues and tell him or her that:

- He or she has a malaria infection.
- Early treatment within 24 hours of fever onset is important to prevent severe illness and death.

Figure 8.5 Give food and fluids prior to malaria treatment.

- To take/give the patient enough food, if possible a fatty meal, prior to taking the drug (Figure 8.5).
- To complete the full dose of treatment of the drug given, for example six doses of treatment for three days for Coartem.
- To return to the Health Post if the fever does not stop or if the patient does not get well after three days. The patient should also return to the Health Post if at any time before three days the condition gets worse — for example if the patient is unable to avoid vomiting up the drug, or there is persistent vomiting, dehydration, confusion, or excessive sleepiness.

8.2 Pre-referral treatment of severe malaria at the Health Post level

It is important that all patients are assessed for the danger signs of severe malaria that you learned about in Study Session 7 (Section 7.2.2). If a patient comes to the Health Post with danger signs, or is found to have any of them, he or she will require urgent medical attention and should be referred to a health centre as soon as possible.

Always remember that a delay in referral could cause death of the patient. The risk of death for severe malaria is greatest in the first 24 hours.

Before referring the patient, give pre-referral treatment for all patients presenting with any of the danger signs of severe malaria, regardless of whether the RDT result is negative or positive. The pre-referral treatments that you should give the patient include:

- The first dose of rectal Artesunate (see Table 8.4 below for the dosages), or if available, an intramuscular injection of Artemether in a dose of 3.2 mg/kg body weight.
- If an Artesunate suppository is expelled from the rectum within 30 minutes of insertion, insert a second suppository.
- In young children, hold the buttocks together for 10 minutes to ensure retention of the rectal dose of Artesunate.

Table 8.4 Rectal Artesunate dosage for pre-referral treatment by body weight and age.

Weight (kg)	Age	Artesunate dose (mg)	Formulation of the regimen (given all at the same time)
5–8.9	0–12 months	50	One 50 mg suppository
9–19	13–42 months	100	One 100 mg suppository
20–29	42–60 months	200	Two 100 mg suppositories
30–39	6–13 years	300	Three 100 mg suppositories
40–59	>13 years	400	One 400 mg suppository
60–80	Adults	800	Two 400 mg suppositories
80+	Adults	1,200	Three 400 mg suppositories

- Remember to give supportive treatment as indicated in Section 8.1.3 of this session if the patient has high fever, or dehydration, and in case of breastfed infants, encourage mothers to provide extra breastfeeding.
- If the patient is unconscious, in addition to the above mentioned pre-referral treatments, perform the activities indicated in Box 8.3.

Box 8.3 Steps in managing an unconscious patient

Ensure ABC of life support, as follows:

- *A = Airway:* in the unconscious or convulsing patient it is imperative that the airway is free of obstructions. In the convulsing child you may thrust the jaw forward to ensure a clear airway. Show family members how to position the patient (on his or her side) to ensure a clear airway is maintained.
- *B = Breathing:* check that the patient is breathing by looking for chest movements and listening for breath sounds.
- *C = Circulation:* feel or observe that hands and fingers are not cold, and colour is normal. Also check that the capillaries are refilling with blood by applying pressure for few seconds to a fingernail bed, then release the pressure to see if the blood returns fast, which is normal. Monitor and record vital signs (blood pressure, pulse, respiration rate).

For all the patients you are referring, ensure that the referral form is completed with detailed information, including:

- Clinical presentation/patient's medical history.
- Suspected diagnosis.
- RDT tests performed and results.
- List of all drugs/medication given, route, dose and time of administration.
- Reason for transfer to health centre.

8.3 Management of malaria in special groups

Special population groups such as infants below the age of four months or below 5 kg weight, and pregnant mothers in the first trimester, need different treatment and special attention.

■ What is the drug you give to treat malaria for an infant less than 5 kg body weight?

□ You give quinine oral tablets three times a day for 7 days, with the dose as indicated in Table 8.3 earlier in this study session.

Pregnant women

Now we will tell you about pregnant women. Pregnant women are at high risk of developing severe malaria. In addition, malaria during pregnancy can cause premature labour, stillbirth or abortion, as well as severe anaemia in the mother. The baby that is born may have low birth weight.

Therefore, you must give effective anti-malaria treatment to pregnant women with malaria immediately.

Pregnant women in the first trimester (the first three months) of pregnancy should NOT take Coartem. During the first trimester give oral quinine three times a day for 7 days (for dosage see Table 8.3 above). However, you can give Coartem if there is no quinine, or if you strongly believe that the mother

may not comply with the seven days of quinine treatment. The first dose should be given under your direct supervision.

If vomiting occurs within 30 minutes after swallowing the drug, the dose should be repeated with a replacement dose to ensure completion of treatment.

Advise the patient to take food while taking the drug, as quinine might cause low blood sugar (hypoglycaemia). Also assure her that symptoms like dizziness, ringing in the ears, blurred vision and tremors might occur, but these are not severe enough to stop treatment, and they will end when the drug treatment is finished. Explain to her the importance of completing her malaria treatment for the health of her unborn baby.

8.4 Adherence to malaria treatment

Adherence to malaria treatment, that is taking all the doses that are given, is very important for successful malaria treatment outcome. If patients do not adhere to the treatment they will not get cured completely and the disease will come back. Not adhering to the treatment can also lead to the parasites becoming *resistant* to the drug, so in future the drug will be less effective against the parasites.

Critical to patients' adherence is good communication between you and your patients. Adherence to malarial medication in patients has been linked to knowledge of malaria, access to information on medication for malaria, perceived benefit from the medication, and perceived barriers to treatment.

To ensure adherence, identify *high risk patients* that might not adhere to the treatment that is given to them. Do this identification during history-taking and clinical assessment. If the patient has one of the risk factors in Box 8.4, then he or she may not adhere to the full course of the drug treatment they received.

Box 8.4 Patients at high risk of low adherence to treatment

- Patients with chronic medical illness.
- Lack of transportation to come back or to send a sick family member.
- History of psychiatric conditions.
- Lack of economic support.
- Pregnant mothers.
- History of poor drug adherence for anti-malaria treatment.

Therefore, arrange a follow-up visit or link the patient to volunteer community health promoters or family members, if he or she is at risk of non-adherence.

During the first contact, if the patient is identified as a malaria case and has the high-risk features shown in Box 8.4, the following are the actions and key messages that you should tell to the patient:

- Ensure the first dose of the malaria treatment is taken under your observation and is well tolerated and not immediately vomited.
- Advise the patient to complete the treatment and educate him or her on the risk of not completing. If the full course is not taken the malaria will occur again.

- Advise patients not to share the drug with other sick members of the family. Advise them to send the sick ones to the Health Post.
- Visit the patient on the second day of the treatment and ensure that he or she takes the drugs properly (this can be aligned with your routine home visit).
- Link the patient to volunteer community health promoters or family members, who will ensure the patient takes the drugs properly.

8.5 The role of the Health Extension Practitioner in malaria treatment

Malaria is a curable and preventable disease, but it still kills many people. The main reasons for this unsatisfactory situation are:

- Some people do not come for treatment until they are very ill because:
  - They do not realise they might have malaria (people often think they have a common cold or other simple common infection).
  - They do not realise that malaria is a very dangerous disease.
- Many people do not know what causes malaria or how it is spread, so they are not able to protect themselves from the disease. (Prevention is covered in Study Sessions 9, 10 and 11.)

As a Health Extension Practitioner you can improve the situation by:

- Educating people to seek treatment immediately if they have a fever. This is especially important in young children and pregnant women, who should receive treatment against malaria within 24 hours of becoming ill.
- Recognising and treating malaria to prevent severe illness and death.
- Explaining how to take the treatment correctly, so that people can avoid repeated attacks of malaria.
- Advising patients who do not improve within 48 hours after starting treatment, or whose condition is serious, to go immediately to the nearest health centre that is capable of managing severe malarial disease.

8.5.1 Key messages and instructions

The problem of poor adherence may be overcome with simple health messages even when the majority of individuals are illiterate and lack formal education. Explain to people in your community that:

- Malaria is a killer disease if the treatment is not taken properly.
- Make sure that the patient has clearly understood drug labels and instructions.
- Clearly explain how to complete the treatment for malaria.
- Tell them not to interrupt taking medication. To take all (full course) of the anti-malaria drugs, prescribed to them.
- Do not share anti-malaria drugs with others.
- Whenever a family member has a fever, take them to the Health Post immediately.

Summary of Study Session 8

In Study Session 8, you have learned that:

1 Treatment of uncomplicated malaria should be based on diagnosis of malaria parasites using RDTs, but in the absence of RDTs, treatment can be given based on clinical diagnosis of malaria.

2 Different anti-malarial drugs that are used to treat malaria are based on the type of the malaria parasite species. All uncomplicated *falciparum* malaria patients and patients with mixed infections, *except* pregnant mothers in the first trimester, and infants less than four months old, are treated with Coartem. *Plasmodium vivax* cases are treated with Chloroquine.

3 It is equally important to treat other symptoms like high fever, dehydration and anaemia in uncomplicated malaria cases with the appropriate supportive treatment methods.

4 Severe malaria should be referred to the nearest health centre very fast. Before referring the patient it is important to give pre-referral treatment; this will help to prevent the patient's condition from getting worse.

5 The key messages you have to give to your community should focus on seeking early treatment and adherence to treatment.

Self-Assessment Questions (SAQs) for Study Session 8

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 8.1 (tests Learning Outcomes 8.1 and 8.3)

Which of the following statements about supportive treatment is *false*? In each case, state why it is incorrect.

A Supportive treatment is given to kill the malaria parasites in the blood circulation of the patient.

B Malaria patients with high grade fever should be given supportive treatment.

C Patients with moderate dehydration have to be immediately referred to a health centre without giving any supportive treatment.

D No supportive treatment is required for women with malaria, with normal temperature, who can breastfeed very well and with no anaemia.

E If the malaria patient has moderate anaemia, then treat with ferrous sulphate (iron tablets).

SAQ 8.2 (tests Learning Outcomes 8.2 and 8.3)

What anti-malaria drug would you give a patient with a clinical diagnosis of uncomplicated malaria, if you cannot do an RDT? How many times a day does the patient take this drug?

SAQ 8.3 (tests Learning Outcome 8.4)

Molamo is a 15 year-old boy who came to your Health Post. You diagnosed him with malaria and gave him Coartem. He took the medicine correctly as you ordered. Three days after his first visit he came back to your Health Post with no improvement of the fever. Describe the actions that you have to take.

SAQ 8.4 (tests Learning Outcomes 8.2 and 8.4)

Describe what you would do if you found that a patient who came to your Health Post is a suspected severe malaria case?

SAQ 8.5 (tests Learning Outcome 8.5)

What could happen if a malaria patient does not take the full course of treatment or does not adhere to the treatment?

SAQ 8.6 (tests Learning Outcomes 8.2, 8.3, 8.4 and 8.5)

Read Case Study 8.1 about Beka and answer the questions that follow it.

Case Study 8.1 Is Beka sick with malaria?

Beka is a five-year-old boy. His mother brought him to you to seek treatment. Beka and his family are living in your catchment area, which is malarious. The mother says he was well until this morning when he woke up and said he was feeling tired and refused his breakfast. When the mother touched him, he felt hot and she gave him ½ a tablet of paracetamol.

When you examined Beka, you found a well-nourished 15-kg child, not pale, alert and with temperature of 38.5°C measured with the thermometer under his armpit. You could not do a RDT because you used the last kit two days ago. In the rest of the examination, Beka is normal.

(a) What is your diagnosis?
(b) What treatment will you give Beka? And what dose?
(c) What will you tell his mother?

Study Session 9 Malaria Prevention: Environmental Management and Larviciding for Vector Control

Introduction

In this study session you are going to learn how you can make the environment unfavourable for mosquito breeding and how to kill the mosquito larvae in water collections. Using your knowledge from Study Session 5 about the distinguishing characteristics of anopheline larvae, we will teach you how to identify areas that are vector breeding habitats in the community, and how to organise and coordinate community participation in larval control measures. By cleaning and modifying the environment you can make it hard for the mosquitoes to complete their life cycle and be able to transmit malaria.

Larval control is one of the most important malaria prevention measures that can be planned and implemented at the community level. Larval control is any method that helps prevent vector breeding or kills the mosquito at its larval stage. There are other malaria prevention or vector control measures that are also very important and you will learn about them in Study Sessions 10 and 11.

Learning Outcomes for Study Session 9

When you have studied this session, you should be able to:

9.1 Define and use correctly all of the key words printed in **bold**. (SAQs 9.1, 9.4 and 9.5)

9.2 Describe how you would identify mosquito breeding habitats. (SAQs 9.2 and 9.3)

9.3 Describe environmental manipulation techniques for mosquito control. (SAQ 9.4)

9.4 Explain environmental modification measures that are useful for vector control. (SAQ 9.5)

9.5 Describe the principles of larviciding for malaria control. (SAQs 9.1 and 9.6)

9.6 Explain how the community can be mobilised to participate in larval control measures. (SAQ 9.7)

9.1 Why are mosquito larval control strategies so important?

Remember the following key points about malaria transmission from previous study sessions:

- Malaria is transmitted by a mosquito vector.
- Not all mosquito types transmit malaria.
- The mosquito lays its eggs in water collections and the life cycle in water takes about 10 days to complete.

The implications of these facts are that:

- No mosquitoes means no malaria transmission.
- Making water collections unfavourable for mosquito breeding means few or no mosquitoes in the community.
- Killing the mosquito larvae in the water collections before they become adults and fly away, means fewer or no mosquitoes in the community.
- Achieving the above goals means very small or no malaria transmission.

Measures that rely on using insect-killing **insecticides** against the adult (flying) mosquitoes inside houses (spraying and using insecticide-treated bed nets (ITNs), as described in Study Sessions 10 and 11), mean that the mosquitoes must be susceptible to the chemicals if the controls are to be successful. Moreover, they kill only the mosquitoes that enter houses to bite people. However, you learned in Study Session 5 that some mosquitoes can bite people outside houses and transmit malaria. So we are starting the three sessions on malaria prevention with larval control for the following reasons:

1 Larval control is the first line of defense in malaria prevention and presents your first chance of breaking the malaria transmission cycle.

2 The mosquito larvae are not flying insects; it is easy to find the water collections where they are developing to become the adult mosquitoes that will start biting people and transmitting malaria.

3 If people in your village get sick and die of malaria, you have to implement more expensive and complicated mosquito prevention and curative measures to protect the community.

4 Many of the larval control measures are inexpensive; they can be implemented by educating, mobilising and coordinating community members to clean their environment.

5 Compared to other measures, the chemical methods of larval control are also not very expensive and are simple enough to be applied by you or volunteer community health workers.

9.2 Larval control for malaria prevention

Mosquito species differ in their preferences for **breeding habitats**. The species that mainly transmit malaria in Ethiopia (*Anopheles arabiensis*) breed in clean and muddy water collections that are either man-made or naturally-occurring near houses; they do not breed in polluted water like in sanitation systems. Once the breeding sites are known, appropriate control measures may be simple and inexpensive. Most breeding sites in and near houses are easy to identify and simple methods are available to eliminate them. Community members can and should take action against any breeding by mosquitoes observed on or near their premises.

Larval control may be the only effective approach when mosquitoes bite outdoors and do not enter houses to feed or rest, or when the mosquitoes are not susceptible to the available insecticides. Insecticide resistance of malaria vectors is particularly important in the Ethiopian situation. An important additional advantage of larval control is that some of the measures provide long-lasting protection.

9.2.1 Environmental management for vector control

Environmental management for vector control refers to the planning, organisation, carrying out and monitoring of activities for the modification and/or manipulation of environmental factors, with the aim of preventing or minimising vector breeding and reducing human-vector-parasite contacts. If such measures result in long-lasting or permanent changes in land, water or vegetation, they are often referred to as **environmental modification**. When such measures have a temporary effect and need to be repeated, they are known as **environmental manipulation**.

In this study session, we will focus mainly on simple and effective environmental *manipulation* tools, which can be planned and implemented at the village level by mobilising the community and under your direct supervision. Some environmental *modification* methods could involve very complicated engineering designs of natural and man-made water systems to make them unfavourable for vector breeding, but these ambitious activities are beyond the objectives of the Health Extension Service.

The first step in planning environmental management activities is to identify the water collections where the potential vectors of malaria are breeding. You might plan to remove or destroy all potential breeding sites, whether they are sheltering mosquito larvae or not. However, this could be unrealistic if there are too many sites and your human and material resources are limited. Then you have to be selective and prioritise water collections according to the following criteria:

- First, water collections with anopheline mosquitoes only, and/or anopheline and other mosquito larvae should be removed.
- Second, all temporary rain water collections should be destroyed.
- Third, all water collections with other mosquito larvae have to be addressed.
- Fourth, any standing water that is not used by people or their animals should be removed.

■ Why give priority to elimination of anopheline breeding sites?

□ Because anophelines are vectors of malaria; other types of mosquitoes are not.

9.2.2 Environmental modification

Environmental modification includes drainage, filling, land levelling and transformation of impoundment margins (e.g. ditches to restrain livestock). Although these modification works are usually of a permanent nature, proper operation and adequate maintenance are essential for their effective functioning. The following are some of the environmental modification activities useful for mosquito control:

Removal or destruction of breeding sites

Mosquitoes do not need big swamps, ponds and big water bodies to lay their eggs and complete their life cycle. Very small water collections such as in hoof-prints, abandoned cans, jars and tyres can serve as mosquito breeding grounds. Therefore, small containers serving as breeding sites can be removed, destroyed or covered to deny access to mosquitoes.

Filling breeding sites

Filling of mosquito breeding sites with soil, stones, rubble, ash or rubbish is the most permanent control measure available. It is most suitable for reducing breeding sites that do not require much filling material, such as small depressions, water holes, **borrow-pits** (a hole that has been excavated by people as a source of soil, stones or dirt), and abandoned ditches or pools. On a small scale, no special expertise is needed and communities can carry out the work with shovels, picks, carts and other simple equipment. The filling material should be obtained without creating new breeding sites. Waste materials can be used for most of the filling. If refuse is used, it should be compacted (pressed down hard) and covered with earth to prevent breeding by flies. Very large areas can sometimes be filled at little cost by making use of waste soil and stones left over from a construction project.

Drainage

Proper drainage reduces mosquito breeding. The drainage of water can be accomplished by constructing open waterways and dykes with tidal gates, subsoil drainage and pumping. Leakages, obstructions and small pools or puddles of residual water in drainage ditches often afford suitable breeding sites for mosquitoes. The planning and construction of some drainage systems are complicated and require the expertise of engineers. However, some small-scale drainage works intended to control mosquitoes can be carried out by community members using simple equipment (Figure 9.1).

Figure 9.1 Community members digging a ditch to drain mosquito breeding pools. (Photo: Dr Daddi Jima)

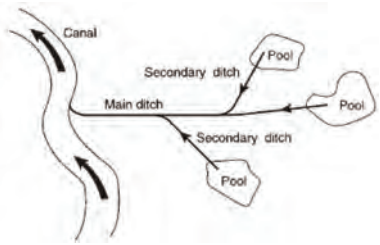


Figure 9.2 Open earth drains for larval control. (Source: WHO, 1997, *Vector Control Methods for Use by Individuals and Communities*)

Open ditches

Open earth drainage ditches like those in Figure 9.2 are the simplest to construct. They are used to prevent the accumulation of excess rainwater in depressions in the ground and to dry out marshy areas, borrow-pits, ground pools and other accumulations of surface water. The ditches carry the water away to an appropriate, lower-lying outlet, such as a river, stream, pond, soak away pit or main drainage ditch. They should follow the natural flow of water along the surface.

As shown in Figure 9.2, a main ditch may have several lateral or secondary ditches to collect water that does not readily drain into the main ditch.

Planting eucalyptus trees

As shown in Figure 9.3, eucalyptus trees can be used for drying marshy areas and other plots of land with a high water table. Species that grow rapidly and use a lot of water are particularly suitable. The trees dry the land by allowing water to evaporate through their leaves. For optimum evaporation they should be planted with adequate spaces between them. An additional advantage of the trees is their commercial value.

Figure 9.3 Planting eucalyptus trees helps to drain marshy land where mosquitoes could breed. (Photo: Dr Yemane Ye-ebiyo Yihdego)

9.2.3 Environmental manipulation

Increasing the flow of streams, regulation of the water level in reservoirs, vegetation removal and shading are examples of **environmental manipulation** activities. The following are some of the environmental manipulation activities which are useful for mosquito control:

Closing, screening or covering breeding sites

Potential breeding sites in relatively small enclosed habitats, such as drinking water storage containers, tyres and wells, should be made inaccessible to adult mosquitoes by covering them (e.g. as in Figure 9.4). Removable covers, such as mosquito-proof lids or wire mesh screening, can be fitted in some cases. Wells can be made mosquito-proof by closing them with slabs, an iron sheet or grass, and installing hand pumps.

Figure 9.4 Potential mosquito breeding sites in small containers can be covered. (Source: WHO, 1997: as in Figure 9.2)

Flushing

Flushing (increasing water flow in streams) is employed in small streams where there is a continuous and abundant supply of water flowing slowly enough to permit mosquitoes to breed in quiet places along the margins. A periodic discharge of a large volume of water washes away the eggs, larvae and pupae from the edges, or strands them on the banks.

In order to collect the water needed for flushing, a small dam is constructed upstream of the area where breeding occurs. The dam site should be at a point where the stream or channel is narrow and the banks are high. The dam could have a hand-operated gate, to release the water at least once a week. The method requires some initial investment, but is long-lasting and requires little maintenance. Health Extension Practitioners can mobilise the community to construct a small dam and water release system wherever such a measure is feasible to control mosquito breeding in the village.

Shading of ponds and stream banks

Where mosquitoes prefer breeding sites that are partly or fully exposed to sunlight, they can be controlled by planting shrubs and trees along the banks of streams and covering ponds with iron sheets or local materials (Figure 9.5). The main vector of malaria in Ethiopia, *An. arabiensis*, prefers to breed in sunlit water, so this intervention could be helpful.

Figure 9.5 Shading a pond with local materials. (Photo: Dr Yemane Ye-ebiyo Yihdego)

Removal of water plants

Figure 9.6 Removing water plants. (Source: WHO, 1997: as in Figure 9.2)

Mosquitoes can be controlled by removing vegetation from water collections. The plants provide the developing larvae with a safe hiding place from predators (e.g. fish), as well as protection from wave movement and currents. In small breeding sites, such as borrow-pits and ponds, the vegetation can be removed manually, for example by the members of communities, using rakes and other simple equipment (Figure 9.6). This method may also be effective in removing resting places for adult mosquitoes. In addition, it promotes evaporation and the drying up of small accumulations of water and makes breeding sites more visible for control purposes.

Straightening and steepening shorelines

Shorelines of streams, ditches and ponds can be made steeper to reduce the availability of shallow places suitable for breeding of mosquitoes, and to increase the speed of the flowing water.

9.2.4 Common vector breeding grounds in Ethiopia

In this section, we summarise the environmental control measures that will be most useful and appropriate in dealing with common mosquito breeding sites in Ethiopia.

Accumulations of water near roads

The construction of roads often leads to the creation of water collections that serve as vector breeding grounds. It often prevents natural drainage of the land and may result in the formation of large ponds alongside the roads.

Control measures include:

- Construction of underground channels allowing streams to continue on their natural courses.
- Use of larvicides (see Section 9.3).

Borrow-pits

Borrow-pits used to extract soil and stones for construction are very common in rural Ethiopia inside and outside villages. Older pits containing vegetation and freshly dug pits collecting rain water (Figure 9.7) can serve as very important vector breeding sites.

Figure 9.7 Ideal breeding ground for the mosquito vectors of malaria. (Photo: Dr Yemane Ye-ebiyo Yihdego)

Control measures include:

- Filling with mud and stones, or the disposal of household rubbish or waste. Filling the pits with rubbish or waste would also pollute the water, making it unfavorable for breeding of the malaria vectors, which normally prefer clean water.
- The removal of water plants and other mosquito shelters can make ponds temporarily unsuitable for breeding by mosquitoes.

Micro-ponds

Micro-ponds are the most common man-made structures in Ethiopia, and are used to harvest rain water for horticulture and small scale irrigation. There are several types of micro-ponds in use. Some are lined with plastic sheet to prevent seepage and some are covered to avoid evaporation. The plastic lining prevents vegetation growth, making it unfavourable for mosquito breeding; covering the ponds denies access to egg-laying mosquitoes. However, many micro-ponds are neither lined nor roofed and serve as very important vector breeding grounds. Moreover, the location of these ponds very close to houses makes them extremely dangerous sites in terms of malaria transmission.

Control measures include:

- Removal of vegetation along margins and steepening shorelines (Figure 9.8) reduces the breeding of vector mosquito species temporarily by taking away protective cover and removing shallows.
- Apply chemical larvicides (see Section 9.3).

Figure 9.8 Steepening shorelines can help to prevent mosquitoes from breeding. (Photo: Dr Yemane Ye-ebiyo Yihdego)

Rivers and creeks

Mosquitoes breed in quiet places close to the banks of rivers and creeks where there is protection from currents by obstacles, protruding roots, plants and so on. Effective control of larvae is generally difficult because of the large areas to be covered. Careful study is required to find out the exact location of the breeding sites. During the dry season mosquitoes may breed in stagnant pools in river beds.

Control measures include:

- Breeding sites may be reduced in some cases by removing obstructions in streams, removing vegetation from river edges, and smoothing and increasing the steepness of the banks to increase the speed of the flowing water.
- In the dry season, pools may form in river beds. If breeding occurs in such pools, they can be drained into the main stream. Some smaller pools may be filled up.
- Pools in river beds may be treated with larvicides (see Section 9.3).

Irrigation

Many development-linked activities (e.g. irrigation) lead to environmental changes and often inadvertently increase the risk of malaria transmission. Appropriate safeguards and actions to reduce the risk are required in the planning, construction, and maintenance phases of development projects. Irrigation canals should be lined and the vegetation cleared to discourage breeding in the canal edges and allow free flow of water. The intervals between releasing a gush of water from an upstream dam can be adjusted to ensure adequate periodic flushing of larvae from pools in the canal beds.

9.3 Larviciding

Larviciding refers to the use of chemicals or biological agents or toxins to kill mosquito larvae. Water collections that cannot be managed by environmental control measures can be dealt with by larvicides. Like environmental control measures, the success of larvicides will depend on the identification of mosquito breeding sites and their distribution in the area, followed by sustained weekly spraying of chemicals (Figure 9.9). Larvicides should be applied in conjunction with other environmental control measures.

Figure 9.9 Applying larvicide into water collections that act as vector breeding sites. (Photo: Dr Yemane Ye-ebiyo Yihdego)

A chemical called Temephos (sold under the trade name Abate) has been the most widely used mosquito larvicide worldwide and in Ethiopia. Temephos is highly active against the nervous system of mosquito larvae and other aquatic insects, and a relatively low dosage can kill them before they reach the adult stage. Its toxicity (ability to poison) fish, birds, humans and other mammals is very low. Its low toxicity to non-target organisms and low effective dosage make Temephos the most appropriate larvicide in many situations. It is recommended for the control of mosquito larvae in drinking-water and in areas where fish, birds and mammals may come into contact with it.

According to the current Ethiopian national strategy for vector control, health posts will be supplied with spray pumps and Temephos, and you are expected to mobilise the community to undertake larviciding when necessary. Unlike indoor residual spraying (described in Study Session 10), larviciding requires little technical skill and therefore you can train community members to spray Temephos into breeding sites under your supervision and technical support. The instructions are given in Box 9.1.

Box 9.1 Preparations for spraying Temephos

1 Estimate (in square metres) the size of the breeding sites positive for *Anopheles* larvae, which cannot be dealt with by environmental management;

2 Use a disposable syringe to measure 8 ml of Temephos (Abate) and mix it into 8 litres (one spray pump) of water;

3 One spray pump should cover an area of water of 320 square metres;

4 Pump by hand 60 times to produce the necessary level of air pressure in the sprayer;

5 Use trained community volunteers to spray the chemical onto the water in the breeding site;

6 Keep good records of the accomplished activities.

9.4 Community participation and organisation of larval control measures

To ensure the prevention and control of malaria in your village, it is important that all temporary or permanent vector breeding sites are identified and dealt with through active participation of community members. This malaria control strategy becomes effective only when the mosquitoes are systematically interrupted from breeding and/or their population is substantially decreased.

In summary, methods to control larvae involve the following:

- Eliminating or changing the breeding place to make it unsuitable for development of larvae;
- Making the breeding place inaccessible to adult mosquitoes.
- Larval control is also possible without changing breeding sites by applying chemical larvicides.

The control of breeding places must be carried out around human settlements in an area with a radius greater than the flight range of the target mosquito species. For many species this is about 1.5–2 km. Control measures that are not permanently effective have to be maintained throughout the period of the mosquito breeding season. The effort and expense needed to obtain effective larval control may vary with the size of the settlement and the type and number of breeding sites.

In areas where malaria is a risk, you have to organise and educate the community to undertake environmental management activities such as draining, filling of communal mosquito breeding sites, irrigation canal water management, and chemical larviciding, etc. These activities have to be well planned (Box 9.2), performed under your supervision and assisted by volunteer community health workers. In addition to the efforts through the Health Extension Programme, community level social and traditional structures such as women's associations, youth associations, cooperatives, health committees, schools and religious and community leaders, will all play a major role in social mobilisation as well as empowerment of the community to implement community based activities.

Box 9.2 Priority actions that support implementation of environmental management for vector control

1 Identify the number and distribution of mosquito breeding sites;
2 Determine the number of people needed for action;
3 Identify working tools by type and number: spade, pick-axe, sickle, cutting knife, wheel-barrow, etc.
4 Estimate the time required to complete the implementation of the environmental vector control measures;
5 Identify the type of vector control activities: levelling and filling; drainage; cleaning and clearing ditches; clearing grass or weeds in irrigation ditches; steepening the sides of water collections, etc.
6 Coordinating and managing the environmental control programme on the scheduled day and place;
7 Keeping a record of the accomplished work.

Environmental management activities for vector control may require large numbers of human volunteers and their successful and sustained implementation can only be assured by active participation of the whole community. The vector control measures should be run at least once every week during the malaria transmission season. You have to educate and mobilise your community members to participate in the identification of the mosquito breeding sites and the environmental and other control measures to be undertaken. You will be responsible for coordinating the environmental management activities and leading the community on what to do, where to do it, when to do it and how to do it, in order to reduce the risk of malaria.

9.5 Other malaria prevention options

Malaria can also be prevented through protective measures in instances where conditions do not permit environmental control options, or the control measures are not enough to provide adequate protection. For example, use of mosquito repellents on the skin and clothes could have additional benefits and so could insecticide treated tents, blankets and fly-sheets. Selection of camping or residential sites could be important to avoid proximity to mosquito breeding grounds. Smoke from an open fire repels insects, especially in still air or poorly ventilated dwellings. The repellent effect of smoke may be increased by burning certain materials such as aromatic wood containing resins. Communities should be encouraged to use traditional and modern repellents for personal protection where it is applicable.

Similarly, due to the rapid expansion of commercial farming in the country and the location of these farms in high malaria risk areas, investors need to be advised on the importance of malaria prevention methods, including environmental management, site selection of residential areas/camps for their workers, mosquito repellents and other protection measures.

Summary of Study Session 9

In Study Session 9, you have learned that:

1 Malaria vectors breed in different types of water collections.

2 Environmental management and larval control refers to any action aimed at eliminating vectors and vector breeding sites.

3 You can modify the environment permanently in ways that are unfavourable for vector breeding.

4 The environment can also be manipulated to deter vector breeding temporarily.

5 Borrow-pits that collect rain water and are not used by humans or animals can be filled by soil, sand or stone to avoid vector breeding.

6 Micro-ponds used to harvest rainwater for irrigation and horticulture can be modified in design to deny access to egg-laying mosquitoes, or cleared of vegetation to make them unsuitable for sheltering larvae.

7 Community participation is key to mosquito larval control through environmental management interventions, such as digging drainage ditches, filling pools or covering small containers where rain water collects.

8 Temephos is the most important and widely used larvicide for larval control in Ethiopia; water collections are mainly treated using spray pumps.

Self-Assessment Questions (SAQs) for Study Session 9

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 9.1 (tests Learning Outcomes 9.1 and 9.5)

Which of the following statements about larviciding is *false*? In each case, explain what is incorrect.

A Larviciding means applying chemicals to kill adult vector mosquitoes.
B Temephos is a chemical used as a larvicide to kill larvae of vector mosquitoes.
C Temephos is sprayed onto water collections using spray pumps.
D Temephos can only be sprayed by trained experts/professionals.
E Larvicides are applied to all vector breeding sites, including those that can be removed by environmental management activities.

SAQ 9.2 (tests Learning Outcome 9.2)

You know that mosquitoes require water collections for breeding and different types of vector breeding grounds can serve as breeding habitats. From the list below, identify places that *cannot* be breeding grounds for the vectors that transmit malaria, and explain why.

- Borrow-pits
- Houses
- Micro-ponds
- Trees
- Stream beds
- Irrigation canals
- Foul smelling polluted water
- Swamps
- Road ditches.

SAQ 9.3 (tests Learning Outcome 9.2)

In most parts of Ethiopia, vector populations increase following the rainy season. What could be the reason for an increase in the vector population after the rains? What is the most important type of water collection that is very good for breeding and development of the main malaria vector in Ethiopia?

SAQ 9.4 (tests Learning Outcomes 9.1 and 9.3)

You have learned that environmental manipulation refers to making temporary changes to the environment to make it unfavourable for the vector to complete its life cycle in water. List three environmental manipulation techniques with this effect.

SAQ 9.5 (tests Learning Outcomes 9.1 and 9.4)

Environmental modification refers to making permanent changes to the environment to make it unfavourable for the vector to complete its life cycle in water. List two examples of environmental modification measures with this effect.

SAQ 9.6 (tests Learning Outcome 9.5)

Imagine that you have a vector breeding site in your community that cannot be eliminated through environmental management methods and you have to use larviciding to kill the larvae. The surface area of the water in the breeding site is 960 square metres (m^2). You have learned that 8 ml of the chemical Temephos mixed in 8 litres of water in one spray pump is enough to treat 320 m^2 surface area of water in the breeding site.

(a) How many spray pumps of Temephos chemical do you need to spray in order to treat the breeding site?

(b) What is the amount of Temephos (in ml) you need to treat the breeding site?

SAQ 9.7 (tests Learning Outcome 9.6)

You learned that most larval control activities are undertaken through community participation and you have to mobilise and convince the community to participate. What are the community organisations that can help you to mobilise local people to participate in larval control activities?

Study Session 10 Malaria Prevention: Indoor Residual Spraying of Houses

Introduction

In this study session, you will learn about one of the most important and widely used methods to control adult mosquitoes in Ethiopia: **indoor residual spraying (IRS)** of houses**.** IRS involves spraying the inside of houses with **insecticides** (chemicals that kill insects). The insecticides used in IRS are long-lasting and kill the vector when it enters houses to bite people.

Your role will be critical in the success of IRS in your community, so it is important for you to understand the objectives, techniques and challenges of undertaking IRS campaigns. We will explain how IRS helps to prevent malaria, and how to plan and carry it out. You will also learn about the safe handling of insecticides, the selection and training of spray operators, and the operation of spray pumps.

To undertake IRS effectively in your village, you will need training in several practical skills, such as spray techniques, training of spray operators, maintenance of spray pumps, etc. The additional practical training will be arranged by your Regional Health Bureau.

Learning Outcomes for Study Session 10

When you have studied this session, you should be able to:

10.1 Define and use correctly all of the key words printed in **bold**. (SAQ 10.1)

10.2 Explain how IRS works to kill malaria vectors and protect people from malaria. (SAQs 10.1 and 10.2)

10.3 Explain the logistic requirements to undertake IRS effectively, using standard IRS techniques. (SAQs 10.3, 10.4, 10.5 and 10.6)

10.4 Calculate the IRS coverage in a village. (SAQs 10.5 and 10.6)

10.5 Describe how to safely handle and dispose of insecticides. (SAQ 10.7)

10.1 Introduction to indoor residual spraying (IRS)

In Study Session 9 you learned that environmental management and other larva killing activities are important in malaria prevention. Larval control is the first line of defense in malaria prevention; its impact in reducing the burden of malaria can be significant in countries like Ethiopia, where vector breeding sites are relatively limited and generally clearly defined. However, it is impossible to identify all vector breeding sites and kill all larvae before they become flying adults. Once mosquitoes become flying adults, environmental management has little impact in controlling them, so measures to control adult mosquitoes are needed to protect people from malaria.

Indoor residual spraying (IRS) has been used in Ethiopia since the 1960s, and has three main aims:

1 To reduce the seasonal rise in malaria.

2 To prevent epidemics.

3 To control epidemics.

Until 2009, IRS was planned and implemented by specialised staff from district, zonal and regional health offices. Temporary spray operators were recruited from district towns and sent to villages to do the spraying.

However IRS will now be planned and implemented by Health Extension Workers and Health Extension Practitioners like yourself in your own village, with the co-operation of your local community. As part of this process, you will need to train **spray operators** (the people who do the spraying) selected from the community, supervise the spray operation, and carry out minor maintenance of the **spray pumps** (equipment used to spray insecticides).

10.2 How does IRS reduce the mosquito population?

In Study Session 5, you learned that mosquitoes enter houses to take blood from humans, mainly at night. Mosquitoes do not fly for long after feeding, as the blood meal they take is more than twice their unfed body weight and they need to spend some time resting. Following a blood meal, the female mosquitoes tend to rest in undisturbed sites for two to three days until their eggs develop and are ready for laying. (Remember that the males do not take blood meals and so are not vectors of malaria.) Understanding the **resting habits** (the preferred resting places and behaviour) of the malaria vectors is extremely important for IRS programmes.

In drier regions, rooms inside houses are important resting places for mosquitoes because they prefer humid environments and it is usually more humid indoors. In humid forested areas mosquitoes may also rest in vegetation outdoors. However, even species that normally rest outdoors enter houses to feed and will spend some time resting indoors after feeding.

If the inside of a house has been sprayed with insecticide, when mosquitoes rest in the house they come into contact with the **residual** (long-lasting) **insecticide** sprayed on walls and furniture, and they die within a few hours.

Parasite development inside a female mosquito takes about 10 days and mosquitoes feed and lay their eggs every two to three days. So they may have to bite people three to four times before the parasite develops fully and they are able to transmit the infection. Every time a mosquito visits a sprayed house to feed on people, it is at risk of coming into contact with the insecticide and dying.

Mosquitoes resting on sprayed walls come into contact with insecticide through their feet and are killed. Some insecticides also irritate mosquitoes and cause them to leave houses before biting. In dry or windy areas, this may also result in death due to lack of suitable outdoor resting places.

Wall-spraying may not prevent biting. Hungry mosquitoes entering a house often bite first and then rest on walls and furniture inside houses. As most anopheline vectors of malaria enter houses to bite and rest, malaria control programmes have focused primarily on the indoor application of residual insecticides to the walls and ceilings of houses.

Indoor residual spraying is one of the primary vector control interventions for reducing and interrupting malaria transmission and one of the most effective methods. The primary effects of IRS towards reducing malaria transmission are:

1 It reduces the life span of vector mosquitoes, so that they cannot live long enough to transmit malaria parasites from one person to another.

2 It reduces the density/number of the vector mosquitoes.

3 Some insecticides used in IRS also repel mosquitoes and by so doing reduce the number of mosquitoes entering the sprayed houses and thus reduce human-vector contact.

However, note that IRS may not provide individual protection – people sleeping in sprayed houses may still be bitten by mosquitoes. Unlike insecticide treated nets (ITNs are the subject of Study Session 11), which provide individual protection from mosquitoes, the aim of IRS is to provide *community* protection.

10.3 The IRS programme in Ethiopia

The insecticide called DDT has been used for IRS in Ethiopia since the mid-1960s. However, there is now widespread resistance of malaria vectors to DDT, so it will not be used in Ethiopia for IRS after 2010. Decisions about which insecticide to spray are made at the national level. When to spray is also often decided by malaria experts at the district or regional level, but you may also have a valuable input because you have better knowledge of the malaria transmission pattern in your village.

Areas less than 2,000 metres above sea level are generally considered malarious in Ethiopia, although there are marked variations between places and seasons. As a result, most of the areas below 2,000 metres are considered IRS targeted areas. The decision on whether your village will be sprayed or not is made at the district level. Depending on the local pattern of malaria cases, the availability of resources and the forecast of the risk of malaria, your village may be sprayed once a year, twice a year, during some years but not others, or not sprayed at all.

IRS has to be done during the rainy season and be completed just before the rain stops.

10.4 Spraying requirements

Before spraying is undertaken, detailed information has to be collected on the number of households in the village, the number of unit structures (houses/rooms) in each household, the average surface area of every house in the village, and the season of malaria transmission. Effective insecticide spraying also requires trained personnel. In your case, the spray operators will be community members selected and recruited by you in consultation with your supervisor at the health centre. The spray operators will carry out spraying duties seasonally. Spraying equipment needs maintenance, and spare parts must be available. Box 10.1 on the next page, lists the supplies and equipment used for IRS.

Box 10.1 Supplies and equipment used for IRS

- Spray pumps (Figure 10.1) of eight litre capacity
- Insecticides
- Spray pump spare kits
- Tool kits for pump maintenance
- Personal protective equipment (you will see a drawing of a spray operator wearing this equipment later, in Figure 10.6):
  - coverall,
  - waterproof hats or helmets,
  - face shields or goggles,
  - respiratory masks,
  - gloves,
  - rubber boots.

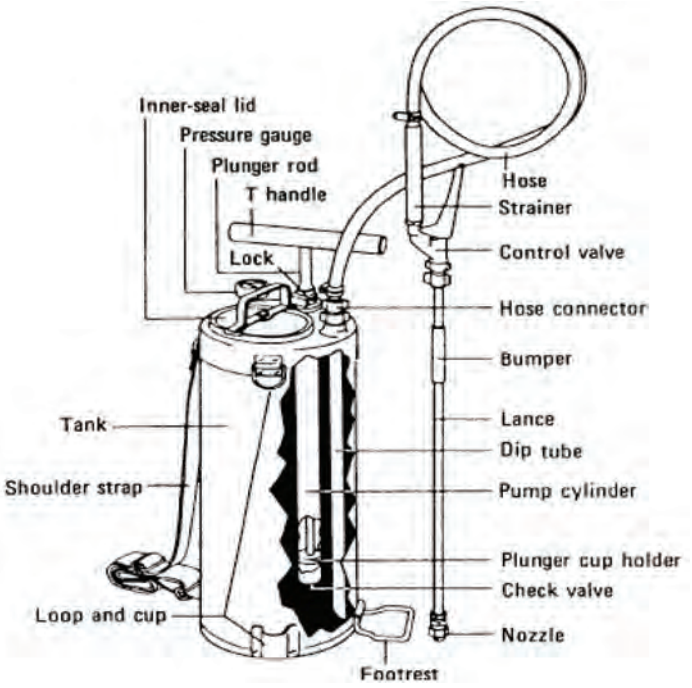


Figure 10.1 Parts of a spray pump for IRS. (WHO, 1997; source as in Figure 9.2)

All these supplies and equipment will be provided to your health post by the District Health Office. They will make sure that you have everything you need before starting to train spray operators and beginning the spraying programme.

10.5 Insecticides for IRS

10.5.1 Choice of insecticides

Insecticide(s) for IRS are selected based on evidence of effectiveness and should have the following properties. They must:

- Kill more than 90% of the mosquitoes that make contact. Note, however, that mosquitoes can develop *resistance* to the insecticide used in IRS. If people in your community experience a high number of mosquito bites even if their houses are sprayed, or there are many mosquitoes resting inside sprayed houses, these could be early signs of resistance and should be reported to your supervisor.
- Remain effective at killing mosquitoes for a long time – that is, they must be long-lasting.
- Be safe for humans and domestic animals.
- Be acceptable to the community.

10.5.2 Commonly used insecticides

Residual insecticides for IRS are generally in the form of powders or liquids. **Water-dispersible powder** consists of a powdered insecticide mixed with a substance that allows the insecticide to dissolve in water. For indoor spraying purposes, the water-dispersible powder is the most effective form. Any of the insecticides shown in Table 10.1 can be used for IRS in Ethiopia for the coming several years. Most insecticides come in pre-weighed sachets; one sachet is to be used per one spray pump of eight litre capacity.

Table 10.1 Insecticides used for IRS in Ethiopia.

Name of insecticide	Chemical type	**Dosage** (in grams per square metre)
Malathion	Organophosphorus	2 g/m^2
Fenitrothion	Organophosphorus	1 or 2 g/m^2
Propoxur	Carbamets	1 or 2 g/m^2
Bendiocarb	Carbamets	0.2–0.4 g/m^2
Deltamethrin	Synthetic pyrethroids	0.025–0.05 g/m^2
Permethrin	Synthetic pyrethroids	0.5 g/m^2
Lambdacyhalothrin	Synthetic pyrethroids	0.025–0.05 g/m^2
Cypermethrin	Synthetic pyrethroids	0.5 g/m^2

10.6 Determining insecticide requirements

The amount of insecticide required for your village depends on:

- The type of insecticide to be sprayed.
- The number of households and **housing units** (a structure/room used by households for sleeping, storage, shelter for animals or other purposes) in your village.
- The **average surface area** of the housing units; surface area refers to the area of the walls, roof and furniture to be sprayed by insecticide; if houses are big in your village, they will have more surface area to be sprayed and need more insecticide per house than will be needed to spray small houses.

The type of insecticide to be sprayed is decided nationally. Information about the number of households and housing units for your village is kept at the District Health Office (and may need to be updated by you from time to time). The average surface area of the housing units in your village is also known by the District Health Office. If necessary you can work with experts from the District or the Regional Health Office to update these measurements. Based on the above data, the amount of insecticide required for IRS in your village is calculated by experts at the District Health Office and sent to you at your health post.

You are responsible for the safe storage and handling of the insecticide at the village level. Most insecticides are pre-weighed and pre-packed in sachets that have to be dissolved in 8 litres (8,000 ml) of water to fill a spray pump. 40 ml of the insecticide needs to be sprayed per square metre (m^2) of surface area, so a full spray pump (8,000 ml) is enough to spray 200 m^2.

10.7 Housing units and structures to be sprayed with insecticide

You need to know which areas and items in a household to spray during IRS.

All potential **resting places** for mosquitoes need to be sprayed. Resting places are all walls and ceilings in the house, window frames, and both sides of doors, furniture (beds, tables and chairs), animal shelters, latrines, stores and outhouses.

- Why are the outer walls and roofs not sprayed?
- These surfaces are not generally used by mosquitoes for resting.

To ensure that IRS provides good protection against malaria vectors, you should aim to spray 100% of the housing units and other structures in your village.

Less than 85% coverage with IRS is not sufficient to provide adequate protection to your community, so it would be a waste of time and resources.

10.8 Training of spray operators

You will get a national manual with detailed instructions on the training of spray operators.

The outcome of IRS is highly dependent on the quality of training given to spray operators. This training will be your responsibility.

The training should address spray techniques, environmental and human safety issues, as well as communication of key IRS messages (explained in Section 10.11). The spray operators should be trained to cover 19 m^2 at a constant rate within one minute. This will allow the application of 40 ml of insecticide suspension per 1 m^2 of sprayable surface; 1 litre of suspension covers 25 m^2 when the nozzle tip is effectively kept at 45 cm distance from the spray surface.

The wall of a building can be used for practice. Mark an area 3 m high and 6.35 m long, divided into nine bands: the first band should be 75 cm wide and the remainder 70 cm wide (Figure 10.2). The spray nozzle will produce a swathe of spray 75 cm wide if kept at a distance of 45 cm from the wall (Figure 10.3).

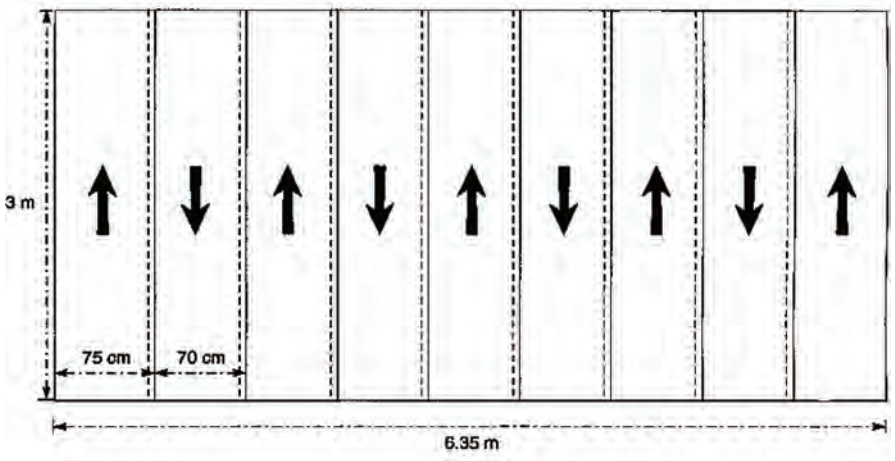


Figure 10.2 Training board for residual spraying which can be marked with chalk on the wall of a large building. (WHO, 1997; source as in Figure 9.2)

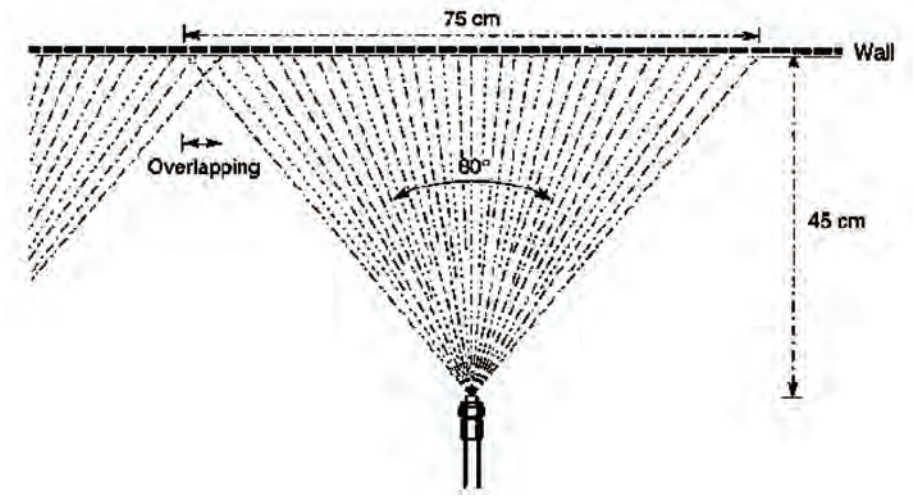


Figure 10.3 The spray nozzle discharge pattern is 75 cm wide when the nozzle is held at 45 cm from the sprayed surface. (WHO, 1997; source as in Figure 9.2)

10.9 Timing of spray operation

In areas where malaria transmission is seasonal, IRS should be completed *just before* the season begins. Generally, only one round of spraying is done per year in Ethiopia. In areas where the main transmission season is from September to late November, spraying must be completed in August at the latest. For areas with a different malaria transmission pattern, the timing of spraying should be adjusted in consultation with malaria experts at the District Health Office.

10.10 Preparation of houses before spraying

Houses need to be prepared for spraying, so householders should be informed in advance of the date and time of spraying. This should help to increase IRS coverage in the community and could be done through the village administration and other community organisations.

To prepare a house for spraying, all food, cooking utensils, bedding and clothes must be protected from the insecticide by taking them outside the house before spraying starts. Alternatively they should be placed in the centre

of a room and covered with a plastic sheet to stop the insecticide settling on them.

All portable furniture should be moved away from the walls so that the walls and all sides of all the pieces of furniture can be sprayed.

10.11 Undertaking IRS operations

You will learn IRS techniques from your local mentor during practical training. You will also receive detailed instructions via the national IRS guidelines from the Federal Ministry of Health. In this section, only the most important aspects of IRS technique will be described.

10.11.1 Correct IRS procedures

- Make sure that the house is ready for spraying (as explained in Section 10.10).
- The outside of the front door is the first surface to be sprayed.
- After entering the house, close the front door and spray it on the inside, including all frames of the door.
- Start the next swathe of spraying from the bottom corner of the wall to the right of the front door and proceed clockwise as shown in Figure 10.4. Spray all edges and corners of windows, as well as all niches and cracks where mosquitoes might rest.
- The backs, undersides and interiors of all cupboards, boxes, ovens, calendars, pictures, stools, beds, chairs and tables must be sprayed.
- Other household areas, i.e., kitchen, store, stable and latrine, should be sprayed next.

Figure 10.4 Correct indoor spraying procedure. (WHO, 1997; source as in Figure 9.2)

- After spraying, a final inspection is made by the spray operator to see that no surfaces on which mosquitoes might find a sheltered resting place remain unsprayed.
- Following inspection by you, the spray operator is assigned to another house.
- After spraying, the spray operator must tell each householder:
  - Not to enter the house for 30 minutes.
  - Not to re-plaster, mud-wash or white-wash inside the house for six months.
  - The spraying is to control malaria vector species, not bed bugs, fleas, etc.
  - To clean the floor and bury or burn the dirt, which is contaminated with insecticide.

10.11.2 What you need to do to support IRS

It is your responsibility as the local member of the Health Extension Service, to carry out the following duties during an IRS operation:

- Inspect all spray pumps daily to make sure they are in perfect working condition.
- Ensure spray operators have enough insecticide sachets for the job, and are carrying all the necessary spraying equipment.
- Carry enough spraying record forms (Table 10.2) for the number of households to be sprayed each day.
- Supervise the work of each of the spray operators to ensure the correct procedures are being followed.
- After spraying is finished, inspect the house for the quality of spraying and complete the spraying record form (Table 10.2) for all households sprayed or unsprayed
- Complete the village spraying report using the form indicated in Table 10.3 (on the next page).
- Make every effort not to leave any houses unsprayed. Householders who refuse to have their houses sprayed have to be convinced by means of proper health education during the operation. Locked houses left unsprayed during the initial visit have to be revisited before the end of the day's work or the next day.

Table 10.2 Household spraying record.

Region _____ **Zone** _____ **District** _____**Village** _____ **Spray Period** _____

Household No.	**Name of head of household or family**	**No. of people in the family**	**Sprayed housing units**	**Not sprayed housing units**	**Spray operator number**	**Remark**
Total						

Table 10.3 Village spraying report by a Health Extension Practitioner

Region _____ District _____ Zone _____ Village _____ Spray Period _____

HEP Name _____

Name of sub-village	Households			Housing units			Population protected		No. of insecticide sachets used	Remark
	Total	Sprayed	Not sprayed	Total	Sprayed	Not sprayed	No. of people in sprayed housing units	No. of people in unsprayed housing units		
Total										

10.12 The role of the health post, health centre and District Health Office in IRS operations

Now that IRS will be decentralised to the health post level, the responsibility of planning, and organising a spray operation is shared between the District Health Office, the Health Extension Supervisor (at the health centre) and you, the Health Extension Worker or Practitioner (at the health post).

Decentralisation of the IRS operation has several advantages compared to the previous method of planning and undertaking it from the district. For example:

- The operation could be more quickly organised at community level and implemented to control epidemics.
- The spraying is undertaken by you, an important and familiar person in the community, and trusted spray operators selected from the community; this will increase acceptability of the operation.
- Pumps will now be available at the health post and can be used for other malaria control purposes, such as larviciding whenever necessary.

Your responsibility in IRS operations in the village will be to:

1 Select capable spray operators from the community.

2 Train the spray operators for 5–7 days; (spray techniques, communication, safe handling of chemicals, etc).

3 Plan when to start and finish the IRS operation in your village; consult also the village leaders.

4 Undertake the IRS operation as the leading person guiding and supervising the spray operators.

5 Mobilise the community to cooperate and participate.

6 Educate the people about the benefits of IRS and what to do after their houses are sprayed.

7 Keep records of your daily output and usage of insecticides.

The operation you undertake in your village will be supervised by the Health Extension Supervisor at the health centre and experts from the District Health Office. They will provide you with any technical support and equipment that you need (spray pumps, insecticides, spray pump spare kits, tool kits for pump maintenance, personal protective equipment), and answer any questions you might have.

10.13 Safe handling of insecticides

All insecticides are poisonous and must be handled with care. The following precautions are recommended and should always be practiced:

- Anyone handling insecticides should be informed of the risks involved in their use, and should receive instructions for handling them safely.
- You should adequately supervise spray operators to ensure they are following instructions.
- The spray operator must wear a hat and clothing that covers as much of the body as possible, including arms and legs; the nose and mouth should be covered with a disposable or washable mask (Figure 10.5).

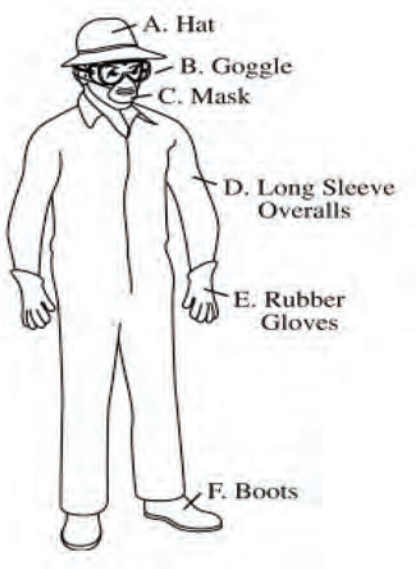


Figure 10.5 Personal protective equipment for spray operators engaged in IRS. (WHO, 1997; source as in Figure 9.2)

- Hands and faces should be washed with soap and water after spraying and before eating, smoking or drinking.
- Insecticide spray should not fall onto arms, legs or other parts of the body. If the insecticide gets on to skin, it should be washed off immediately with soap and water.
- Leaky spray equipment should be repaired.
- Operators should bathe at the end of every day's work and change into clean clothes
- Clothes should be changed immediately if they become contaminated with insecticides.
- Operators should inform you immediately if they do not feel well.
- At the end of the day's work, washings from the sprayer should be put into pit latrines, if available, or into pits dug especially for this purpose and away from sources of drinking water.

- Any leftover insecticide must not be poured into rivers, pools or drinking water sources.
- Empty insecticide containers should not be re-used.

10.14 Some problems related to house-spraying

1 In some areas mosquitoes may become resistant to commonly used insecticides. If resistance develops, insecticides are changed by the national experts.

2 Spraying walls often leaves a visible deposit of insecticide, especially when a wettable powder suspension is used. To prevent objections to spraying on these grounds, you should educate householders on the benefits of IRS.

3 Some people may object to wall-spraying on religious grounds; the education and communication you offer is important.

4 The washing or re-plastering of walls, for religious or cultural reasons, reduces or eliminates the killing-power of insecticides; households should know that re-plastering during the malaria season is bad for their health.

5 The community may be reluctant to allow strangers into their houses, for fear that they will interfere with women or steal; this will not be a problem if spray operators are recruited from the community.

6 The insecticides may not kill other domestic pests, such as bedbugs; acceptability increases when the insecticides also kill other pests, but households should know that the objective of IRS is to kill mosquitoes and prevent malaria.

Summary of Study Session 10

In Study Session 10, you have learned that:

1 IRS is one of the most important vector control and malaria prevention methods widely used in Ethiopia.

2 Insecticides are sprayed onto the inner walls of houses, furniture and other structures using hand-operated spray pumps.

3 The main objective of IRS is to kill adult mosquitoes that enter houses to bite people and rest inside houses after a blood meal.

4 IRS may not provide individual protection; people sleeping in sprayed houses can still be bitten by mosquitoes.

5 Unlike ITNs which provide individual protection, the aim of IRS is to provide community protection. All structures that could be used as resting places should be carefully sprayed to deny any safe shelter for the vector mosquito; achieving high coverage is extremely important.

6 It very important that instructions on safe handling and disposal of insecticides are strictly followed.

7 Proper communication and education of the population will help to increase acceptability of IRS operation; people have to know that re-plastering of houses before three to six months would make IRS ineffective.

8 IRS operations should be completed just before the beginning of the malaria transmission season.

9 Quality of spray operation is very important for IRS to be effective and the quality depends on effective training of the spray operators.

10 The community should understand that the objective of IRS is to kill the mosquitoes and protect people from malaria; it is not to kill bedbugs or other pests.

11 You are the key person in planning and implementation of IRS in your village; ask for support from community leaders, the health centre and District Health Office whenever necessary.

Self-Assessment Questions (SAQs) for Study Session 10

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 10.1 (tests Learning Outcomes 10.1 and 10.2)

The *resting habits* of mosquitoes are very important for IRS. Which of the following sites can serve as resting places for a blood-fed mosquito, so they should be sprayed with insecticide? Which ones cannot be sprayed?

- Walls of houses
- Furniture in houses
- Streams
- Animal shelters
- Lakes
- Rivers
- Latrines.

SAQ 10.2 (tests Learning Outcome 10.2)

Which of the following statements is *false*? In each case, explain what is incorrect.

A Blood-fed mosquitoes rest on either the inside of houses or in vegetation outdoors.

B Mosquitoes that rest outside houses after feeding are easier to control with IRS.

C After taking a blood meal, mosquitoes have to rest about 10 days before laying their eggs and seeking their next blood meal.

D Blood-fed mosquitoes can often rest on the outside walls of houses.

E IRS kills mosquitoes entering houses and resting on sprayed walls and furniture.

SAQ 10.3 (tests Learning Outcome 10.3)

You will be responsible for undertaking IRS in your village and before you start the operation you have to make sure you have all the resources ready. What are the items you have to request from the District Health Office, and what do you have to do at the community level?

SAQs 10.4, 10.5, 10.6 and 10.7 are on the next page.

SAQ 10.4 (tests Learning Outcome 10.3)

What is the capacity of the spray pump used for IRS in Ethiopia? What is the surface area that can be sprayed by one full spray pump of insecticide?

SAQ 10.5 (tests Learning Outcomes 10.3 and 10.5)

Your village has 800 households and the average housing unit per household is 1.5. At the end of your spray operation, your record shows that 900 housing units were sprayed and the rest were unsprayed.

(a) How many housing units were expected to be sprayed?
(b) How many housing units were unsprayed?
(c) What is the coverage of this IRS operation? Express you answer as % of housing units sprayed.
(d) Is the coverage of this IRS operation acceptable? Say why or why not.

SAQ 10.6 (tests Learning Outcomes 10.3 and 10.5)

Read Case Study 10.1 carefully and then answer the questions below it.

Case Study 10.1 A village IRS programme

Your village has 500 households and each household has two housing units. One spray operator sprays 20 housing units per day. You have five spray operators with five spray pumps to undertake the operation. The average surface area of one housing unit is 100 m^2. From Section 10.5 you have learned that one spray pump of insecticide (one sachet) covers 200 m^2 surface area.

(a) How many working days will be needed to spray the entire village?
(b) How many sachets of insecticide do you need for the village?
(c) How many sachets does one spray operator need to carry for one day's work?

In each case, explain how you arrived at your answer.

SAQ 10.7 (tests Learning Outcome 10.6)

Which of the following statements about the safe handling of insecticides is *false*? In each case, explain what is incorrect.

A Spray operators need to wear a shirt and trousers during spraying.
B Hands and faces should be washed with soap after spraying, and before eating or drinking.
C Any leftover insecticide should be poured into rivers.
D Spray operators can keep wearing contaminated clothes for a week without washing.

Study Session 11 Malaria Prevention: Insecticide Treated Nets

Introduction

In Study Sessions 9 and 10 you learned about two important malaria prevention methods targeted at malaria vectors: killing mosquito larvae as they develop in water, and using IRS to kill adult mosquitoes that enter houses to bite people. In this study session, you will learn about another malaria prevention strategy directed against adult mosquitoes, which is widely used in malaria risk areas: the use of **insecticide-treated nets** (**ITNs**). An ITN is a mosquito net impregnated with insecticide that repels, disables or kills mosquitoes coming into contact with it.

An important part of your responsibility is distributing ITNs to the community and maintaining high coverage through replacement of damaged nets, sustained coverage of people at risk, educating households on how to hang the nets, how to use them properly and consistently, and how to repair them when damaged. In this study session you will learn the objectives of using ITNs for malaria prevention, and about methods of effective net distribution, replacing old nets and monitoring their use. It will help you understand your role in the ITN programme, including what you need to do to make sure people in your community benefit fully from using ITNs.

The skill and knowledge you obtain from this study session about ITNs as a malaria prevention strategy will help you ensure that people in your community get the maximum benefits from the nets distributed. Like other malaria control and prevention tools, ITNs protect people from malaria and save lives.

Learning Outcomes for Study Session 11

When you have studied this session, you should be able to:

11.1 Define and use correctly all of the key words printed in **bold**. (SAQ 11.1)

11.2 Discuss the principles of bed net use in malaria prevention. (SAQs 11.2 and 11.3)

11.3 Describe the different mechanisms of net distribution. (SAQs 11.4 and 11.5)

11.4 Explain the importance of correct and sustained net use and the mechanisms for monitoring your local ITN programme. (SAQs 11.6 and 11.7)

11.1 ITNs as a malaria prevention tool

Insecticide treated nets (**ITNs**) are one of the most effective methods of preventing malaria in malaria-risk areas. The insecticides used for treating bed nets kill mosquitoes, as well as other insects, and they also repel mosquitoes, reducing the number entering the house to feed on the people inside. In addition, if high community coverage of ITNs is achieved, the numbers of mosquitoes, as well as their life span, will be reduced. When this happens, all members of the community are protected, regardless of whether or not they are using a bed net. To achieve such effects, high community coverage is

required. The use of ITNs has repeatedly been shown to reduce the incidence of severe disease and mortality due to malaria in malaria-affected regions. ITNs can also have a beneficial effect on other insect pests, such as head lice, ticks, bedbugs and cockroaches.

11.1.1 How ITNs work

Mosquito nets fall into two groups: those that are *not* treated with insect killing or repelling chemicals, and those that *are* treated with such chemicals (i.e. ITNs). All mosquito nets act as a physical barrier, preventing bites by vector mosquitoes and thus providing personal protection against malaria to the individual(s) using the nets. In addition, ITNs can kill or disable mosquitoes by contact with the insecticide.

ITNs are most useful when a large proportion of biting by local mosquitoes takes place after people have gone to sleep inside houses. ITNs have three main functions:

- ITNs (like all nets) reduce contact between the person and mosquito by acting as a physical barrier.
- When mosquitoes are in contact with the ITN, the insecticide on the nets kills them.
- The insecticide on the nets also has a *repellent effect*, that is, it prevents mosquitoes from coming close to a person sleeping under ITNs, and to some extent it prevents mosquitoes from entering and staying in a house. The repellent effect adds a chemical barrier to the physical one, further reducing human–vector contact and increasing the protective effect of the mosquito nets.

Individuals sleeping under ITNs have effective personal protection against malaria vectors. However, if ITN use is widespread in a village or community, it can actually increase protection against malaria vectors even for those who are not sleeping under nets.

■ Can you explain why widespread ITN use in a community could increase protection against malaria vectors even for people who are *not* sleeping under ITNs?

□ ITNs can kill mosquitoes on contact. For this reason, if ITN use is widespread, the local malaria vector population will be reduced, so even people who do not have ITNs will be less likely to be bitten by a malaria vector.

Thus ITNs can be a very effective vector control intervention for reducing malaria transmission for individuals and communities.

11.2 Types of ITNs

Pyrethroids are the only family of insecticides used to treat bed nets, as they are safe to humans. Nets requiring re-treatment every six months are no longer used in malaria control programmes in Ethiopia or elsewhere. Therefore, the term ITN in the rest of this study session refers to LLINs.

There are two types of ITNs: conventionally treated nets and **long-lasting insecticidal nets** or **LLINs**. A conventionally treated net is a mosquito net that has been treated by dipping in a pyrethroid insecticide. Dipping is often done at the village level, by health workers or communities themselves. However, to ensure its continued insecticidal effect, the net needs to be re-treated after three washes, or at least every six months. A much better alternative is the long-lasting insecticidal net. LLINs are factory-treated mosquito nets made with a netting material that has insecticide incorporated into the fibres, or as a coating on the fibres. LLINs are effective against

mosquitoes for at least 20 standard washes, or three to five years under field conditions. As the lifespan of most nets is three to four years, the insecticides in LLINs remain effective for the whole life of the net. Therefore, there is no need to re-treat LLINs.

11.3 Mosquito net models

Mosquito nets are produced in different sizes and shapes. A net should cover the sleepers completely and should cover sufficient space for them to avoid contact with the fabric. Sufficient length is needed so that the net can be tucked in under the mattress or sleeping mat. Different models have been developed for different situations. They differ in convenience for daily use, and prices vary widely. The method of suspension is an important consideration.

11.3.1 Rectangular nets

The rectangular net (Figure 11.1) is normally used over a bed or sleeping mat. It is the model widely used in Ethiopia. It is suspended from four or more loops along the upper edges.

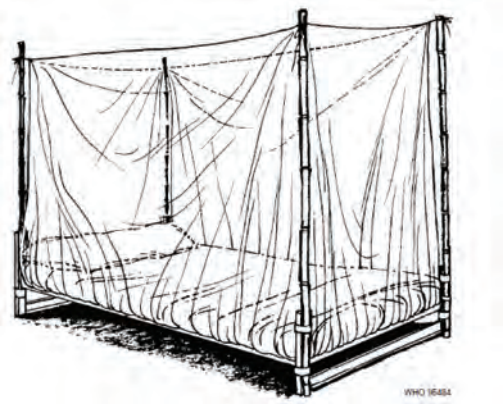


Figure 11.1 Rectangular bed net. (WHO, 1997; source as in Figure 9.2)

Dimensions vary: most nets have a height of about 150 cm and a length of 180–190 cm. A single-size net has a width of 70–80 cm, contains about 9 m^2 of netting material and is used to cover one person on a single bed or sleeping mat. Double nets with a width of 100–110 cm (10–11 m^2 of netting) and family-size or large double nets with a width of 130–140 cm (12–13 m^2 of netting) are used for larger beds. The optimal size depends on sleeping habits and available space. All nets distributed in Ethiopia are family size nets.

Special supports for rectangular bed nets

Indoor supports: Where it is customary to rearrange and use beds for seating during daytime, nets should be supported using detachable poles or mosquito net supports attached to the ceiling or walls.

Outdoor supports: In some villages where the climate is hot, people tend to sleep outdoors during the peak malaria season. People may also stay late outdoors working or chatting before going indoors to sleep. In many cases, people let their children sleep outdoors until the adults go indoors to sleep late at night. Where people usually sleep outdoors, or stay outdoors late into the night during the hot season, nets should be used outdoors. Outdoors, nets are best supported by a frame that can be easily detached from the bed (Figure 11.2). Most vectors of malaria bite people from sunset to dawn. To get

If possible children should go to sleep as early as possible indoors under nets; if they have to sleep outdoors they *must* sleep under nets.

full protection from the nets, people must use nets from dusk to dawn. If people stay late outdoors chatting, they should use the nets outdoors too. In particular, children should not be left to sleep outdoors without nets.

Figure 11.2 Special supports for rectangular nets for outdoor use. (WHO, 1997; source as in Figure 9.2)

11.3.2 Circular nets

Circular, or conical, nets are sometimes preferred because they can be hung from a single support (Figure 11.3a). The nets are mostly available in double size. Compared with the rectangular net, more care has to be taken to avoid contact between the body and the net, which would allow mosquitoes to feed. Circular nets could be better suited to circular houses with limited space, which are very common in Ethiopia (Figure 11.3b).

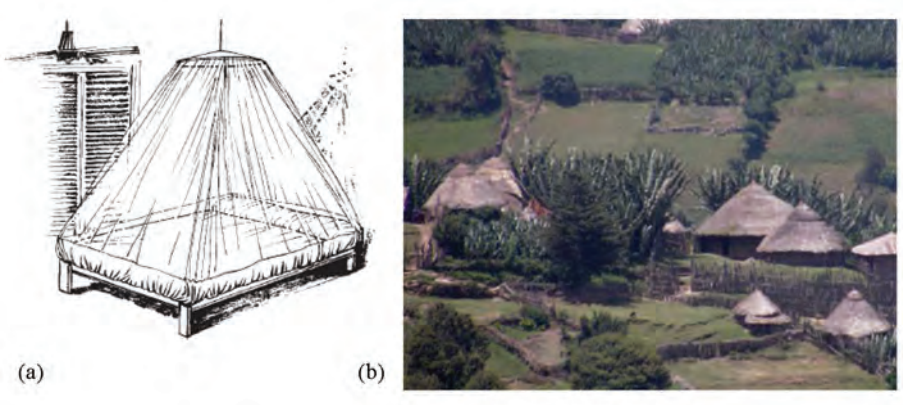


Figure 11.3 (a) A circular bed net. (WHO, 1997; source as in Figure 9.2); (b) Traditional Ethiopian 'tukul' round houses. (Photo: Basiro Davey)

11.4 Deciding the number of ITNs per household

The first step in ITN programmes is making the nets available to the community. Several methods have been tried to make ITNs available to a large number of people in malaria-risk areas. They included encouraging people to buy nets from the market at full price, making nets available at subsidised or reduced prices, and credit schemes.

However, none of these methods was effective in scaling up coverage of nets in poor communities like those in rural Ethiopia. Therefore the current policy of the malaria programme in Ethiopia is to distribute nets free of charge to all population groups, using the methods described in Section 11.5 of this study session.

The objective is to ensure that communities living in malaria-risk villages have enough nets to cover all sleeping sites in the household. In Ethiopia, the strategy since 2005 has been to provide, on average, two ITNs per household in all malaria-risk areas. Between 2005 and 2007 this strategy provided access to ITNs to an estimated 10 million households, or approximately 50 million people, living in malaria-risk areas.

- Approximately how many ITNs were distributed in Ethiopia between 2005 and 2007?

- 10 million households received ITNs. Households received on average two ITNs per family; so around 20 million ITNs were distributed.

Although an *average* of two ITNs per household is used for logistical or planning purposes, it does not mean that every household will get two nets. The number of ITNs a household will receive depends on family size, and is based on the general principles shown in Table 11.1.

Table 11.1 General guide to determine the number of nets per household based on family size.

Family size	Number of ITNs to be supplied
1 to 2	1
3 to 5	2
6 to 7	3
More than or equal to 8	4

The number of sleeping sites in the household must also be taken into account during distribution of the nets. For example, even if there are only two people in the household, if they sleep separately in two different sleeping sites, the household needs two nets — not just one as indicated in Table 11.1. You must also make sure that pregnant mothers and children under five years old always get *priority access* to ITNs, even if this means supplying extra ITNs to the household.

- Why should children and pregnant mothers get special attention during ITN distribution?

- Because children and pregnant mothers are at higher risk of getting ill and dying of malaria (Study Session 6).

11.5 Methods of ITN distribution

There are two main methods of supplying nets to the community and maintaining high coverage. One is *mass distribution*, which is termed **catch-up distribution** of nets. This is a method used to achieve coverage of the entire community, or of target groups, as quickly as possible. The other method is termed **keep-up distribution** of nets. This is a method employed to *maintain* the coverage achieved by mass distribution by replacing nets as needed and providing nets for newcomers and newborns in a community.

There are a number of advantages of distributing ITNs through the Health Extension Programme under your supervision:

- ITN distribution is integrated into the existing health system, instead of relying on special campaigns.
- All malaria-risk villages of 5,000 people should have at least two Health Extension Workers or Practitioners like yourself deployed close to the community. Your knowledge of the customs and culture of your community will be very helpful in increasing the acceptability and use of ITNs. You will also have first hand information about family size and the number of sleeping sites in each household, which determines the number of nets needed in your community (as in Table 11.1).
- Through your activities, ITNs can quickly be replaced or supplied as needed, ensuring continuous access to ITNs (summarized in Box 11.1). This should reduce the proportion of people in your community remaining uncovered due to damage or loss of nets, and ensure that additional nets are available for pregnant mothers and newborn babies.
- Planning the requirement of ITNs for continuous replacement and additional distribution can be based on precise information collected by community-based health workers such as yourself, so it is more likely to reflect ITN requirements accurately.

Box 11.1 Health Extension Programme activities in ITN distribution in malarious villages

You are expected to perform the following activities in order to effectively and efficiently undertake ITN distribution in your village:

1 Determine the number of households in your village.

2 Determine the average family size in your village (the total number of people in your village divided by the total number of households in the village).

3 Prepare a record of the number of people in each family and if possible the number of sleeping sites in each household.

4 Submit your plan, including the above data, to the District Health Office.

5 Discuss with community leaders and elders, and with community health workers, how to distribute the nets as quickly as possible, and involve them in distribution of the nets.

6 Transport the required number of nets from the District Health Office to the health post.

7 Arrange temporary storage of the ITNs.

8 Train community health workers on procedures of ITN distribution and the key messages about proper and consistent use, which they should communicate to the households during ITN distribution.

9 Always give priority to children under five years old and pregnant women, when there are not enough nets to cover the whole population. Pass the message to the households about prioritising the nets to protect their young children.

10 Distribute nets as soon as they arrive at the health post.

11 Consider distributing the nets through house-to-house visits, as this will be the best way to assist the households with hanging the nets and teaching them the proper use of the nets.

12 Ask households to remove badly damaged nets, tear them down to be used as window screens or put them under the mattress or mat to kill other pests, like bedbugs. Never allow households to keep using damaged old nets while keeping new nets unused.

13 Always unpack nets before handing them to beneficiaries.

14 Convince households to repair damaged nets promptly, to extend their useful life.

The following are different ITN distribution mechanisms that you have to know to do your job effectively. Remember that appropriate mechanisms of nets distribution and replacement should be discussed with your supervisors at the health centre and District Health Office. The choice of distribution and replacement methods depend on the availability of nets at Regional and District levels.

11.5.1 Mass distribution (catch-up) of nets

A variety of methods are available to distribute ITNs to a whole community, as described below.

ITN distribution via house-to-house visits

The best way to distribute ITNs in the community is to visit every house to distribute them. In this way you can ensure that:

- The nets are given to the right people.
- The nets are hung up and not left in their packages.
- The nets are hung properly.
- People get information about how to hang and use the nets outdoors, if outdoor sleeping is common in the village.
- Non-functional old nets are removed and used for other purposes.
- People receive face-to-face education on the benefits of proper and consistent use of ITNs, including the benefits of putting children under nets as early as possible at night.

However, the problem with house-to-house distribution is that it is time-consuming, so it might take you and your colleagues a lot of time to visit 1,000 or so households. To overcome this problem, you should train volunteer community health workers and village leaders to help with the mass distribution of the nets via house-to-house visits.

Stand-alone ITN distribution campaigns

ITNs can also be distributed to all households in the village that need them by inviting people to come to central distribution points, where households are given ITNs based on the village register. At the same time, education and demonstrations can be given collectively to a large number of people. The advantage of this kind of distribution is that a large number of nets can be distributed quickly. However, the health education messages and practical demonstrations may not be adequately communicated to individuals (Figure 11.4).

Figure 11.4 Campaigns like this one can distribute a large number of nets quickly, but the practical demonstrations of how to use the nets may not be adequately communicated to everyone. (Photo: UNICEF Ethiopia/Indrias Getachew)

Distribution integrated with immunization or outreach campaigns

ITNs can also be delivered through the systems and organisations used to deliver immunization, so immunization and ITNs can be delivered at the same time. ITN distribution can also be linked to the other outreach services such as the structure used to deliver bi-annual vitamin A supplements, de-worming, and nutrition screening campaigns.

The disadvantage of linking ITN distribution to immunization and other outreach programmes is that only households with young children (one to five years old) are targeted by these programmes, so other households will not be covered. In fact, such distribution methods are not generally recommended in Ethiopia, as the country has strong community-based health delivery systems, such as the Health Extension Programme, of which you are a part.

11.5.2 Replacement or 'keep-up' distribution

As you learned above, the aim of ITN distribution in Ethiopia is to protect everyone living in malaria-risk areas, so every effort is made to achieve 100% coverage of all people living in malaria-risk villages.

After the initial distribution of ITNs to as many people as possible via 'catch-up' campaigns, you need to maintain high coverage continuously, so as many people as possible remain protected and the disease can be controlled. Such follow-up distribution of ITNs is known as 'keep-up' distribution, and it is necessary because:

- Currently the ITNs used for malaria prevention are only functional for three to four years. After three to four years, the ITNs become damaged and have to be replaced by new ones. Nets can also be torn or damaged before three to four years, for a variety of reasons. You should replace any damaged nets regularly to keep the coverage high.
- Mothers who become pregnant after the 'catch-up' distribution may move to their own sleeping site separate from other family members and may need to be provided with their own ITN. Giving ITNs to all pregnant mothers attending antenatal care (ANC) will keep them protected from malaria. This could also serve as an incentive for mothers to attend ANC, where attendance in rural Ethiopia is generally low.
- Newcomers to a village and newborns will need additional ITNs.

11.6 Proper and sustained use of ITNs

To give the required protection, ITNs need to be used properly and regularly. One of the biggest challenges for the ITN programme in Ethiopia, and in many other African countries, is *to ensure proper and consistent use of ITNs*. A malaria indicator survey (MIS) conducted in Ethiopia in 2007 showed that, despite a national ITN coverage rate of 68% of households in malaria-risk areas, less than 50% of the people who have nets slept under an ITN. The MIS results also showed that many people do not understand how malaria is transmitted, or why ITNs are important for malaria prevention.

Understanding how malaria is transmitted, and why it is important to sleep under ITNs, is important for people to change their behaviour. This needs education. Mass media and education materials such as posters and banners can provide information and create awareness about the need to use ITNs correctly. Personal messages from you are even more effective.

11.7 The role of the health worker in education about ITNs

Health workers at all levels of the health system need to try and make sure that ITNs are used properly by the community. However, as a locally-based Health Extension Worker or Practitioner you are the person in the best position to make a significant difference, by educating and convincing the people in your community to use ITNs properly and consistently. The success or failure of the ITN programme depends on your efforts to make people aware of the benefits of ITNs, and to change their behaviour so they use ITNs properly. Please consult your supervisors at the health centre and District Health Office if you face any problems in this regard.

Many health posts now also have a network of volunteer community health workers (CHWs) to support you in community-based activities. You need to use these CHWs to help you increase contact with each household in a more organised way, in order to increase the use of ITNs in your village.

Using CHWs effectively is covered in the Module on *Health Education, Advocacy and Community Mobilisation*.

Misuse of ITNs by community members, for example for covering hair, for fishing and for carrying goods, should be identified and discouraged. Not sleeping under ITNs consistently, or sleeping outdoors without ITNs (whether for adults or children) needs to be addressed if they are part of the problem. Some people may also be selling their nets.

Multiple contacts and one-to-one interactions are known to be important in bringing about changes in behaviour.

11.8 Monitoring ITN utilisation

Continuous monitoring of the possession and proper use of ITNs is also very important if ITN programmes for preventing malaria are to be successful. You should visit a sample of households regularly and check:

- Whether all the nets you gave the family are physically present in the household.
- Whether the nets have been hung properly (Figure 11.5).
- Whether everyone in the household slept under the nets the previous night.
- The physical condition of the nets and advise the family to repair minor damage.

- The names of the family members who sleep under each net.
- If possible ask them what time children under five years and adults normally go to sleep in the evening; advise alternative solutions if outdoor sleeping or staying out late is an issue.
- Address any concerns or problems about net use from the household.

Figure 11.5 A correctly hung bed net. (Photo: Dr Yemane Ye-ebiyo Yihdego)

As a health worker providing antenatal care (ANC) and immunization services to the community, you should always ask pregnant women at every ANC visit, and parents of children at all vaccination visits, whether they have nets and whether they are using them properly. You should check if the mothers and their children slept under ITNs the previous night, and you should record their responses on the Expanded Programme of Immunization (EPI) monthly form.

As you learned from this study session, the most important components of an ITN programme in malaria prevention are distributing the ITNs correctly, maintaining high coverage, educating people on proper and consistent use, and monitoring their utilization. You are the key person who can effectively implement all the above activities and protect people from malaria-related illnesses and deaths.

Summary of Study Session 11

In Study Session 11, you have learned that:

1 ITNs are one of the most important malaria prevention methods and are widely used in Ethiopia.

2 ITNs provide personal protection for individuals who use them properly.

3 When coverage with ITNs is high, they can provide community protection by killing a large number of mosquitoes trying to feed on humans.

4 To achieve high coverage, ITNs need to be distributed to the community free of charge.

5 The most effective way to distribute ITNs is through house-to-house visits; however other methods can also be used (e.g. stand-alone campaigns).

6 You are the most important person in planning and undertaking distribution of nets to the community.

7 Volunteer community health workers and village leaders can support ITN distribution campaigns in the village.

8 Keeping coverage high through replacement of damaged nets, and distributing new ones to people in need, is important for effective community protection.

9 Proper and consistent utilisation of nets is important for ITNs to be effective.

10 Educating people on proper and consistent use of nets and monitoring behaviour change is one of your most important tasks in the ITN programme.

Self-Assessment Questions (SAQs) for Study Session 11

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 11.1 (tests Learning Outcome 11.1)

Sleeping under an insecticide treated net (ITN) protects people from getting malaria. Which of the following statements about ITNs is *false*? In each case, explain what is incorrect.

A ITNs protect people from malaria by killing the malaria parasites.
B ITNs do not kill mosquitoes that come in contact with the nets.
C ITNs can repel mosquitoes from coming closer to people sleeping under nets.
D ITNs have chemicals in (or coated onto) their fibres, which can kill mosquitoes.
E The chemical on ITNs kills only mosquitoes.
F The chemicals coated on ITNs are harmful to humans.

SAQ 11.2 (tests Learning Outcome 11.2)

Describe the difference between non-treated and insecticide-treated nets (ITNs).

SAQ 11.3 (tests Learning Outcome 11.2)

What is the difference between regularly/conventionally treated nets and long lasting insecticidal nets (LLINs)?

SAQ 11.4 (tests Learning Outcome 11.3)

Different methods are used to distribute nets to communities. State two important mechanisms of mass net distribution, in each case with their advantages and disadvantages.

SAQs 11.5, 11.6 and 11.7 are on the next page.

SAQ 11.5 (tests Learning Outcome 11.3)

What methods can you use to keep coverage of nets high in your community, after they have been distributed by mass (catch-up) methods?

SAQ 11.6 (tests Learning Outcome 11.4)

One of the most important challenges in ITN programmes is a low rate of net utilisation. State at least two behaviours of people that are not considered to be proper use of nets.

SAQ 11.7 (tests Learning Outcome 11.4)

High net coverage is expected to protect people from malaria and reduce the incidence of new cases. Imagine that, in spite of high net coverage in your village, many people are getting infected with malaria and coming to your health post for treatment. What could be the possible explanation for this problem?

Study Session 12 Monitoring and Control of Malaria Epidemics

Introduction

Early detection and a prompt response to malaria epidemics is essential to minimise the impact of the illness (including deaths) and the socio-economic burden following malaria epidemics. In this study session you will learn how a malaria epidemic is defined in general and how it can be recognised in your village. You will also learn about factors that can trigger epidemics, about the supplies and drugs you need to be prepared for epidemics, and the different ways to contain epidemics. All this information will enable you to detect malaria epidemics early and to implement interventions to contain them fast.

Disease surveillance and epidemic monitoring and control are discussed in detail in Study Sessions 40–42 of *Communicable Diseases*, Part 4.

Learning Outcomes for Study Session 12

When you have studied this session, you should be able to:

12.1 Define and use correctly all of the key words printed in **bold**. (SAQs 12.1, 12.5, 12.6 and 12.7)

12.2 Define a malaria epidemic in general and in your village. (SAQs 12.1, 12.2 and 12.5)

12.3 List and explain how you would monitor the factors that trigger malaria epidemics. (SAQs 12.1 and 12.2)

12.4 Explain why you have to prepare for malaria epidemics, and list the supplies and drugs you need in reserve in case an epidemic occurs. (SAQs 12.1 and 12.3)

12.5 Explain the measures that can be taken to prevent malaria epidemics. (SAQ 12.4)

12.6 Describe how to use early warning and detection tools for malaria epidemics. (SAQs 12.1 and 12.5)

12.7 Describe the measures used to control malaria epidemics. (SAQ 12.6)

12.8 Describe the importance of post-epidemic evaluation. (SAQ 12.7)

12.1 What is a malaria epidemic?

An **epidemic**, in general, is defined as the occurrence of cases *in excess* of the number *expected* in a given place and time period. **Malaria epidemics** are defined in this way.

In some places, malaria transmission increases after the rainy season and then decreases during the dry season every year. If this is what normally occurs in your village, then an abnormal increase above this normally expected seasonal variation is considered an epidemic.

■ Imagine that your village is in an area where there is no malaria. How many malaria cases would be expected? Giving reasons, say how many malaria cases would have to occur in your village for an epidemic to be recognised?

□ Zero malaria cases would be expected. If even one case of malaria occurs in the village, then this would be recognised as a malaria epidemic, because it is *more* than the number that would be *expected* in this village.

In order to know whether there is malaria in the village you are working in, look at the patient register in your Health Post and see if there are malaria cases for the past three to five years. If there are malaria cases, and the patients had no travel history to a malarious area prior to their infection, then your village is in a malarious area. If there are no malaria cases for these years, then your village is malaria-free.

12.2 Factors that trigger epidemics

In Study Session 7 you learned about factors that affect the transmission of malaria. In this section you will learn how some of those factors are also associated with the occurrence of malaria epidemics.

The 'host' is the infected organism — in malaria, the host is always a human.

Malaria epidemics are triggered by factors linked to the human host, the mosquito vector (the environment) and malaria parasites, as you can see in Figure 12.1. The change or disruption of the 'balance', between these three factors at any one time may increase the likelihood of an epidemic. That is, there is an increased risk of a malaria epidemic, if there is an increase in:

- the susceptible human population
- the number of mosquito vectors
- an increase in the number of people who have the malaria parasite in their blood.

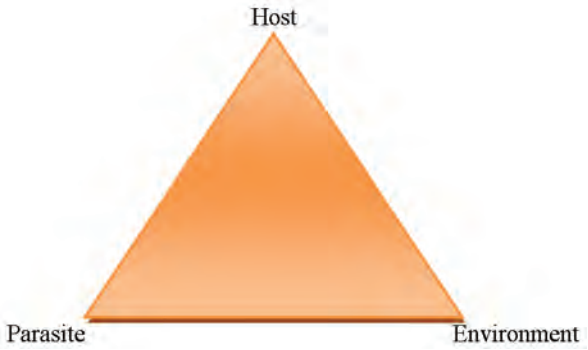


Figure 12.1 The three factors that affect the malaria transmission (host, parasite and environment).

You need to carefully and closely monitor changes in these factors in order to predict the risk of an epidemic. How some of these factors can be monitored is described next.

12.2.1 Environmental factors

Temperature, humidity and rainfall are major environmental factors affecting the development of both mosquitoes and parasites, as you learned in Study Session 6.

Higher environmental temperatures, between 22°C and 30°C, increase the potential lifespan of mosquitoes, and also increase the frequency of blood meals taken by female mosquitoes. Higher temperatures also speed up development of the mosquito larvae, shortening the amount of time it takes the mosquito to develop from egg to adult. All these increase the risk of malaria transmission.

■ Can you mention the stages of the lifecycle of the *Anopheles* mosquito?

□ Egg →larva → pupa → adult.

Increased rainfall generally leads to the creation of new water pools, allowing mosquitoes to breed in larger numbers. Increased rainfall also leads to increased humidity. On the other hand, sometimes during the *dry* season, rivers and streams can shrink to create water pools, making them ideal for mosquito breeding.

So observing significant changes in rainfall, temperature and humidity in your village can help you assess the risk of malaria epidemics.

12.2.2 Human factors

Immunity

Lack of immunity or low immunity to malaria in the human population makes epidemics more likely. In areas of unstable transmission, such as Ethiopia, population immunity is generally low, so epidemics are more likely. Indeed, malaria is a risk in 75% of the villages in Ethiopia and epidemics can occur in those villages.

Migration

Movements of people can contribute to malaria epidemics in two ways. First, people with malaria moving into an area where malaria has been controlled or eliminated can be sources of *Plasmodium* parasites for local mosquitoes, precipitating an epidemic. Second, non-immune people moving to areas where malaria is highly endemic can cause an apparent epidemic, as they are more susceptible than the local population to malaria.

Interruption of vector control efforts

In Study Sessions 9, 10 and 11 you learned that larval control, indoor residual spraying (IRS) of households with insecticides, and use of insecticide treated nets (ITNs), are important malaria prevention tools. If the implementation of these measures is stopped, vector populations and thus malaria transmission may increase dramatically. Similarly, epidemics can occur if vectors become resistant to insecticides and are no longer killed by spraying.

12.2.3 Parasite factors

Drug resistance

Use of non-effective drugs may cause a malaria epidemic since *Plasmodium* infections will not be properly cleared, allowing parasites to stay longer in the blood of an infected person. This increases the number of people who carry the parasite in their blood, which in turn increases the opportunities for the mosquito vector to take an infected blood meal and then transmit parasites to new susceptible hosts.

12.3 Preparedness for malaria epidemics

As you have learned above, malaria epidemics can be triggered by a variety of factors, making it difficult to predict an occurrence. As malaria epidemics could occur in all malaria prone areas at *any* time, you need to be prepared for them at *all* times.

At Health Post level, preparedness includes having a stock of anti-malarial drugs, RDTs, insecticides and other supplies that are important to prevent or contain a malaria epidemic, *in addition* to the amount that is required for normal situations. This added amount (25% of the annual need) is called a **contingency stock**. You must keep the contingency stock in your store for use during epidemics. Following an epidemic, the contingency stock should be replenished.

■ If the usual annual requirement of the anti-malarial drug Coartem for your village is 800 doses, calculate the contingency requirement for the year. What is the total requirement of Coartem for your Health Post?

□ The contingency requirement is 200 doses. (To calculate the contingency multiply 800 by 25% or by 0.25. This gives 200 doses.) The total doses of Coartem required for the year for your Health Post is therefore 800+200 which is equal to 1,000 doses.

In this way, you should calculate the contingency stock for all the drugs and supplies listed in Box 12.1 below, and keep them in your store. If an epidemic does not occur, make sure you use the contingency stock before the expiry date.

Box 12.1 List of drugs and supplies needed in your contingency stock for a possible malaria epidemic

- Chloroquine tablets
- Chloroquine syrup
- Coartem tablets
- Quinine tablets
- Artemether injections
- Artesunate suppositories
- Multi-species Rapid Diagnostic Tests (RDTs)
- Insecticides for indoor residual spraying (IRS)
- Temephos for larval control.

12.4 Prevention of epidemics

Epidemic prevention depends on close monitoring of the epidemic-triggering factors described in Section 12.2. If you suspect that there is a favourable condition for malaria epidemics to occur, you must implement the following prevention activities immediately.

Indoor residual insecticide spraying (IRS)

In some villages IRS is undertaken every year in anticipation of epidemics following the rainy season. In other areas IRS is done when there is a change in one or more epidemic-triggering factors and the risk of an epidemic seems high. It is essential to apply IRS *before* the malaria transmission season or the anticipated epidemic. In this way it can have a significant effect on the incidence of transmission and reduce the likelihood of an epidemic.

Larval control

This is another important measure to prevent epidemics. As you learned in Study Session 9, anti-larval measures can easily be organised by mobilising the community. They are also cheap to implement. Larval control measures can only be implemented very close to or during the transmission season.

Insecticide treated nets (ITNs)

Providing ITNs to 100% of households in malaria-risk villages aims to reduce the risk of malaria epidemics.

12.5 Detection of malaria epidemics

In this section you will learn about methods for the **early detection** of malaria epidemics. Early detection means recognising potential epidemics as early as possible, so action can be taken to contain them before they get out of control and affect a large number of people. As a Health Extension Practitioner, you are the first to take action against any malaria epidemic that is detected.

Two major early detection methods for malaria are used in Ethiopia:

- Constructing an epidemic monitoring chart, using the 'second largest number' method;
- Doubling of weekly malaria cases compared to last year's data.

These methods are described below.

12.5.1 Epidemic monitoring charts using 'second largest number' method

An **epidemic monitoring chart** is a chart drawn on a large sheet of paper. The x-axis (bottom or horizontal axis) of the chart shows the number of weeks, and the y-axis (the left-side, or vertical axis) shows the number of malaria cases (see Figure 12.2 on the next page).

The epidemic monitoring chart is a tool that you can use only if you have data on malaria cases for the past five years.

You construct the epidemic monitoring chart using the second largest number seen on a weekly basis, in order to determine the *expected* number of malaria cases in your village.

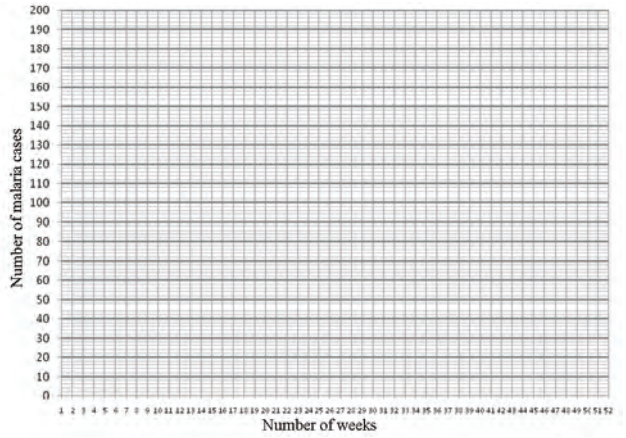


Figure 12.2 Epidemic Monitoring Chart. (You will use this to complete SAQ 12.5.)

Weeks are labelled as 1, 2, 3, 4 up to 52, which sometimes becomes 53. They are World Health Organization (WHO)'s epidemiological weeks. Week 1 always starts around the end of Tahsas. Note that every week starts on Monday and ends on Sunday. Table 12.1 shows the exact dates of the start of the weeks for the Ethiopian calendar (EC) for 2003, 2004, 2005 and part of 2006. Following the same pattern, you can calculate the week number for any year in the future.

Table 12.1 WHO epidemiological weeks for 2003–2006 in the Ethiopian calendar (EC).

Week No	2003/2004 EC	2004/2005EC	2005/2006 EC
Week 1	Tahsas 25–Tir 1/2003	Tahsas 23–29/2004	Tahsas 22–28/2005
Week 2	Tir 2–8/2003	Tahsas 30–Tir 6/2004	Tahsas 29–Tir 5/2005
Week 3	Tir 9–15/2003	Tir 7–13/2004	Tir 6–12/2005
Week 4	Tir 16–22/2003	Tir 14–20/2004	Tir 13–19/2005
Week 5	Tir 23–29/2003	Tir 21–27/2004	Tir 20–26/2005
Week 6	Tir 30–Yekatit 6/2003	Tir 28–Yekatit 4/2004	Tir 27–Yekatit 3/2005
Week 7	Yekatit 7–13/2003	Yekatit 5–11/2004	Yekatit 4–10/2005
Week 8	Yekatit 14–20/2003	Yekatit 12–18/2004	Yekatit 11–17/2005
Week 9	Yekatit 21–27/2003	Yekatit 19–25/2004	Yekatit 18–24/2005
Week 10	Yekatit 28–Megabit 4/2003	Yekatit 26–Megabit 2/2004	Yekatit 25–Megabit 1/2005
Week 11	Megabit 5–11/2003	Megabit 3–9/2004	Megabit 2–8/2005
etc.	etc.	etc.	etc.
Week 35	Nehase 23–29/2003	Nehase 21–27/2004	Nehase 20–26/2005
Week 36	Nehase 30–Pagume 6/2003	Nehase 28–Pagume 4/2004	Nehase 27–Pagume 3/2005
Week 37	Meskerem 1–7/2004	Pagume 5–Meskerem 6/2005	Pagume 4–Meskerem 5/2006
Week 38	Meskerem 8–14/2004	Meskerem 7–13/2005	Meskerem 6–12/2006
etc.	etc.	etc.	etc.
Week 51	Tahsas 9–15/2004	Tahsas 8–14/2005	Tahsas 7–13/2006
Week 52	Tahsas 16–22/2004	Tahsas 15–21/2005	Tahsas 14–20/2006

Steps for plotting an epidemic monitoring chart

To establish a threshold or reference line for the expected number of malaria cases, you need to have data for malaria cases over the past five years, week by week (as shown in Table 12.2). Using the data you need to follow the steps below to graphically plot the relevant information on the epidemic monitoring chart. This will help you to detect a possible malaria epidemic as early as possible.

Table 12.2 The number of malaria cases per numbered week in each year from 1998–2002 (EC), the second largest number of cases per numbered week over this period, and the number of cases per week in the current year (2003).

Week No.	1998	1999	2000	2001	2002	Second largest number (1998–2002)	Current year (2003)
1	8	42	6	36	14	36	20
2	12	42	27	38	17	38	22
3	10	42	43	49	21	43	35
4	20	17	34	59	32	34	37
5	34	17	46	20	30	34	36
6	18	10	34	22	23	23	30
7	12	19	33	24	25	25	29
8	37	10	27	41	23	37	32
9	32	18	37	29	26	32	30
10	31	24	28	17	13	28	25
11	22	19	22	12	23	22	
.	.	.	.	.	.	.	.
51	26	40	34	32	39	39	
52	23	35	10	27	25	27	

Step 1 The villages that your Health Post serves is your catchment area. Therefore the data you use to determine the upper limit of the expected number of malaria cases are the cases from your catchment area.

Step 2 Check whether your data are arranged in weeks, as indicated in Table 12.2. One of the sources of the weekly data is the weekly surveillance report that you send to the higher level health facility. The weeks you use are the same as those used in your weekly surveillance report.

Step 3 Tabulate your malaria case data for the previous five to six years (as in Table 12.2). Look at the data: if there was a major epidemic with a large number of malaria cases in the previous five years ignore that year and consider data from the year before.

Step 4 If you have weekly data on malaria cases for five years, note the *second largest number* of cases from the previous 5 years' data for a particular week. For example in the five years from 1998 to 2002 (EC), the *second largest number* of cases during week one is 36, and in week two it is 38 (see Table 12.2). Identify the second largest number of cases for each of the 52 weeks.

Step 5 Plot the *second largest number* for each week on the epidemic monitoring chart. The line in blue ink in Figure 12.3 is a plot of the upper limit or second largest number, based on the data in Table 12.2. (Note that not all the data plotted in Figure 12.3 are shown in Table 12.2, for reasons of space). This line represents the normal upper limit for the *number* of cases, or the *expected* cases of malaria, in the catchment area. It is called the **reference line**, because it serves as a reference point with which to compare weekly data on malaria cases for the following year.

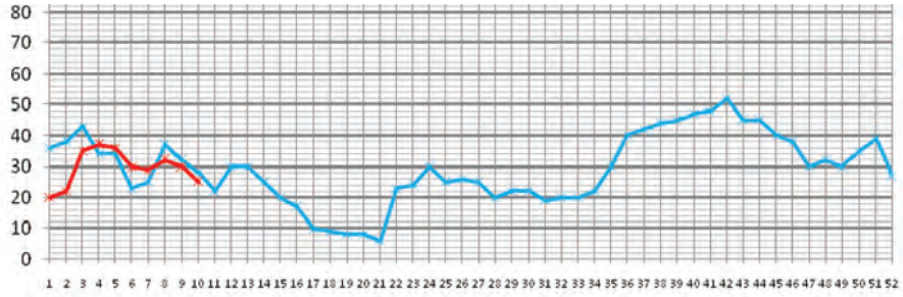


Figure 12.3 Sample epidemic monitoring chart with reference line (blue) plotted using the second largest number of cases per numbered week from 1998–2002 (see Table 12.2). The red line shows the number of cases of malaria in the 'current' year, 2003 (see data in Table 12.2).

Step 6 During the following year (in the case of Table 12.2 this is 2003, EC), using a different colour of ink, plot the number of malaria cases seen each week on the epidemic monitoring chart (on which you already have the reference line). Plot the previous week's data on Monday morning.

Step 7 If the number of cases for a particular week in 2003 exceeds the number on the reference line, it indicates the beginning of an epidemic. For example in Table 12.2, in weeks 4, 5 and 6, the number of malaria cases seen are *above* the reference line. Therefore, by definition, there is an epidemic in these weeks. We say an epidemic has stopped when the weekly number of cases drops *below* the reference line.

Step 8 After data from all 52 weeks have been plotted for comparison with the reference line, you should draw a new reference line, using the most recent five-year data, to use for the following year. For example in Table 12.2 you would drop the 1998 data, and using the 1999–2003 data, identify a *new* second largest number for each week. Then using the new second largest number, you would plot the new reference line, against which you would plot data from 2004.

12.5.2 'Doubling of cases in a week method'

Doubling of the number of malaria cases in a given week compared to the same week in the previous year is another method used to detect epidemics early. You can use this method when you have less than five years of previous data (see Table 12.3). For example, if you only have data from 2003 that is broken down into weeks, you can compare data from the current year (2004, in this example) with the number of cases in the *same* week from the *previous* year, 2003. That is, you should compare Week 1 of 2003 with Week 1 of 2004, and so on.

You declare an epidemic if the number of cases in a particular week is double, or more than double, the number of cases in the same week of the previous year. For example in the data shown in Table 12.3, the data cases are doubled, or more than that, in Weeks 4 and 5.

Table 12.3 The weekly number of malaria cases for 2003 and 2004 (EC).

Week No.	2003	This year (2004)
Week 1	20	19
Week 2	22	20
Week 3	35	35
Week 4	37	74
Week 5	36	75
Week 6	30	38
Week 7	29	29
Week 8	32	29
.	.	.
Week 51	20	33
Week 52	25	31

If you do not have last year's data, then you can compare last *week's* data with *this* week. If cases become doubled, or more than double, in this week, then you can consider it as an epidemic.

12.6 Epidemic control

If, using the methods described above, you detect a malaria epidemic, you must implement epidemic control measures *immediately*. You should also start searching for cases actively (active surveillance is described below) until the number of cases falls below the reference line. The epidemic control measures and actions you should take are summarised in the flow chart in Figure 12.4 on the next page.

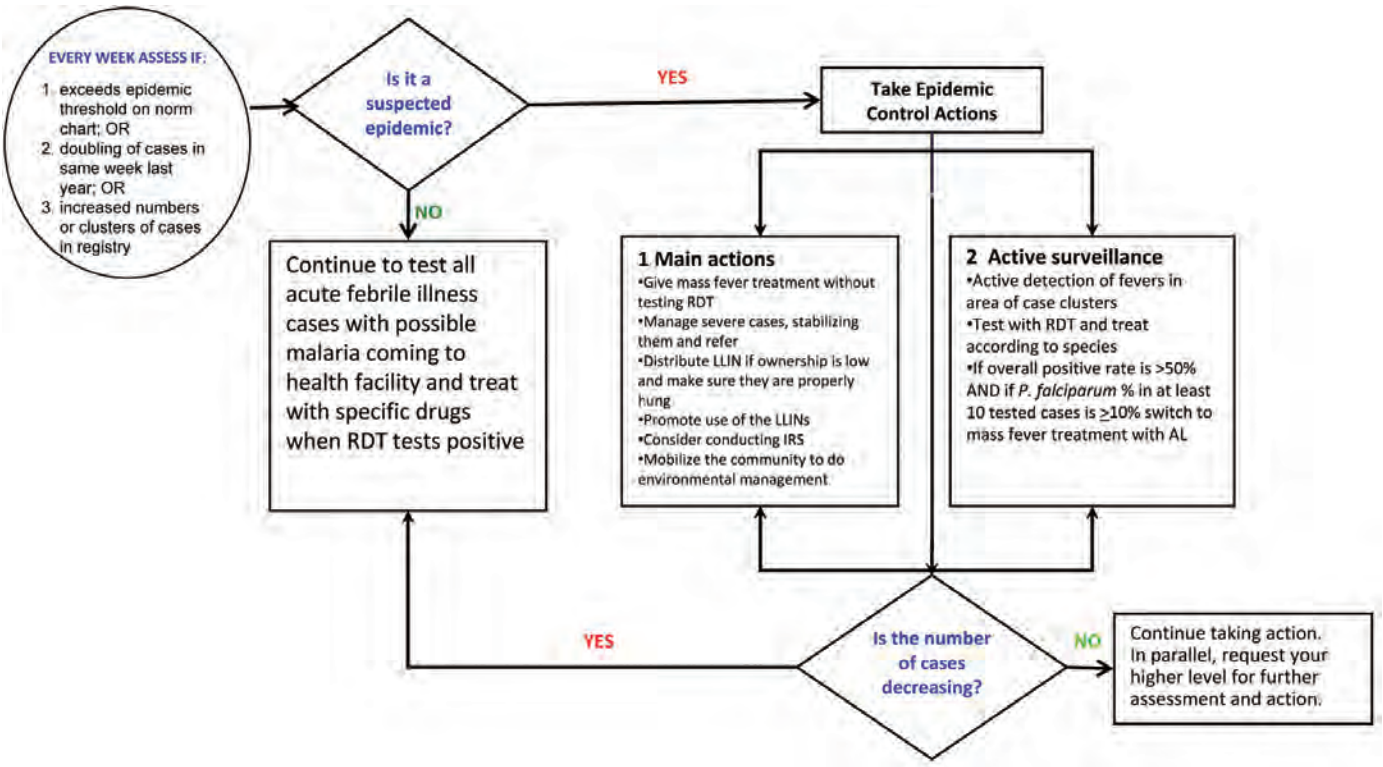


Figure 12.4 Flow chart for the early detection of malaria epidemics, and for control measures and actions to be taken if an epidemic is detected. (Source: Adapted from Ethiopian Federal Ministry of Health, *Guidelines for Epidemic Prevention and Control in Ethiopia*, 3rd edition, 2010)

12.6.1 Epidemic control measures

Mass fever treatment

Once a malaria epidemic is detected and confirmed, treat all those people with fever *without testing* with RDTs. This is called **mass fever treatment**. Give Coartem to treat cases during mass fever treatment, unless the epidemic is definitely confirmed to be caused by *P. vivax* only, in which case you can use Chloroquine. Oral quinine is recommended for the treatment of infants of less than 5 kg body weight or less than four months old, and pregnant women with uncomplicated malaria (for dosage see Study Session 8). Severe cases should be treated as indicated in Study Session 8.

Vector control

Implement the following vector control measures immediately:

ITNs: If ITN coverage is low or if existing ITNs are worn out, distribute ITNs and make sure that they are hung properly and used by all family members.

Indoor residual spraying of all houses (IRS): This has a quick impact on transmission. In an epidemic this technique is highly reliable and recommended since its efficacy has little or no dependency on human behaviour.

Larval control: This should be undertaken by mobilising and organising the community to take action.

12.6.2 Active surveillance

After mass fever treatment, actively search for fever cases, test with RDTs and treat them according to the species of *Plasmodium* detected. Continue **active** surveillance until the number of cases has decreased to normal levels or to zero.

12.7 Post-epidemic assessment

So far in this study session you have learned how to prepare for, detect and control malaria epidemics. However, sometimes malaria epidemics occur in spite of your best efforts. In such cases you need to assess various aspects of the epidemic after it is over. The aim of **post-epidemic assessment** is to learn lessons that may strengthen your preparedness, detection, prevention and control methods in case of future epidemics.

12.7.1 Assess adequacy of epidemic detection and response

Some of the questions you should ask during post-epidemic assessment are:

- Did you use an epidemic monitoring chart?

If yes,

- How effective was it in detecting the epidemic early?
- How adequate were your contingency stocks?
- How speedy were your actions for vector control?
- How successful were your case management activities?

Careful post-epidemic assessment will show the strengths and weaknesses of the system in place at your Health Post level and of your actions in tackling the epidemic. The investigation should focus on how efficient the system was in *confirming* the epidemic, the status of *preparedness* (drugs, insecticides, logistics, etc), the *timing* and *impact* of intervention measures, and the *participation* of the community and other partners. Identify both the strengths and weaknesses of the response to the malaria epidemic so you can build on the strengths and take appropriate actions to correct weaknesses. Your report or assessment will help you and your supervisors to improve the epidemic response system.

The following indicators will help you to monitor the success of your interventions.

Input indicators

- Availability and quality of active epidemic monitoring
- Stockpile of anti-malaria commodities, mainly RDTs, Coartem and other anti-malarial drugs and insecticides
- Community participation.

Process indicators

- Number of houses sprayed
- Number of larval control measures
- Number of trained village volunteers for emergency interventions such as spraying.

Output indicators

- Volunteers trained and people educated
- High coverage of vector control measures (LLINs and IRS).

Outcome indicators

- Time taken by cases to seek treatment
- Adherence to treatment
- Percentage of patients developing severe disease who were referred
- Flattening or sharp falling of the epidemic curve.

Summary of Study Session 12

In Study Session 12, you have learned that:

1 A malaria epidemic is defined as the occurrence of cases in excess of the number expected in a given place and time period.

2 The factors that trigger the occurrence of malaria epidemics are linked to environmental factors, human factors and parasite-related factors; the change in the balance between these factors leads to malaria epidemics.

3 It is important to get prepared by having 25% contingency stock of anti-malaria drugs and other supplies to control unexpected malaria epidemics that might happen at any time.

4 The three major interventions that you have to implement to prevent the occurrence of predicted malaria epidemics are indoor residual insecticide spraying, larval control, and distribution and correct use of ITNs.

5 The two main methods you use to detect malaria epidemics as early as possible are construction of an epidemic monitoring chart using the second largest number method, and the use of doubling of weekly malaria cases compared to last year's data.

6 To contain a malaria epidemic, you implement mass fever treatment and vector control measures.

7 Post-epidemic assessment of the response to malaria epidemics helps to evaluate the weaknesses and strengths of the response activities for better preparation for future epidemics.

Self-Assessment Questions (SAQs) for Study Session 12

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 12.1 (tests Learning Outcomes 12.1, 12.2, 12.3, 12.4 and 12.6)

Which of the following statements is *false*? In each case, state why it is incorrect.

A Malaria epidemics are defined as the occurrence of cases *in excess* of the number *expected* in a given place and time period.
B Malaria epidemics can sometimes occur during the dry season.
C The contingency stock of Chloroquine tablets is 25% of the stock that is required to treat all *P. vivax* cases in a non-epidemic year.
D The reason why you use an epidemic monitoring chart or doubling of weekly cases at Health Post level is to detect epidemics early and report to district level without taking any control measures.

SAQ 12.2 (tests Learning Outcome 12.3)

Assume your village is located in a malaria epidemic risk area. An unusually heavy rain in your area ended one week ago. Now the weather becomes full of sunshine. About 500 migrant workers come to your village from a non-malarious area one week after the rain ends to work on agriculture. From this story list the factors that might trigger a malaria epidemic.

SAQ 12.3 (tests Learning Outcome 12.4)

List the drugs and supplies that you are required to keep in your contingency stock.

SAQ 12.4 (tests Learning Outcome 12.5)

What are the main malaria epidemic prevention strategies?

SAQs 12.5, 12.6 and 12.7 are on the next page.

SAQ 12.5 (tests Learning Outcome 12.6)

Table 12.4 contains seven years of weekly data on malaria cases. Study the table and then answer the questions below it.

Table 12.4 Weekly malaria cases in 1998–2004.

Week No.	1998	1999	2000	2001	2002	2003	second largest number	This year (2004)
1	16	42	105	36	14	42		33
2	12	42	100	38	17	22		35
3	16	42	103	49	21	34		40
4	20	17	134	59	32	40		39
5	34	17	146	20	30	39		33
6	18	10	134	29	23	27		30
7	30	19	133	24	25	25		29
8	37	10	127	41	23	42		42
9	32	18	137	29	26	29		35
10	31	24	128	17	13	32		30
.	.	.	.	.	.	.		.
51	26	40	134	32	39	39		.
52	23	35	110	27	25	33		.

(a) Which year do you think the data shows an abnormally high number of malaria cases? What do you do with this year before you start identifying the second largest number?
(b) Identify the second largest number for the six years of data (1998–2003) and fill in the column in the table.
(c) Use the blank epidemic monitoring chart in Figure 12.2 to plot a reference line of the second largest numbers and the data for the year 2004 against it.
(d) Does the graph show weeks when an epidemic occurred? If yes, in which weeks?

SAQ 12.6 (tests Learning Outcome 12.7)

What is mass fever treatment and which drug do you use for it?

SAQ 12.7 (tests Learning Outcome 12.8)

What do you think is the benefit of post-epidemic assessment?

Notes on the Self-Assessment Questions (SAQs) for *Communicable Diseases*, Part 1

Study Session 1

SAQ 1.1

Diabetes mellitus is not communicable; rather it is non-communicable for the following reasons:

- The main cause of the disease is not an infectious agent
- It cannot be transmitted from a person with diabetes mellitus to another person.

SAQ 1.2

C *Protozoa* is the correct answer. This group of infectious agents are single-celled organisms, which are bigger than bacteria but not visible with the naked eye.

SAQ 1.3

A The infectious agents are hookworms.
B Humans are the reservoir for this parasite.
C The mode of transmission is indirectly by contaminated soil.
D The route of exit is through the anus with faeces, and the route of entry is through the skin.

SAQ 1.4

The risk factors for hookworm infection include walking barefooted and poor environmental hygiene due to expelling faeces into the soil.

SAQ 1.5

(a) The likely modes of transmission are contaminated food and water served in the café.
(b) Abebe and two of the five infected persons who did not develop the disease are carriers; whereas the three persons who developed the disease are active cases.
(c) All the 20 people who Abebe served in the cafe were in the stage of exposure. Only five of these persons were infected and hence were in the stage of infection. Among the five infected, the three who developed typhoid fever were in the stage of infectious disease. And among these, the stage of outcome for two was recovery and for one it was death.

Study Session 2

SAQ 2.1

Using the given information, the classification could be based on the clinical manifestations of the disease (cough and shortness of breath); accordingly tuberculosis is classed as a respiratory disease.

SAQ 2.2

Pulmonary tuberculosis is classified epidemiologically as an airborne disease. Such classification helps you in applying prevention and control measures against the disease.

SAQ 2.3

(a) Treatment of each patient targets the human reservoir.
(b) Eradication of breeding sites targets the mode of transmission.
(c) Bed net use targets the susceptible host.

SAQ 2.4

A is *false*. It is true that isolation is applied for severe and easily transmitted diseases, but it is applied to the *infected* hosts (not the susceptible hosts) until the risk of transmission is reduced or stops.
B is *true*. Sterilisation kills all forms of micro-organisms, unlike disinfection which kills most but not all forms.
C is *false.* Vaccination mostly targets the *susceptible* host and vector control targets the mode of transmission.

SAQ 2.5

(a) The other criteria to be considered include the severity of the diseases, the feasibility of implementing effective interventions, and the concern of the community and the government.
(b) Malaria has priority in two out of the five criteria: that is severity, community and government concern, whereas ascariasis has priority in only one criterion, which is the higher prevalence. Both diseases have equal priority in feasibility of implementing interventions. Therefore, malaria should be given higher priority for prevention and control.

Study Session 3

SAQ 3.1

Pneumonia, meningitis, tuberculosis, pertussis and diphtheria all have the same mode of transmission: they are airborne bacteria.

SAQ 3.2

The preventive strategies of meningitis include early case identification and treatment, education of the community on the preventive methods such as avoiding close contacts with meningitis cases, and vaccination against meningitis.

SAQ 3.3

Fever, neck stiffness and rigid posture (as in Figure 3.6) are the signs of meningitis in a child. A young baby will also have bulging of the fontanelle. Tetanus can also be manifested with rigid posture. You should immediately inform the family and refer the child to hospital for urgent diagnosis and treatment.

SAQ 3.4

Neisseria meningitidis and *Streptococcus pneumoniae* are the two major bacteria that cause meningitis in children and adults. The two bacteria have similar symptoms (Table 3.1) and it is difficult to differentiate them by symptoms alone. As a Health Extension Practitioner, you need to refer patients with symptoms of meningitis to the nearest hospital or health centre.

Study Session 4

SAQ 4.1

A is true. Pneumonia and clouding of the cornea are two of the common complications of severe measles.
B is *false.* Measles can be fatal, particularly in malnourished children. Around 165,000 children died of measles worldwide in 2008.
C is *false.* The transmission of poliovirus is easily prevented by routine vaccination of all children. The aim is to eradicate polio totally from the world by this measure.
D is true. Acute flaccid paralysis (AFP) is a rare complication of polio; most children infected with poliovirus show no symptoms.
E is *false.* 90% of adults infected with hepatitis B virus (HBV) will get rid of the virus from their bodies within six months.
F is true. Jaundice is a common complication of hepatitis B disease.

SAQ 4.2

The child is showing the characteristic signs of measles, and in his case the ear infection shows the illness is severe. For severe measles cases, give the child the first dose of vitamin A according to his age, and refer him immediately to the nearest health centre. He may need antibiotics to treat the ear infection and prevent other complications.

SAQ 4.3

The completed version of Table 4.2 is shown below.

Table 4.2 Modes of transmission and prevention of three common viral diseases.

Disease	Mode of transmission	Prevention
measles	Respiratory route	measles vaccination and vitamin A drops
polio	Faeco-oral route	oral polio vaccination
hepatitis B	Unprotected sex or other contact with infected blood or body fluids	hepatitis B vaccination

Study Session 5

SAQ 5.1

P. falciparum is the most likely cause of the infection, because the symptoms began after 8 days. The period between infection with the parasites that cause the disease and the beginning of malaria symptoms (incubation period) for *P. falciparum* is 7–14 days. It is longer for the other species of *Plasmodium*.

SAQ 5.2

- Malaria incidence is high in countries around the tropics or closer to the equator.
- It is low in northern and southern African countries.

SAQ 5.3

- Malaria incidence is high in the western lowlands of Ethiopia where the temperature and humidity is high and favourable for mosquito and parasite development.
- There is no malaria in the highlands because of low temperature.
- There is less malaria in the eastern lowlands because rainfall and humidity are low.

SAQ 5.4

The body parts directly associated with the development and reproduction of the malaria parasites are:

- Mosquito: gut and salivary glands.
- Human: liver and red blood cells.

SAQ 5.5

A is *false*. The malaria vector mosquito lays its eggs on water surfaces (not grass).

B is true. The malaria vector life cycle has four stages: eggs, larvae, pupae and adults.

C is true. The mosquito needs to feed on human or animal blood to develop its eggs.

D is *false*. The adult female mosquito lays eggs several times in its life cycle.

E is *false*. The stage that hatches from the eggs is the larvae.

SAQ 5.6

Two characteristics that distinguish the *Anopheles* larvae from other types are:

- It has no breathing siphon.
- It rests parallel or horizontal to the water surface.

SAQ 5.7

(a) Yes; the 10% of mosquitoes living more than 10 days will have the potential to transmit malaria.

(b) Malaria transmission will be higher in September because a larger percentage of mosquitoes live more than 10 days during September.

Study Session 6

SAQ 6.1

There will be malaria transmission in September, but not in February. At 40% humidity, mosquitoes cannot live long enough to transmit malaria in February.

SAQ 6.2

A daily average temperature of 12°C is not enough for the parasites to develop inside the mosquito vector. It is too cold.

SAQ 6.3

- Located at 1,000 metres above sea level, your village will have favourable temperatures for mosquito growth and parasite development.
- High vegetation coverage increases humidity and high humidity helps the vector to live longer; malaria is transmitted by long-living vectors.

SAQ 6.4

The rains create several vector breeding grounds; many vector breeding sites produce many vectors; more vectors mean more malaria transmission.

SAQ 6.5

- *An. arabiensis* will be a better vector of malaria.
- Mosquitoes that prefer to feed on humans have a better chance of picking up the parasite from an infected person and transmitting it to another person.

SAQ 6.6

- Village A will have more deaths due to malaria than village B.
- *Falciparum* malaria is the more dangerous form of malaria that often causes deaths; people very rarely die of *vivax* malaria.

Study Session 7

SAQ 7.1

The RDT or Rapid Diagnostic Test for malaria is available at health post level.

SAQ 7.2

You would ask him about his travel history to malaria-endemic areas in the last two weeks. You would also ask him if he has had fever in the last two to three days.

SAQ 7.3

The danger signs of severe malaria are anaemia, convulsions, repeated vomiting, high fever (>39°C), shivering, sweating, severe dehydration, drowsiness or confusion, and reduced urine output.

SAQ 7.4

- The RDT is simpler than microscopy and can be easily handled at health post level, whereas microscopy tests can only be done at a health centre.
- RDT results are ready within 15–20 minutes, whereas microscopy tests may take much longer as the patient has to go to the health centre.

SAQ 7.5

Write each patient's name on the RDT cassette to avoid mixing-up the results if you have to do several tests at the same time.

SAQ 7.6

- Wear gloves when handling blood from patients.
- Use one pair of gloves for each patient.
- Swab the patient's finger with alcohol before and after pricking it with the lancet.
- Use one lancet for each patient.
- Dispose of the lancet and gloves safely immediately after use.

SAQ 7.7

(a) Refer the child to the health centre for microscopic examination of his blood; RDT positive results after three days of anti-malaria treatment are not reliable, because RDTs can give a positive test up to two weeks after treatment.

(b) The advantages of microscopy over RDT are:

- Microscopy can tell you if parasites are cleared and a patient is cured immediately after anti-malarial treatment.
- Microscopy can tell you the number of parasites in the patient's blood; a high number of parasites could mean a high risk of developing severe complicated malaria.

Study Session 8

SAQ 8.1

A is *false*. Supportive treatment is what is given to treat other conditions at the same time as the malaria treatment. It is not the supportive treatment that kills the parasites; rather it is the anti-malaria drugs that you give to the patient that kills the parasites in the blood circulation.
B is true. Malaria patients with high grade fever should be given supportive treatment such as paracetamol tablets, or cooling the body of the patient with clean pieces of cloth dipped in slightly warm water, or by fanning.
C is *false*. Malaria patients with moderate dehydration should be given oral rehydration salts (ORS) as supportive treatment. The patient should also be advised to drink increased amounts of clean water or other fluids.
D is true. If the temperature is normal, there is no sign of dehydration and no anaemia, you do not need to give supportive treatment to a malaria patient even if she is breastfeeding. Just treat the malaria.
E is true. Malaria patients with mild or moderate anaemia should be treated with ferrous sulphate (iron tablets) 200 mg once daily for two months, and advised to return for recheck in two months.

SAQ 8.2

If you diagnose malaria clinically (if there is no RDT) you give the patient Coartem, unless the patient is a pregnant woman in the first trimester, or an infant under 5 kg or under four months (they get quinine tablets instead).

Coartem is given two times a day (in the morning and in the evening) for three days. The first dose is given in front of you immediately after the diagnosis of malaria. The rest of the drug is given to the patient/ caregivers to take at home.

SAQ 8.3

Give pre-referral treatment to Malomo (one 50 mg rectal suppository of Artesunate — see Table 8.4) and immediately refer him to the nearest health centre.

SAQ 8.4

Severe malaria should be referred to the health centre very fast. Before referring the patient it is important to give a pre-referral treatment with rectal Artesunate (or intramuscular injection of Artemether, if available). This will help to prevent the patient's condition from getting worse.

SAQ 8.5

If the patient does not adhere to the treatment he or she will not get cured completely and the disease will come back. It also leads to the development of resistance to the drug by the malaria parasites.

SAQ 8.6

(a) Uncomplicated malaria is the diagnosis you should give to Beka.

(b) Coartem is the correct treatment for a child of five years. The full dose is 12 tablets. Beka takes two tablets in the morning and two tablets in the evening for three days. You give two tablets to swallow immediately and give the remaining 10 tablets to Beka's mother to take home.

(c) Advise Beka's mother on the following issues:

- Tell her the reason for giving the drug.
- Demonstrate to her on how to give the correct dose.
- Tell her to watch while Beka is taking each dose of the drug.
- Explain that the drugs must be finished even if Beka feels well.
- Advise her on when to return if Beka does not improve.

Study Session 9

SAQ 9.1

A is *false*. Larviciding is a method of killing mosquito larvae using chemicals or toxins; not the adults.

B is true. Temephos is a chemical widely used as larvicide in Ethiopia.

C is true. Temephos is sprayed to vector breeding water collections using spray pumps.

D is *false*. Temephos can be sprayed by HEWs or community health workers.

E is *false*. Larviciding is done in vector breeding sites that cannot be treated through environmental management measures.

SAQ 9.2

Borrow-pits, micro-ponds, stream beds, irrigation canals, swamps, and road ditches can serve as water collection sites and thus vector breeding grounds. Houses and trees are not water collection places and cannot be vector breeding sites. Foul smelling polluted water is not good for breeding of malaria transmitting mosquitoes.

SAQ 9.3

Rainfall creates several water collections that serve as vector breeding grounds. Small rain water pools are the most important breeding sites for the main vector of malaria in Ethiopia.

SAQ 9.4

You may have thought of removing water plants from water collections, removing obstructions from streams, flushing, shading ponds and river banks, etc.

SAQ 9.5

You may have thought of filling of pits and depressions, levelling uneven ground, shore lining, planting trees to drink up ground water, etc.

SAQ 9.6

(a) 960 m^2 divided by 320 m^2 = 3, so you need three spray pumps of Temephos to treat the vector breeding site.
(b) 3 multiplied by 8 ml of Temephos in each spray pump = 24 ml of the chemical to treat the vector breeding site.

SAQ 9.7

Women's and youth associations, cooperatives, health committees, schools and religious leaders and community leaders, all may help you to mobilize local people to undertake larval control activities.

Study Session 10

SAQ 10.1

Walls of houses, animal shelters and latrines, as well as household furniture, can serve as resting places for blood-fed mosquitoes, and should be sprayed with insecticides.

Streams, lakes and rivers are not resting places for adult mosquitoes.

SAQ 10.2

A is true. Blood-fed mosquitoes can rest either indoors or outdoors.
B is *false*. Mosquitoes that rest outside houses are *harder* to control using IRS.
C is *false*. After taking a blood meal mosquitoes rest for about two days (not 10 days) before laying eggs.
D is *false*. Blood-fed mosquitoes do not usually rest on the outside walls of houses. They prefer shaded and undisturbed sites.
E is true. IRS only kills mosquitoes entering and/or resting in sprayed houses.

SAQ 10.3

You have to request the following items from the District Health Office:

- Spray pumps, insecticides, spray pump spare kits, tool kits for pump maintenance, personal protective equipment.
- At the community level you have to select and train spray operators.

SAQ 10.4

- The spray pumps used in Ethiopia have eight litres capacity.
- One spray pump full of insecticide can spray 200 m^2 of surface area.

SAQ 10.5

(a) 800 households multiplied by 1.5 housing units per household = 1,200 housing units.
(b) 900 housing units were sprayed. Therefore 1,200 – 900 = 300 housing units were unsprayed.
(c) The coverage of this IRS operation is (900/1,200) × 100 = 75%.
(d) The coverage is not acceptable; the minimum coverage acceptable for IRS to be effective is 85%.

SAQ 10.6 (tests Learning Outcome 10.6)

(a) Ten days. This is worked out as follows: there are 500 × 2 = 1,000 housing units. Number of units 5 spray operators can spray in one day = 5 (spray operators) × 20 (units each operator sprays in a day) = 100 units. So the number of days to spray the entire village of 1,000 units at 100 units per day = 10 days.
(b) Five hundred sachets. This is worked out as follows: one sachet sprays 200 m^2 which is equal to 2 housing units. 1,000 housing units divided by 2 units per sachet = 500 sachets.
(c) Ten sachets. This is worked out as follows: one spray operator sprays 20 housing units per day. One sachet is needed to spray 200 m^2 surface area, which is enough for 2 housing units of 100 m^2 each. To spray 20 housing units at 2 housing units per sachet = 10 sachets.

SAQ 10.7 (tests Learning Outcome 10.7)

A is *false.* Shirts and trousers do not give enough protection. Spray operators also need to wear a hat, mask, goggles and gloves etc. to protect themselves from contamination.
B is true. Hands and faces should be washed with soap after spraying and before eating or drinking
C is *false*. Any leftover insecticides should be disposed of in a pit prepared for this purpose; they should *never* be poured into a river (or other water body).
D is *false*. Contaminated clothes have to be changed and washed immediately.

Study Session 11

SAQ 11.1

A is *false.* ITNs protect people by killing or repelling the *mosquitoes* (not the parasites).
B is *false.* ITNs do kill mosquitoes that come in contact with the nets.
C is true. ITNs can repel mosquitoes from coming closer to people sleeping under nets
D is true. ITNs are impregnated with chemicals that kill mosquitoes.
E is *false.* ITNs also kill other household pests like bedbugs that come in contact with the nets.
D is *false.* The chemicals used to treat nets are harmless to humans and animals.

SAQ 11.2

Non-treated nets have no chemicals, so they cannot kill mosquitoes and other insects. Treated nets do have insecticides coated or incorporated into them. Untreated nets only act as physical barriers against mosquito bites, while ITNs can also kill or repel mosquitoes.

SAQ 11.3

Conventionally treated nets have to be dipped in chemicals every six months or after three washes; LLINs have chemicals in them that remain effective for the life of the nets (three to four years).

SAQ 11.4

- House-to-house visits: The advantage is that these visits ensure that nets are given to the right people and effective face-to-face education on net use is provided. However, it can take a lot of time to distribute nets to all households in this way.
- Inviting people to come to the health facility or other central location in the village: this is a good method to distribute a lot of nets rapidly. However, education about using the nets may not be effective as it is given to everyone and some individuals may not understand or accept the messages.

SAQ 11.5

- Giving nets to pregnant mothers during antenatal care visits
- Giving nets to children during immunization visits
- Giving nets to newcomers to the village
- Giving nets to replace old or torn nets.

SAQ 11.6

At least two of the following:

- Not sleeping under nets.
- Using nets for fishing or other purposes.
- Selling them.
- Not hanging nets properly.
- Not using nets for sleeping outdoors.

SAQ 11.7

- A large number of people are not sleeping under their nets.
- Many people are sleeping under nets, but too late in the night, after mosquitoes have already begun to feed on humans.
- Many of the nets are old and damaged.

Study Session 12

SAQ 12.1

A is true. Like any other epidemics, a malaria epidemic is defined as the occurrence of cases *in excess* of the number *expected* in a given place and time period.

B is true. Malaria epidemics can occur during the dry season because the rivers that might get interrupted or shrink can create breeding sites for the *Anopheles* mosquitoes, and lead to epidemics.

C is true. As a rule 25% of contingency stock should be kept for the drugs and supplies that are required for the management of epidemics.

D is *false*. The purpose of early detection of malaria epidemics is so action can be taken to contain them before they get out of control and affect a large number of people. You are the first to take action against any malaria epidemics that are detected. Of course you also report to the district level.

SAQ 12.2

The factors in the story that might trigger a malaria epidemic are:

- Heavy rainfall, followed by sunshine and warm temperatures, can lead to good breeding conditions for mosquitoes.
- High numbers of migrants who were not immune to malaria parasites because they came from a non-malarious area.

SAQ 12.3

The following are the lists for your contingency stock:

Drugs

- Chloroquine tablets
- Chloroquine syrup
- Coartem tablets
- Quinine tablets
- Artemether injections
- Artesunate suppositories

Supplies

- Multispecies Rapid Diagnostic Tests (RDTs)
- Insecticide for indoor residual spraying
- Temephos for larval control.

SAQ 12.4

IRS, larval control and distribution of ITNs are the main malaria epidemic prevention strategies

SAQ 12.5

The completed version of Table 12.4 is below.

Week No	1998	1999	2000	2001	2002	2003	2nd largest number	This year (2004)
1	16	42	105	36	14	42	36	33
2	12	42	100	38	17	22	38	35
3	16	42	103	49	21	34	42	40
4	20	17	134	59	32	40	40	39
5	34	17	146	20	30	39	34	33
6	18	10	134	29	23	27	27	30
7	30	19	133	24	25	25	25	29
8	37	10	127	41	23	42	41	42
9	32	18	137	29	26	29	29	35
10	31	24	128	17	13	32	31	30
.	.	.	.	.	.	.		.
51	26	40	134	32	39	39	39	.
52	23	35	110	27	25	33	33	.

(a) It is the year 2000. As you can see from Table 12.4 the weekly cases in 2000 are abnormally higher than the other five years of data. As a principle you do not use the 2000 data in constructing the normal chart. So before you identify the second largest number, remove the year 2000 from the data.

(b) See the table for the second largest number for the six years of data filled in the correct column.

(c) The reference line of the second largest numbers and the data for the year 2004 are shown in Figure 12.5.

(d) As you can see from Figure 12.5, epidemics occurred in weeks 7 to 10.

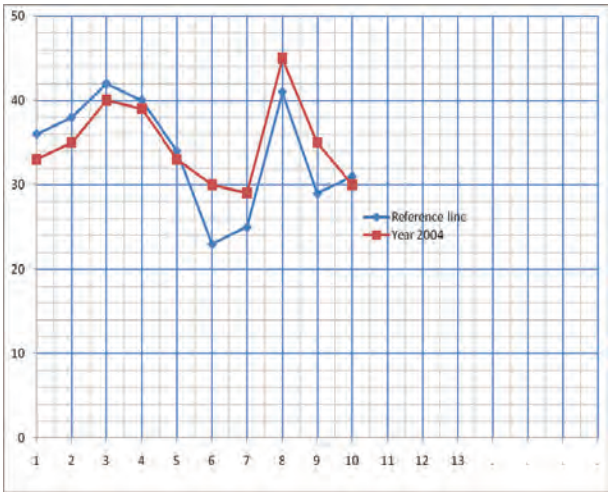


Figure 12.5 Completed epidemic monitoring chart for SAQ 12.5.

SAQ 12.6

Mass fever treatment means treating all the people who have fever *without* testing with RDTs, followed by malaria treatment to contain epidemics. The drug you give is Coartem, except for those contraindicated for whom you give quinine tablets.

SAQ 12.7

Post-epidemic assessment benefits you in such a way that you learn your strengths and weakness. During the next epidemic you will correct your weaknesses and become more efficient in preparedness, detection, prevention and control of the epidemic.

Federal Democratic Republic of Ethiopia
Ministry of Health

Communicable Diseases

Part 2 Tuberculosis and leprosy

Blended Learning Module for the Health Extension Programme

HEAT
Health Education and Training
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Contents

Study Session 13 Introduction, Transmission and Tuberculosis Case Finding

Introduction

Tuberculosis (TB) is one of the major common diseases in Ethiopia and you are very likely to have come across this disease in your daily work as a health worker. In this study session, you will learn about the cause of TB, how important it is as a public health problem in the world, in Africa and in Ethiopia. You will also come to understand how TB is transmitted (spread) in the community. This study session will also help you to understand the approach adopted by the World Health Organization (WHO) to tackle the problem of TB worldwide.

You will become aware of what you and other health workers can do, in line with the global plan, to reduce and eliminate the problem of TB in your community. You will also learn how to identify a suspected case of TB and how to confirm your suspicions by reaching a diagnosis. Early diagnosis and prompt treatment of TB patients is essential if you are to help reduce the sufferings of patients and stop the spread of TB in your community.

Learning Outcomes for Study Session 13

When you have studied this session, you should be able to:

13.1 Define and use correctly all of the key words printed in **bold**. (SAQs 13.1, 13.2, 13.4 and 13.7)

13.2 Describe the burden of TB in the world, Africa and Ethiopia. (SAQs 13.2 and 13.3)

13.3 Describe the global approach to fight tuberculosis, known as the Global Stop TB Strategy. (SAQ 13.4)

13.4 Describe the mode of transmission of tuberculosis and identify the groups most at risk of TB infection. (SAQs 13.1 and 13.5)

13.5 Detect and confirm a case of TB based on clinical signs and screening of sputum specimens. (SAQs 13.6 and 13.7)

13.1 What is TB?

Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis*; another name for these bacteria is **TB bacteria** or *tubercle bacilli*. TB usually affects the lungs (80% of TB cases are of this type), hence the name **pulmonary TB** (**PTB**). When other organs of the body are affected, such as the bones, joints, lymph-nodes, gastro-intestinal tract, meninges (coverings of the brain), or the reproductive system, kidneys and bladder (also known as the genito-urinary tract), the disease is called **extra-pulmonary TB (**or **EPTB)**.

'Pulmonary' is the term given to anything affecting the lungs. 'Extra-pulmonary' means *outside* the lungs.

■ You have probably come across people who suffer from TB. Do you know what the most common symptoms are?

□ If you have direct experience of TB patients, you will probably know the symptoms are: persistent cough, weight loss, chest pain, tiredness, difficulty in breathing, sometimes spitting up blood, and general symptoms like sweating and fever.

13.2 Global and regional burden of TB disease

TB is a major public health problem throughout the world. According to the World Health Organization's (WHO) Global Report 2009, one-third of the world's population is estimated to be infected with TB bacteria and at risk of developing the active form of the disease. In 2009, the annual incidence of TB (the number of new cases) across the world was about nine million people. The annual number of deaths due to TB was 1.7 million, including 195,000 patients infected with HIV. In developing countries, TB comprises 25% of all avoidable adult deaths. The disease affects both sexes equally and most TB cases are found among the age group 15–54 years. Since this group constitutes the majority of the working population, their deaths can be a major blow to the economy of any country.

Thirty percent (30%) of the estimated total TB cases in the world in 2008 occurred in Africa. Among African countries, South Africa has the highest estimated number of cases (0.38–0.57 million), followed by Nigeria (0.37–0.55 million), and Ethiopia is third with 0.24–0.36 million. Throughout the world, almost 30,000 cases of **multidrug resistant-TB** (**MDR-TB**), a form of TB that does not respond to the standard treatments using the drugs most commonly used against TB, were reported in 2008.

The main reasons for the increasing burden of TB globally include:

- Poverty.
- Neglect of the disease (inadequate case finding, diagnosis and cure).
- Collapse of the health system in countries experiencing severe economic crisis or civil unrest.
- Effect of the HIV pandemic.

TB is a disease of poverty because most cases occur among poor peoples of the world, often living in very poor conditions and hard-to-reach communities. Because of their circumstances, poor people do not have easy access to health care services, including diagnosis and treatment for TB. This is why your role as a Health Extension Practitioner is crucial, because you can bring TB diagnosis and treatment within reach of the rural community dwellers.

13.2.1 Tuberculosis burden in Ethiopia

According to the Ethiopian Federal Ministry of Health's hospital data, tuberculosis is the leading cause of morbidity (sickness), the third cause of hospital admission, and the second cause of death in Ethiopia, after malaria.

Sputum is jelly-like mucus coughed up from the lungs. TB bacilli can be seen in sputum smeared thinly onto a glass microscope slide and stained with special dye.

Ethiopia ranks seventh among the 22 countries with high TB burden, and third only to South Africa and Nigeria in Africa, with an estimated incidence of all forms of TB at 378/100,000 in 2009. This means that among every 100,000 Ethiopians, 378 new cases of TB were estimated to have occurred in 2009. The estimated incidence of **smear-positive** (a form of TB in which TB bacteria are seen when a sputum smear is stained and examined under the

microscope) is 163 per 100,000 population. If the population of Ethiopia is assumed to be 80,000,000, then 302,400 new cases of all forms of TB and 130,400 new smear-positive TB cases were expected to have occurred in the country in 2009. However, of the estimated figures, only 145,924 (48%) of all forms of TB cases and 44,593 (34%) of estimated new smear-positive TB cases were actually detected. This suggests that the number of TB cases detected in Ethiopia in 2009 is far below the expected numbers.

For all forms of TB the expected cases calculation is 80,000,000 divided by 100,000 = 800, then 800 x 378 = 302,400 cases. For smear-positive cases it is 80,000,000 divided by 100,000 = 800, then 800 x 163 = 130,400 cases.

The **global target for TB control** is to detect at least 70% of the smear-positive cases and cure at least 85% of the detected cases. If we do not detect TB cases as they occur in the communities, it means that people who are sick with active TB will continue to spread the disease among the healthy population and many people will continue to suffer and/or die in our communities.

The HIV epidemic (which you will learn more about in *Communicable Diseases*, Part 3) has made the TB situation significantly worse by accelerating the progression of TB infection to active TB disease, thus increasing the number of new TB cases. Another challenge to TB control in Ethiopia is the emergence of MDR-TB, with 5,979 estimated cases in 2007.

As a Health Extension Practitioner, you have an important role to play in the community to prevent and control TB.

13.3 Global strategy for the prevention and control of TB

In 1994, WHO launched their global strategy for the prevention and control of TB. The key feature of the strategy remains the **Directly Observed Treatment, Short-course (DOTS)**, as the best approach to TB. DOTS has five key components:

1 Sustained government political and financial commitment to TB control

2 Access to quality-assured laboratories for the confirmation of persons suspected of having TB

3 Uninterrupted supply of quality-assured drugs to treat TB

4 Standardized treatment and care for all TB cases, including Directly Observed Treatment Short-course (DOTS)

5 Setting up of a recording and reporting system through which the progress of patients and the overall performance of the TB control programme can be assessed. Box 13.1 outlines the records and forms that will be used to monitor the progress of your patients and how effectively TB is being controlled in your area.

Box 13.1 Record keeping and the TB patient

To help TB patients, you will need to know about different forms that need to be completed. For example, a *TB lab register* is used to record information on all patients investigated for TB; *a sputum request form* needs to be sent with the sputum samples that are sent for investigation. A *TB unit register* has to be completed for all patients where TB is detected, where the details of their treatment are recorded; there is also a *TB referral/transfer form*. Find out from where you work what these different forms looks like. Keeping them up-to-date is essential for checking the progress of patients and seeing how effective the control of TB in your area is proving.

Let us focus now on those components of the DOTS strategy that are carried out at the health facility and community levels. As you've just read, one of the most important components of the global strategy is the Directly Observed Treatment, Short-course, which means that a health worker or a treatment supporter (such an individual could be a family member, a religious or community leader) must support and watch the patient taking each dose of his/her treatment. DOTS is important to:

- Ensure that patients take the correct treatment regularly
- Detect when a patient misses a dose, find out why, and solve the problem
- Monitor and solve any problem that the patient may experience during treatment.

13.3.1 The Global STOP TB Strategy

Figure 13.1 The STOP TB logo used by the WHO (Photo: courtesy of SEARO, WHO).

The **Global STOP TB Strategy** was launched by WHO in 2006 to improve the achievements of the DOTS strategy (Figure 13.1). It comprises the following elements:

1 Improve and scale-up DOTS so as to reach all patients, especially the poor.
2 Address the problems of TB/HIV, drug resistant TB and other challenges.
3 Contribute to health system strengthening by collaborating with other health programmes and general services, for example, in mobilizing the necessary resources to make the health system work.
4 Involve all public and private care-providers to increase case finding and ensure adherence to the International Standards for TB Care.
5 Engage people with TB and affected communities to demand, and contribute to, effective care. This will involve scaling-up of TB control at community level by creating community awareness and mobilizing local authorities and community members for action.
6 Enable and promote research for the development of new drugs, diagnostic tools and vaccines.

The things that you can do in line with the Global STOP TB Strategy to reduce the problem of TB in your community, include educating the community members about TB, identifying community members with TB symptoms, making sure people know their HIV status, encouraging community members, active and ex-TB patients to participate in TB control activities, and finally persuading private health practitioners, including traditional healers to participate in TB control activities.

13.4 How is TB transmitted?

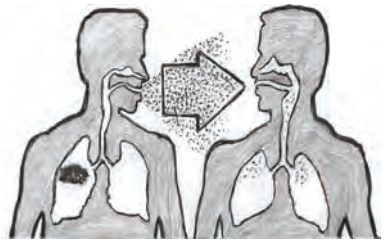

Figure 13.2 TB bacteria released during coughing, sneezing and talking can infect a contact person.

When an adult with infectious TB coughs, sneezes, sings or talks, the TB bacteria may be expelled into the air in the form of small particles called *droplet nuclei*, which cannot be seen except through a microscope. Transmission occurs when a person in close contact inhales (breathes in) the droplet nuclei.

Figure 13.2 shows an infectious TB patient expelling a large amount of droplet nuclei after coughing, and those nuclei being inhaled by a nearby person. If an infectious adult spits indiscriminately, the sputum containing bacteria dries and wind can carry the droplet nuclei into the air, so anyone can inhale them.

In addition, consumption of raw milk containing *Mycobacterium bovi* (TB bacteria found in domestic animals such as cows, goats and lambs) may also cause TB in humans, though nowadays it is much less frequent because of boiling milk or pasteurization (the processing of removing germs from milk).

The contact person does not usually develop active TB immediately. In some cases, the person's immunity is able to remove the bacteria and he/she does not develop TB infection. In other cases, the person develops an immune response that controls the bacteria by 'walling it off' inside the body. This causes the bacteria to become inactive. The person does not develop active TB or become ill at the time, but is said to have **latent tuberculosis infection** (**LTBI**). Up to one-third of the world's population is thought to be infected with latent TB.

If the immunity of a person with LTBI is weakened, the body is no longer able to contain the TB bacteria, which then grow rapidly and the person becomes sick with symptoms and signs of TB. The person is then said to have **active TB**. This process of progression from LTBI to active TB is called **reactivation**. The greatest risk for developing active TB is within the first two years following the initial infection.

A person with latent TB infection is well and cannot spread infection to others, whereas a person with active TB is sick and can transmit the disease.

13.4.1 Who is at risk from tuberculosis?

In a country like Ethiopia, with a very high number of TB cases, certain factors increase a person's risk of developing active TB, either on first exposure or when a latent TB infection overcomes the body's immunity to become active. These risk factors include:

- Poverty, causing poor living conditions and diet
- Prolonged close contact with someone with active TB
- Extreme age (the very young or old age groups), when the effectiveness of the immunity is lowered
- Malnutrition, which prevents the immune system from working properly
- Inaccessible health care, making it harder to diagnose and treat TB
- Living or working in a place or facilities such as a prison or a refugee camp, where there is overcrowding, poor ventilation, or unsanitary conditions
- Healthcare workers such as yourself, with increased chances of exposure to TB
- Lowered immunity factors, like HIV/AIDS or diabetes, drug treatments for cancer, and certain arthritis medications, will decrease the ability of the body's defence mechanisms to keep the TB in check; this increases the chances of active TB developing.

13.4.2 Natural history of tuberculosis

Look at Figure 13.3 (on the next page) which illustrates the different outcomes of a person exposed to TB infection. You can see that exposure to TB does not lead to infection of the contact in 70–90% of cases. For those 10–30% of individuals that do become infected with *M. tuberculosis*, in about 90% of them, the body's immunity either kills the bacteria, or perhaps more often, keeps them suppressed (inactive), causing LTBI. (In HIV infected persons, TB infection progresses to disease more rapidly due to the weakening of their immunity.) In healthy individuals, only about 10% of infected persons develop active disease and become ill.

Without treatment, 50% of patients with pulmonary TB will die within five years, but most deaths are within two years; 25% will remain sick with chronic, infectious TB which can be spread to the community. Another 25% will spontaneously recover and be healthy, due to their strong immune defences, but they could become sick again at any time if the TB bacteria are latent.

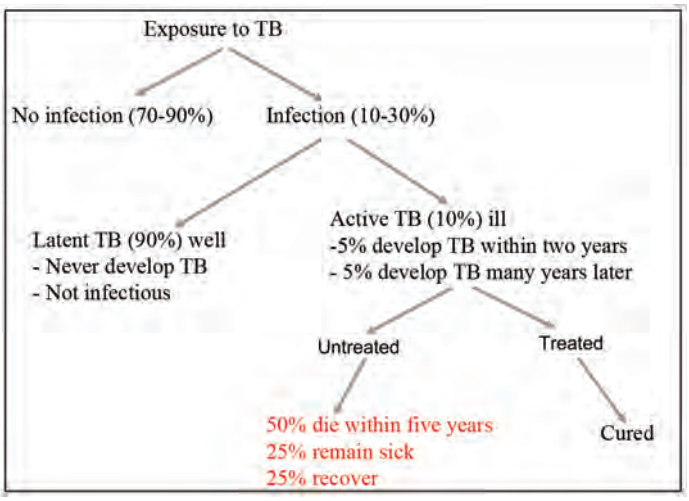

Figure 13.3 Natural history of tuberculosis after exposure to an infectious person.

13.4.3 What is the difference between TB infection and TB disease?

As you've just learnt, in a TB *infection*, an individual has no signs and symptoms of TB disease, whereas in pulmonary TB *disease*, signs and symptoms are evident. There are other differences between TB infections and pulmonary TB disease and these are summarised in Table 13.1.

Table 13.1 The distinction between TB infection and pulmonary TB disease.

Descriptions	TB infection	TB disease (in the lungs)
M. tuberculosis in the body	Yes	Yes
Symptoms	No	Yes
Chest X-ray	Normal	Abnormal
Sputum smears	Negative	Usually positive
Culture	Negative	Positive
Infectious to others?	No	Yes
A case of TB	No	Yes

TB bacteria isolated from the patient are grown in a **culture** medium in the laboratory, so they can be identified.

13.5 Case finding

Now it's important you learn about how to identify a person with suspected TB and confirm a TB case in the community and at a health facility.

Detection of the most infectious cases of tuberculosis (sputum smear-positive pulmonary cases) is a critical step in the control of TB in the community where you are working. The process of determining a TB case is known as **case finding**. The objective of case finding is to identify the source of infection in the community, that is, individuals who are discharging large numbers of TB bacteria, so that they can receive prompt treatment, which in

turn will cut the chain of transmission (stop the spread) and therefore lower the prevalence and mortality of TB.

The identification of people with suspected TB (or **TB suspects**) is the first step in case finding. The second step involves the laboratory investigation of the TB suspect's sputum samples to confirm those who have active TB. This process is called **TB screening**. When selecting people for TB screening you should always be aware that certain individuals are at high risk of becoming infected and developing tuberculosis, in particular, contacts of those who are in prison, drug abusers, diabetic patients and People Living with HIV (PLHIV). You should educate the general public about the need for these high risk groups to be screened for TB regularly to reduce the burden of TB in the community. It is your responsibility to identify people in such groups at all times and to regularly refer them for sputum examination. It is also important to ask all household contacts of smear-positive TB patients whether they have been coughing and for how long they have been doing so. All children under the age of five years, anyone who is HIV-positive and any TB suspects among them in the family, or in prison should also be screened for TB.

13.5.1 How to identify a person with suspected TB

First, remember that you need to inform the general public about the signs and symptoms of TB and to tell them about where TB screening can be done.

How to suspect pulmonary TB

You can identify a TB suspect with pulmonary TB by asking two simple questions:

- Do you have a persistent cough?
- How long have you had the cough?

Remember that any person with a persistent cough of two or more weeks is a TB suspect and should be screened for TB.

You may also come in contact with persons who have extra-pulmonary TB, in which case you can use Table 13.2 as a guide on how to proceed. What is important for you to appreciate is that while a patient with EPTB is likely to have general symptoms such as weight loss, fever, night sweats, their specific symptoms will depend on which organ has been affected by the TB bacteria.

Table 13.2 Identifying a person with extra-pulmonary TB (EPTB)

Organ affected	Symptoms
Vertebral spine	Back pain, swelling on spine
Bone	Long-lasting bone infection
Joints	Painful joint swelling, usually affecting one joint
Kidney and urinary tract	Painful urination, blood in urine, frequent urination, lower back pain
Upper respiratory tract (larynx)	Hoarseness of voice, pain on swallowing
Pleural membrane of lungs	Chest pain, difficulty in breathing, fever
Meninges of the brain (meningitis)	Headache, fever, neck stiffness, vomiting, irritability, convulsions
Lymph node	Swelling of the node, draining pus. Long-lasting ulcer despite antibiotic treatment, draining pus

Any person suspected of extra pulmonary TB should be referred to a medical doctor or clinician for diagnosis. If the patient is also coughing, sputum must be examined.

How to suspect TB in children

What about diagnosis of TB in children? This is often quite difficult because sputum is not so easy to obtain. What is more, the symptoms are not as clear cut as in adults. They include:

- Low grade fever not responding to malaria treatment
- Night sweats
- Persistent cough for three weeks or more
- Loss of weight, loss of appetite
- Failure to thrive
- Lymph node swellings
- Joint or bone swellings
- Deformity of the spine
- Listlessness
- Neck stiffness, headache, vomiting (TB meningitis).

Any child suspected of having TB should be referred to a Medical Officer/Clinician for diagnosis. The tuberculin test is a skin test to see if there is a reaction to extracts of TB bacteria.

Diagnosis in children rests largely on the results of clinical history, family contact history, X-ray examination and tuberculin test. A medical officer experienced in TB should make the decision whether to treat or not to treat.

13.5.2 Case finding through confirmation of a TB suspect by sputum examination

The purpose of sputum examination is to determine whether TB bacteria are present. You will need to collect three sputum samples (also called specimens) from each person with suspected TB for this purpose, as follows:

- First, explain to the TB suspect the reason for sputum examination and ask for his/her cooperation
- Then explain that examining sputum under a microscope is the best way to determine the presence of TB bacteria in the lungs
- Collect three sputum specimens from the TB suspect and write his or her name on the specimen containers (a small plastic bottle with a lid to prevent the spilling of the specimen while being transported to the laboratory).

How to collect sputum samples

You need three sputum containers on which the name of the suspect is to be written. Do not write the person's name on the lid as this can cause confusion in the laboratory. Before you begin, explain to the person what collecting a specimen involves, and where possible guide him/her through the process. Begin by giving the person the container, then:

- Ask the person to open the lid and, holding the container like a glass of water, to take a deep breath and then cough out sputum (not saliva) into the container, without allowing sputum to spill on the edge or side of the container.
- Ask the person to put the lid on the container tightly.
- This first sample is collected 'on the spot'. Keep the specimen in a safe place away from children, heat or sunlight. Heat or sunlight can kill the TB bacteria in the specimens (Figure 13.4).
- Give the person another labelled container to take home and collect a specimen immediately after waking up the next morning.

- Explain to the person that before collecting this second specimen, he or she should rinse their mouth with water so that food or any other particles do not contaminate the specimen. This second specimen is the 'early morning specimen'. It is important to tell TB suspects to bring this second specimen with them when they come back to you the following day.
- When the person comes back with their 'early morning' specimen the following day, take the third specimen 'on the spot'.

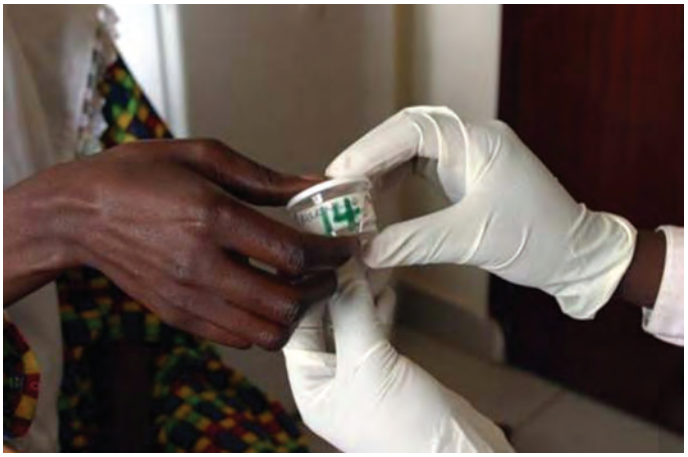

Figure 13.4 A woman hands over her sputum sample to a health worker (Photo: courtesy of the Lung Health Image Library, World Lung Foundation).

Box 13.2 summarises the key action points involved in collecting sputum for TB case finding.

Box 13.2 Important points to remember about sputum collection

- Use three containers labelled with the person's name; do not write the name on the lids.
- Collect specimens in an open area or a well ventilated room
- Check that the lid is tightly closed after the specimen is collected
- Wash your hands with soap and water after handling the container
- Ensure that three specimens are collected and kept safely before sending them to the laboratory
- Send the specimens with a request form to the nearest laboratory for examination.
- Tell the TB suspect when to come back for the laboratory result
- If the sputum is positive and the person does not come back to hear the result, then trace him or her as soon as possible, and explain the outcome and refer them for treatment. Treatment needs to be started immediately to prevent the spread of TB.

Summary of Study Session 13

1 Tuberculosis (TB) is a chronic disease caused by *Mycobacterium tuberculosis*, also known as TB bacteria.

2 Pulmonary TB affecting the lungs is the commonest type of TB; extra-pulmonary TB arises when TB affects other organs of the body.

3 TB is a major health problem in Ethiopia and around the world. The Global STOP TB strategy, including DOTS (directly observed treatment, short-course) is designed to reduce the level of TB infections and transmission.

4 Transmission of TB occurs mainly by inhalation of infectious droplets produced when an untreated person with TB coughs, sneezes, sings or talks.

5 Identification of the most infectious cases of tuberculosis (sputum smear-positive pulmonary TB cases) by screening sputum smears is crucial to TB control.

6 Three sputum specimens are sent in labelled containers to the laboratory for sputum examination. Tell the TB suspect when to come back for the result.

7 If a person who is smear-positive fails to come back for the report, locate and inform him or her about their TB status as soon as possible. Treatment needs to be started immediately to prevent the spread of TB.

Self-Assessment Questions (SAQs) for Study Session 13

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 13.1 (tests Learning Outcome 13.1)

In lay person's language, how would you describe TB and its symptoms to a person who comes to your Health Post? Explain why it is important to follow the treatment exactly.

SAQ 13.2 (tests Learning Outcomes 13.1 and 13.2)

What are the global targets for TB case finding and treatment?

SAQ 13.3 (tests Learning Outcome 13.2)

If the population of a *woreda* in Tigray is 200,000 people, what is the estimated number of new smear-positive TB cases? (Remember in Ethiopia as a whole, the estimated number of new smear-positive TB cases is 163/100,000 annually.)

SAQ 13.4 (tests Learning Outcomes 13.1 and 13.3)

What are the components of the Global STOP TB Strategy?

SAQ 13.5 (tests Learning Outcome 13.4)

How is TB spread?

SAQ 13.6 (tests Learning Outcome 13.5)

How does a health worker identify TB suspects from among all the persons in the community, or those visiting a health facility?

SAQ 13.7 (tests Learning Outcomes 13.1 and 13.5)

A person with smear-positive pulmonary TB lives with family members in your community. Whom among the family members are you going to screen for TB by sending sputum specimens to the laboratory?

Study Session 14 Diagnosis and Treatment of Tuberculosis

Introduction

In this study session you will learn about methods for diagnosis of tuberculosis, be introduced to different categories of patient with TB and also learn about treatment of tuberculosis with drugs, including the major side-effects of these medications. Even though you are not the person with responsibility for diagnosing and prescribing anti-TB drugs, having this information will enable you to swiftly identify and refer people suspected of having TB and ensure there is follow-up for confirmed cases. You will also learn more about the main method of diagnosis of TB, which is sputum examination under a microscope, and other supportive measures like chest X-ray, which is likely to help diagnosis of individuals who are smear-negative.

Your role is to make sure that every person diagnosed with TB takes the recommended drugs, in the right combinations and at the right time, for the appropriate duration. The best way to achieve this is for you to watch each patient swallow the drugs. This is called Directly Observed Treatment, Short Course (DOTS) and was introduced in Study Session 13. Directly observed treatment can take place at a hospital, health centre or health post, the patient's workplace or home. If drugs are taken incorrectly or irregularly, the patient will not be cured and drug resistance may arise. To a large extent, the success of TB treatment by drugs depends on your effectiveness in overseeing the patient's adherence to the treatment.

Learning Outcomes for Study Session 14

When you have studied this session, you should be able to:

14.1 Define and use correctly all of the key words printed in **bold**. (SAQs 14.1, 14.2 and 14.3)

14.2 Describe methods used to diagnose tuberculosis and the different types of case definitions. (SAQ 14.2)

14.3 Describe different treatment categories used to treat tuberculosis. (SAQs 14.2 and, 14.3)

14.4 Describe the main drugs used to treat tuberculosis and the processes that help you ensure patients are following the correct treatment schedules. (SAQ 14.3)

14.5 Describe the potential side-effects associated with the drugs used to treat tuberculosis and explain how such side effects are managed. (SAQ 14.4)

14.1 Diagnostic methods

In Study Session 13 you learnt about the clinical symptoms of TB. They are a cough for two or more weeks, spitting up blood in the sputum, weight loss, fever or night sweats for three or more weeks, fatigue, and loss of appetite, chest pains or difficulty breathing.

Sputum is a secretion coughed up from the lungs and expectorated (expelled) through the mouth.

- If a person comes to you complaining of a persistent cough that has lasted for over two weeks and they are also producing whitish sputum, what should you do?

- This person is showing symptoms that are consistent with an active TB infection. You should obtain sputum samples from this individual to send for sputum examination to confirm the diagnosis.

Remember, taking a history from the person you suspect of having TB will allow you to determine if they need to be referred for a sputum examination.

If you ask the right questions and make the right observations, you will be able to identify those individuals who you suspect of having TB. What to look for depends on the type of TB involved. The key symptoms of both forms of TB are summarised in Box 14.1.

Box 14.1 Key symptoms of both forms of TB

Active Pulmonary TB disease (PTB)

Pulmonary TB has several manifestations. The most common and obvious one is a persistent cough that lasts for two weeks or more which is usually accompanied with the production of whitish sputum.

A **low grade fever** is defined as a slight increase in body temperature that does not exceed 38.5°C.

Other key symptoms are spitting of blood, weight loss, low grade fever, loss of appetite, night sweating, chest pain and shortness of breath or difficulty in breathing. Any person with persistent cough of two or more weeks (with or without any of these other symptoms) should be suspected of having TB and you should refer them for a sputum examination.

Extra-Pulmonary TB disease (EPTB)

Persons with one or more of these symptoms should be investigated for extra-pulmonary TB and referred urgently to a health facility.

The symptoms of EPTB will vary depending on the organ affected (this was summarised in the previous Study Session in Table 13.2), but they can include: back pain, swelling on the spine, long-lasting bone infection, painful joint swelling (usually affecting one joint), painful urination, blood in urine, frequent urination, hoarseness of voice, pain on swallowing, headache, fever, neck stiffness, vomiting, irritability, convulsions, swelling of the lymph node with draining pus and long-lasting ulcers resistant to antibiotic treatment.

We will now describe in more detail different methods used to diagnose tuberculosis and other procedures that are used to diagnose extra-pulmonary tuberculosis (EPTB). Diagnosis of tuberculosis is made at health centres and hospitals, but you will make a vital contribution by identifying those individuals who may be infected with TB and referring them for investigation. Part of your role is to provide information and counsel those who are about to undergo diagnostic investigation and treatment.

14.1.1 Microscopic examination of sputum smears

Sputum microscopy is the most efficient way of identifying a tuberculosis infection. It is the primary tool used for diagnosing TB and for monitoring the progress of treatment until the patient is cured. You are expected to oversee the collection of sputum samples during initial diagnosis, and at various times during drug treatment to monitor the effectiveness of the treatment.

You will recall from Study Session 13 that three sputum samples will be collected over two consecutive days, and that one of the sputum samples is collected in the morning. The samples are sent to a laboratory and Figure 14.1 illustrates a health professional examining a sputum smear using a microscope. The smear is treated with chemicals that reveal the presence of TB bacteria and these can be seen using a microscope (they cannot be seen with the naked eye). The examined specimens are classified as being either **smear-positive** pulmonary TB or **smear-negative**. However, you should know that a smear-negative result could either mean the patient has TB but it is not showing in the sputum, or that the person does not have TB.

Figure 14.1 A health professional is examining a sputum smear under a microscope.

An example of a positive smear, seen under a microscope, is shown in Figure 14.2. The smear has been stained with chemicals to reveal the presence of TB bacteria (they appear as purple rod-shaped bacteria).

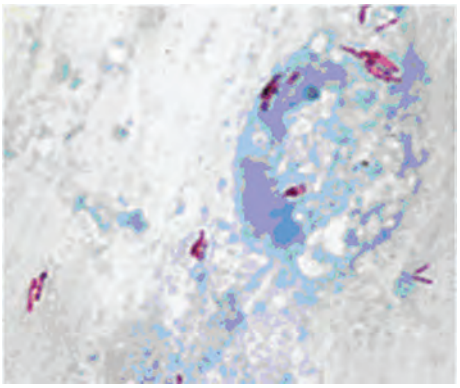

Figure 14.2 The photograph shows you what the health professional sees under the microscope and is an example of a smear-positive sputum specimen. (Photo courtesy of the WHO; *'The Natural History of Pulmonary Tuberculosis, Facilitator Guide'*, 2001).

A diagnosis of TB is made if at least two out of the three sputum smears are positive for TB bacteria. TB is also confirmed if one sputum specimen is positive for bacteria, and there is also evidence of abnormalities in a chest X–ray. Finally, in people living with HIV (or in the presence of a strong clinical suspicion of HIV infection), only one positive smear result is necessary to make a diagnosis of smear-positive pulmonary TB.

14.1.2 Chest X-ray

Chest X-ray is another tool used in diagnosing TB. It is particularly important when diagnosing TB in individuals who are smear-negative for the TB bacteria or who are unable to produce sputum. It is also an important diagnostic tool for those persons who may have extra-pulmonary tuberculosis; such individuals may not be able to produce sputum and should be referred to the doctor/clinician for a chest X-ray. It is also possible to have EPTB and a normal chest X-ray.

A chest X-ray can only be ordered by a doctor or a clinician.

■ What distinguishes EPTB from PTB?

□ In EPTB the active infection occurs in an organ other than the lungs (see Study Session 13, Table 13.2 for a list of organs that can be affected and the symptoms associated with EPTB infection).

■ Why do you think a chest X-ray is useful in diagnosing TB?

□ If you recall from Study Session 13, TB enters the body via inhalation of droplet nuclei contaminated with TB bacteria. Because they enter the body via the lungs they produce changes in the lungs that can be seen on a chest X-ray.

14.1.3 TB culture from sputum

A **culture** involves growing the bacteria in the laboratory; this test can only be ordered by a doctor or a clinician.

Culturing of TB bacteria from a sputum sample in the laboratory is very expensive and takes several weeks to produce a result; however it is a very sensitive and highly specific tool. It plays a key role in identifying the type of drug-resistant TB found in a patient, such as those patients who are not responding to treatment as well as expected. Culture with Drug Sensitivity Testing (DST will be covered in Study Session 16) takes even longer; but provides crucial information about which antibiotics will kill the bacteria isolated from the patient. You should send patients for TB culture and DST if they are suspected of drug-resistance.

14.1.4 Biopsy

Biopsy is an important tool used to diagnose extra-pulmonary TB. It is the removal and examination of tissues from the living body to determine the existence or cause of a disease. It involves the microscopic examination of a small specimen of tissue extracted from the patient's body. It is particularly useful for diagnosing extra-pulmonary TB in the lymph nodes and joints, as well as other affected organs. It can also be used to confirm pulmonary TB by sampling lung tissue in smear-negative suspects. Again, only doctors and clinicians are allowed to request this type of examination to diagnose TB.

14.2 Treatment of tuberculosis

The main objectives of anti-TB treatments include: to cure TB patients (by rapidly eliminating most of the bacteria), to prevent death or organ damage from active TB, to prevent relapse of TB (by eliminating the inactive bacteria), to prevent the development of drug resistance (by using a combination of drugs) and importantly to decrease TB transmission to others.

14.2.1 Classifications of TB and treatment categories

Classifications of TB cases are based on the following factors and you will see these terms used when cases are confirmed:

- organ involved: pulmonary or extra-pulmonary
- sputum result: smear-positive or smear-negative
- history of TB treatment: new or previously treated or relapsed
- severity of the disease: severe or not severe (covered later in this study session).

14.2.2 Definition of types of TB cases

You are already aware that a 'case of TB' is an individual in whom tuberculosis has been confirmed by microscopic examination, or diagnosed by a clinician or medical doctor.

However, there are several different types of TB cases (in other words different **case definitions**) and these are based on the smear result, history of previous treatment and severity of disease. These different case definitions are listed in Table 14.1, from which you'll also see that if a patient does not fall into any of the main types, they are registered as 'other'.

Knowing these different case definitions will help in your recording and reporting of cases, as well as giving you important information about the infectiousness of the patient, the risk of drug resistance, and where there is a need for follow-up of patients.

Table 14.1 Case definitions of TB patients

Type of patient	Case definition
New	A patient who has never had treatment for TB, or has been on anti-TB treatment for less than four weeks.
Relapse	A patient who has been declared cured or treatment completed for any form of TB in the past, but who reports back to the health service and is found to be sputum smear-positive or culture positive.
Treatment after previous treatment failure	A patient who, while on treatment remained sputum smear-positive or became sputum smear-positive at the end of the five months or more, after commencing treatment.
Treatment after default (did not complete previous treatment)	A patient who had previously been recorded as defaulted from treatment and returns to the health service with smear-positive sputum.
Transfer in	A patient who is transferred from another district to continue treatment.
Other	A patient who does not fit into any of the above categories.
Chronic case	A patient who is still sputum smear-positive at the completion of a re-treatment regimen.

14.3 Patient categories and treatment regimens

In order to establish treatment priorities, the WHO recommends that TB patients should be classified into four categories, as shown in Table 14.2. Patients are started on anti-TB drugs according to their category.

You should refer patients with the following symptoms urgently to hospital for proper management:

- Coughing up blood
- Increasing breathlessness
- Suddenly increasing chest pain
- Progressively deteriorating general condition.

Table 14.2 Treatment category by type of patient.

Treatment category	Type of patient
I	Sputum smear-positive; new Sputum smear-negative; seriously ill, new EPTB; seriously ill, new Others (e.g. TB with HIV infection)
II	Sputum smear-positive; relapse Sputum smear-positive; failure Sputum smear-positive; return after default PTB patients who become smear-positive after two months of treatment (case definition = other) Return after default from re-treatment Relapses after re-treatment
III	Sputum smear-negative, not seriously ill, new EPTB, not seriously ill, new
IV	Chronic and drug resistant-TB cases (still sputum positive after supervised re-treatment)

Always keep in mind that patients with severe forms of EPTB may come to you with the types of symptom mentioned in Study Session 13, Table 13.2 — perhaps with TB affecting the lining of the brain (**TB meningitis**) or the kidney (**renal TB**) or the spine (**spinal TB**). You must refer such patients to the hospital for proper management because they need additional medication and/or special care. **Disseminated TB** is often used to describe TB involving two or more organs or tissues of the body and it is considered as one of the severe forms of TB.

14.3.1 Treatment regimens for different TB categories

A **regimen** is a defined course of drug treatment.

If you are already a health worker, you will be familiar with the types of anti-TB drugs used in Ethiopia. However, we will teach the regimens here in detail because they may have been updated since you learned about them. The first line anti-TB drugs used are (drug abbreviation in brackets):

rifampicin (R), ethambutol (E), isoniazid (H), pyrazinamide (Z) and streptomycin (S).

These drugs are provided in combination. For instance R, H, Z and E are combined in one preparation in the proportions (RHZE 150/75/400/275 mg). Similarly, two drugs can be combined in one preparation, for example R and H are combined (RH 150/75 mg), and so are E and H (EH 400/150 mg). Some drugs are available as single drug preparations; such as ethambutol 400 mg, isoniazid 150 mg and 300 mg, and streptomycin sulphate vials (1 g). Streptomycin is administered by injection while the other drugs are taken orally. All the drugs should be taken by patients together as a single, daily dose, preferably on an empty stomach to improve drug absorption.

Vials are small glass bottles of liquid injectable medications (or vaccines).

14.3.2 Phases of chemotherapy

The **chemotherapy** (drug treatment) of tuberculosis has two phases, known as the intensive and the continuation phases.

Intensive phase

The **intensive phase** consists of four or more drugs for the first eight weeks for new cases, and 12 weeks for re-treatment cases. It makes the patient non-infectious by rapidly reducing the load of bacteria in the sputum, usually within two to three weeks (except in cases of drug resistance). During the intensive phase, the drugs must be collected daily by the patient and must be swallowed under the direct observation (DOTS) of you or another health worker or a treatment supporter.

Continuation phase

The **continuation phase** immediately follows the intensive phase and is important to ensure completion of treatment and a cure; it is essential to avoid relapse after completion of treatment. This phase requires at least two drugs, to be taken for four or six months in the case of Category I and Category III patients, or for five months for Category II patients. During the continuation phase, you should encourage the patient to go and collect the drugs every month — perhaps you can accompany the patient to collect the drugs — and then follow-up to ensure that the patient is taking their medication properly.

14.3.3 Treatment regimens

According to WHO recommendations and the national guidelines that apply in Ethiopia, the following treatment regimens should be used:

- Category I and III patients are treated in the intensive phase with combinations of four 'first-line' drugs: isoniazid, rifampicin, pyrazinamide and ethambutol for two months, which can be summarized as 2 (HRZE). In the continuation phase, they receive either a combination of isoniazid and rifampicin for four months 4 (HR), or a combination of isoniazid and ethambutol for six months 6 (HE).
- For Category I patients with a smear-positive sputum result after two months of intensive treatment, extend the intensive phase for an additional one month. Then follow the continuation phase as above. If a patient is still smear-positive after five months of treatment, then they need to be categorised as 'treatment failure' and restart treatment (Category II).
- Category II patients are treated with five drugs for the initial two months of the intensive phase: a combination of isoniazid, rifampicin, pyrazinamide and ethambutol 2 (HRZE), plus streptomycin (S); then continue with four drugs, excluding streptomycin, for an additional one month; then followed by five months of the continuation phase with isoniazid, rifampicin 5 (HR), and ethambutol (E).
- Category IV patients are treated with 'second-line' anti-TB drugs, which you do not need to know the details of.

Note that the number before the bracket refers to the number of months the drug is taken.

These different treatment regimens are summarised in Table 14.3.

The number in front of each drug combination indicates the number of months the drugs are taken. For example, 2 (HRZE) means that this combination is taken for two months.

Table 14.3 Recommended treatment regimens for each treatment category.

Treatment category	TB treatment regimen	
	Intensive phase (daily or three times every week)	Continuation phase (daily or three times every week)
I	2 (HRZE)	4 (HR) or 6 (HE)
II	2 (HRZES) followed by 1 (HRZE)	5 (HRE)
III	2 (HRZE)	4 (HR) or 6 (HE)
IV	Second-line drugs	Second-line drugs

Knowing this information will enable you to understand the type of drug regimen prescribed by the doctor or clinician for different patient categories. This will help you ensure that the drug treatment is being followed correctly.

Tables 14.4 and 14.5 show the amounts of the different drugs to be administered to patients — in particular the number of tablets they take at any one time. The number of tablets depends upon the body weight of the patient. You are not expected to know the precise dosage of each drug — for example how many milligrams of isoniazid is taken when the patient takes their tablets — but it is *very important for you to know the number of tablets a particular patient should be taking*. So it is important to check the weight of your patients periodically and refer them to a clinician for an adjustment of drug dose if there is change in their body weight during treatment.

Table 14.4 Drug dosage of Category I and III regimens: (2 HRZE) followed by (6 HE).

Regimen	Intensive phase (2 months)	Continuation phase (6 months)
	2 (HRZE) daily	6 (HE) daily
	H 75 mg + R 150 mg + Z 400 mg + E 275 mg tablets	H 150 mg + E 400 mg tablets
Patient's weight	**Number of tablets**	
20–29 kg	1½	1
30–39 kg	2	1½
40–54 kg	3	2
55–70 kg	4	3
Over 70 kg	5	3

Table 14.4 shows the 2 (HRZE) and 6 (HE) drug regimen for categories I and III. The Ethiopian Federal Ministry of Health have now approved a move to the adoption of 4 (HR) in the continuation phase in such cases, which means four months of isoniazid and rifampicin. It may be some time before 4 (HR) becomes the standard in such cases, so in Table 14.3 both 6 (HE) and 4 (HR) are shown.

Table 14.5 Dosage for Category II regimen: 2 (HRZES), then 1 (HRZE), then 5 (HRE)

Regimen	Intensive phase (3 months)		Continuation phase (5 months)
	2 (HRZES) then 1(HRZE) daily		5 (HRE) (three times per week)
	H 75 mg + R 150 mg + Z 400 mg + E 275 mg tablets	S (vials) 1 g intramuscular	H 75 mg + R 150 mg + E 400 mg tablets
Patient's weight (kg)	**Number of tablets (or vials)**		
20–29 kg	1½	½	1½ + 1
30–39 kg	2	½	2 + 1½
40–54 kg	3	¾	3 + 2
55–70 kg	4	1	4 + 3
Over 70 kg	5	1	5 + 3

- What is the regimen prescribed for the Category II relapsed TB patient?

□ The drug regimen used for Category II is 2 (HRZES), then 1 (HRZE), then 5 (HRE). Because the intensive phase is three months, but streptomycin is used for only two months (56 doses), it is helpful to write a reminder on the card about when to stop streptomycin.

14.3.4 Anti-TB drug treatment in special situations

Pregnancy

Be sure to ask women patients whether they are pregnant. Most anti-TB drugs are safe for use in pregnancy, with the *exception* of streptomycin, because this can cause permanent deafness in the baby. Pregnant women who have TB must be treated, so ethambutol is used instead of streptomycin. Refer pregnant TB patients to a clinician who can prescribe the appropriate anti-TB drug regimen.

Anti-TB drug treatment for people with HIV on antiretroviral drugs will be discussed in Study Session 16.

Oral contraception

Rifampicin interacts with oral contraceptive medications with a risk of decreased protection against pregnancy. A woman who takes the oral contraceptive pill (which you'll probably know is medication used for preventing pregnancy) may choose between two options while receiving treatment with rifampicin, following consultation with a clinician. She could either take an oral contraceptive pill containing a higher dose of oestrogen (50 µg), or she could use another form of contraception. You should be in a position to give advice on the options for women in this situation; the Module on *Family Planning* will give you more guidance on topics such as this.

Breastfeeding

A breastfeeding woman who has TB can be treated with the regimen appropriate for her disease classification and previous treatment. The mother and baby should stay together and the baby should continue to breastfeed in the normal way.

The benefits of breastfeeding to the baby are greater than the risk of getting TB from the mother, or diarrhoeal diseases when the baby is fed with animal or formula milk using a feeding bottle. However, you need to advise the mother to take her child for screening for TB to a higher health facility. If the baby is not infected with TB, he or she will be provided with isoniazide preventive therapy. It is also important that the mother cover her mouth during coughing or sneezing, to prevent TB transmission to the baby.

14.3.5 Treatment of TB patients under Directly Observed Treatment (DOTS)

WHO recommends that directly observed treatment continue through the continuation phase if the regimen includes rifampicin.

As you appreciate from Study Session 13, DOTS is essential during the intensive phase of treatment (the first two to three months); it will also be needed during the continuation phase for patients with previous treatment failure who are being re-treated. Directly observed treatment ensures that the drugs are taken in the right combinations and on schedule, and that the patient continues treatment until all the doses have been taken. The health facility is the recommended place for treatment because of the ease of supervision. However, some patients live far away or do not find it convenient to come to a health facility, in which case you need to directly observe treatment at a place and time more convenient for them.

Figure 14.3 Patient under DOTS therapy. (Photo: Lung Health Image Library, World Lung Foundation)

14.4 Side-effects of anti-TB drugs and their management

14.4.1 Types and severity of side-effect

Side-effects are unwanted symptoms, discomfort or more serious adverse (harmful) consequences of drug treatment. Serious side-effects are rare in patients taking anti-TB drugs. A minority of TB patients treated with Category I or Category II regimens experience adverse side-effects categorised as:

- major adverse side-effects giving rise to serious health concerns that require the stopping of anti-TB treatment
- minor side-effects causing relatively little discomfort and often responding to simple treatment of the symptoms; they may occasionally persist for the whole period of anti-TB treatment.

Possible side-effects of the anti-TB drugs and their management are listed in Table 14.6.

Table 14.6 Symptom-based approach to management of anti-TB drug side-effects

Side-effects		**Drugs**	**Management**
(a) Minor (continue anti-TB drugs)	Decreased appetite, nausea, abdominal pain	rifampicin pyrazinamide	Give tablets with small meals or last thing at night
	Joint pains	pyrazinamide	Aspirin
	Burning sensation in the feet	isoniazid	Pyridoxine 100 mg daily
	Orange/red urine	rifampicin	Reassurance; symptom is harmless
	Itching, skin rash	streptomycin; rifampicin or isoniazid	Refer to higher health facility where TB treatment is available
(b) Major (stop the drug(s) responsible)	Deafness	streptomycin	Refer to higher health facility where TB treatment is available
	Dizziness (vertigo, imbalance and loss of balance)	streptomycin	Refer to higher health facility where TB treatment is available
	Yellowish discoloration of the eye (hepatitis)	most anti-TB drugs	Refer to higher health facility where TB treatment is available
	Vomiting and confusion	most anti-TB drugs	Refer to higher health facility where TB treatment is available
	Visual impairment	ethambutol	Refer to higher health facility where TB treatment is available
	Shock, skin rash and decreased urine output	rifampicin	Refer to higher health facility where TB treatment is available

In the next study session we turn to the subject of following-up patients and tracing patients who are not taking their medication.

Summary of Study Session 14

In Study Session 14, you have learned that:

1 Sputum examination should be done for all persons suspected of TB who are able to produce sputum; other diagnostic methods (chest X-ray, TB culture) support sputum examination but cannot replace it as the primary tool used for TB diagnosis.

2 Treatment for TB consists of the intensive phase (two to three months) followed by the continuation phase (four to six months). Treatment involves a combination of drugs.

3 If anti-TB drugs are taken incorrectly or irregularly, the patient will not be cured and drug-resistance may develop.

4 Health workers have to take an active role in ensuring that every TB patient takes the recommended drugs, in the right combinations, on the correct schedule, for the appropriate periods of time.

5 Anti-TB drugs are given under DOTS for the first two months for Category I and III patients, and for the whole course for re-treatment cases.

6 If a patient has major side-effects related to the anti-TB drugs, refer the patient to a clinician or hospital. If the patient has minor side-effects, reassure the patient and give advice on how to relieve the symptoms.

Self-Assessment Questions (SAQs) for Study Session 14

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 14.1 (tests Learning Outcome 14.1)

What are the phases of anti-TB treatment and how do they differ from each other?

SAQ 14.2 (tests Learning Outcomes 14.1 and 14.2)

A 54-year-old farmer came to the health centre complaining of a cough that had lasted for over three weeks and produced whitish sputum. He also complained of low grade fever, drenching night sweat, marked loss of weight and decreased appetite.

(a) How would you classify this farmer, and what would you do for him?
(b) What additional test would you advise?

SAQ 14.3 (tests Learning Outcomes 14.1, 14.3 and 14.4)

W/r Almaz had experienced a cough with bloody sputum for one month; she was seen at a health centre and sputum examination showed positive for TB bacteria. She had no previous history of TB treatment.

(a) How do you classify W/r Almaz based on the smear result?
(b) Which type of patient is she (new, relapse, treatment failure, etc)?
(c) What category of treatment is needed for this patient and what is the correct treatment regimen?

SAQ 14.4 (tests Learning Outcome 14.5)

A 34-year-old female was diagnosed by sputum examination to have pulmonary TB and started on anti-TB drugs two weeks ago. She noticed reddish discoloration of her urine, but has had no other symptoms for one week. She was worried and came to you.

(a) What do you think is the most likely cause of discoloration of the urine in this patient?
(b) What advice would you give her?

Study Session 15 Follow-up of Patients on Anti-Tuberculosis Treatment and Defaulter Tracing

Introduction

In this study session you will learn about the follow-up of patients put on anti-tuberculosis drugs during the intensive and continuation phases of treatment. You will also read about what to do when people with TB default (i.e. stop their medication in the course of treatment) and how to trace them. TB treatment is a long process and it is critical to maintain contact with patients throughout treatment to ensure successful outcomes. However, sometimes circumstances interfere with maintaining contact, so that these patients stop their medication or take their drugs irregularly, often resulting in development of drug resistance by the TB bacteria in the patient's body. This study session will describe how to maintain contact with patients, even in difficult circumstances, and thus improve the chances that they will complete treatment and be cured of their illness.

Learning Outcomes for Study Session 15

When you have studied this session, you should be able to:

15.1 Define and use correctly all of the key words printed in **bold**. (SAQ 15.1)

15.2 Describe how tuberculosis patients are monitored during the intensive and continuation phase of treatment with anti-tuberculosis drugs. (SAQ 15.1)

15.3 Describe the arrangements for medical referrals and transfer of tuberculosis patients to ensure that people with TB continue treatment. (SAQ 15.1)

15.4 Describe how you can trace those people with TB who default from tuberculosis treatment, and how you should try to resolve this problem. (SAQ 15.2)

15.5 Define the possible anti-tuberculosis treatment outcomes. (SAQ 15.3)

15.1 Monitoring of TB patients during treatment

In the first part of this study session you will learn how to follow patients throughout the course of anti-TB treatment by checking the results of sputum examinations and hence monitor their clinical response to treatment. For patients who interrupt their medication, we will also talk about possible reasons for them doing so and how such problems can be resolved.

Monitoring is the regular observation and recording of activities and results taking place in a programme.

Like any medical activity, TB programmes need continuous monitoring. To achieve this, patients need to be followed very strictly and the outcome of treatment needs to be clearly defined. As a health worker, your role is very important in ensuring patients are taking their drugs properly. This is called **adherence** to treatment. Part of your responsibility is to tell your patients very clearly not to interrupt their treatment and to look for side-effects of drugs of the type described in Study Session 14 and to seek help accordingly.

15.2 Refilling of medication and adherence to treatment

It is important for you to monitor all individuals with TB during treatment, both adults and children — checking that they are taking their medication properly during the intensive phase of treatment, and that they are periodically collecting their drugs during the continuation phase — this is called **refilling** their drugs.

Monitoring with sputum examination is readily available only for patients with sputum smear-positive pulmonary tuberculosis and these are usually adults and older children. Routine monitoring of treatment response by chest X-ray (recall from Study Session 14) is unnecessary and wasteful of resources because it is not readily available and also costly to the patient. But if patients with smear-negative TB and extra-pulmonary TB do not show clinical improvement (their symptoms do not improve and there is no weight gain), or if patients get worse during or after anti-TB drug treatment, you must refer such patients to a hospital for further evaluation. For such patients, it is essential that you monitor clinical symptoms and keep monitoring their weight over time.

- How is the monitoring that you do different in the intensive and continuation phases?

- In the intensive phase, monitoring drug taking involves directly observed therapy; in the continuation phase, you need to check that patients are refilling their anti-TB drugs from the health centre or hospital.

How can you ensure that patients are adhering to their treatment regimen? In all your interactions with patients, you need to be strong-minded and clear in your instruction, but also polite, considerate and respectful. Always treat the patient with dignity and give the patient every opportunity to voice concerns and to regularly ask questions.

Behaving in this way will help create a relationship of trust and confidence between you as the DOTS provider and the TB patient, which will help bring about the patient's adherence to treatment. Also, adherence is all the more likely if the patient and his or her family members learn from you the basic information about TB, including what is necessary for effective treatment and cure.

15.2.1 Monitoring of patients with sputum smear-positive pulmonary TB

As you have learnt in Study Session 13, sputum examination is required for diagnosis for all persons suspected of TB who are able to produce sputum; this test is also essential for follow-up of smear-positive TB individuals, as we will now discuss. Table 15.1 shows the required schedule of sputum examination for a smear-positive TB patient during treatment. You must refer the patient for testing at the times on this schedule.

Table 15.1 Monitoring of patients with sputum smear-positive pulmonary TB.

When to refer patients for sputum smear examination	8 month treatment regimen	6 month treatment regimen
At time of diagnosis	All persons suspected of having TB and producing sputum	All persons suspected of having TB and producing sputum
At end of intensive phase (end of two months)	Smear-positive TB patient at diagnosis needs sputum examination at end of two months	Smear-positive TB patient at diagnosis needs sputum examination at end of two months
In continuation phase	Smear-positive TB patient at diagnosis needs sputum examination at month five	Smear-positive TB patient at diagnosis needs sputum examination at month five
At end of treatment	Smear-positive TB patient at diagnosis needs sputum examination at month eight	Smear-positive TB patient at diagnosis needs sputum examination at month six

- Most patients improve their symptoms within the two months of the intensive phase of drug treatment and as a result some patients assume that they are cured. Should such patients stop taking their drugs if they feel better?

- No — it is essential that they continue taking drugs up until the end of the continuation phase, in other words that they fully adhere to the treatment.

Sputum smears at the end of the intensive phase

The majority of patients will have a negative sputum smear at the end of the intensive phase. If the sputum smear is still positive at this time, intensive phase treatment with the same four drugs 1 (RHZE) should be continued for four more weeks. When the sputum smear is checked again after this extra period, it is unlikely still to be positive. The continuation phase should be continued even if the sputum smear after the extra four weeks of intensive phase treatment is still positive.

Sputum smears in continuation phase

In eight month treatments, a positive smear at five months (or any time after five months) means treatment failure. In six month treatments, a positive sputum smear at five months (or any time after five months) means treatment failure. The patient treatment category changes to Category II (you should recall what this means from Table 14.2 in Study Session 14), and the re-treatment regimen described in Study Session 14 begins.

Sputum smears on completion of treatment

If a patient has a negative sputum result at the end of treatment and one additional result at the end of two months, or at five months, that is also negative — the patient is defined as cured.

15.3 Referral of people suspected of being infected with TB and TB cases

You know from Study Sessions 13 and 14 that a very important role for you is referring people suspected of having TB — specifically those with a cough for two or more weeks — to a health institution for TB diagnosis. Referrals can come about in other ways. Sometimes a doctor may diagnose TB and then refer the patient with the drugs to your health facility to continue their treatment under your supervision. Those patients need registration at your level and continued follow-up needs to be put into place.

If a patient is very sick or has major treatment side-effects (recall Study Session 14), it may be necessary to refer the patient to a doctor or to a hospital for care of the acute problem. However, sometimes such a patient then believes that, because of the treatment received at the hospital, there is no need to come to you for regular TB treatment and he or she may then discontinue treatment. When a referral of this type comes about, discuss the situation with the patient and their family and emphasise the need to return to your health facility to continue treatment after discharge from the doctor or hospital.

15.3.1 Coordinating transfers when a patient is moving

Figure 15.1 A health worker discusses the needs of a TB patient who is about to move to another area.

If a registered patient plans to move out of the area permanently, find out when and where the patient is moving and identify an appropriate treatment facility in the new area. In your discussions with the patient in the period before the move, stress the need to continue treatment and the importance of reporting to the new health facility (Figure 15.1). Make sure that the patient understands that to be cured, he or she must continue taking all of the required drugs for the entire time required. If necessary, provide self-administered doses for several days until the patient has reached their new home.

If you do not receive confirmation from the receiving health facility, contact the facility to ask whether the patient has reported for treatment. If not, tell the facility where to locate the patient. Ask the District TB Coordinator whether there is any new information about the patient. If the transfer is never confirmed (i.e. the patient never reports to the new facility), the patient's treatment outcome will be recorded as a 'transfer out (transfer TB patient to other health facility)'. If the transfer is confirmed, at the appropriate time, ask the new health facility where the patient was referred about his or her treatment outcome, so that you can record it on the patient's registration.

It is important that you are in contact with the District TB Coordinator — this is the person who controls and coordinates TB activity at district level. If the patient originates from your district, it is your district's responsibility to find the treatment outcome for the patient.

So, remember that it is the responsibility of the originating health facility (in other words, the first one involved) to find out about the treatment outcome for a patient who transfers out, but you can help the process. When you receive a patient from another health facility, make a note that this is a transferred-in patient to remind you to report the treatment outcome to the originating health facility. When any patient completes treatment, check to see whether the patient has been transferred in. If so, contact the originating health facility and report the treatment outcome.

15.3.2 Arrangements for patients who travel

During their regular treatment visits, ask patients to inform you if they have plans to travel, so that arrangements can be made to continue treatment without interruption. If a patient is to travel out of the area, or will be unable to have directly observed treatment for one or more days, provide instructions and drugs for a short period of self-administration; if necessary, you may provide drugs for up to two weeks.

If a patient will be travelling or absent for longer than two weeks, identify a health facility in the area where the patient's treatment can be followed.

If the patient's drugs are not pre-packaged, prepare a separate packet of drugs for each day that the patient will be absent (Figure 15.2). Give the patient careful instructions, in your conversation with him/her and in writing, about how to take the drugs. Point out the number and colour of the drugs in each day's packet and tell the patient to take the drugs at the same time each day, take the pills with water and take all of the drugs for the day together.

Figure 15.2 Anti-TB drugs are being sorted into separate packages for a patient who is about to travel to another district (Photo: courtesy of the World Lung Foundation/Gary Hampton).

Ask questions such as 'how do you take the medication?' and 'do you divide the dose?' to make sure that the patient understands when and how to take the drugs. On the patient's registration, record the days when you observed treatment and then draw a line through the days on which the patient will take self-administered drugs.

15.4 Tracing patients who missed doses and defaulters

What about patients who miss doses and those (called **defaulters**) who discontinue their treatment during the course?

15.4.1 Conducting home visits for patients who miss a dose

If a patient misses a dose of anti-tuberculosis medication during intensive treatment for more than 24 hours, find the patient by making a home visit within the next couple of days. Use the address on the patient's TB registration to find the patient. When you go on the home visit, take the patient's drugs with you. If the patient is not at home, ask the family or neighbours where the patient is and see if you can find out why treatment was missed. If necessary, visit the contact person listed on the patient's TB registration.

Give the patient the missed doses one day at a time. Do not give an extra dose on any days.

When the patient is found, talk to the patient and the family about the problem that caused the interruption in treatment. Ask direct questions such as: 'Why did you miss your appointment?' and 'Will this problem happen again?' When you have found the cause of the problem, try to help the patient to solve it with the help of the information given in Table 15.2.

Table 15.2 Some examples of possible causes and solutions for missed doses of anti-TB medication.

Examples of possible causes of missed doses	**Possible solutions**
Coming to the health facility is inconvenient.	Identify a convenient community TB treatment supporter.
Patient dislikes coming to the health facility because of the long queue.	Make arrangements so that TB patients do not have to wait in a queue. For example, let them enter through a back or side door.
Supervisor at work kept the patient late.	• Offer to talk with the supervisor and explain the importance of the treatment, or • Identify a community TB treatment supporter at work.
Patient had troublesome side-effects.	• Give appropriate advice for side effects, or • Refer the patient for further evaluation.
Patient had difficulty swallowing because of pain (due to oral ulceration, common in AIDS patients).	Give appropriate advice and refer patient as necessary for further evaluation.
Patient cannot leave small children at home and is tired of bringing them to the health facility.	• Suggest that a family member or neighbour watch the children. • Remind family members/neighbours that the patient must continue treatment to protect their health, and particularly the health of the children. • If possible, identify a community TB treatment supporter closer to the patient's home.
The patient may simply need to be forced to comply and be reminded of the reasons not to interrupt treatment.	Remind the patient of the need to take all of the recommended drugs together, for the recommended time, to be cured. Even after beginning to feel better, the patient must continue taking the drugs for the entire period of treatment. Motivate the patient with statements such as the following: • TB can be cured if you keep coming for the medicine, and then you will not have to worry about it any more. • You only have 10 more doses to take every day. After that, you will come less often. • These are the safest, most effective drugs available to treat TB anywhere in the world. • Almost all patients who take their medicines as recommended are cured. • If you keep taking your medicine, you will not spread TB to your family.

15.4.2 Home visits for patients who fail to collect drugs for self-administration

Suppose a patient on a self-administered continuation regimen fails to collect the drug supply on the appointment day. What should you do? If a patient does not come for the drugs within a week, visit the patient's home to find the

patient, deliver the drugs and determine the problem. Try to solve any problems after discussion with the patient, as outlined in Table 15.2.

15.4.3 Tracing patients who interrupt treatment

If you cannot locate a 'defaulter' patient who has interrupted treatment at the home address recorded on the TB unit register form, try to find the patient through the contact person listed on the card. Seek information and leave messages with neighbours and relatives or at the patient's workplace. Try to find out whether the patient is just temporarily missing or has permanently moved. If the patient has moved, try to find out the new location and notify the District TB Coordinator. In this way the patient may eventually be transferred to the care of another health facility.

If a patient is found and resumes treatment within a month, the same treatment should be continued and should be prolonged to make-up for the missed doses. If treatment is interrupted for between one and two months, the patient will need a new sputum examination before the appropriate treatment can be determined. If treatment is interrupted for two months or more, the patient has defaulted. The treatment outcome 'default' should be entered on the TB unit register form. If the patient returns, he or she will need to be re-assessed to determine the appropriate treatment.

15.5 Treatment outcomes

As you know, treatment is completed when the patient has taken the correct number of doses of the continuation-phase drugs. If the patient has missed some doses along the way, the duration of the treatment extends until all the doses in the patient's drug box are taken, which will be some days or weeks longer. Some patients do not complete treatment, either because they die during treatment or more likely they stop coming for treatment and cannot be located. When each patient completes treatment or stops coming for treatment, record that patient's outcome on the TB treatment registration form.

Possible treatment outcomes are defined as follows:

Cured

An intensively smear-positive patient who is sputum smear-negative at completion, or one month prior to the completion of treatment, and on at least one previous occasion (usually at the end of the second or fifth month).

Treatment completed

A patient who completed treatment but for whom smear results are not available at month seven or one month prior to the completion of treatment.

Treatment failure

A patient who remains or becomes again smear-positive at the end of month five or later during treatment. The same outcome would apply to a patient who was sputum smear-negative at the beginning of treatment and smear-positive at the end of the intensive phase.

Died

A patient who dies for any reason during the course of treatment.

Defaulter

A patient who has been on treatment for at least four weeks and whose treatment was interrupted for eight or more consecutive weeks.

Transfer out

A patient who started treatment and was transferred to another reporting unit and for whom the treatment outcome is not known at the time of evaluation of treatment results.

Treatment success

The total number of patients who are declared 'cured' and those who have 'completed' treatment.

At the end of treatment of tuberculosis with anti-TB drugs the outcome for the treated patient should be documented and reported to the District Health Office. You will no doubt be very pleased with 'cures' and you should achieve some satisfaction that as a HEP you have contributed to making such a difference to a person. In fact, for all the TB patients that come into your care, you are in a position to make an important contribution to improving their well-being and increasing the chances of success.

Summary of Study Session 15

In Study Session 15, you have learned that:

1 Patients on anti-TB drugs must be monitored throughout the course of treatment for adherence and potential side-effects.

2 Sputum examination during follow-up is important for smear-positive TB patients and looking for symptom improvement is essential for other forms of TB.

3 When a TB patient is referred to a hospital or clinician for special care, inform the patient and the receiving clinician that the patient is expected to return to the original health facility for continuing TB treatment after referral care is completed.

4 When a patient moves and transfers to a new treatment facility, follow-up to ensure that the transfer is successfully completed.

5 It is the originating (first) health facility's responsibility to find out the treatment outcome for a patient who transfers out.

6 The outcome 'transfer out' is used only if the patient was transferred and another outcome cannot be determined.

7 If TB patients must travel, drugs may be provided for up to two weeks of self-administration (if the patient will be absent for more than two weeks, a transfer should be arranged).

8 If a TB patient misses a dose for more than 24 hours, make a home visit within the next 24–48 hours, give patients the missed dose only, finding out reasons for missed treatment.

9 If a TB patient on a self-administered regimen fails to refill the drug supply within a week of the scheduled day, use a home visit to find the patient, deliver the drugs and determine the problem.

10 If a TB patient interrupts treatment, make every effort to find the patient through family, neighbours and the contact person listed on the TB registration form.

Self-Assessment Questions (SAQs) for Study Session 15

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 15.1 (tests Learning Outcomes 15.1, 15.2 and 15.3)

For each of the following statements, decide if it is true or *false*. In each case explain your reasoning.

A Monitoring of TB treatment is the regular observation and recording of activities taking place during treatment of patients with anti-TB drugs.

B Smear-positive patients do not require sputum examination at five months into treatment.

C After a temporary referral to a clinician or hospital, a patient should return to the original health facility to continue treatment for TB.

D When a TB patient transfers to a new facility, that facility should notify the original health facility that the patient has reported for treatment.

SAQ 15.2 (tests Learning Outcome 15.4)

Suppose a known TB patient has been on anti-TB drugs for six weeks and they interrupt treatment for two weeks. What would you do for this patient and what advice would you give him/her for the future?

SAQ 15.3 (tests Learning Outcome 15.5)

For each of the following scenarios, write down the appropriate treatment outcome:

(a) A TB patient who developed severe skin rash is referred from your health facility to the health centre health officer. The patient never returns to the health facility. The rash went away, but the health officer has not seen the patient for two months.

(b) A TB patient plans to move and transfer to another health facility. You send the patient with a TB referral/transfer form. The receiving health facility never confirms that the patient has reported.

(c) A TB patient on treatment transferred to a new health facility, but you do not receive written confirmation. Later you contact the new health facility and find that the patient has reported there for treatment. At the appropriate time you contact the health facility again and find that the patient has been cured.

Study Session 16 Tuberculosis Treatment in Special Conditions: TB in Children, HIV/TB and Drug Resistant TB

Introduction

In this study session, you will first learn about diagnosis and management of tuberculosis in children and how this differs from the adult (Section 16.1). Section 16.2 discusses what happens with patients who are infected with both TB and HIV — an example of a **co-infection** — and how this is managed. Finally, in Section 16.3 we look at the situation where patients have TB that is resistant to drugs.

Of all TB cases registered with the National Tuberculosis programme in Ethiopia, up to a fifth occur in children. Children can present with TB at any age, but the most common age is between one and four years. In most cases, TB in children is a result of primary TB (i.e. the first infection) from an infectious adult or older child, unlike cases in adults which are most often due to reactivation of a previous TB infection. The best way to prevent childhood TB is therefore by proper identification of those who may be infected with TB, and treatment of active TB patients in the home and community.

The HIV epidemic has made the position with regard to TB worse by increasing the risk of reactivation of latent TB infection and by facilitating more rapid progression of TB disease. TB can readily be transmitted to both HIV-negative and HIV-positive households and to other close contacts of infectious patients.

Learning Outcomes for Study Session 16

When you have studied this session, you should be able to:

16.1 Define and use correctly all of the key words printed in **bold**. (SAQ 16.3)

16.2 Describe the key differences in the diagnosis and management of TB in children and adults. (SAQ 16.1)

16.3 Identify the key factors that will help you look after patients with HIV/TB co-infection. (SAQ 16.2)

16.4 Describe the main causes and consequences of drug-resistant tuberculosis. (SAQ 16.3)

16.1 Diagnosis and management of TB in children

In this section, you will learn how to diagnose and treat TB in children and how to follow their progress after treatment. The diagnosis is made at the health centre or hospital and children will be referred to you to continue treatment in the community under your supervision. The families of children who have TB may ask you questions regarding the drugs that their child is required to take, so it is very important to know a little about the major anti-TB drugs, even though you are not the key person involved in diagnosing TB and prescribing anti-TB drugs.

Note that sputum smear-negative, but culture positive patients are also infectious, but to a lesser degree.

Very often children who are exposed to a positive contact within their close environment (especially the household), will acquire tuberculosis infection. A **close contact** is defined as someone living in the same household, or being in frequent contact with a person who is sputum smear-positive for TB. This exposure leads to the development of a primary (the first or original) lesion in the lungs, which is likely to spread to the regional lymph node(s). In the majority of cases, the child's immunity will control the disease process at this stage. Progression to TB disease occurs more commonly in children under five years of age and in children who are HIV infected (because their immune systems are therefore compromised), or who have had measles, or who are malnourished.

16.1.1 Symptoms of childhood TB

Children with TB develop chronic symptoms in most cases, and TB may be a more acute disease in the presence of HIV infection. The commonest symptoms that parents notice are:

- *Chronic cough:* persistent cough (present for more than two weeks) and not improving.
- *Fever:* fever of greater than 38°C for 14 days, after common causes such as malaria and pneumonia have been ruled out.
- *Weight loss:* documented weight loss or failure to gain weight.

Figure 16.1 A mother suspected of TB coughing and releasing droplet nuclei into the air that could infect other members of the household, particularly children. People with HIV are at greater risk of being infected with TB.

16.1.2 Signs of childhood TB

The clinical picture of pulmonary TB in older children is similar to that of pulmonary tuberculosis in the adult. For older children capable of producing sputum, samples should be collected as for adults. A range of additional physical signs are suggestive of EPTB. These can include swelling over the spine (called a gibbus) and/or an enlargement of the side of the neck, and neck rigidity not responding to treatment with antibiotics. Other signs are abdominal swelling and non-painful enlarged joints. If a child has the symptoms of pulmonary or extra-pulmonary TB, you should refer him or her for investigation.

The diagnosis of TB in younger children (less than a year of age) can be more difficult. One of the indictors that you should be aware of is contact with a family member or close associate with TB. Another key factor in diagnosis is loss of weight and failure to thrive. One of the problems is that children of this age rarely produce sputum and, as you know, this laboratory test is the main method of diagnosis in adults.

In those cases of younger children where you suspect TB, you must tell the family to take the child to a higher health facility for diagnosis. To make the diagnosis of childhood TB with a fair degree of accuracy, one or more of the tests outlined in Box 16.1 are generally followed.

You should always ask adult TB suspects and patients if there are children in their households. Any child suspected of having TB should be referred for investigation.

Box 16.1 Recommended approach for diagnosing TB in children

- Careful history-taking, including history of TB contacts and symptoms consistent with TB
- Clinical examination, including growth assessment; where you see failure to grow, especially in younger children, and weight loss, suspect TB and send the child for investigation
- Sputum examination; children able to produce sputum should submit sputum for examination
- Chest X-ray; this investigation is relevant for suspected pulmonary TB cases not producing sputum and for extra-pulmonary TB
- Biopsy for extra-pulmonary TB; this procedure was mentioned in Study Session 14
- HIV testing; where appropriate, advise the parents of a child TB suspect to agree to an HIV test for the whole family.

16.1.3 Diagnosis of tuberculosis in HIV-positive children

As in adults, pulmonary TB (PTB) is the most common manifestation of TB in HIV-positive children. The diagnosis of PTB in children under four years old has always been difficult, and infection with HIV makes the effective diagnosis of TB in such cases more challenging.

The approach to diagnosing TB in HIV-infected children is essentially the same as for those children who are HIV-negative, i.e. the presence of three or more of the characteristic symptoms indicates a diagnosis of TB. It is especially important to look for chronic symptoms suggestive of TB, and for physical signs that are highly suggestive of TB — including the results of chest X-ray findings (refer to Study Session 14). Children who present with chronic symptoms suggestive of TB also need testing for HIV infection.

16.1.4 Treatment of tuberculosis in children

As you read in Study Session 13, DOTS (Directly Observed Treatment, Short-course) should be used for all children with tuberculosis. Even when drugs are given under DOTS, tolerance of the medications must be closely monitored. Do not rely solely upon the parents of the child to supervise DOTS; you are responsible for monitoring.

Table 16.1 show different categories of TB cases that you are already familiar with, together with the drug treatment regimen required in children (the number of months for each treatment is indicated by the number in front of the bracket containing the drug combination).

Table 16.1 TB diagnostic category and the recommended treatment regimen in children.

TB treatment category	TB cases	Regimen (daily or three times every week)	
		Intensive phase	Continuation phase
I	• New smear-positive pulmonary TB • New smear-negative pulmonary TB with extensive involvement of lung tissue • Severe forms of extra-pulmonary TB (other than TB meningitis) • Co-infection with HIV disease	2 (HRZE)	4 (HR)
I	TB meningitis	2 (HRZS)	4 (HR)
II	Previously treated smear-positive pulmonary TB: relapse, treatment after interruption and treatment failure	2 (HRZES) followed by 1 (HRZE)	5 (HRE)
III	New smear-negative pulmonary TB (other than in category I). Less severe forms of extra-pulmonary TB	2 (HRZ)	4 (HR)
IV	Chronic and MDR-TB	Specially designed standardised or individualised regimens	

■ What are the differences in the drug treatment regimens for adults and children for each category? (Hint: compare Table 16.1 and Table 14.3).

□ In general, the treatment of TB in children is similar to that used to treat adults. However, there are some important differences; if you study Table 16.1 very closely, alongside Table 14.3 from Study Session 14, you will notice some differences. For children, the continuation phase in Categories I and III uses isoniazid and rifampicin in combination (HR), and during the intensive phase for Category III, a combination of three drugs is used (isoniazid, rifampicin and pyrazinamide (HRZ)). For cases of TB meningitis in children, streptomycin is used instead of the preferred drug for adults, ethambutal.

16.1.5 Management of TB in HIV-infected children

Children with TB should be screened for HIV; likewise, HIV-positive children should also be investigated for TB. International guidelines recommend that TB in HIV-infected children should be treated using a six-month drug regimen similar to that used for HIV-negative children; however rifampicin should be given for the entire duration of treatment. It has been found in HIV-infected adults that higher relapse rates occur when ethambutol is used in the continuation phase.

16.1.6 Follow-up and referral of children with TB

As a health worker, you will need to do all you can to administer the chosen treatment and ensure that patients adhere to what they have been told to do. Many children with TB can be managed on an out-patient basis. However, some conditions, such as TB meningitis and other types of EPTB where the infection has spread to organs of the body other than the lung, may require hospitalisation, usually for the first two months of anti-TB treatment. If you find cases where children have respiratory distress, TB involving the spinal cord or they develop severe side effects, they should also be referred to a hospital.

At a minimum, follow-up should include an assessment of symptoms, an evaluation of adherence, an inquiry about any adverse events or side-effects, and the weight of the child should be measured. If the child is losing or gaining weight, they should be referred, because it may be necessary to adjust their medication. As with adult patients, children who were smear-positive for TB at the beginning of treatment should be referred for follow-up sputum smear microscopy at two months, five months, six months and eight months. A child who is not responding to TB treatment should also be referred for further assessment and management.

16.2 TB/HIV co-infection

A person not infected with HIV usually has some natural immunity against tuberculosis. However, the HIV-infected person will be more vulnerable to infection because they will have lost some of their natural immunity. This provides the TB bacteria with a favourable environment in which to multiply and bring about the full disease, showing all the common signs and symptoms. Raising awareness of **TB/HIV co-infection** is an important role for all health workers (Figure 16.2).

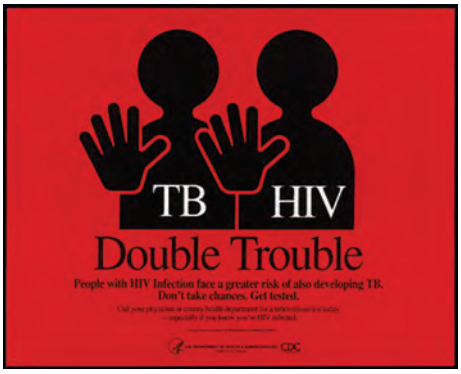

Figure 16.2 Poster campaign to raise awareness of TB/HIV co-infection. (Source: Center for Disease Control and Prevention, USA, accessed from: http://apps.nlm.nih.gov/againsttheodds/exhibit/action_on_aids/new_disease.cfm)

16.2.1 Effect of HIV on tuberculosis

Ethiopia has one of the highest levels of TB/HIV co-infection in Africa. The WHO Global Report of 2008 estimates that in Ethiopia, 40% of TB patients tested for HIV were HIV-positive, while routine data from 1999 EFY (2006/7) estimates that as many as 31% of TB patients were co-infected with HIV.

Health workers should strongly recommend and routinely offer HIV testing to all TB patients and TB suspects, after providing adequate information on the benefits of such testing.

HIV increases the risk of infection with *M. tuberculosis*, and more importantly, increases the risk of progression to TB disease, and hence the incidence and prevalence of active TB. In addition, the HIV pandemic has led to an increase in the number of patients developing side-effects to anti-TB drug treatment. This has produced an increase in the workload for healthcare providers, which can compromise the quality of service and deplete resources. It has also been found that latent TB infection in HIV-positive persons reactivates at a rate of 10% per year, as opposed to 5–10% over a lifetime for HIV-negative persons. HIV-positive persons are prone to re-infection with new strains of TB from the community, and drug resistance may occur more frequently in TB/HIV co-infections.

16.2.2 Effect of tuberculosis on people living with HIV

TB is the leading cause of illness and death among people living with HIV (PLHIV). It increases the occurrence of other infections, increases the rate at which HIV progresses, and influences antiretroviral therapy (ART) in various ways. Late diagnosis and delayed treatment of TB contributes to increased death rates in PLHIV.

A new strategy for tuberculosis control in high-HIV prevalence populations has been developed and the various approaches are summarised in Box 16.2.

Box 16.2 New strategies for dealing with TB/HIV co-infections

Activities directed against TB control are:

- Intensified case finding (look actively for TB suspects and investigate for TB)
- Treatment of TB cases (reduces risks of transmission)
- Isoniazide Preventive Therapy (IPT) for patients who are HIV-positive but do not have an active TB infection. This is also recommended for children in contact with active pulmonary TB and children investigated for TB but found to be normal. This treatment prevents progression of TB infection to active disease.
- BCG vaccine, given to children at birth. It is a modified 'live' vaccine for the prevention of severe forms of TB (TB meningitis, disseminated TB) which usually occur in childhood. It is one of the vaccines in Ethiopia's Expanded Programme of Immunization (EPI).

Activities directed against HIV (and therefore indirectly against tuberculosis) are:

- Safer sexual practices (e.g. use of condoms) to prevent transmission of the virus
- STI (sexually transmitted infection) treatment to reduce the risk of transmission of HIV
- Cotrimoxazole Preventive Therapy (CPT) prevents development of other opportunistic infections
- Antiretroviral therapy (ART) to suppress HIV multiplication and increase natural immunity against TB infection.

If an HIV-positive patient develops symptoms of TB, it is essential you encourage them to seek treatment and refer them to a treatment facility.

BCG vaccination is described in the *Immunization* Module.

All of these topics are covered in detail in the Study Sessions on HIV/AIDS in Part 3 of this Module.

16.2.3 TB classification in HIV-positive patients

Classification of TB for those individuals who are also HIV-positive differs slightly from the classification categories described in Study Session 14. They are all category I patients, but can be further classified into one of three revised sub-categories. This revision was introduced by the WHO in 2009 and you will need to be aware of these revised categories for registration and the follow-up of patients with both diseases. The revised sub-categories are listed below:

(a) Smear-positive pulmonary tuberculosis (one or more sputum smears found to be positive for TB bacteria)

(b) Smear-negative pulmonary tuberculosis

(c) Extra-pulmonary tuberculosis.

16.2.4 Diagnosis of TB in HIV-positive patients

The following methods are used for diagnosis of TB in HIV patients; whenever you suspect patients having both diseases you need to send them for investigation.

Clinical examination

Pulmonary tuberculosis is the most common manifestation of tuberculosis in adults infected with HIV. Tuberculosis occurs at various stages of HIV infection, with the clinical pattern correlating with the patient's immune status and could broadly be classified as early and late presentation. If a patient presents during the early stages of HIV-infection, the symptoms of TB are usually similar to those seen in non-HIV patients. However, if the patient comes at a late stage of HIV-infection, the presentation of TB is similar to primary TB, or it may spread to different organs. The clinical features in pulmonary TB are generally similar in HIV-infected and HIV-negative patients. However, cough and spitting of blood are reported less frequently by HIV-infected patients.

Sputum examination

Most HIV-positive pulmonary TB patients are sputum smear-positive. However, the proportion of smear-negative tests is much greater in HIV-positive than in HIV-negative TB patients, especially in the late stage of HIV.

Chest X-ray in HIV-positive patients

If the sputum smear remains negative, chest X-ray can be of additional value in diagnosis. However, the appearance of the X-ray may not be typical for TB. Diagnosis of TB in the HIV-infected patient is difficult.

HIV-positive patients who you suspect may have extra-pulmonary TB should be referred.

Diagnosis of smear-negative TB in HIV patients

Important diagnostic methods have been developed recently by the WHO. This was necessary because HIV-positive patients were presenting with a cough of two to three weeks duration and then on investigation with sputum microscopy were found to be TB negative. However, if the symptoms and clinical state still strongly suggest TB, such patients are to be divided into the ambulatory ill (which means they could walk) and the seriously ill.

The adult patient will be classified as seriously ill if one or more of the following danger signs are present:

- Unable to walk unaided
- Respiratory rate over 30 breaths per minute
- Fever of more than 39°C
- Pulse rate of over 120 heart beats per minute.

A patient classified as seriously ill on this basis should immediately be referred to a higher level health facility. When immediate referral of this type is not possible, the following measures should be undertaken in the nearest health facility with the necessary equipment and trained staff:

Sputum microscopy: at least two sputum specimens should be taken and examined, one of which should be an early-morning sputum, produced after an overnight sleep. One positive smear will be sufficient to classify a patient as a smear-positive case if the patient is HIV-positive, or if there is strong clinical suspicion of HIV infection.

HIV testing: HIV testing should be routinely offered along with sputum examination in HIV-prevalent settings for patients presenting with cough of two to three weeks' duration. A person with an unknown HIV status (e.g. because of unavailability of HIV test kits or refusal to be tested) can be classified as HIV-positive if there is strong clinical evidence of HIV infection.

16.2.5 Prevention and management of TB among PLHIV

- *Isoniazid preventive therapy (IPT):* IPT is given to HIV patients after investigation where there is no evidence of TB. It is given for six months; you are expected to follow those patients on IPT for adherence and possible side-effects.
- *Cotrimoxazole preventive therapy (CPT):* It is well-documented that administration of CPT decreases illness and deaths among HIV-infected TB patients. Cotrimoxazole is given for this category of patients and to all HIV-positive TB patients.
- *Treatment of TB in PLHIV:* When patients with TB/HIV are treated with anti-TB drugs and ART, problems related to the medication regimen may result. This group of patients therefore needs frequent follow-up and support; you should be alert for possible side-effects and prepared for early intervention and referral.

Sometimes TB drugs and ART can produce adverse reactions that may worsen or cause new infections. Patients should be advised to continue their medication and report any problems.

16.3 Drug-resistant TB and multi-drug resistant TB

The emergence of resistance to anti-tuberculosis drugs, and particularly of **multidrug resistant-TB** (MDR-TB) arises when TB bacteria develop resistance to rifampicin and isoniazid. MDR-TB has become a major public health problem in a number of countries and an obstacle to effective global TB control. When a patient has TB with bacteria that are no longer sensitive to one or more anti-TB drugs, for instance isoniazid, using this antibiotic will not be helpful. Other drugs (known as second-line drugs) have to be used instead of the first-line drug regimens.

A good TB control programme — especially with regard to patient follow-up and adherence, will not generate much drug resistance. Resistance to TB drugs usually occurs as a consequence of inadequate treatment, be it irregular, too short or too weak. Resistant TB bacteria can be transmitted to other people like any other form of TB.

16.3.1 Drug sensitivity testing (DST)

Drug sensitivity testing (**DST**), performed in a reference laboratory, is the only means by which resistance to anti-TB drug(s) can be confirmed. DST involves growing TB bacteria and treating the culture with one or more anti-TB drugs and seeing if the bacteria are killed or not. If the bacteria are not killed by giving the drug(s), they are considered resistant.

Table 16.2 makes the point that there are three sources for the development of drug resistance. The first and most important category reflects shortcomings by health providers — they can give an inadequate drug regimen, or the wrong guidelines, or they can fail to treat correctly through lack of training and a poor monitoring system. The second category is related to the drugs themselves — they can be of poor quality, in short supply or they can be poorly stored. The last factor contributing to the development of drug resistance relates to the TB patients themselves, and reflects factors such as poor adherence, lack of information about the disease and the influence of social barriers, any one of which can result in patients discontinuing the drugs.

Table 16.2 Causes of inadequate anti-tuberculosis treatment contributing to development of MDR-TB.

Healthcare providers	**Drugs**	**Patients**
Inadequate regimens	Inadequate supply	Inadequate drug intake
Inappropriate guidelines	Poor quality	Poor adherence (or poor DOT)
Non-compliance with guidelines	Unavailability of certain drugs (stock-outs or delivery disruptions)	Lack of information
Absence of guidelines	Poor storage conditions	Lack of money (no treatment available free of charge)
Poor training	Wrong dose or combination	Lack of transportation
No monitoring of treatment		Adverse side-effects
Poorly organised or funded TB control programmes		Social barriers
		Poor absorption of drugs
		Substance dependency disorders

Treatment of MDR-TB is more complicated and takes longer than treatment of TB that is not resistant to the first-line drugs. In Ethiopia, the management of MDR-TB is currently available only at St Peter Specialized TB hospital, but there are plans to expand provision to other regions. As a health worker, the most significant way in which you can help now and in the years ahead is to do all you can to ensure that patients adhere to their treatment, in order to increase the number of cured cases and reduce the incidence of drug-resistant TB.

Summary of Study Session 16

In Study Session 16, you have learned that:

1 Children are usually infected with TB by an adult or an older child with sputum smear-positive PTB, often a family member.

2 The best way to prevent childhood TB is therefore by proper identification and treatment of infectious patients, but diagnosis can be difficult for younger children not able to produce sputum.

3 The DOTS strategy is applicable to all patients with TB, including children and those with TB/HIV co-infection.

4 TB is a leading cause of morbidity and mortality, and the spread of HIV has increased the TB epidemic in Ethiopia. HIV increases risk to infection with *M. tuberculosis*, the risk of progression to TB disease, and the incidence and prevalence of TB.

5 All patients diagnosed with TB should be encouraged to undergo counselling and testing for HIV, and all HIV-positive patients should be screened for TB.

6 Sputum smear microscopy remains the main method to confirm a diagnosis of pulmonary TB, including in HIV-positive patients. It also helps in identifying infectious patients so that transmission can be stopped.

7 Most of the time, drug-resistant TB is due to inadequate treatment, poor adherence to drug regimens, poor quality or insufficient drugs, and lack of training of healthcare providers in drug prescribing, monitoring and follow-up.

8 For all TB patients, do all you can to ensure adherence to drug regimens, which will reduce the prevalence of TB, including the drug-resistant forms.

Self-Assessment Questions (SAQs) for Study Session 16

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 16.1 (tests Learning Outcome 16.2)

When do you suspect tuberculosis disease in children?

SAQ 16.2 (tests Learning Outcome 16.3)

A 32-year-old male patient was diagnosed with HIV three months ago; he was started on ART 10 weeks ago. He presented with cough productive of whitish sputum and low grade fever of one month duration. What will you do for this patient and what advice would you give him and his family?

SAQ 16.3 (tests Learning Outcomes 16.1 and 16.4)

What is multidrug resistant-TB (MDR-TB)?

Study Session 17 Tuberculosis Infection Control

Introduction

TB infection control is a combination of measures aimed at minimising the risk of TB transmission within a population. The foundation of TB infection control is early and rapid diagnosis, and proper management of TB patients.

In this study session you will learn about TB infection control and the methods you can use to control TB infection at the health facility, in your community and at home. You will learn that when you use more than one method at a time, you will get better results than when you use only one method. Your knowledge of the methods will enable you to provide proper advice to the community members you are hoping to help, in order to control TB infection at home, in the community and health facility. The different approaches you will learn about need to be promoted as a package because their adoption in that way reduces transmission of TB in healthcare facilities.

Learning Outcomes for Study Session 17

At the end of this study session, you should be able to:

17.1 Define and use correctly all of the key words printed in **bold**. (SAQ 17.1)

17.2 Define the general principles of infection control applied during handling of TB suspects or TB cases. (SAQ 17.1)

17.3 Explain how you would limit TB transmission in the community and at household level. (SAQs 17.1, 17.2 and 17.3)

17.4 Describe the main elements of TB infection control measures used at the community health facility level. (SAQs 17.1 and 17.2)

17.5 Describe the measures for TB infection prevention in areas where many people gather, at homes and in the community. (SAQ 17.3)

17.6 Explain how you would inform, educate and persuade community members to participate in TB infection control. (SAQ 17.3)

17.1 Principles of TB infection control

In this study session you will learn about the general principles of infection prevention measures that should be taken when dealing with patients and in particularly about infection control of TB. First, three main TB control measures that are used to prevent TB infection are sometimes called the **three Is**, given that they all three start with that letter. You already know about the first two from reading earlier study sessions and it is the last topic we are going to focus on in this study session.

- Intensified case finding for TB
- Insoniazid preventive therapy (IPT) for prevention of TB amongst people living with HIV
- Infection control for prevention of TB.

17.1.1 What is infection control?

In general, **infection control** refers to the interventions required to prevent the transmission of micro-organisms from infected patients to other patients and health workers. Infection control measures are based on an understanding of how different diseases are transmitted. Types of infection control include:

Standard precautions, which should be applied regardless of disease or type of institution. For this reason, they are also known as *universal precautions*.

Transmission-based precautions, which should be applied in specific circumstances, depending on the transmission routes of various diseases.

17.1.2 What are standard or universal precautions?

Standard precautions are those which should always be applied when dealing with any patients, including TB patients. These include:

- Hand washing and antisepsis
- The use of personal protective equipment (e.g. gloves)
- Appropriate handling of patient care equipment and soiled cloths
- Prevention of accidental needle stick/sharp injuries to healthworkers
- Environmental cleaning and spills management
- Appropriate handling of clinical waste (e.g. swabs).

For TB, the transmission-based precautions are those that protect people from airborne bacteria entering the body through inhalation, as you will now learn.

17.2 TB infection control measures at community health facility level

The control measures — or interventions — that need to be brought into play at the level of the health facility fall into the four broad categories shown in Box 17.1 (on the next page). They begin with managerial activities and under that heading a range of national and sub-national interventions are listed that help give managerial order and direction to what happens at the level of the health facility to enable effective TB infection control. The other categories give similar detail on what happens by way of administrative controls, environmental controls and also at the level of the individual health worker.

Describing TB control measures using the headings in Box 17.1 is a useful way of explaining their importance to you as a health worker. We will introduce each of these categories in turn — you will then have a sound understanding of how each intervention operates at a particular point in the airborne TB transmission process. In a later section, we'll use the same four headings to describe the interventions that are appropriate for places where people gather (congregate settings) in the community and at the level of the household.

Box 17.1 Interventions for TB infection control in health-care settings

Managerial activities

- Identify and strengthen coordinating bodies, and develop a comprehensive human resources plan for planning and implementation at all levels
- Conduct surveillance and assessment at all levels of the health system
- Engage civil society and promote communication and social mobilisation
- Conduct monitoring and evaluation
- Enable and conduct operational research.

Administrative controls

- Develop strategies to promptly identify potentially infectious cases (triage), separate them, control the spread of pathogens (cough manners) and minimise time in healthcare settings.

Environmental controls

- Natural ventilation
- Mechanical ventilation
- Ultraviolet germicidal irradiation (UVGI) fixtures
- Health facility design and renovation.

Personal protective interventions

- Respirators
- Package of prevention and care for healthcare workers, including isoniazid preventive therapy (IPT) for HIV-positive health-care workers.

17.2.1 Managerial controls

Managerial activities need to be given a high priority in this package of measures since they establish the overall programme for the implementation, operation and maintenance of the other interventions. As a health worker, you do not have the responsibility of taking on these managerial activities but it is important you know about them. You will see from Box 17.1, that these managerial activities include assessing the scale of the problem, setting up the periodic evaluation of activities, establishing coordinating bodies at all levels, and planning and evaluating the outcomes of the control interventions.

17.2.2 Administrative controls

This component of TB infection control is more important for you since you need to apply these interventions at the health facility level. As you will read later on, these same interventions are also important in places where people gather and at the level of the household.

Administrative control interventions needed at healthcare facility level are described below:

Triage

The term **triage** refers to the process of identifying of TB suspects and referring them for investigation. People who you suspect of having TB must be separated from other patients and placed in well-ventilated areas, *where the movement of the air is in a direction from non-TB suspects to TB suspects.* Instruct TB suspects on cough manners, following advice you will learn about in a moment. Once you have separated the TB suspects from those who do not have TB (i.e. reduced the risk of airborne transmission), you should refer them for diagnosis and treatment.

- Why do you think it is important that the movement of air should be in a direction from non-TB suspects to TB suspects?

- The spread of TB is largely by inhalation of droplet nuclei containing the bacteria. By making sure non-TB suspects are not *downwind* from TB suspects you reducing the risk of transmission.

Separation

Separation of potentially infectious patients needs to continue after the process of triage, isolating suspects or confirmed pulmonary TB cases as much as possible. In particular, patients living with HIV and other forms of immunosuppressive illnesses should be physically separated from those with suspected or confirmed infectious TB. Drug-resistant TB suspects or patients should be separated from other patients, including other TB patients. In general, after providing the *immediate* services that TB suspects and cases might require, try to shorten their stay in the health facility; send them home as soon as possible, in order to minimise exposure for non-infected patients.

Cough manners (or cough etiquette)

In order to minimise the generation of potentially infective droplet nuclei, any coughing patient with a respiratory disease — in particular TB patients or those suspected of having TB — should be educated on good cough manners. The key points of **cough manners** are listed below and illustrated in Figure 17.1:

Figure 17.1 A poster 'Getting across the message on cough manners'. (Source: FMOH Ethiopia, 2009, *Guidelines for Prevention of Transmission of TB in the Health Facility*)

- To cover their nose and mouth when sneezing, coughing or talking by using a *gabi*, *nethela*, handkerchief or scarf, piece of cloth, tissue paper and if there is nothing available, place the arm in front of the mouth.
- The same applies to health workers, visitors and families in healthcare (or indeed all places where people gather). Those who cough should cover their mouth and nose with a physical barrier which can be a piece of cloth, a tissue, a surgical mask or an arm placed in front of the mouth.
- The information, education and communication (IEC) activities given at health facilities should strongly focus on *cough manners*.
- Good respiratory hygiene includes proper disposal of tissue paper, pieces of cloth and masks used for covering the mouth. Proper disposal of sputum should be enforced *immediately* when a TB suspect is identified. Spitting on floors has to be stopped; collect sputum in a cup and bury it.

Patients and their families should also be educated on the signs and symptoms of TB disease. TB is a treatable disease; explain the risks of not completing treatment. Public health and awareness messages can be delivered as simple posters on the walls and presentations by health educators.

17.2.3 Environmental controls

When environmental controls are implemented, managerial activities and administrative controls need to be in place to ensure proper use and maintenance of equipment and the effective training of staff. The most successful approach is to use the administrative and environmental control measures together. Environmental controls aim to reduce the concentration of infectious respiratory particles in the air. The most important steps are outlined below.

Natural ventilation

A simple but effective approach — and one that is not expensive — is to ensure air from areas where there are TB patients is diluted and moved away from areas where there are patients without TB. This you can do by increasing *natural ventilation* through open windows and doors, as shown in Figure 17.2.

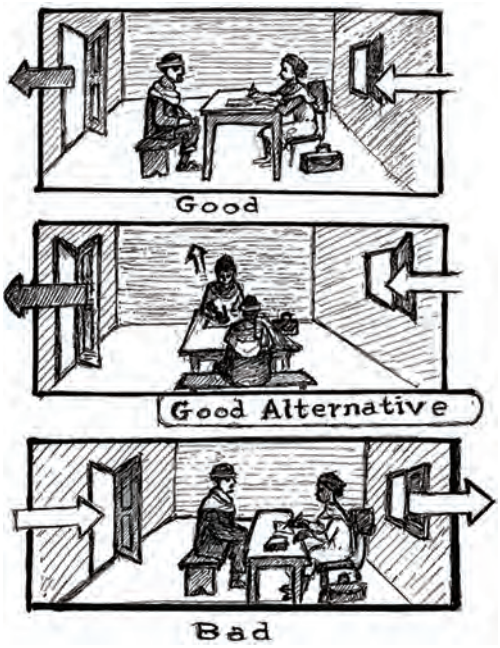

Figure 17.2 Use of natural ventilation to reduce the risk of airborne transmission of TB bacteria from the patient (on the left in the top and bottom diagrams) to the healthworker.

As a healthworker, always try to be *upwind* of a TB patient — which should ensure that clean air will flow from behind you towards the patient, rather than the other way round.

Ventilation refers to the removal of old, stale or 'diseased' air, and replacing it with new, fresh or 'clean' air. This has the effect of removing infectious particles, and diluting those that remain, so that the chances of inhaling infectious particles are kept to a minimum. Good ventilation means that air flows from less contaminated to more contaminated areas, not the other way round.

The important point for you is to ensure that at your health facility, doors and windows should be opened, to encourage natural ventilation.

You might ask the question 'Is mechanical ventilation (air conditioning) better than natural ventilation?' The problem with mechanical ventilation is that it is costly, needs regular maintenance, a reliable electricity supply and testing which can be especially difficult for developing countries such as Ethiopia. A research study done in Peru, which measured how much of the air within a room is replaced over a period of time, showed that natural ventilation is almost always more effective in maintaining ventilation than mechanical ventilation.

17.2.4 Personal protective interventions

Figure 17.3 N95 respirators of different sizes. (Source: FMOH Ethiopia, 2009, as in Figure 17.1)

Personal protective equipment helps to prevent the individual healthworker or other TB-free individuals from getting infected. Key items for personal protection against TB are respirators and surgical masks (sometimes called procedure masks) and there are important differences between them (see Figures 17.3 and 17.4).

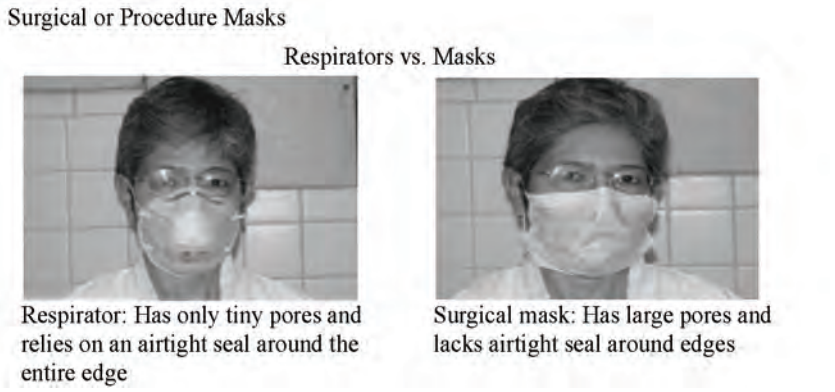

Figure 17.4 Health professional wearing a respirator (left) and mask (right). (Source: FMOH Ethiopia, 2009, *Guidelines for Prevention of Transmission of TB in the Health Facility*)

Respirators

There are different respirators and the most commonly used type in the prevention of TB is the N95 class of respirator (also recommended by the WHO); examples of this type of respirator are shown in Figure 17.3. **Respirators** have very small pores (too small to see with the naked eye) that allow the wearer to breathe but prevent infectious agents from passing through (they are too big to pass through the pores). Importantly, these respirators form a tight seal around their entire edge so that the air you breathe has to pass through the respirator. Wearing these devices substantially reduces the risk of acquiring a TB infection. Health workers should use respirators when providing care to infectious TB patients or suspects, particularly those individuals who you suspect of having a drug-resistant form of the disease.

It is important that you know how to fit a N95 respirator, ensuring that you have a good seal between the mask and your skin.

Masks

Surgical masks prevent the spread of micro-organisms from the wearer (the surgeon, healthworker or TB patient, etc.) to others by capturing the large wet particles found in the wearer's breath near the nose and mouth, and also limiting the distance aerosols are expelled when coughing, sneezing and talking. Surgical masks do not provide adequate protection to the wearer from inhaling infectious droplet particles produced by TB patients (Figure 17.4). This is because masks fit loosely over the mouth and nose, which means they allow free entry of aerosols that may be contaminated with *M. tuberculosis*.

Surgical masks do not adequately protect wearers from inhalation of air contaminated with *M. tuberculosis* and should not be used for that purpose.

17.3 Infection control where people gather, at community and household level

We can now build on your understanding of the control interventions already outlined at health facility level to look at other places in the community where people gather. You will learn about interventions that operate at the managerial, administrative and environmental level, as well as personal protective interventions, following the structure adopted in the last section. The term **congregate settings** is used in the following sections of this study session — the term applies to all the types of public place where people gather (or congregate).

17.3.1 Infection control for congregate settings

The recommendations for congregate settings are less specific than those for healthcare facilities, because congregate settings are so diverse. They include a mix of settings that range from correctional facilities and military barracks, to homeless shelters, refugee camps, dormitories and nursing homes. Each facility differs in the type of population it contains and the duration of stay; in turn, this affects the dynamics of TB transmission. Congregate settings are often divided into two categories — long-term (e.g. prisons) and short-term (e.g. jails and homeless shelters) — to reflect the different duration of stay of the inhabitants.

Managerial activities in congregate settings

The full set of national and sub-national managerial activities already described should also apply to congregate settings. This level of activity may involve other ministries besides the Federal Ministry of Health, such as the Ministry of Justice, plus a range of other stakeholders. In any congregate setting, overcrowding should be avoided because it can lead to non-infected individuals being exposed to TB. Any information, education and communication (IEC) material needs to include a specific focus on congregate settings, including the monitoring and evaluation of TB infection control measures at this level.

Administrative controls in congregate settings

The administrative controls used in healthcare facilities were introduced earlier in this study session and they are also equally important in congregate settings. Cough manners and respiratory hygiene should be implemented, as should early identification of TB suspects and cases, followed by separation and proper treatment of infectious cases.

In long-term residential facilities and similar long-stay congregate settings, occupants should be screened for TB before entry. All staff should be given appropriate information and encouraged to undergo TB diagnostic investigation if they have signs and symptoms suggestive of TB. People suspected of having TB should be diagnosed as quickly as possible. In short-term residential congregate settings, such as jails and homeless shelters, a referral system for proper case management should be established.

In congregate settings with a high prevalence of HIV (particularly in correctional services), patients living with HIV and other forms of immunosuppression should be separated from those with suspected or confirmed infectious TB. All staff and persons residing in the setting should be given information and encouraged to undergo HIV testing and counselling. In congregate settings with patients having, or suspected of having drug-resistant TB, such patients should be separated from other patients (including other TB patients), and referral for proper treatment should be established.

Environmental controls in congregate settings

Buildings in congregate settings should fulfil national norms and regulations for ventilation in public buildings, and the specific norms and regulations for prisons, where these exist. In congregate settings in which there is a high risk of TB transmission and where adequate ventilation cannot be achieved, other (mechanical) ways of maintaining ventilation should be adopted.

Personal protective equipment in congregate settings

When a person is a long-term resident and suspected or diagnosed as having TB, but is physically separated from other people, then the same recommendations on personal protective equipment apply as for healthcare facilities (outlined in Section 17.2.4). In short-term residential congregate settings, appropriate strategies for referral should be organised.

17.3.2 Infection control in households

The important steps in effective infection control in households is the early identification of cases, adherence to treatment and implementation of proper TB infection control measures (e.g. cough manners and respiratory hygiene), before and after a diagnosis of TB in a family member. To reduce exposure in households the following additional measures should be taken:

- Houses should be adequately ventilated, by opening doors and windows, particularly rooms where people with infectious TB spend considerable time. Natural ventilation can be sufficient to reduce the likelihood of transmission of infection.
- Smear-positive TB patients should spend as much time as possible outdoors. They should sleep alone in a separate, adequately ventilated room, and spend as little time as possible in congregate settings or on public transport.
- The importance of infection control in the community should be promoted.
- In households with TB patients, additional guidance is important. Cough manners (including use of masks) and respiratory hygiene need to be adopted when in contact with people. Ideally, health service providers should wear respirators when attending patients in confined spaces.

Ideally, family members living with HIV, or family members with strong clinical evidence of HIV infection, should not provide care for patients with culture-positive drug-resistant TB. If there is no alternative, HIV-positive

family members should wear respirators, if available. Children below five years of age should spend as little time as possible in the same living spaces as culture-positive drug-resistant TB patients. Such children should be followed up regularly with TB screening and, if positive, should be tested for drug-resistance and treated. If possible, renovation of the patient's home should be considered, to improve ventilation (e.g. constructing a separate bedroom, or installation of a window or wind catcher, or both).

17.3.3 Community-based TB control

It is useful at this point to remind you of a range of TB control measures that are important at the level of the community. Importantly, these are the community-based TB control measures that need to be coordinated and delivered by *you* as the health worker and include the following:

- Create community awareness about TB transmission, the treatment of TB and the prevention methods used to stop the spread of the disease
- Identify and refer TB suspects in the community as early as possible
- Provide BCG vaccine to children at birth
- Refer TB patients for sputum examination or arrange for sputum collection
- Monitor adherence to prescribed anti-TB drugs during the intensive and the continuation phases of treatment
- Keep records on what you are doing for TB control
- Trace patients who miss doses or default on medication and ensure medication is resumed
- Give support for patients throughout the course of treatment
- Ensure TB/HIV co-infection patients benefit from both programmes; advise TB patients to be screened for HIV and HIV-positive patients to be screened for TB
- Coordinate TB control activities of volunteers/model families in their *kebeles* and report their monthly activities.

Ensuring that treatment is resumed reduces the risk that the patient will develop Multi-Drug Resistant TB.

17.3.4 Information, education and communication (IEC)

The aim of communication is to increase awareness of the community regarding basic information about tuberculosis. By giving adequate information about this disease and raising levels of community awareness you can influence what is socially normal and acceptable. This has an impact on TB control; it also changes behaviour in both individuals and groups of people. It is a good idea to involve previously treated and cured TB patients in what you do — they can help improve communication and counselling between people with TB, their families and providers.

Do all you can to ensure that the community you are part of is well-educated about TB infection, prevention and control. Patients should understand that they should know their HIV status, that they may be eligible for isoniazid preventive therapy (IPT) and have a right to rapid TB diagnosis and treatment. They should know that TB can be spread by coughing and they should be encouraged to adopt good coughing manners. IEC campaigns should include messages such as 'Our community is TB-safe' or 'Our health facilities are stopping TB', which will help create a positive and forward-looking attitude in your community that you will have helped to establish.

Summary of Study Session 17

In Study Session 17, you have learned that:

1 TB infection control is a combination of measures aimed at minimising the risk of TB transmission within the population. Its foundation is the *early* and *rapid* diagnosis of people with TB and their proper management.

2 TB infection control is part of the national infection prevention and control policies for health in general. It also extends the national policy by targeting airborne infections.

3 The interventions of TB infection control fall into four main categories; managerial, administrative, environmental, and personal protective interventions.

4 Managerial activities involve assessment, establishing coordinating bodies at all levels and planning and evaluating the performance of infection control interventions.

5 Administrative controls include policies and procedures which promptly identify potential and known infectious cases of TB, separating and treating them with minimal delay.

6 Natural ventilation is a simple, but effective and inexpensive environmental technique to move and dilute air from TB-patient areas away from people without TB, by maximising airflow through open windows and doors.

7 The use of personal protective equipment, such as respirators and masks, helps to protect healthworkers from airborne transmission of TB. They should also follow standard precautions for infection control.

8 Healthworkers have an important role in community-based TB control, especially in identifying TB suspects and guiding, supporting and following-up patients during treatment.

9 Healthworkers can make an important contribution to TB control in their communities by providing information and education (for example, about cough manners) and communication more generally, helping to change social norms and behaviours.

Self-Assessment Questions (SAQs) for Study Session 17

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 17.1 (tests Learning Outcomes 17.1, 17.2, 17.3, 17.4 and 17.6)

(a) What is meant by TB infection control?

(b) What are the standard (universal) precautions that should be taken when dealing with TB suspected cases?

SAQ 17.2 (tests Learning Outcomes 17.4, 17.5 and 17.6)

(a) What administrative control interventions are needed for TB control at the level of the healthcare facility?

(b) What are the personal protective measures you would recommend for a healthworker giving care to drug-resistant TB patients in their homes?

SAQ 17.3 (tests Learning Outcomes 17.3, 17.4, 17.5 and 17.6)

What community-based TB control measures could you use in your village to limit the spread of TB? Try to think of at least five ways you could help to reduce TB in your community.

Study Session 18 Leprosy Diagnosis

Introduction

Leprosy is a mildly infectious chronic disease caused by the bacterium *Mycobacterium leprae* — a type of bacterium similar to the one that causes TB. After entering the body, the bacteria grow very slowly and usually affect the **peripheral nerves** (nerves situated close to the body surface). However, as you will shortly learn, leprosy bacteria can have an influence on other organs of the body, such as the skin and eyes.

Leprosy patients have to deal with stigma and discrimination associated with the disease – feelings of shame or disgrace about the condition and unfair treatment from others. Leprosy patients are often referred to as lepers, but nowadays this is not acceptable; you should refer to them as *people with leprosy or leprosy patients*. Leprosy is curable with **multidrug therapy (MDT)**, treatment using combinations of anti-leprosy drugs. You will learn all about it in Study Session 19. MDT kills the bacteria responsible and stops the spread of the disease. Early detection and treatment will prevent disabilities.

In this study session, you will learn how to identify a leprosy 'suspect' and confirm a leprosy patient. In addition, you will learn how leprosy affects the body and how you can provide support for people living with leprosy. The knowledge and skills you gain will enable you to provide information to the community about leprosy. You will also be able to advise them on what they can do to prevent the spread of the disease, support patients during treatment and help to reduce stigma and discrimination suffered by persons affected by leprosy.

Learning Outcomes for Study Session 18

When you have studied this session, you should be able to:

18.1 Define and use correctly all of the key words printed in **bold**. (SAQs 18.2 and 18.3)

18.2 Describe the burden of leprosy in the world, Africa and Ethiopia. (SAQ 18.2)

18.3 Describe the mode of transmission of leprosy and how the disease is treated. (SAQ 18.3)

18.4 Explain how you would identify a person with suspected leprosy and diagnose the condition. (SAQs 18.1 and 18.4)

18.1 Leprosy and its control

18.1.1 What is leprosy?

The sources of infection are untreated **multibacillary leprosy** patients – patients that have a large number of leprosy bacteria lodged in their body, especially inside the breathing tubes leading to the throat, mouth and nose.

In Study Session 19 you will also learn about *paucibacillary* leprosy patients, i.e. those who have few bacteria in their body. Pauci is the Latin word for 'few'.

Leprosy affects all age groups and both sexes, with the most affected being the 15–45 years age-group. In the majority of persons infected with leprosy bacteria, the body's natural immunity is able to kill the bacteria. Only about 5% of individuals infected will develop the disease during their lifetime. Because the bacteria grow very slowly in the body, the incubation period varies from six months to 20 years. As the condition develops, the immune

system of the body shows a number of inflammatory responses (called **leprosy reactions**, which you will learn more about in Study Session 19), which can come about in both treated and untreated patients. Damage to nerves is one commonly-seen reaction, including those that control the function of the hands, feet and eyes, and inflammation of the skin is another.

If the disease is untreated, leprosy leads to severe loss of function of organs – one or more disabilities, such as loss of fingers/toes, disfigurement of the nose and blindness (see Figure 18.1).

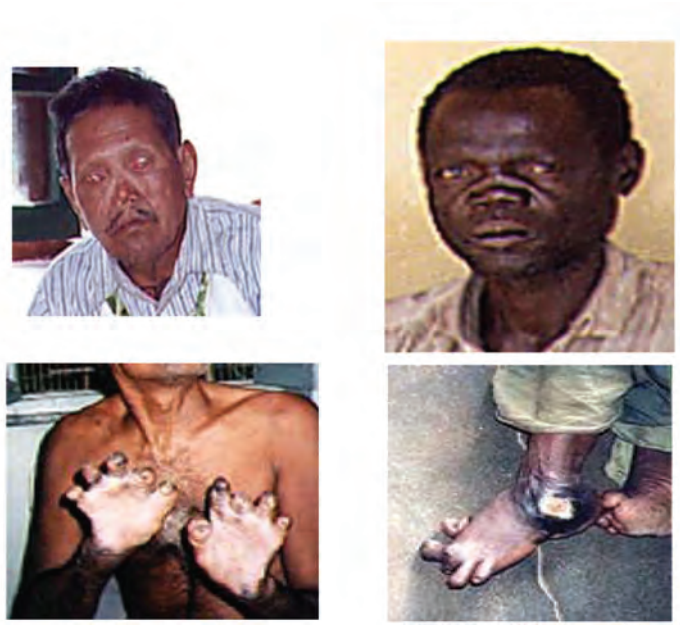

Figure 18.1 Damage to the eyes, face, hands and feet of leprosy patients. (Photos: courtesy of All Africa Research and Training Centre (ALERT), Addis Ababa.)

18.1.2 How can leprosy be controlled?

Prevalence refers to the total number of cases existing at a given time.

Access to leprosy information, diagnosis and treatment with MDT remain key elements in the strategy to eliminate the disease as a public health problem (see Box 18.1). **Elimination** is defined as reaching a prevalence rate of less than one leprosy case per 10,000 population.

Box 18.1 Leprosy control measures

- Early case finding of infectious persons.
- Adequate treatment using combination of anti-leprosy drugs, multidrug therapy (MDT) and support for all leprosy patients.
- Public education about early signs and symptoms of leprosy, control measures and action against stigma and discrimination.

18.2 Burden of leprosy in the world

Leprosy once affected every continent and left behind a terrifying image of mutilation, rejection and exclusion from society. But what is encouraging is that leprosy is a now a communicable disease 'in retreat'. Of the 122 countries where it was considered to be a public health problem in 1985, in 119 of them, including Ethiopia, the disease has been eliminated in recent years.

In Ethiopia, 5,004 new cases of the disease were reported between the last quarter of 2007 and the third quarter of 2008 (European calendar), with the lowest number (seven cases) reported by Harar region and the highest number (2,610 cases) reported by Oromia region. Although Ethiopia has attained a leprosy elimination level of 0.57 cases per 10,000 population nationally, over the last few years the number of new child cases, and the number of new cases detected with disabilities of the type shown in Figure 18.1, are seen as unacceptably high by WHO standards. Rates at this level usually indicate continuing transmission of leprosy bacteria in the affected communities.

18.3 Transmission, identification and diagnosis

The exact route of *transmission* for leprosy is still uncertain at the present time. However, the inside lining of the nose and the mouth is thought to be the main route through which the leprosy bacteria enter the human body – in other words, the main **portal of entry**. When an untreated leprosy patient coughs or sneezes, the droplets of mucus containing the leprosy bacteria are expelled into the air and can be inhaled by a susceptible person.

Suspecting and then diagnosing someone with leprosy is called **case finding**. The next section explains how you can do this in your community.

18.3.1 Case finding

The main purposes of case finding are to:

- Identify the sources of infection in the community
- Diagnose and cure leprosy cases before irreversible nerve damage and disability occur.

There are two general strategies for case finding:

Passive case finding: where you ask about, or observe, symptoms and signs of leprosy when individuals attend the health facility or meet you in your community work.

Intensified/active case finding: where you examine all household contacts of a leprosy patient to identify leprosy cases early.

Whenever you are in doubt whether an individual has leprosy or not, encourage and refer such a person to the nearest health facility capable of diagnosing leprosy.

18.3.2 Diagnosing leprosy

Doctors often call key signs such as these **cardinal signs**; the term can be applied to the key signs of any disease or health condition.

Diagnosis of leprosy is most commonly based on the clinical features. The signs and symptoms will be easy for you to look for and observe after a short period of training, based on the descriptions in this section. In rare instances, laboratory and other investigations are necessary to confirm a diagnosis of leprosy. An individual should be regarded as having leprosy if one or both of the following very significant cardinal signs are present:

- **skin lesion**: an area of skin with definite loss of sensation (lack of feeling), with or without thickened nerves (we will explain about such nerves shortly);
- **positive skin smears**: in a small proportion of cases, leprosy bacteria may be seen in the smears taken from the affected skin when examined under a microscope.

Other symptoms and signs of leprosy are:

- Numbness or tingling of the hands and/or the feet
- Weakness of eyelids, hands or feet (tests for muscle weakness are described later)
- Painful and/or tender nerves
- Burning sensation in the skin
- Painless swelling or lumps in the face and earlobes (see Figure 18.2a)
- Painless wounds or burns on the hands or feet
- Loss of eyebrows and or eyelashes.

The skin lesion can be single or multiple, usually less pigmented than the surrounding normal skin (see Figure 18.2b). Sometimes the lesion may be reddish or copper-coloured. The variety of skin lesions which may be commonly seen include **macules** (which are flat), **papules** (raised), and **nodules**.

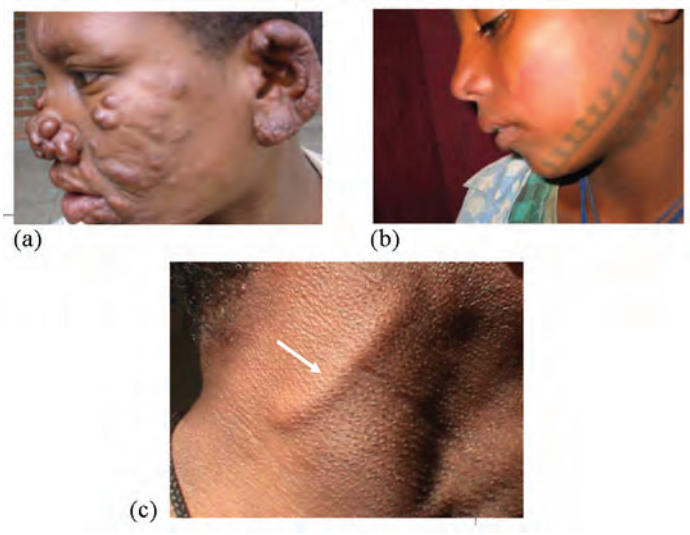

Figure 18.2 (a) Nodules on the face, (b) skin patch on the face, (c) an enlarged nerve in the neck. (Photos: courtesy of All Africa Research and Training Centre (ALERT), Addis Ababa)

Features of the skin that are *not* indicative of leprosy

Skin patches:

- that are birth marks
- where there is normal feeling
- that itch
- that are white, black or dark red
- with scaling
- that appear or disappear suddenly and spread fast.

If you are not sure about the cause of the skin lesion, you should refer to a clinician.

Thickened nerves (see Figure 18.2c) constitute another feature of leprosy. These occur mainly on peripheral nerve trunks, which are nerve bundles close to body surface. Nerve thickening is often accompanied by other signs of damage, such as a loss of sensation in the skin and weakness of muscles supplied by the affected nerve. Nerve thickening by itself, without sensory loss and/or muscle weakness is usually not a reliable sign of leprosy.

18.3.3 What to do if you suspect leprosy

An individual may present with skin lesions or symptoms suggestive of nerve damage, but the cardinal signs may be absent or doubtful; such a person should be called a **leprosy suspect** in the absence of any immediately obvious alternative diagnosis. Such individuals should be informed about the basic facts of leprosy and advised to see you again if their symptoms persist for more than six months, or if at any time the symptoms worsen. In these circumstances, suspect cases should be referred to health facilities with more capacities for diagnosing leprosy. Use Box 18.2 to help you take a history from a person you suspect may have leprosy.

Box 18.2 Checklist for history-taking from leprosy suspects

Make the individual comfortable, and ask for the name, age, sex, address, etc. Take a history of the present illness by asking:

- How long has the skin patch been there? How did it start? Has it changed? (Leprosy patches usually appear slowly.)
- Do the patches itch? Is there pain? (Leprosy patches do not itch and are not usually painful.)
- Does the person have unusual sensations in the hands or feet, such as numbness, tingling or burning feeling? (Unusual sensation in the hands or feet, chronic ulcers and eye problems are all signs of leprosy.)
- The nature of the first lesion or symptom, including the time (when) and site (where) the lesion first appeared and the subsequent development of the disease.
- Did the person have any treatment for leprosy in the past? If yes, which type, and for how long?
- Is there any other person in the family with similar symptoms or signs, or who has been treated or is being treated for leprosy?

18.4 Examining the person with suspected leprosy

In this section, we will teach you how to examine someone whom you suspect may have leprosy.

18.4.1 Checklist for examination of the skin

- Ask the person to remove all his/her clothes/garments.
- Examine the skin under adequate light and ensure privacy for the person to feel at ease.
- Examine the person systematically from the head to toe. Examine the front side of the body first and then examine from the back.
- Examine, count and record the presence of skin lesions; look for pale or reddish discoloration of the skin (see Figure 18.3a).
- Examine for loss of sensation in the skin lesions by rolling the end of a wisp of cotton into a fine point and explaining to the person the purpose of the test is for him/her to point to the spot where he/she feels the touch of the cotton wool. Then touch the skin patch lightly until the cotton wisp bends, first of all while the person has his/her eyes fully open and wait for the reaction of the person to the touch.
- Now repeat the test when the person's eyes are closed (see Figure 18.3b). If the person points away from where the skin is tested, the skin patch has no sensation and the suspect is probably a case of leprosy. If he/she points accurately to the spot or near the spot where you touched the skin patch with the cotton wisp, and if there are no other signs of the disease, they probably don't have leprosy.
- Look for loss of eyebrows and/or eyelashes. These are signs of leprosy when they are not due to deliberate removal for cosmetic reasons.

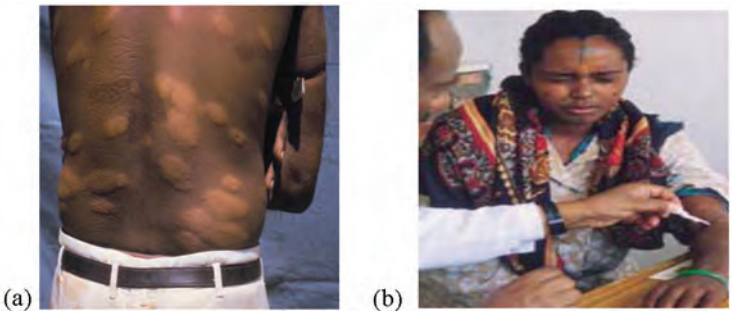

Figure 18.3 (a) Pale skin lesions on the back of a person with leprosy;
(b) Demonstration of how to test skin sensitivity – notice the person has his eyes closed. (Source: How to Diagnose and Treat Leprosy, International Federation of Anti-Leprosy Associations (ILEP), 2001.)

18.4.2 Examination/palpation of the peripheral nerves

The examination of the nerves is an important part of examination of a person suspected of leprosy. The two most commonly affected nerves in leprosy patients are the ulnar and peroneal nerves, and can be felt quite easily (see Figure 18.4). Palpate ('feel') the nerves shown in Figure 18.4, starting from the head to the feet; do so following the technique described in Box 18.3 and the photos in Figure 18.5.

Box 18.3 Palpating the nerves in a person with suspected leprosy

- Peripheral nerves are examined for enlargement or thickening and for tenderness
- When palpating a nerve always use two or three fingers (see Figure 18.5)
- The nerve should be rolled over the surface of the underlying bone
- The same nerve on the left and right sides of the body must always be compared.

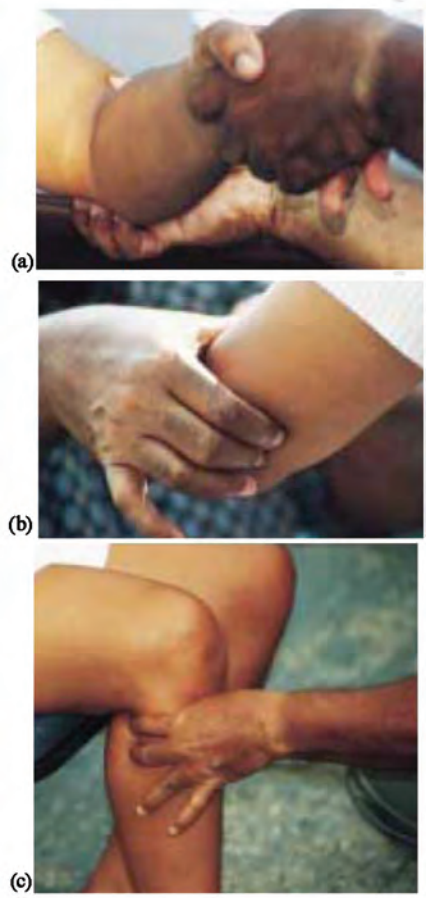

Figure 18.5 Palpating (a) and (b) the ulnar nerve, and (c) the peroneal nerve. (Source: ILEP, 2001, as in Figure 18.3)

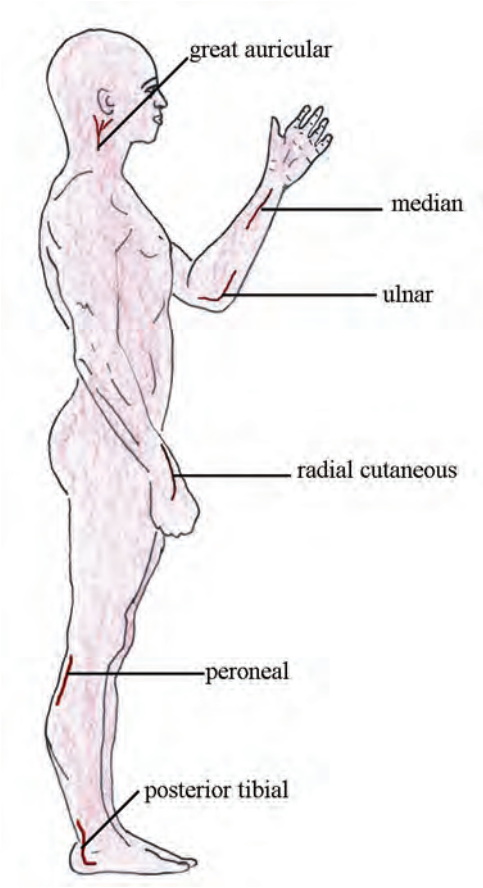

Figure 18.4 The main nerves that may be affected in a person with leprosy.

18.4.3 Examination of hands and feet for loss of sensation

The sensation test (ST) is an examination to test sensation in the hands, served by the ulnar and median nerves, and also in the feet.

Your aim is to compare the sensation in the little finger with that of the thumb, and the sensation of one hand with the other, to see if there is any difference. Then repeat the test on the feet. If you have done these tests on the same person previously, compare the findings with those shown on any earlier records.

Before you start the test, make a note of any wounds or cracks or bone loss on the hands/feet.

First, support the person's hand or foot so that fingers/toes are well supported to prevent joint movement during the test (see Figure 18.6).

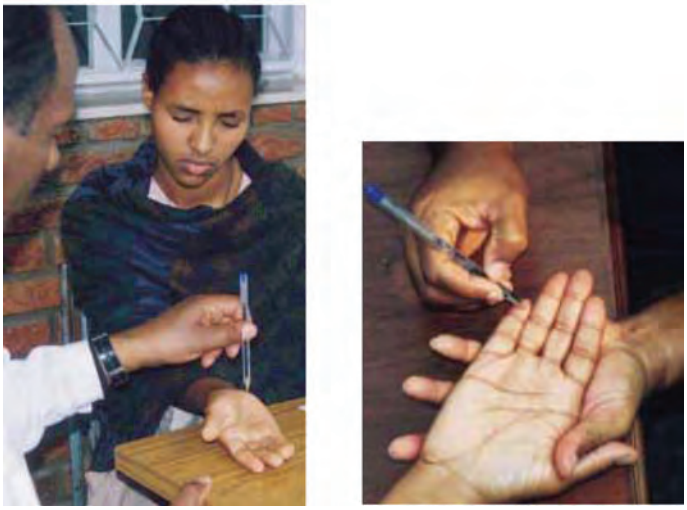

Figure 18.6 Support the hand you are testing and record the results on the patient's record card. (Source: ILEP, 2001, as in Figure 18.3)

Make sure you get hold of a Record Card for a leprosy patient and spend time looking at it. On it, you can record all the important details that relate to the patient, such as the skin lesions you can see, the results of palpation and the outcomes of the voluntary muscle tests you will perform.

Explain the test to the person and rehearse it with him/her with eyes open. Then perform the test (described below) with the person's eyes closed. A book or another suitable object can be held in front of the eyes, so that the person cannot see.

Use the point of a ballpoint pen (biro) to dent the person's skin to a depth of 1–2 mm at the four test points (dots) on the palm of the hand (Figure 18.7a and c).

Do not allow the pen tip to slide across the skin – press it straight down and lift it straight up again. Ask the person to point to the exact site whenever he/she feels the pressure from the pen – first the 'rehearsal' with eyes open, and then with eyes closed. The test points should be pressed at irregular intervals and each test point should be chosen at random – don't test them in a fixed pattern, so that the person can't guess where you will test next. Avoid repetitive testing at any one test point. Provide time for a response: older people may need a little more time to respond.

Repeat this process at four test points (dots) on the feet (Figure 18.7b and d).

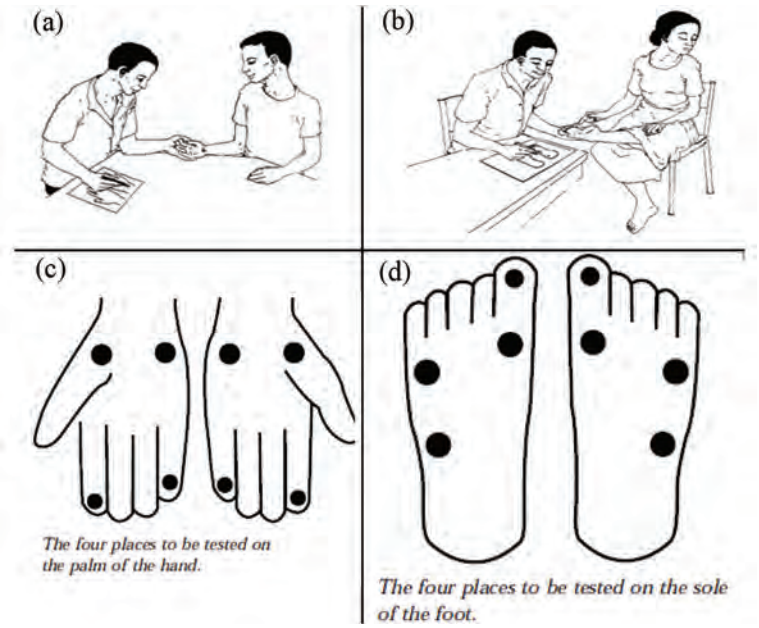

Figure 18.7 (a) The person's hand is first tested for sensitivity with his eyes open. (b) This person's foot is being tested for sensitivity with her eyes closed. (c) and (d) Test points on the hands and feet. (Source: ILEP, 2001, as for Figure 18.3)

Record the results in a leprosy patient record card, or mark the results on suitable diagrams of the type shown in Figure 18.7(c) and (d). On a record card, mark ✓ if the person feels the pressure at a particular test point, or X if he/she does not feel it.

Where possible, compare your findings with those shown on any earlier records – look for differences over time. Make sure that the change is real and not simply a result of one or other of the tests having been recorded in a careless and therefore inaccurate way.

18.5 Examining the eyes and eyelids

18.5.1 Testing for corneal sensation

The surface of the eye is called the cornea. It is very sensitive to being touched in a healthy person, who will blink if something touches the cornea. Corneal sensitivity is lost in a person with leprosy. Observe the person's blink when talking to him/her. If the blink is normal, corneal sensation will be normal and there is no need for the test. If there is no blink, the eye is at risk.

Look at Figure 18.8 and Box 18.4 (on the next page) to see how the corneal sensation test is done.

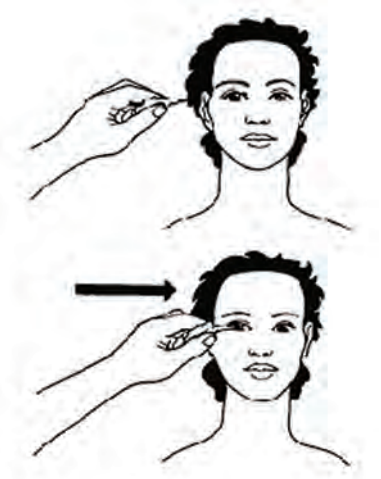

Figure 18.8 The corneal sensation test. (Source: Essential Action to Minimise Disability in Leprosy Patients, Jean M. Watson, second edition, 1994)

Box 18.4 Steps in the corneal sensation test

1 You should wash your hands before testing. Then make a point out of a wisp of cotton wool and explain the test to the person.

2 The person should look to the opposite side and upwards, away from you.

3 You should:
   - Approach from the side
   - Touch the edge of the cornea with the cotton wisp
   - Observe the person's reaction.

4 Take note or record on the person's record card: Write *yes*, if he/she blinks, which means corneal sensation is normal; write *No* if sensation is absent (no blink).

18.5.2 Eyelid closure to test facial nerve function

Ask the person to close his/her eyes as in sleep. A lid gap may be a sign of leprosy. You can also test the strength of the eyelid muscles by asking the person to close his/her eyes tightly and to resist your gentle efforts to part the eye lids. Record full eye closure with full strength as 'S' = Strong. This type of test is known as a **voluntary muscle test** (or VMT).

Next we will look at somewhat similar VMT tests on the hands and feet of a person you suspect may have leprosy.

18.6 Examination of hands and feet for muscle weakness

By testing the strength of the voluntary muscles (which means the muscles we can move at will, e.g. in our arms and legs), you can find out if the person's nerve function is normal, or has been weakened or paralysed by leprosy. The findings are recorded as follows:

- *Paralysed* (P): the muscle has lost all strength and cannot produce any movement;
- *Weak* (W): there is some movement, but muscle strength is reduced;
- *Strong* (S): the muscle strength is normal.

18.6.1 'Little finger out' test of ulnar nerve function

The muscles that move the little finger are activated by the ulnar nerve. Keep the person's hand flat, palm level and facing the ceiling during this test, as shown in Figure 18.9.

As shown in the left of Figure 18.9, first ask the patient to move his little finger all the way in (touching the side of the ring finger) and all the way out until he can make no further movement at the joint). Is the movement full? How large is the gap between the little finger and the ring finger?

If movement is full, ask the patient to hold his little finger out fully while you give resistance to the outward movement at the base of the finger by pushing it in. Resistance can also be tested in the way shown in the diagram to the right of Figure 18.9. Record your findings.

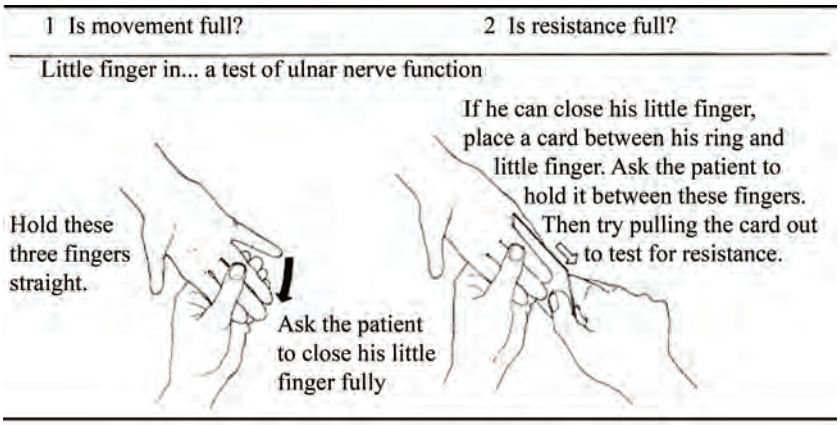

Figure 18.9 The 'little finger out' test. (Source: Watson, 1994, as for Figure 18.7)

18.6.2 'Thumb up' test of median nerve function

The muscles that move the thumb are activated by the median nerve. Keep the hand flat, palm level and facing the ceiling and the wrist slightly extended backwards during this test, as shown in Figure 18.10.

First, ask the patient to bring his thumb up in front of the index finger but as far away from it as possible, in the way shown to the left of Figure 18.10. Focus your attention on the degree of movement that is possible at the base of the thumb rather than the tip. Can the patient achieve this starting position for the test? Is movement full?

Now test the strength of this movement as shown to the right of Figure 18.10 – seeing if the individual can resist the pressure you apply to the side of the thumb. Ask the patient to stare at you during the test, while you try to push his thumb out and across, away from his little finger.

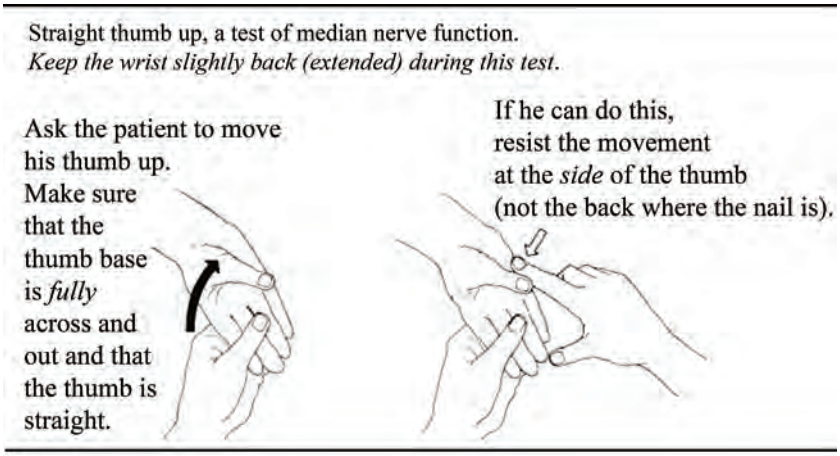

Figure 18.10 The 'thumb up' test. (Source: Watson, 1994, as for Figure 18.7.)

18.6.3 'Wrist back' test of radial nerve function

Study Figure 18.11, which shows you how to perform the test for radial nerve function. Again you are testing for how much resistance there is to pressure you apply, this time to the individual's raised hand, while you support the wrist.

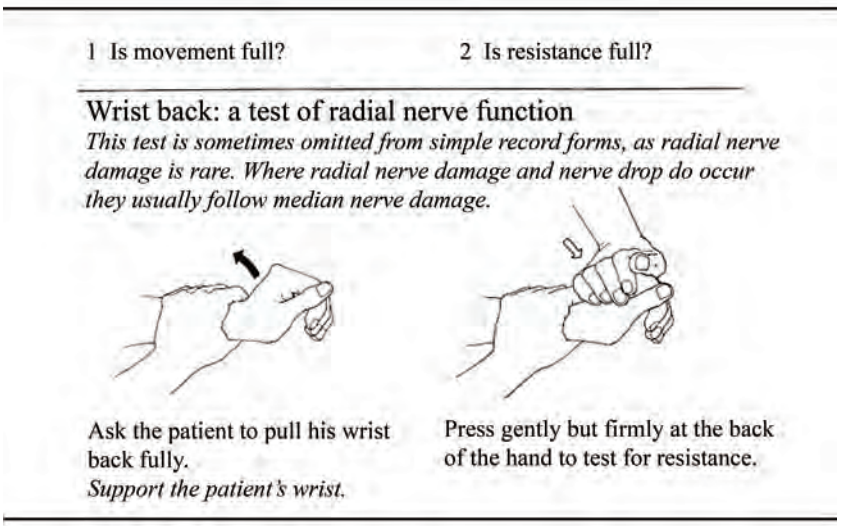

Figure 18.11 The 'wrist back' test. Source: Watson, 1994, as for Figure 18.7.

18.6.4 'Foot up' test of peroneal nerve function

The movement of the foot is due to muscles activated by the peroneal nerve and the test for muscle power in this case is shown in Figure 18.12. You apply pressure to the top of the raised foot by trying to push it down. Can the person still lift up the foot against your pressure? A second test of this type is shown at the bottom of Figure 18.12.

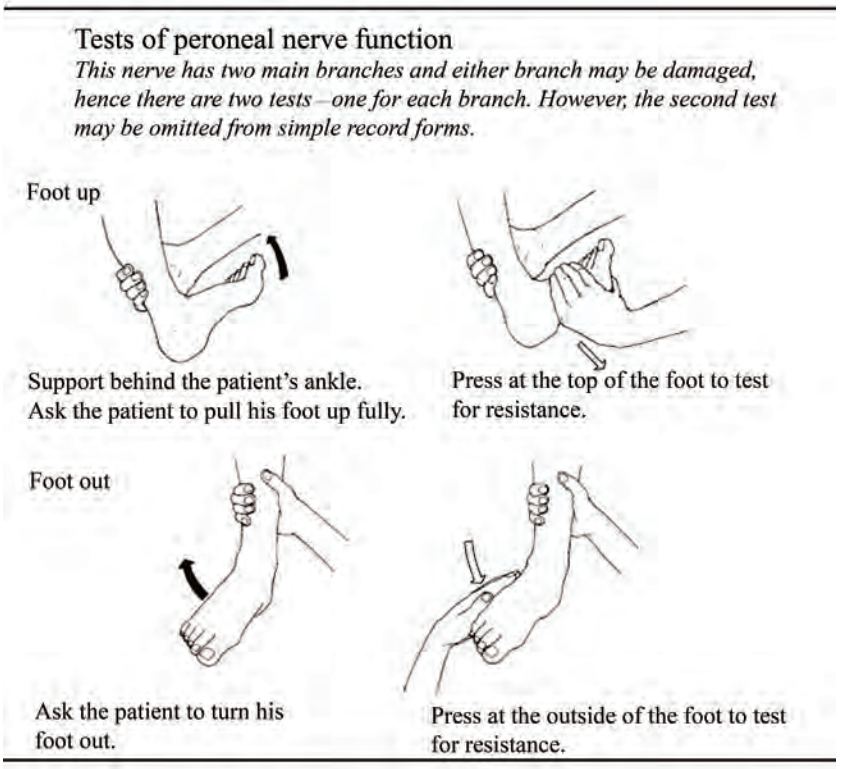

Figure 18.12 The 'foot up' test. (Source: Watson, 1994, as for Figure 18.7.)

It is useful to have ended the main part of this study session by describing these different tests of voluntary muscles. Along with palpation, these are very useful clinical tests for detecting the type of nerve damage typical of leprosy and therefore it is important that you know about them.

Summary of Study Session 18

1 Leprosy is a chronic infectious disease affecting mainly the skin and peripheral nerves. Its incubation period is between six months and 20 years.

2 Leprosy does not kill, but it can disfigure the sufferers. When discovered early and treated promptly it is fully curable and no disabilities will arise.

3 Cardinal symptoms and signs of leprosy are skin lesions, with a lack of sensation, and leprosy bacteria seen in positive skin smears. Thickened nerves are commonly associated with the disease, but they are not always present. Additional signs and symptoms include weakness of eyelids, hands or feet and painful and/or tender nerves.

4 Leprosy bacteria are expelled into the air when untreated leprosy patients cough or sneeze and can be inhaled by a susceptible person.

5 Diagnosis of leprosy is most usually based on the clinical features. Most often affected areas are the skin, peripheral nerves and the eyes. Palpation of nerves and the testing of a range of voluntary muscles, for example those associated with the hands and feet, are key methods of detecting nerve damage to aid diagnosis. So is testing for reduced skin and corneal sensitivity.

Self-Assessment Questions (SAQs) for Study Session 18

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 18.1 (tests Learning Outcome 18.4)

Look at the skin lesions in Figure 18.13(a) and (b). Identify, with reasons, which one shows the signs of leprosy. Keep in mind that in Figure 18.13(a) there is loss of sensation, but no loss of sensation or nerve enlargement in Figure 18.13(b).

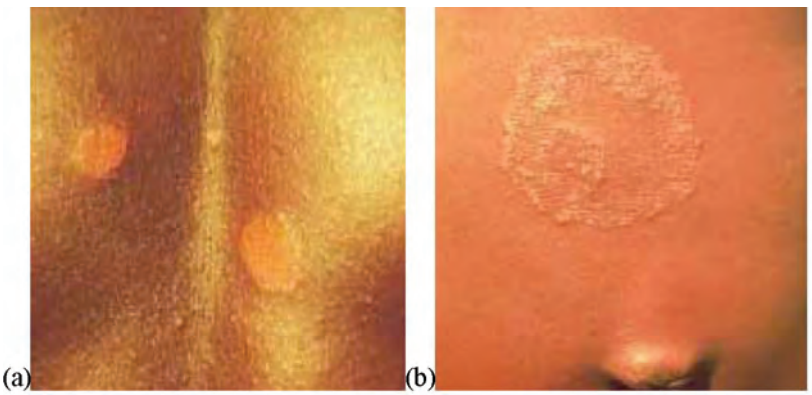

Figure 18.13(a) and (b) for use with SAQ 18.1. (Source: WHO, 2000, as for Figure 18.3)

SAQ 18.2 (tests Learning Outcome 18.2)

Is it right to say that leprosy has been eliminated in Ethiopia and that as a Health Extension Practitioner you therefore don't need to be looking out for cases of the disease?

SAQ 18.3 (tests Learning Outcomes 18.1 and 18.3)

Which of the following statements is *false*? In each case, explain what is incorrect.

A The inside lining of the nose and the skin are major portals of entry of leprosy bacteria.

B MDT has not proved successful in the fight against leprosy.

C MDT treatment helps nerves and organs damaged as a result of leprosy to start functioning again normally.

D If leprosy is untreated, organs such as the eyes can become damaged and fingers and toes can be lost.

E Case finding is essential to the task of reducing the prevalence of leprosy.

F Case finding involves only the process of carefully looking at individuals attending your health facility for signs of leprosy.

SAQ 18.4 (tests Learning Outcome 18.4)

(a) Someone at your health facility presents to you with weakness of both hands. Should you suspect he has leprosy or not? What should you do to confirm your suspicion?

(b) Another individual explains to you that she has some areas of skin that are sore and that are very itchy. When you test her, she has normal responses to VMT. Do you suspect leprosy or not?

Study Session 19 Leprosy Treatment

Introduction

As you learned in Study Session 18, early detection combined with prompt treatment is an effective way to prevent the spread of leprosy in the community. In this study session, you will learn how to treat a leprosy patient, monitor treatment progress, what you need to do if a patient interrupts treatment and what kind of advice you can give to a patient or a family member while a patient is on treatment.

Multidrug therapy (MDT) kills the bacteria responsible for leprosy and stops the spread of the disease. Leprosy patients can lead completely normal lives and if the disease is detected early and treated with MDT, leprosy need not lead to disabilities. In this study session you will learn about how to detect and manage leprosy complications to alleviate the sufferings of your patients.

Learning Outcomes for Study Session 19

When you have studied this session, you should be able to:

19.1 Define and use correctly all of the key words printed in **bold**. (SAQs 19.1, 19.6 and 19.8)

19.2 Explain how you would classify leprosy patients for the purpose of treatment. (SAQ 19.2)

19.3 Explain key features of leprosy treatment and management. (SAQ 19.3)

19.4 Explain how you would identify and manage patients who interrupt or default from leprosy treatment. (SAQ 19.4)

19.5 Describe how you would inform leprosy patients and supporters about their treatment in an effective way. (SAQ 19.5)

19.6 Describe how you would discharge leprosy patients after completion of treatment. (SAQ 19.6)

19.7 Describe the main complications of leprosy and what actions you would take. (SAQ 19.7)

19.1 Classification of leprosy

Classification of leprosy patients is based on the clinical features (see Table 19.1). The World Health Organization (WHO) distinguishes between two major types, one of which (multibacillary leprosy) was introduced in Study Session 18. **Paucibacillary leprosy** is characterized by the low number of skin lesions and the low number (or absence) of visible *Mycobacterium leprae* in microscope slides taken from these patients.

Table 19.1 Classification of leprosy types.

Clinical features	Paucibacillary (PB)	Multibacillary (MB)
Skin lesions	One to five lesions	Six or more lesions
Nerve damage	Only one nerve involved	Two or more nerves involved

Paucibacillary is pronounced 'pore-see-bass-ill-ary'. Pauci comes from the Latin word meaning 'few'.

19.2 Multidrug therapy (MDT) for the treatment of leprosy

Regimen is the term used to describe the drug dosages, the number of times the drugs are taken in any given period (e.g. per day), and the duration of treatment in days, weeks, months or years.

Multidrug therapy (MDT) is the treatment of choice for all leprosy patients. It entails the swallowing of a combination of anti-leprosy drugs on a daily basis, in the recommended doses for the recommended duration of treatment and according to the WHO leprosy classification.

19.2.1 MDT drug regimens

The drugs used in MDT leprosy treatment are rifampicin (R), dapsone (D) and clofazimine (C). There are two MDT regimens: PB-MDT for paucibacillary patients and MB-MDT for multibacillary patients, in dosages for adults and for children in blister packs; see Figure 19.1(a) to (d). Each blister pack contains treatment for four weeks.

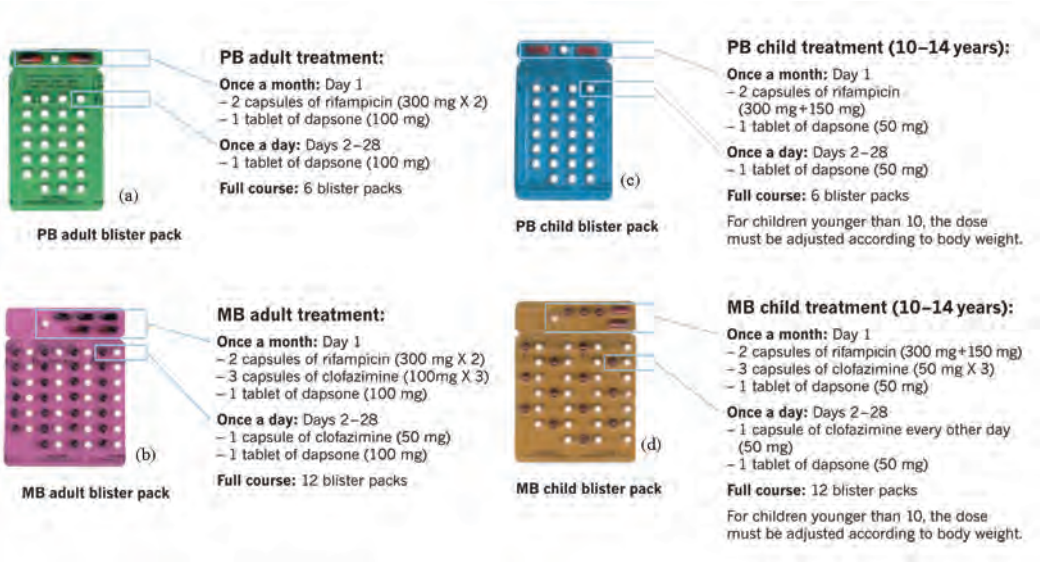

Figure 19.1 MDT regimens in blister packs, (a) paucibacillary treatment for adults, and (b) multibacillary treatment for adults; (c) paucibacillary treatment for children, and (d) multibacillary treatment for children. (Source: *Guide to Eliminate Leprosy as a Public Health Problem,* WHO, 2000, accessed from http://www.who.int/lep/resources/Guide_Int_E.pdf)

19.2.2 How to administer MDT for leprosy

Box 19.1 summarises how to administer multidrug therapy to treat leprosy.

Box 19.1 Before giving MDT you should:

- Count the number of skin patches and check nerve involvement in order to classify the patient as PB or MB for treatment, (see Table 19.1 above and Figure 19.2). If in doubt, classify as MB.
- Inform the patient and anyone accompanying the patient about the disease and its treatment. Encourage them to ask questions and clear up any doubts.
- Give the patient the first dose at home or in the Health Post under your supervision. Show them which drugs from the MDT blister pack should be taken every day for days 2–28. Give the patient enough blister packs to last until the next visit.

- Give patients the full course of treatment if it is difficult for you to visit them at home, or for them to come to the Health Post. Explain to them what they have to do (see later in this study session).

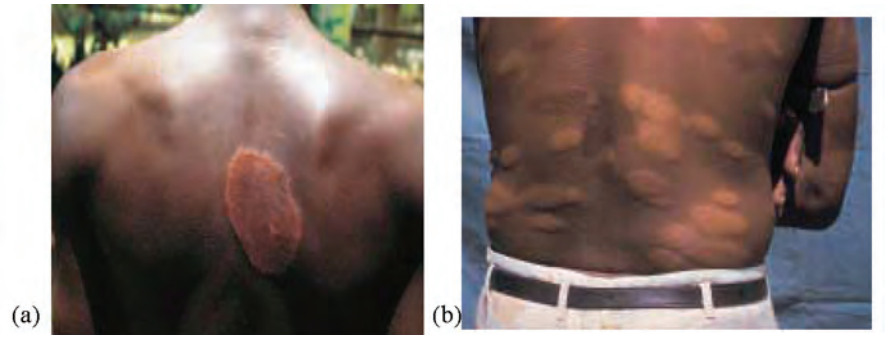

Figure 19.2 Recognising paucibacillary (PB) and multibacillary (MB) leprosy. (a) one to five patches indicates PB leprosy. The six blister packs should be completed within a maximum period of nine months. (b) More than five patches indicates MB leprosy. The 12 blister packs should be completed within a maximum period of 19 months. (Source: WHO, 2000, as for Figure 19.1)

19.2.3 Accompanied MDT

Normally, patients are given their MDT drugs every month when they come to the health facility for the next blister pack and their check-up. However, this is not always possible. **Accompanied MDT** is a type of treatment strategy where a patient is able to receive all the MDT drugs needed for the full course of treatment on their first visit after diagnosis. It is designed to address a frequent problem in rural programmes. Patients often have to interrupt their treatment because of a shortage of drugs at the health centre, poor access to the health services or simply because no one is at the health centre when they come to collect their drugs.

This approach means that the patient has to take more responsibility for adherence to the drug regimen, although a treatment supporter should accompany the patient when they collect the drugs. If the patient chooses accompanied MDT, give PB patients six PB blister packs and MB patients 12 MB blister packs. Reassure patients that they can lead normal lives. Tell patients to report any problems and to come back when treatment is completed.

■ Yacob, a new leprosy patient, lives two streets away from a health centre. Should he be given accompanied MDT or not? Explain your answer.

□ No. He is close to the health centre and is likely to be able to collect more drugs when he needs to.

19.2.4 Side-effects of anti-leprosy drugs

Serious side-effects of leprosy treatment are rare. The most serious side-effects are serious allergy to one of the drugs, or jaundice (yellowness of the eyes). If either of these happens, you should stop the treatment and refer the patient to a clinician. Whenever you refer a patient, write down details of the complaint, when this first occurred and medicines taken. Send this referral note with the patient to show to the clinician.

The patient may have other, less serious side-effects such as rifampicin turning urine red, or black spots on the skin due to dapsone, or change of the colour of the skin due to clofazimine. When this happens it is important to continue the treatment. You should let the patient know that they are not serious side effects and will go away when the treatment is finished.

19.3 Identifying and managing defaulters

A **defaulter** is an individual who fails to complete treatment within the maximally allowed period of time. Whenever a PB patient has missed more than three months treatment, or an MB patient more than six months treatment, they should be declared as defaulters from treatment and should be referred immediately to the clinician for further management. Any defaulter, particularly one who remains very irregular on treatment and repeatedly defaults despite every effort on the part of the health staff, should also be referred, so that a more experienced person can decide if further treatment is required and if so, how much.

You have an important role to play in helping prevent patients from interrupting treatment and becoming a defaulter. You can also retrieve a defaulter — taking steps to bring patients back into treatment by getting information about those who fail to show up on clinic day, by asking other patients or by sending a reminder directly to the patient. But if she/he does not turn up after 28 days, you should visit him/her at home to find out the reason for non-attendance. Then you should complete the defaulter retrieval form (make sure you know where these forms are located in your place of work) and take any other appropriate action, such as referring the patient to a clinician for assessment.

There are a number of ways in which you can help ensure that patients keep to their treatment until completion. You should always inform patients of what's required by way of treatment and why, and you should make sure that drug collection is accessible and flexible. Giving medicines regularly and identifying and referring patients with complications promptly are also important. Also, you should try to trace patients who miss a drug collection date or clinic day, carry out regular patient's review and discuss findings with them during clinic visits. As a Health Extension Practitioner, you have a big responsibility for helping to motivate patients by adopting a professional attitude and by using encouraging words. Box 19.2 summarises the key points you need to remember for patients and their families.

Box 19.2 Key points for patients and their families

- Educate patients, their families and the public about leprosy treatment.
- Ensure that patients adhere to treatment and that they get the support and encouragement they need.
- Tell patients and their families that leprosy is curable, and the drugs help stop the disease from spreading.
- Tell patients to keep the drugs in a safe, dry, shady place and out of the reach of children.
- Make sure patients know that if the drugs are spoiled (change colour or broken), they will be replaced, as MDT drugs are free of charge.

- Make your patients aware that leprosy drugs can turn their urine red or skin darker, but they should not worry if this happens because it will go away when treatment is completed.
- Tell your patients that MDT is safe during pregnancy, and safe for patients being treated for tuberculosis (TB) and those who are HIV-positive.
- Make sure patients tell you about any problems and that they come monthly for their check-up and to collect their medicines.

19.4 Discharging patients after treatment

Finally in this section, what about discharging leprosy patients after completing MDT treatment? Remember that MDT is therapy of fixed duration. When six doses of PB-MDT have been completed stop the treatment, examine the patient and record all clinical findings. Then refer the patient to the health centre for discharge as treatment is completed. Do the same when 12 doses of MB-MDT have been completed by MB patients.

19.5 Leprosy complications and management

You will remember that you learned in Section 18.1.1 that leprosy reactions are the body's immune response to the leprosy bacteria and are natural reactions as part of the normal course of the disease. Your patients need to understand that reactions are *not* adverse side-effects of MDT and do not mean that the disease is becoming worse or that the treatment is not working. Reactions can occur before, during or after the discharge of the patient from treatment.

19.5.1 Signs and symptoms of leprosy reactions

The symptoms and signs of inflammation in a leprosy patient include the appearance of new skin lesions, redness and/or swelling of skin lesions, swelling and/or increased tenderness of the skin lesions, plus the appearance of tender nodules in the skin. Figure 19.3 shows typical reactions of this type in two patients.

Other reactions relate to the affected nerves; there can be swelling and tenderness of peripheral nerves, with or without loss of nerve functions, and sudden nerve function impairments or loss, such as weakness of muscles of the hands and feet or inadequate closure of eyelids, due to untreated inflamed nerves. You will recall that you learnt about nerve examination in Study Session 18, so that you are able to spot signs and symptoms such as these and take appropriate steps by referral to a clinician.

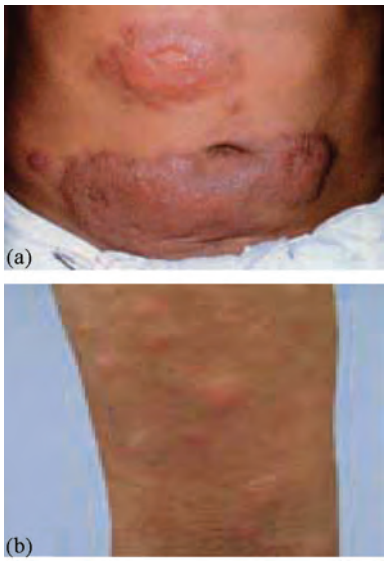

Figure 19.3 Signs of reactions to leprosy treatment: (a) on the abdomen, (b) on the leg. (Source: WHO, 2000, as for Figure 19.1)

19.5.2 Managing leprosy reactions

A range of factors can lead to or help bring about leprosy reactions. They include stressful conditions such as pregnancy and childbirth, acute infections, vaccination, physical exhaustion, mental stress and strain. You should be on the lookout for the presence of any of these conditions — including asking your patients directly about problems they face.

Refer patients with leprosy reactions urgently to a higher health facility.

If a patient has any of the symptoms or signs of reaction, refer them immediately to a higher level health centre or hospital for appropriate management. Reactions require urgent treatment with special medicines as they can lead to irreversible deformities. Give aspirin or paracetamol to reduce pain and fever, but stress that it is important that patients continue to take MDT while they go to the higher health facility.

19.5.3 Disability

Disability in leprosy is an inability to perform some or all of the tasks of daily life. The disabilities associated with leprosy are mainly due to nerve damage. As you learned in Study Session 18, some nerves are responsible for the movement of the hands or feet or closure of the eyelids; others signal the sensation of pain, hotness or coldness, or trigger sweating in the skin. When leprosy reactions go untreated for a few months, they may result in damage of nerves which control the functions of the hands, feet or eyes; you saw some examples of these in Figure 18.1 in the previous study session. Primary nerve damage can lead to complications, which in turn affects other nerves (so-called secondary nerve damage); for example:

- Dryness of skin, leading to cracked skin, which may become infected.
- Loss of sensation, which may lead to ulcers (areas of damaged infected tissue that won't heal, usually on the legs).
- Weakness or paralysis, which may lead to 'claw' fingers or toes.

You should watch out for reduced skin sensation, impaired nerve function such as weakness in the hands or feet and/or eye closure, which you can detect using simple observation and history-taking; you learnt about voluntary muscle tests (VMTs) and sensation tests (STs) in Study Session 18. Where you see such indications of damage, refer the patients to the clinician for advice on how to manage them. You can prevent primary nerve damage by early diagnosis, prompt and adequate treatment and by regular VMTs and STs. Secondary complications can be prevented by teaching patients how to carry out self-care, which we will discuss in more detail shortly.

19.5.4 Measures to prevent and manage disabilities

Patients with insensitive hands or feet injure themselves without noticing it. They can develop wounds which can get infected and, over time, lead to irreversible deformities. It is the task of all health staff working with leprosy patients to *preserve nerve function* and to prevent further deformity and disability in those cases where there is some irreversible disability present at the time of diagnosis. The process and measures undertaken to preserve nerve function is often referred to as **prevention of disabilities (POD)** by:

- Early diagnosis and prompt treatment.
- Recognising signs and symptoms of leprosy reactions with nerve involvement and referring to a clinician for advice on what to do.
- Carrying out VMTs and STs regularly to detect nerve function impairment.
- Encouraging and training patients in the practice of self-care.
- Educating patients to recognise early signs of nerve function impairment and to report this immediately.

POD depends, to a very large extent, on the patients themselves. So, priority should be given to POD through training on self-care, i.e. what the patients can do themselves to prevent development and/or worsening of disabilities and by wearing protection on feet and hands. You should tell leprosy patients with insensitive feet not to wear closed plastic shoes because such shoes can lead to more sweating, formation of blisters and skin infections in the feet. Where wounds occur, you should manage them just like any other cuts or wounds, dry skin, or eye problems. Use Table 19.2 to guide you on simple measures you can take to prevent and manage disabilities at the community or health post level. Use it to teach your patients about self-care.

Table 19.2 Care of the hands, feet and eyes in people with leprosy.

Care of the hands	
Injury on hand while working/cooking	Clean wound and apply clean dressing. Advise rest. Advise and teach patient to use a cloth to protect the hands when touching hot or sharp objects.
Hands with dry cracks and fissures	Advise and teach patient to soak hands for 20 minutes every day in water and to apply Vaseline or cooking oil regularly.
Care of the feet	
Feet with dry cracks and fissures	Advise and teach patients to soak their feet for 20 minutes every day in water and apply cooking oil/Vaseline regularly. Advise them to use shoes or slippers to protect their feet from injury.
Blister on the sole or between toes	Dress blister with clean cloth. Apply cotton wool and bandage. Teach patient how to do the same.
Feet with ulcers without any discharge	Clean the ulcer with soap and water. Cover with clean dressing. Advise rest.
Feet with ulcers with discharge	Clean the ulcer. Apply antiseptic dressing. Advise rest. If no improvement in four weeks, refer to hospital.
Care of the eyes	
Patient presents with red eye, pain, blurring of vision and discharge	Give aspirin or paracetamol. If available apply 1% atropine drops and steroid ointment. Keep eye covered with a pad. Whenever possible, advise to go to the hospital.
Patient with injury on cornea (corneal ulcer)	Apply antibiotic ointment if available. Keep eye covered with a pad. Wherever possible, advise to go to the hospital.

Source: WHO, 2000, as for Figure 19.1

Summary of Study Session 19

In Study Session 19 you learned that:

1 Leprosy is a disabling disease and complications can occur before, during and after treatment.

2 Patients are classified using WHO guidelines into paucibacillary (PB) and multibacillary (MB) for the purpose of treatment with multidrug therapy (MDT).

3 Prompt treatment with MDT is an effective way to prevent the spread of leprosy in the community. The duration of treatment for PB and MB patients is 6 and 12 months respectively.

4 If detected early and treated with MDT, leprosy will not lead to disabilities. Leprosy patients can lead completely normal lives.

5 Patients can collect their treatment at regular intervals from you or from the health centre, or (with accompanied MDT) take the entire course away with them when diagnosed.

6 As a health worker, you have an important role to play to ensure treatment adherence and completion and prevent patients from defaulting from treatment.

7 Leprosy patients can develop reactions, as part of the natural course of the disease. Urgent treatment is essential, otherwise irreversible impairments (e.g. reduced or partial loss of nerve function in the hand, foot or eye, along with loss of sensation, weak grips, impaired vision), or deformities (total or partial loss of hand, foot or eye functions, clawed fingers and toes, partial or total blindness) will develop.

8 Many complications of leprosy are due mainly to nerve damage and occur when reactions go untreated for a few months. The main result is damage of nerves which control the functions of the hands, feet or eyes.

9 Disabilities can be prevented and managed by early diagnosis and prompt treatment, plus a range of simple protective measures requiring patient self-care of the hands, feet and eyes.

Self-Assessment Questions (SAQs) for Study Session 19

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 19.1 (tests Learning Outcomes 19.1 and 19.2)

How would you classify the following leprosy patients?

(a) Tesfaye with four skin lesions and weakness of both hands.
(b) Hiwot has three skin lesions with loss of sensation.
(c) Getachew reported with five skin lesions and inability to close his eyelids.

SAQ 19.2 (tests Learning Outcome 19.3)

What is the correct treatment for each of the following leprosy patients? Classify each person for either PB-MDT or MB-MDT and explain why you reached your decision.

(a) Bizuwork has four skin patches located on the right upper arm.
(b) Ato Mesele complains of weakness in both hands and there is also a big skin patch on his back.
(c) Yohanes has three skin lesions on his back and two lesions on his face, but no muscle weakness.

SAQ 19.3 (tests Learning Outcome 19.3)

What would you do when a leprosy patient on treatment comes to you for a monthly visit and why?

SAQ 19.4 (tests Learning Outcome 19.4)

Briefly describe all the actions and attitudes of healthworkers like you that will help to prevent your leprosy patients from defaulting.

SAQ 19.5 (tests Learning Outcome 19.4)

Hailemariam started MB-MDT treatment eight months ago under your care but has not collected his MDT drugs in the last three months due to illness. He returns to see you today. What should you have done before now? What will you do today?

SAQ 19.6 (tests Learning Outcomes 19.1 and 19.5)

How would you educate a leprosy patient who is about to commence MDT?

SAQ 19.7 (tests Learning Outcome 19.6)

What should you do before discharging a leprosy patient from MDT treatment?

SAQ 19.8 (tests Learning Outcomes 19.1 and 19.7)

John has been on MB-MDT treatment for six months. He has come to you today to complain of redness and pain in his skin lesions. He feels unwell and has not been able to go to the farm for four days. What is wrong with John? What would you do and why?

Notes on the Self-Assessment Questions (SAQs) for *Communicable Diseases*, Part 2

Study Session 13

SAQ 13.1

In language a lay person could understand, you would say first that TB is an infectious disease caused by TB bacteria (germs). It is a disease that normally affects the lungs, though it can infect other parts of the body too. The symptoms of TB are a persistent cough, weight loss, chest pain, tiredness, difficulty breathing, sweating, fever and sometimes the spitting up of blood. When someone with TB coughs or sneezes they breathe out droplets that contain the bacteria. If these droplets are breathed in by a healthy person, they could also become infected with TB.

Most people infected with TB bacteria do not go on to develop TB. Instead the bacteria remain 'asleep' in their bodies, and in some cases they may even clear the bacteria completely. However, those who do develop an active infection will die in a few years if not treated. The treatment of TB takes many months and it is important that those undergoing treatment follow the treatment exactly. This ensures a good outcome and also prevents the development of drug-resistant strains of TB which are more difficult to cure.

Tell the person that if he or she suspects they or someone in their community may be infected, then please seek medical treatment at the nearest health facility. Children and those with other conditions, such as HIV, are very susceptible to TB infection.

SAQ 13.2

The global targets for TB case finding and treatment are to detect at least 70% of the smear-positive cases and cure at least 85% of the detected cases.

SAQ 13.3

326 new smear-positive TB cases are expected in 200,000 people. (Remember that in Ethiopia as a whole, in 100,000 people a total of 163 new smear-positive cases are expected every year. Therefore, in 200,000 people you would expect $2 \times 163 = 326$ cases).

SAQ 13.4

The main features of the Global STOP-TB Strategy are practising and scaling-up DOTS, addressing MDR-TB and TB/HIV co-infections, supporting the strengthening of the health system, and engagement with stakeholders such as public and private care-providers and the affected communities to raise detection, treatment and adherence to high standards. In addition, the strategy enables and promotes research into new drugs, diagnostic tools and vaccines.

SAQ 13.5

When an infectious adult coughs, sneezes, sings or talks, the *tubercle bacteria* may be expelled into the air in the form of droplet nuclei. Transmission of the TB bacteria occurs when a person in close contact inhales (breathes in) the droplet nuclei.

SAQ 13.6

Case finding strategies in these circumstances are intensified TB-screening in high-risk groups and screening of people who have been in close contact with them.

SAQ 13.7

The following people should be screened for TB in the family of someone with active TB:

- Children less than five years old
- Anyone who is HIV-positive
- All family members (children older than five years and adult) who have any symptoms of TB.

Study Session 14

SAQ 14.1

There are two phases in TB treatment: the intensive phase and the continuation phase. During the intensive phase the patient took anti-TB drugs in front of you, or another health professional, or another treatment supporter. While in the continuation phase, the patient collects their medication monthly and you check that timely collection and adherence to treatment is occurring.

SAQ 14.2

(a) This patient has symptoms of TB and is therefore a TB suspect and in need of investigation for TB. So you should refer this patient for sputum smear examination to a TB treatment facility.

(b) This patient also needs counselling for HIV testing, since there is significant overlap between these two diseases and HIV is one of the major risk factors for a patient to develop TB disease.

SAQ 14.3

(a) W/r Almaz should be classified as 'smear-positive pulmonary tuberculosis'.

(b) This patient is categorised as 'new' since there is no previous treatment for TB.

(c) This patient is put under 'Category I' and treated with the following regimen:

- Initial phase 2 (HRZE/S)
- Continuation phase 4 (HR) or 6 (HE).

SAQ14.4

(a) The most likely cause in this patient is related to rifampicin, since this drug can cause reddish discoloration of urine.
(b) Reassure the patient that this causes no harm; the patient should be advised to continue her medication.

Study Session 15

SAQ 15.1

A is true; when you monitor TB treatment you observe and record all treatment activities and this in turn helps to monitor the TB programme at national level.
B is *false*; at the fifth month a sputum examination is required for all TB patients with initial smear-positive results.
C is true; it is the responsibility of the original health facility to conduct subsequent follow-up once the patient is discharged from hospital.
D is true; it is the responsibility of the new facility to inform the original health facility that the transferred patient has reported for treatment.

SAQ 15.2

If a patient interrupts anti-TB treatment for less than one month the appropriate action is to trace the patient, solve the cause of the interruption and advise to continue treatment and prolong it to compensate for missed doses. Then you should advise the patient not to interrupt treatment again. Mention that if he or she continues interruption, the chances of cure will be lessened, as the patient may develop drug-resistant TB.

SAQ 15.3

(a) Defaulter
(b) Transfer out
(c) Cure.

Study Session 16

SAQ 16.1

You suspect tuberculosis disease in children for one or more of the following reasons:

(a) Presence of contact history with TB suspect or TB case in the family.
(b) Chronic symptoms of TB – a cough for more than two weeks, fever, and sweating, decreased weight and decreased appetite.
(c) Presence of a risk factor like HIV infection, malnutrition, after measles etc.

SAQ 16.2

This HIV patient should be suspected of having tuberculosis or other infections that occur at the late stage of HIV. You should refer the patient for possible TB diagnosis, including clinical evaluation, sputum examination and chest X-ray.

Advise him not to stop taking his ART drugs, or cotrimoxazole (CPT). You should also advise screening of family members for TB, as well as for HIV.

SAQ 16.3

Multidrug resistant-TB (MDR-TB) is active TB involving *M. tuberculosis* organisms that are resistant to at least isoniazid and rifampicin, the two most powerful anti-TB agents.

Study Session 17

SAQ 17.1

(a) TB infection control is a combination of measures aimed at minimizing the risk of TB transmission.

(b) Standard universal precautions include:

- hand washing and antisepsis
- use of personal protective equipment (e.g. gloves)
- appropriate handling of patient care equipment and soiled cloths
- prevention of needle stick/sharp injuries
- environmental cleaning and spills management
- appropriate handling of clinical waste.

SAQ 17.2

(a) Administrative control interventions needed at healthcare facility level are: triage (identify TB suspects and refer them for investigation), physical separation (cohorting) or isolation of patients or TB suspects, cough manners and minimizing time spent in healthcare settings.

(b) Respirators for health workers and surgical masks for the patients.

SAQ 17.3

You could use the following measures:

- Create awareness about TB on routes of transmission, diagnosis, treatment and prevention.
- Identify and refer TB suspects to a higher health facility for diagnosis and treatment.
- Educate on TB vaccination (BCG), cough manners and respiratory hygiene.
- Supervise TB treatment for patients on anti-TB drugs.
- Keep TB patients' records updated.
- Advise TB patients to have HIV screening and HIV patients to have TB screening.
- Involve the community members and previous TB patients in TB awareness and prevention campaigns (advocacy, communication, social mobilisation).

Study Session 18

SAQ 18.1

Figure 18.13(a) is a photo from a leprosy patient, because it shows a skin lesion with accompanying loss of sensation. If you are told there is no loss of sensation or signs of nerve enlargement (Figure 18.13b) you should not suspect leprosy.

SAQ 18.2

Leprosy is understood to be eliminated in countries where fewer than 1 case for every 10,000 population is identified; the rate in Ethiopia is 0.57 cases per 10,000 population, so it has been eliminated in Ethiopia. However, this does not mean there are never any cases. So, as a HEP, you need always to be looking out for leprosy suspects to help reduce the incidence in Ethiopia even further.

SAQ 18.3

A is true: as you will have learned early in Section 18.3.
B is *false*: MDT has resulted in the elimination of leprosy in many countries.
C is *false*: MDT can stop the progress of the disease, but it cannot restore damaged nerves.
D is true: as you see in Figure 18.1.
E is true: case finding is a very important way of reducing the incidence of the disease.
F is *false*: this is only one part of case finding. Also involved (Section 18.3.1) is active case finding, where contacts of those with leprosy are examined.

SAQ 18.4

(a) You should suspect leprosy because weakness of the hands is a sign of leprosy. You should take his history according to the guidelines in Box 18.2 and examine any skin patch for loss of sensation. In addition, you should do sensitivity tests (ST) and voluntary muscle tests (VMT) on both wrists.
(b) Skin signs such as these do not suggest leprosy and the fact that the patient's responses to VMT are normal is further evidence that the disease is not present.

Study Session 19

SAQ 19.1

First, count the number of skin patches and check whether a peripheral nerve is involved in order to classify the type of leprosy into PB or MB (Section 19.1). If in doubt, classify as MB.

(a) Tesfaye is MB because he has four skin lesions and weakness in both hands, which is a sign of nerve involvement.
(b) Hiwot is PB because she has only three skin lesions.
(c) Getachew is MB because he has five skin lesions and eyelid gap, an indication of involvement of the nerves serving both eyes.

SAQ 19.2

First determine the classification of the leprosy patient, then decide whether to give PB- or MB-MDT.

(a) Bizuwork is a PB patient because she has four skin lesions. She should be given PB-MDT.
(b) Ato Mesele is an MB patient because although he has only one skin patch he also has weakness in both hands (an indication that the nerves responsible for movements of both hands are involved). He should receive MB-MDT treatment.
(c) Yohanes has a total of five skin lesions and no muscle weakness. He is a PB patient and should receive PB-MDT.

SAQ 19.3

You should ask the patient how she/he feels and whether she/he has any complaint since the last visit. Then carry out VMT/ST and record your findings. Then inform the patient about treatment, looking for feedback to check what you say has been understood and clarify any issues the patient may raise. Finally, give/supervise and record the first dose of MDT for the new month, give the patient the blister pack, and remind the patient to inform you about any complaints during the month.

SAQ 19.4

You can prevent patients from defaulting by giving medicines regularly and informing the patient about what is required. In addition, make drug collection accessible and flexible, identify and refer patients with complications promptly. It is also important that you trace patients who miss a drug collection date or clinic day, carry out regular patient reviews and discuss any findings or concerns during clinic visits. Overall, you need to display an encouraging and positive attitude, to help motivate patients.

SAQ 19.5

Before now, you should have visited him at home to find out why he has been absent from treatment and discuss how to prevent future treatment interruption. You should have reminded him about the need to keep treatment appointments to avoid worsening of illness and possible resistance of the bacteria to treatment.

On his return today, you should ask him about the progress of treatment and carry out a physical examination. Remind him that he has to complete the remaining seven blister packs within 11 months without fail. Tell him to always inform you in advance if he needs to be away from home so that you can give him his medicines for self-administration for the anticipated period of absence.

SAQ 19.6

Look back at Section 19.1 to check your recall of what to do; see how many of the following points you have remembered. You need to:

- Educate patients about leprosy treatment to ensure that she/he adheres to the treatment plan.
- Tell patients that leprosy is curable, and the drugs stop the disease from spreading.
- Remind patients to keep the drugs in a safe, dry, shady place, out of the reach of children.
- Mention that if the drugs are spoiled (change colour or broken), they will be replaced, as MDT drugs are free of charge.
- Tell your patients that leprosy drugs can turn their urine red or skin darker, but they should not worry because this will go away when treatment is completed.
- Make sure your patients know that MDT is safe during pregnancy, for patients being treated for tuberculosis (TB) as well as those who are HIV-positive.
- Ask your patient to inform you when they notice any problem and that she/he will be seeing you monthly for a check-up and to collect MDT.

SAQ 19.7

Prior to discharge from MDT you should examine the patient and record all clinical findings.

SAQ 19.8

Redness and pain in skin lesions of a leprosy patient are signs/symptoms of a leprosy reaction. So, in John's case you should inform him about his sickness, as you learnt in Section 19.3, then give him some aspirin or paracetamol tablets to relieve his pain, before referring him to a clinician for immediate management. John must continue to take MDT. If possible, you should accompany him to the clinic.

Federal Democratic Republic of Ethiopia
Ministry of Health

Communicable Diseases

Part 3 HIV and AIDS

Blended Learning Module for the Health Extension Programme

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Contents

Study Session 20
Introduction to HIV/AIDS

Introduction

In Parts 1 and 2 of this Module, you learnt about the basic principles underlying the transmission, diagnosis, management and prevention of communicable diseases, and the application of this knowledge to vaccine-preventable diseases, malaria, tuberculosis and leprosy. In Part 3 of the Module, we focus on HIV and AIDS — a cause of increasing concern for the health of Ethiopians.

The **human immunodeficiency virus** (**HIV**) is a virus that infects humans and weakens the immune system. As a result, HIV-infected people are more prone to acquiring other infections and diseases that individuals who haven't been infected with HIV are able to fight off easily. The collection of diseases that results from HIV infection is called **Acquired Immunodeficiency Syndrome** (**AIDS**). In this study session, we will first briefly describe the status of the HIV epidemic in Ethiopia, so you understand the magnitude of the problem and how it may affect your community. We will then describe some important functions of the immune system — the main target of HIV in the human body — so that you have a basic understanding of the biology of HIV infection, and how it eventually leads to AIDS. Finally, we will outline the different modes of HIV transmission between humans. This knowledge will help you in providing effective care and health education for your HIV-infected clients, and in the implementation of HIV prevention measures in your community. Care, health education and prevention in the context of HIV/AIDS will be discussed in greater detail in later study sessions.

Learning Outcomes for Study Session 20

When you have studied this session, you should be able to:

20.1 Define and use correctly all of the key words printed in **bold**. (SAQs 20.1 and 20.2)

20.2 Summarise the main features of the HIV epidemic in Ethiopia. (SAQ 20.1)

20.3 Describe the basic components and functions of the immune system, and explain what HIV is and how the immune system is affected by it. (SAQs 20.1, 20.2 and 20.3)

20.4 Describe the usual course of an HIV infection and how it progresses to AIDS in the absence of effective treatment. (SAQs 20.1, 20.2 and 20.3)

20.5 Describe the modes of transmission of HIV. (SAQ 20.1)

20.1 The HIV epidemic in Ethiopia

We begin this study session by describing the current extent of the HIV epidemic in Ethiopia. In order to do this, we first need to remind you of several terms that you learnt in earlier study sessions, which you will need to know again here as we describe the *epidemiology* of HIV/AIDS.
Epidemiology is the statistical study of the occurrence, distribution, potential causes and control of diseases, disabilities or other health problems in human populations.

■ In relation to disease epidemiology, can you recall the difference between prevalence and incidence?

□ Prevalence and incidence were described in Study Session 2 of this Module. **Prevalence** refers to the *total number* of cases of a particular disease or health condition existing in a population at a certain point in time, or during a given period (e.g. a particular month or year). **Incidence** refers only to the numbers of *new cases* of a disease or condition that are identified in a given period.

In the context of HIV/AIDS, you will also come across the term **people living with HIV** (abbreviated to **PLHIV**) when describing epidemic statistics, and indeed when we talk about other aspects of this disease. PLHIV refers to everyone who is infected with the virus, whether or not they remain in good health or have developed any HIV-associated diseases, including AIDS.

In Ethiopia, there were an estimated 1.2 million PLHIV in 2010. Thus, the *prevalence* of HIV infection in Ethiopia in 2010 was estimated to be 2.4% of the general population (2.9% of all females and 1.9% of all males). The HIV epidemic in Ethiopia is generally levelling off (stabilising), with signs of decline in major cities, but a rising epidemic in small towns and market centres. Women and children are particularly affected by HIV/AIDS; in 2010, close to 60% of the PLHIV in the country were females (totalling around 700,000 women) and about 80,000 were children.

Another important factor for you to consider in terms of the impact of HIV/AIDS in your community is geographical distribution. There is a marked variation in HIV infection between regions in Ethiopia (Figure 20.1).

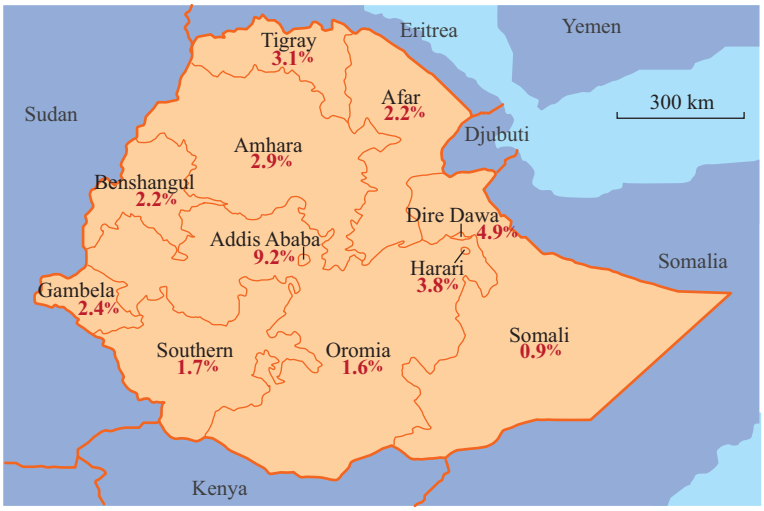


Figure 20.1 Prevalence of HIV in the general population in Ethiopia according to region in 2007. (Source: Federal HIV/AIDS Prevention and Control Office, *Single Point HIV Prevalence Estimate in Ethiopia 2007: Sixth Report*)

■ Compare the prevalence of HIV infection in Addis Ababa to that of other regions in Figure 20.1. Would you expect HIV infection to be more prevalent in urban or rural areas in Ethiopia?

□ The prevalence of HIV in Addis Ababa, an entirely urban population, is much higher (9.2%) than in other regions with a mixed urban and rural population. Therefore, HIV infection appears to be more prevalent in urban than in rural areas.

Indeed, the average prevalence of HIV infection across all urban areas in Ethiopia is 7.7%, whereas in rural areas it is 0.9%. Another epidemiological factor that you should consider in order to help target prevention programmes is the fact that the highest HIV prevalence occurs in the 15–24 years age group. Note that reproductive health issues related to this risk group are covered in the Module on *Adolescent and Youth Reproductive Health*.

In response to the HIV/AIDS epidemic, the government of Ethiopia launched a free HIV/AIDS therapy programme in January 2005. Currently, about 550 health facilities, most of which are health centres, provide HIV/AIDS therapy services in Ethiopia, and you should become aware of the nearest one to your health post. Similarly, you should know the location of the nearest centres providing HIV counselling and testing services (see Figure 20.2; there are more than 2,184 sites providing counselling and testing in Ethiopia), and/or providing services for pregnant mothers (about 1,352 health facilities are mainly focused on prevention of mother-to-child transmission of HIV).

Figure 20.2 Voluntary HIV counselling and testing centres can be found all over Ethiopia. (Photo: Carrie Teicher)

20.2 HIV and the immune response to infection

In this section, you will first learn what HIV is and then about the basic functions of the immune system, which are gradually destroyed by HIV infection. This knowledge will help you to understand how HIV induces disease in infected people.

20.2.1 What is HIV?

HIV is a **virus**, and like all viruses it is not a true cell, but a microscopic particle much smaller than a bacterium. Viruses are essentially minute 'boxes' made of proteins containing the genetic material that carries the information needed to make more viruses of the same type. But viruses cannot reproduce themselves *unless* they invade a true cell and take control of the normal chemical processes taking place in the cell. The virus turns the cell into a virus 'factory', producing millions of new viruses and killing the host cell as it sheds its load of viruses into the body.

There are different types of viruses, and HIV belongs to a group called the **retroviruses**. This name is important because the drugs that have been developed in recent years to treat PLHIV are called **antiretrovirals** (or **ARVs**), and the combination of drugs and other treatments that an individual receives is called **antiretroviral therapy** (or **ART**). You will learn all about ARVs and ART in Study Sessions 22 and 23.

There are two species of HIV, known as HIV-1 and HIV-2. HIV-1 is the virus responsible for the majority of HIV infections in most countries, including Ethiopia. HIV-1 is more infectious and has a much greater ability to be transmitted between people than HIV-2. (HIV transmission will be discussed in more detail in Section 20.4.) HIV-2 infection is mainly prevalent in West African countries, and it is thought to induce progression to HIV-associated diseases and AIDS more slowly than HIV-1.

20.2.2 The human immune system

The **immune system** is a collection of cells, tissues and organs in the human body, with the combined function of protecting us against invasion by infectious agents (see Figure 20.3 on the next page). In the absence of an effective immune system, our bodies would easily be invaded by **pathogenic** (disease-causing) viruses, bacteria, protozoa and parasites, which would

rapidly cause our death. The exact functioning of the immune system is very complex, and explaining it in detail would go beyond the scope of this Module. Rather, we will focus here on a particular aspect of the immune system, so that you can understand what HIV does to the human body once it gets inside us.

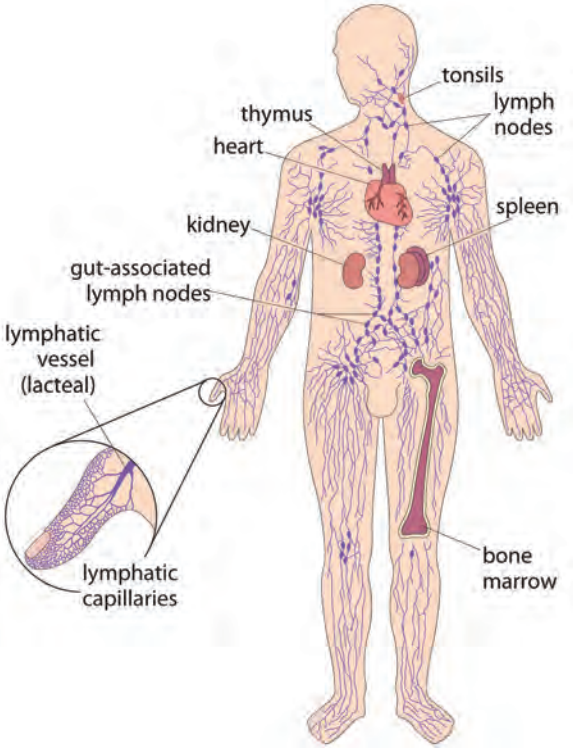


Figure 20.3 The sites in the body (in addition to the blood) where cells of the human immune system are concentrated. (Source: The Open University, SXR376 Preparatory Reading, Figure 1.2, page 7)

Biologists and doctors use the term 'leukocytes' instead of white blood cells; we will use both terms in this study session. You will probably say 'white blood cells' when talking to your clients.

The immune system first recognises infectious agents as not being a normal part of the body, or, in other words, 'foreign' to the body. Then the cells of the immune system organise a concerted attack against the infectious agents in order to destroy them. These immune cells are most often known as **white blood cells** — although the name is misleading because they are found throughout the body's tissues and organs, as well as in the blood, as Figure 20.3 shows. There are several different types of white blood cells, and we will say more about one of them shortly.

The immune response by a person's white blood cells takes a few days to build up during the first time that a particular type of infectious agent gets into his or her body. During this delay, there is usually time for the infectious agents to multiply and cause symptoms of the illness. However, as the immune attack builds up, it may become strong enough to eliminate the infection, and the person recovers spontaneously from a so-called **self-limiting infection**. But in some types of infection, the immune response cannot protect the person sufficiently from the infectious agents, they become more and more ill, and without medical intervention they may eventually die. This is what happens in PLHIV unless they receive modern medical treatments.

One important feature of the immune system is that it very quickly recognises the *same* infectious agents if they have invaded that individual in the past. This is known as **immunological memory**. It enables the immune system to organise a stronger, faster and more efficient attack if it comes across the same infectious agent again in the future. You will see later that the immune

system manages to keep HIV under control for months or years after it first invades the body, but eventually it becomes overwhelmed by the virus.

20.2.3 Lymphocytes and the immune response to infection

We will now describe how the immune system attacks a virus (such as HIV), but note that similar processes occur when bacteria and protozoa invade the human body. The most important group of white blood cells in our defence against infection are the **lymphocytes**, of which there are several types (Figure 20.4). Lymphocytes called *B cells* are responsible for producing special proteins called **antibodies** against the invading infectious agents. Antibodies are proteins that bind to viruses (and other infectious agents), attracting other types of lymphocyte (we have called them *cytotoxic T cells* in Figure 20.4) to come and destroy the invaders. Viruses can only multiply inside the body's own cells, so destroying our own body cells if they have been infected by viruses is a price worth paying, because it slows down the production of more viruses.

Cytotoxic means 'able to kill cells'.

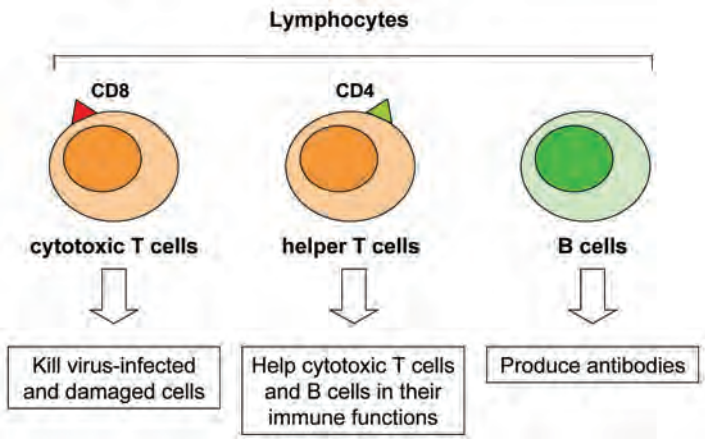


Figure 20.4 Three types of lymphocytes involved in the immune response against infectious agents in the human body. (Diagram: Dr Ignacio Romero)

Most importantly, the *helper T cells* in Figure 20.4 'help' all the other cells of the immune system to make antibodies and attack invading infectious agents. These cells are also known as **CD4 lymphocytes** (or **CD4 cells**) because they have a special protein on their surface called CD4. These are the terms we will use in this Module. Without a large number of CD4 lymphocytes circulating around the body acting as 'helpers', the functioning of the whole immune system collapses, and the person is defenceless against invasion by infectious agents.

20.2.4 Lymph nodes

If you look back at Figure 20.3, you can see that lymphocytes accumulate in sites located throughout the body, including the **lymph nodes** (or lymph glands). When an infection occurs, cells of the immune system, particularly lymphocytes, divide and produce more cells that help fight the infection. This process results in the lymph nodes becoming enlarged, as a result of the increased number of lymphocytes they contain. The lymph nodes in the neck can sometimes be seen as small swellings under the skin, or felt by touching with your fingers, if you have a bad cold or a throat infection. Enlarged lymph nodes may also be felt in the armpits and groin during some other infections. They return to their normal size once the infection has been eliminated.

20.3 How does HIV disable the immune system?

In this section, we explain how infection with HIV disables the human immune system. The key to this lies in the CD4 lymphocytes.

20.3.1 HIV infects the CD4 lymphocytes

Like all viruses, HIV has to enter (i.e. infect) healthy cells in the body in order to produce more copies of itself. These newly-produced viruses are then released into the blood in order to infect other susceptible cells. You may think of an HIV-infected cell as a sort of HIV factory. However, not all cells in the human body can be infected by HIV. Its main targets are the CD4 lymphocytes. Figure 20.5 shows in more detail the mechanism of infection of a CD4 lymphocyte by HIV.

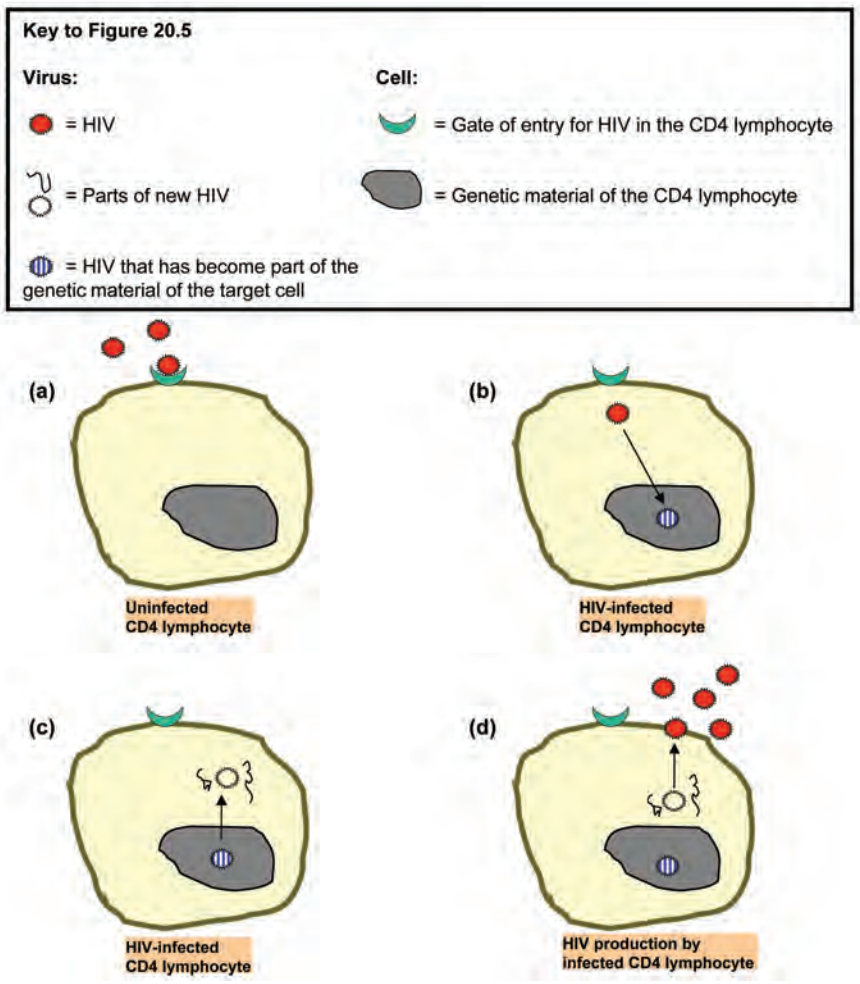


Figure 20.5 the life cycle of HIV. (a) HIV binds to proteins located on the surface of the target cell, in this case a CD4 lymphocyte. (b) HIV enters the cell, changes its structure and becomes part of the genetic material of the infected cell. (c) Many copies of HIV's genetic material are produced inside the cell, together with viral proteins necessary to construct more viruses. (d) HIV's genetic material and proteins assemble at the surface of the cell, and millions of new viruses are released outside the cell, where they can infect other CD4 lymphocytes. (Diagram adapted by: Drs Aschalew Endale and Ignacio Romero, from Participants Manual, WHO/IMAI, *Integrated Management of Adolescent and Adult Illness*, Basic Clinical HIV Care, ART and Prevention Training Course, 2007)

20.3.2 How does HIV damage our immune system?

In a newly HIV-infected person, the virus enters some of the CD4 lymphocytes, which produce many new copies of the virus and shed them into the body. The CD4 lymphocytes eventually die as they release their load of viruses. The new copies of HIV circulate in the body and attack other CD4 lymphocytes, which in turn produce more HIV and then die. This goes on and on — more and more CD4 lymphocytes are destroyed, as more and more HIV copies are made.

- What effect will the destruction of many CD4 lymphocytes have on the immune system's ability to protect the person from other infections?

- The CD4 lymphocytes give essential help to the other types of lymphocytes that make antibodies, or kill virus-infected cells in the body; without this help, the rest of the immune system cannot function properly.

Over time, the number of CD4 lymphocytes declines to the extent that the immune system cannot protect the person from illnesses like chest infections and diarrhoeal diseases that it would normally fight off. We will return to this point shortly.

20.4 The progression from HIV infection to AIDS

Understanding the difference between HIV and AIDS, and the natural course of an HIV infection, is important when you teach community members about HIV transmission and prevention. It also explains why you need to refer PLHIV quickly if they develop new health problems, or their health deteriorates.

20.4.1 The natural course of HIV infection

As you learnt in Study Session 1 of this Module, an infected person may not show symptoms of the disease right away — it generally takes some time to develop a disease after an infection. Likewise, when we say someone is 'infected with HIV', we mean that the person has the virus in their blood, and this has been confirmed by doing a laboratory analysis for HIV, or a rapid diagnostic test (RDT) on their blood. Note that an HIV-infected person may not have any symptoms and may look healthy, but they can still transmit the virus to their sexual partner(s).

You will learn how to do the HIV rapid diagnostic test in Study Session 24 of this Module.

During the first years of infection, the immune system, although weakened by the loss of some of its CD4 lymphocytes, still functions quite well. The infected person will have no symptoms, or only minor symptoms — perhaps a little loss of weight, or inflammation of the sinuses in the head. Many HIV-infected people do not know that they have acquired the virus at this stage.

Over several years, the person's immune system gradually becomes weaker, and they become vulnerable to persistent communicable diseases that they would previously have fought off before symptoms even developed, or would have quickly recovered from. These diseases are called **opportunistic infections (OIs)** because the infectious agents that cause them only have the 'opportunity' to multiply in the body because the PLHIV's immune system has been so badly affected by HIV.

You will learn about opportunistic infections in detail in Study Session 21.

You will learn about prevention of mother-to-child transmission of HIV in Study Session 27, and about HIV in children in Study Session 28.

In adults, it usually takes around 5–10 years after HIV infection before the person becomes very sick, if he/she is not taking ART. The natural course of HIV infection is shorter in children and infants when compared to adults. In Section 31.1 you will learn why HIV-infected children progress faster to AIDS.

20.4.2 Clinical staging of HIV disease and AIDS

WHO HIV clinical staging is described in Study Session 21.

As time passes and the number of CD4 lymphocytes declines even further, to a very low level, the incidence of opportunistic infections and other health problems in PLHIV increase, and the person is said to have reached a particular stage of HIV disease. The final stage of this progressive deterioration is known as AIDS — **Acquired Immunodeficiency Syndrome** — based on diagnostic criteria developed by the World Health Organization (WHO).

20.5 Modes of transmission of HIV

Now you know what HIV does once it has infected someone. But how is HIV transmitted from person to person? Getting infected with HIV does not happen as easily as, for instance, infection by the viruses that cause measles or influenza, which are transmitted in airborne droplets, typically during normal social contact with an infected person.

HIV needs 'transport' to get into the body of another person. This 'transport' can be blood, semen (the male sexual secretion containing sperm), vaginal fluid, or breastmilk.

- Suggest some ways in which these transport media could be transferred from one person to another.

- HIV can be transmitted through sexual intercourse with an infected person; through transfusion of contaminated blood, or blood products, in medical treatment; through sharing of needles, syringes and cutting or perforating objects contaminated by HIV-infected blood or body fluids; through the blood of an infected mother passing into the baby during pregnancy or delivery; and finally through the breastmilk of an infected mother being fed to the baby.

We will look briefly at each of these routes in turn, but you will discover more details in later study sessions.

20.5.1 Transmission through sexual relations

Unsafe sex (sexual intercourse without a condom) is responsible for the majority of HIV infections worldwide. HIV is primarily considered as a **sexually-transmitted infection (STI)**, an infection that is transmitted through sexual intercourse. Different types of sexual practice have different degrees of risk for transmitting HIV, as described below.

Anal sex

Mucosa (also known as mucous membrane) is a very thin layer of moist tissue that lines some organs and body cavities, including the mouth, anus and the reproductive tract.

Anal sex refers to the penetration by the male penis into the anus of another person. It represents the biggest risk of infection if one of the partners is HIV-infected, because the anal **mucosa** does not produce natural lubrication, is fragile, and wounds and bleeds very easily during anal sex. Also, the penis can have **microlesions** (tiny areas of damaged tissue that are too small to be visible with the eyes), which permit the entrance of the virus into the

bloodstream. The soft tissue of the male foreskin in uncircumcised men is especially vulnerable to infection during both anal and vaginal (see below) sex.

Vaginal sex

Vaginal sex involves penetration of the female vagina by the male penis, and is the most common type of sexual practice. HIV can be found in large quantities in the semen of infected men, and to a lesser amount in the vaginal secretions of infected women. The risk of infection is still high in vaginal sex, but less than with anal sex, because the vagina produces natural lubrication and is more elastic. However, unprotected vaginal sex represents a serious risk of HIV infection, because the vaginal mucosa (as well as the penis) can have microlesions which permit entry of the virus into the body. Figure 20.6 is a poster which was designed to raise awareness about the dangers of unprotected vaginal sex, and to inform people about ways to reduce the risk of HIV infection

Figure 20.6 An HIV/AIDS awareness-raising poster used in Ethiopia to warn of the dangers of unprotected sex and inform people about ways they can protect themselves from HIV

Oral sex

The term **oral sex** means there is contact between the genitals and the mouth. Compared to anal and vaginal sex, oral sex represents the smallest risk for HIV transmission. However, very small wounds in the mouth can allow entry of the virus into the body.

Other STIs increase HIV transmission risk

Note that in all types of sexual practice, the presence of other STIs causing damage to the genitals (discharge or ulcers) increases the risk of acquiring and transmitting HIV. This is because, in people with an STI, transmission of HIV is easier due to the presence of lesions in the genital mucosa.

You will learn about other STIs in Study Session 31.

20.5.2 Transmission through blood contact

The blood is another way of transmitting HIV. HIV can be transmitted through transfusion of an infected blood or blood products; sharing contaminated needles and syringes to inject illegal drugs; accidental puncturing of the skin by contaminated instruments during healthcare; and sharing contaminated piercing or cutting instruments used in tattooing or harmful traditional practices, like *uvulectomy* (cutting out the uvula in the roof of the throat) and *female genital mutilation* (cutting the clitoris and labia).

20.5.3 Transmission from mother to child

HIV can be transmitted from an infected mother to her child through the placenta during pregnancy, or (more often) during labour and delivery. Also, breastfeeding can transmit the virus from mother to child because the breastmilk of an infected mother contains HIV, which can penetrate the mucosa lining the baby's gastrointestinal tract.

20.5.4 Myths about HIV transmission

Knowing how HIV is *not* transmitted, and educating community members about the myths that some may believe (see Box 20.1 and Figure 20.7), helps to increase the *inclusion* of PLHIV in society, and reduce the stigmatisation and discrimination they often experience.

Figure 20.7 A poster raising awareness about work-related issues connected with HIV. (Source: http://indiandevelopmentfoundation.blogspot.com/2008/12/facts-about-hivaids.html)

Box 20.1 Myths about HIV transmission

HIV is *not* transmitted by:

- tears, saliva, sweat or urine
- personal contacts — kisses on the mouth, hugging, handshakes
- social contact — at work, in school, in cafés and restaurants
- air or water — sneezing, coughing or swimming
- contact with common items — pens, toilets, towels, sheets, soap
- insects — mosquito bites or bites by other insects.

In Study Sessions 25–27, we demonstrate how understanding the modes of transmission of HIV is the basis for implementing prevention measures against HIV infection at the community level, and for healthcare providers, including yourself.

Summary of Study Session 20

In Study Session 20, you have learned that:

1 At the time of writing, the HIV prevalence in Ethiopia is 2.4%, and an estimated 1.2 million people live with the virus; prevalence is much higher in urban than in rural areas, and more women than men are infected.

2 HIV affects the immune system by destroying the CD4 lymphocytes, which 'help' all the other white blood cells to defend the body against infection.

3 Infected CD4 lymphocytes produce many new copies of HIV and then die. The new viruses infect other CD4 lymphocytes, which make more new viruses and die, until so many CD4 lymphocytes are destroyed that the immune system weakens, and the PLHIV develop opportunistic infections.

4 The first few years with an HIV infection are usually healthy, or with only mild symptoms; the person may not know they are infected and can transmit HIV to others.

5 It may take 5–10 years following HIV infection to develop more serious opportunistic infections and progress to AIDS (in the absence of ART).

6 HIV is transmitted by sexual intercourse, by contact with infected blood and from mother to child.

7 The highest risk of sexual transmission is through unprotected anal sex, but the most common route is unprotected vaginal sex.

8 There are many myths about HIV transmission; educate your community that it cannot be transmitted by normal personal and social contacts with PLHIV, or contact with air, water, common objects or biting insects.

Self-Assessment Questions (SAQs) for Study Session 20

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 20.1 (tests Learning Outcomes 20.1, 20.2, 20.3, 20.4 and 20.5)

Which of the following statements is *false*? In each case, explain what is incorrect.

A HIV is more prevalent among young sexually active people than among elderly people.

B In Ethiopia, more females than males are infected with HIV.

C In most cases, an HIV infection can lead to AIDS in a few months.

D In the early course of HIV infection, people may not know that they are infected with the virus because they feel healthy (have no symptoms and signs).

E HIV mostly infects the red blood cells of humans.

F HIV can only be transmitted through sexual intercourse with an infected person.

G HIV is not transmitted through oral sex.

H Unprotected anal sex has a lower risk of transmission of HIV than unprotected vaginal sex.

I Eating and shaking hands with PLHIV *cannot* transmit HIV to uninfected individuals.

SAQ 20.2 (tests Learning Outcomes 20.1, 20.3 and 20.4)

The main targets of HIV infection are the CD4 lymphocytes.

(a) What is a CD4 lymphocyte and what is its role in the human body?
(b) How does HIV infection of the CD4 lymphocytes determine the natural course of HIV disease progression to AIDS?
(c) Is the progression from HIV infection to AIDS the same for every person living with HIV?

SAQ 20.3 (tests Learning Outcomes 20.3 and 20.4)

Why are opportunistic infections given this name?

Study Session 21 Opportunistic Infections and WHO HIV Clinical Staging

Introduction

In this study session, you will be introduced to the most common opportunistic infections and diseases that result from the decreased immunity observed in people living with HIV (PLHIV). Knowledge of the signs and symptoms of opportunistic infections will enable you to easily recognise them in patients in your healthcare and community settings.

In addition, you will learn how to categorise HIV patients into the four stages recognised by the World Health Organization (WHO). The WHO clinical staging system has been adapted by the Ethiopian Federal Ministry of Health (FMOH) to include a list of the common infections and diseases occurring in PLHIV in an Ethiopian context. After studying this session, you should be able to group patients living with HIV into the four different WHO clinical stages of HIV/AIDS. Staging will help you to differentiate patients who need urgent clinical assessment and referral to the nearest health facility to receive standardised care and treatment interventions.

Lastly, this session describes the standard **chemoprophylactic treatments** for opportunistic infections offered to PLHIV. You are not expected to provide prophylactic treatments at your setting, but you should be familiar with the commonly used prophylactic drugs so that you can make community follow-ups for PLHIV.

Chemoprophylactic treatments (or chemoprophylaxis) refers to drug-based medication taken to prevent opportunistic infections from developing.

Learning Outcomes for Study Session 21

When you have studied this session, you should be able to:

21.1 Define and use correctly all of the key words printed in **bold**. (SAQ 21.1)

21.2 Explain why opportunistic infections occur more frequently in PLHIV. (SAQs 21.1 and 21.2)

21.3 Identify common opportunistic infections in PLHIV and use this knowledge to help patients seek healthcare promptly. (SAQs 21.2 and 21.3)

21.4 Describe WHO HIV clinical staging and classify patients into the appropriate clinical stages. (SAQ 21.3)

21.5 Explain the use of chemoprophylactic treatments to prevent opportunistic infections in PLHIV. (SAQs 21.1 and 21.4)

21.1 What are opportunistic infections?

An **opportunistic infection** is an infection caused by harmful infectious agents, or **pathogens** (bacteria, viruses, fungi, parasites or protozoa), that usually do not cause disease in a healthy person, i.e. one with an immune system whose function is not impaired. Opportunistic infections observed in PLHIV include a wide range of diseases, from minor ailments like chronic skin itching to severe diseases such as tuberculosis (TB).

You may be asking yourself why PLHIV are so susceptible to opportunistic infections compared to an uninfected person. Remember from Study Session 20 that the immune system in HIV-infected people becomes progressively weakened. A weak immune system presents an ‘opportunity’ for

An **immune-competent** person is an individual whose immune system is healthy and functions normally.

pathogens to cause an infection. Thus, PLHIV can be infected by pathogens causing opportunistic infections more easily than HIV-negative immune-competent people, because HIV damages the function of the immune system.

There are several important issues that we need to consider here before we describe the possible opportunistic infections that PLHIV may present (Section 21.4).

First, serious opportunistic infections usually develop 5 to 10 years following infection with HIV. You should expect a person who is infected with HIV to show minor and/or mild episodes of opportunistic infections during the early period of the disease. However, untreated PLHIV will increasingly acquire more serious infections as they progress to AIDS, mainly due to the gradual deterioration of their immune system.

- Based on your previous study of the role of the immune system in the progression to AIDS, why do you think serious opportunistic infections do not develop until later in the course of the disease?

- As you learnt in Section 20.2, during the first few years of HIV infection, a person's immune system is weakened, but it still functions quite well. Thus, it is able to fight off most infectious agents for some time.

Nasal means associated with the nose and its related structures.

Indeed, an HIV-infected person may have no symptoms during the first stages of HIV infection. Sometimes minor symptoms like skin diseases, a little loss of weight, or repeated *sinusitis* (inflammation of the nasal sinuses and nasal passages) may be present, and this is indicative of a slightly weakened immune system. The most important information for you to remember here is that the immune system has to be compromised beyond a certain level for serious opportunistic infections to arise in PLHIV.

Secondly, the onset of opportunistic infections will be different for each person living with HIV, and will depend on many factors such as nutritional status, exposure to pathogens, individual level of immunity, etc. These factors differ from person to person. Hence, in some cases PLHIV may progress to AIDS rapidly, while in others it may take longer for serious opportunistic infections to arise.

Thirdly, not all PLHIV develop the same opportunistic infections. The opportunistic infections developed by a person living with HIV depend primarily on the pathogens they have been exposed to. Although progression to AIDS from HIV infection follows a somewhat stereotyped series of different clinical stages, each individual patient has a unique pattern of progression through them (i.e. they present with different opportunistic infections at each stage).

Finally, we also need to briefly consider opportunistic infections in the context of HIV-infected children (Study Session 28). Indeed, opportunistic infections appear earlier in children than in adults. In the absence of treatment, around half of HIV-infected children die by the age of two years, due to serious opportunistic infections and diseases. This is because children have immature immune systems, so their immune system becomes weakened faster than in adults, who already have a well-developed immune system before they get HIV.

In addition, other factors that influence the onset of opportunistic infections, such as exposure to pathogens and malnutrition, are more common problems in children than in adults. You will be learning about HIV in children in detail in Study Session 28. Here, we will be focusing on opportunistic infections occurring in adults.

21.2 Why are opportunistic infections common in PLHIV?

In Study Session 20, you learned that **CD4 lymphocytes** (also known as **CD4 cells**) are a type of white blood cell with important functions in immunity. In this study session, we will use the simpler term, CD4 cells.

■ What is the function of CD4 cells in the immune system?

□ CD4 cells help to activate other white blood cells in the immune system, in the defence of the body against invasion by pathogens (Section 20.2.3).

Indeed, a reduced number of CD4 cells results in an impaired immune system. The lower the number of CD4 cells, the more impaired the immune system will be. Remember that HIV weakens the immune system precisely by infecting (and ultimately destroying) CD4 cells. Hence, the **CD4 count** (i.e. the number of CD4 cells in a specified volume of blood) is a good indicator of the 'health' of the immune system in PLHIV.

The CD4 counts of *uninfected* people usually fall between 800 and 1500 cells/mm³. At the early stages of the disease, HIV-infected people with immune systems that are functioning adequately have CD4 counts between 450 and 1500 cells/mm³. However, the risk of acquiring opportunistic infections increases proportionally to the decline in CD4 counts observed as the disease progresses. In other words, if the CD4 count falls below a certain limit, the immune system is unable to cope with invading pathogens and opportunistic infections become more frequent. In general, the following thresholds concerning CD4 counts are observed in adults and adolescents:

The concentration of cells in the blood is usually expressed as the number of cells per cubic millimeter (cells/mm^3), which is the same volume of blood as a millilitre (ml).

- When the CD4 count has decreased below 450 cells/mm³, a person living with HIV will start to acquire some mild or moderate opportunistic infections.
- When the CD4 count has decreased below 200 cells/mm³, a person living with HIV is highly likely to acquire severe opportunistic infections. It is at this stage that a person living with HIV is considered to have AIDS.

■ Based on your previous studies, why are CD4 counts determined in the blood, and not in other tissues and/or fluids such as urine?

□ CD4 cells reside primarily (although not exclusively) in the blood, where they are most likely to encounter invading pathogens (Section 20.2.2 and Figure 20.3).

21.3 WHO HIV clinical stages in adults and adolescents

The **WHO HIV clinical staging system** is a staging system developed for PLHIV to help healthcare providers, such as Health Extension Practitioners, estimate the degree of immune deficiency that an HIV patient presents. **Staging** means categorising the patient clinically into one of the four WHO HIV stages. It is useful to know these stages because it enables you clinically to identify patients with mild and severe diseases associated with HIV.

A PLHIV in WHO clinical stage 1 usually does not have a serious immune deficiency, and shows no signs of opportunistic infections (i.e. they are asymptomatic — no symptoms). A patient in WHO clinical stage 2 also does not have a serious immune deficiency, but usually shows signs of mild opportunistic infections. Patients in stage 3 or 4 usually have a severe immune deficiency, and show signs of moderate and severe opportunistic infections respectively. Stage 4 is considered to be AIDS.

- Would you expect a person living with HIV in stage 2 to have a higher or lower CD4 cell count than a person living with HIV in stage 4 of the WHO clinical staging system? Why?

- As the immune status of a person living with HIV becomes weaker, the HIV clinical stage gets higher. Therefore, stage 2 patients have stronger immunity than stage 4 patients, and the CD4 cell count is higher in stage 2 than in stage 4 patients.

Table 21.1 (on the next page) summarises the WHO HIV clinical staging for adults and adolescents adapted for the Ethiopian primary healthcare setting. Most opportunistic infections common in PLHIV will be explained in detail in Section 21.4, but for now you should use Table 21.1 as a reference to give you an idea of how clinical staging of PLHIV is implemented. Some opportunistic conditions may be diagnosed by a health worker in a health centre, whereas others need a diagnosis by doctors or health officers working at regional hospitals (marked with an asterisk in Table 21.1). These patients should be referred for appropriate diagnosis and treatment. Note that if the patient has clinical conditions that fall into more than one WHO clinical stage, the patient will be placed in the *highest* WHO clinical stage that fits the symptoms.

We will discuss the WHO paediatric staging for children with HIV in Study Session 28.

However, staging of a person living with HIV is not a permanent fixture. For example, a PLHIV who has been successfully treated for, and recovered from, *Pneumocystis* pneumonia may be downgraded from stage 4 to stage 3 if no other severe conditions are present.

Some opportunistic conditions may be easily identified by Health Extension Practitioners (HEPs), and these will be explained in detail in Section 21.4. For other opportunistic infections you may come across in PLHIV, a short description has been included in the table. You are not expected to memorise the details of these latter conditions. All conditions that require a diagnosis by doctors or health officers working at regional hospitals are marked with an asterisk.

Table 21.1 WHO adult and adolescent HIV clinical stages. (* requires diagnosis by a doctor or health officer)

Stage 1 **Asymptomatic**	**Stage 2** **Mild disease**
No symptoms or only persistent generalised lymphadenopathy (PGL) (Section 21.4.1)	Weight loss 5–10% Skin problems (Section 21.4.2): seborrhoea prurigo (PPE) herpes zoster Mouth/throat problems (Section 21.4.3): angular chelitis recurrent mouth ulcers Recurrent upper respiratory infections (repeated throat infections, sinusitis, or ear infections)
Stage 3 **Moderate disease**	**Stage 4** **Severe disease (AIDS)**
Weight loss greater than 10% Mouth/throat problems (Section 21.4.3): oral thrush oral hairy leukoplakia acute necrotising ulcerative gingivitis/periodontitis (severe gum disease accompanied by ulcers) Diarrhoea (for more than 1 month; sometimes intermittent) Unexplained fever (for more than 1 month; sometimes intermittent) Severe bacterial infections (e.g. pneumonia, muscle infection): pulmonary TB (Section 21.4.4) TB lymphadenopathy (chronic swelling of lymph nodes around the lungs)	HIV wasting syndrome (Section 21.4.5) Oesophageal thrush (Section 21.4.3) Herpes simplex ulcerations (large and chronic painful wounds on the genitals and/or anus for more than 1 month) Lymphoma* (cancer of the immune system) Kaposi's sarcoma* (dark lesions on the skin and/or mouth, eye, lungs, intestines) Invasive cervical cancer* (cancer of the female reproductive system) *Pneumocystis* pneumonia* (severe pneumonia with shortness of breath on exertion and dry cough) *Extrapulmonary* TB* (TB in tissues other than lungs, e.g. bone) *Cryptococcal* meningitis* (meningitis caused by a fungus which can present without neck stiffness) *Toxoplasma* brain abscess* (infection of the brain by a parasite) Visceral leishmaniasis* (infection of internal organs by a protozoan) HIV encephalopathy* (neurological impairment).

21.4 Common opportunistic clinical manifestations in people with HIV

In this section, we will be describing the clinical signs and symptoms associated with common opportunistic clinical manifestations that you may encounter in PLHIV during community visits, or at your health post. Where possible, we have included photographs showing typical clinical manifestations of an opportunistic disease in a PLHIV, so that you become familiar with them.

Identifying opportunistic infections and diseases will help your work in the context of PLHIV in two ways. First, you may be able to categorise patients in one of the four stages of the WHO HIV clinical staging. You will then be able to refer them to the nearest health centre for comprehensive HIV services, such as cotrimoxazole chemoprophylaxis (used for prevention of opportunistic infections, explained in Section 21.6), and for specific treatments for HIV/AIDS. In some cases, you will need to refer the person living with HIV urgently, whereas in others you will just need to reassure the patient, and/or treat minor ailments. Note that all conditions described below should be referred to the nearest health centre if they are clinical stage 2 and above, with increasing urgency the higher the WHO clinical stage.

Secondly, if staging has been carried out by a health worker at a health centre or hospital, you will be able to appreciate at what stage of the disease a person living with HIV is, and provide the best possible care for that patient.

21.4.1 Persistent generalised lymphadenopathy (PGL)

Persistent generalised lymphadenopathy (PGL) is a chronic swelling of the lymph nodes in at least two areas of the body outside the groins, which lasts three months or longer. PGL is common in the neck and underarm areas, as shown in Figure 21.1. Up to half of PLHIV show PGL at one point during disease progression. In some instances, PGL is present even if they are in the early stages of the disease (asymptomatic stage), i.e. when the patient has relatively good immunity. PGL results from a reaction of the patient's immune system against the virus entering the body and establishing a chronic infection. You should reassure a person living with HIV that this sign does not affect their overall health.

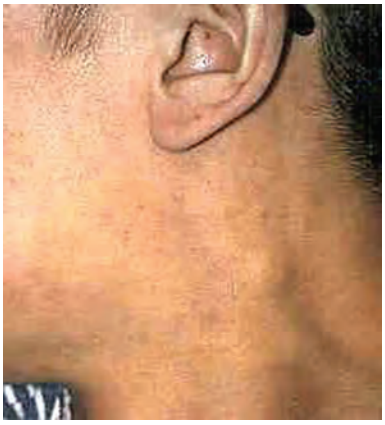


Figure 21.1 PGL on the left side of the neck. Note the swelling of the lymph node. (Photo: *Training Guidelines for Integrated Management of Adolescent and Adult Illnesses* (IMAI), World Health Organization, Ethiopian Adaptation, 2007)

21.4.2 Skin problems

Skin problems are common in HIV/AIDS patients. You need to differentiate minor skin problems from other severe opportunistic diseases that also present with skin manifestations, but need urgent referral. For instance, fungal infections in the blood and internal organs such as *cryptococcosis* (Stage 4; see Table 21.1), may also result in nodular skin lesions. The following minor skin problems are indicative of WHO clinical stage 2, and you should refer PLHIV presenting these to the nearest health centre for treatment.

Itching skin rash may be due to the following two conditions:

Seborrhoea is a scaly skin rash that usually appears on the edge between face and hair, on the side of the nose, or on the chest. The areas with the rash often contain greasy or oily scales, and are surrounded by some redness of the skin (Figure 21.2).

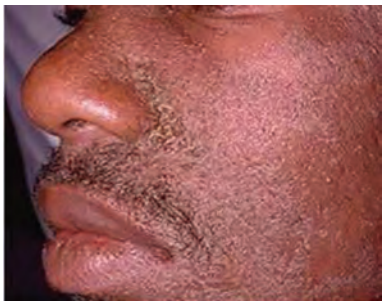


Figure 21.2 Scaly skin rash on the face, mainly around the nose, caused by seborrhoea.
(Photo: WHO, 2007, as in Figure 21.1)

Prurigo (Pruritic Papular Eruptions, PPE) is an itchy skin eruption on the arms and legs. Often it has small **papules** (small, solid and usually inflammatory elevations of the skin) and scratch marks. Once cleared, papules may leave dark spots with light centres (Figure 21.3).

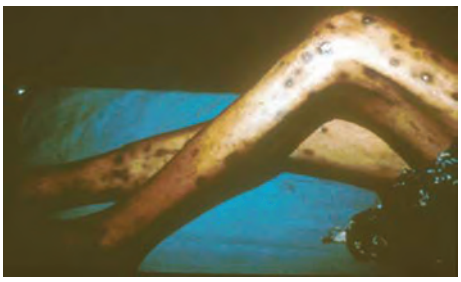


Figure 21.3 Multiple papular rash caused by PPE.
(Photo: WHO, 2007, as in Figure 21.1)

Herpes zoster ('*almaz bale chira*' in Amharic) is a painful blistering skin rash caused by the *herpes zoster* virus (also known as *varicella zoster*). It is characterised by **vesicles** (fluid-filled blisters formed in, or beneath, the skin) that appear in only one area on one side of the body, usually on the chest (Figure 21.4), but also on a leg, arm or one side of the face or the back. Vesicles then turn into lesions, and later into crusts that may become inflamed, and even infected. Vesicles usually heal in two to three weeks and they rarely reappear, but there is often scarring after healing. Note that vesicles are accompanied by intense shooting pain, and sometimes the pain may continue after the lesions heal.

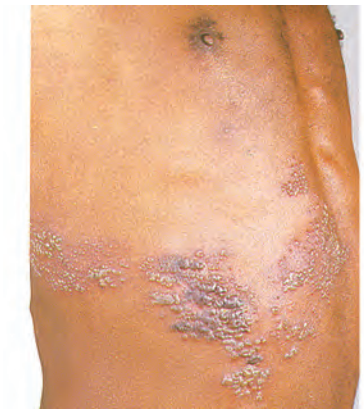


Figure 21.4 Vesicles around the lower chest area, caused by herpes zoster.
(Photo: WHO, 2007, as in Figure 21.1)

21.4.3 Mouth, throat and oesophagus problems

Mouth and throat problems are also common in HIV patients. Mouth and throat problems include sores at the corners of the mouth, and fungal infections of the oral mucosa and the oesophagus (the tube that connects the mouth and throat to the stomach). These problems are indicative of different WHO clinical stages (2 to 4), and you should refer PLHIV presenting these to the nearest health centre, with a degree of urgency related to the specific stage.

Angular chelitis: These are small chronic sores or cracks around the lips, often at the corners of the mouth (Figure 21.5). Angular chelitis occurs early in HIV infection, and is indicative of WHO clinical stage 2.

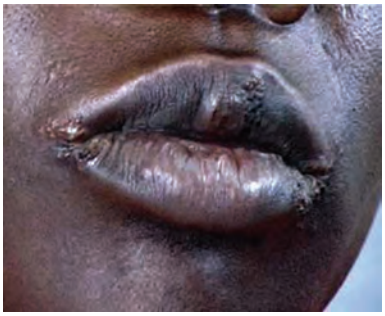


Figure 21.5 Small sores and cracks, at the corners of the mouth caused by angular chelitis. (Photo: WHO, 2007, as in Figure 21.1)

Recurrent mouth ulcers (aphtous ulcers): These are small sores or ulcers inside the mouth that appear repeatedly. Ulcers are painful, self-healing and can recur. They can also involve the gums and throat. Note that mouth ulcers are also common in people who are not HIV positive who, for example, have malnutrition. However, in PLHIV, the ulcers are usually severe, making food intake difficult.

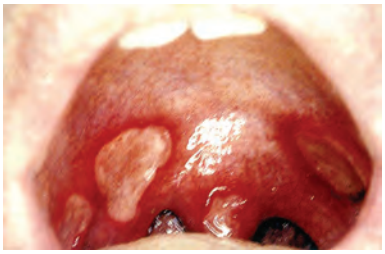


Figure 21.6 Recurrent aphtous ulcers on the upper part of the mouth. (Photo: WHO, 2007, as in Figure 21.1)

Oral thrush: Also known as oral candidiasis, this is an infection of the lining of the mouth caused by a fungus called *candida* (the same organism that causes oesophageal thrush which is decribed below, and vaginal candidiasis; see Study Session 31). Oral thrush is a sign of clinical stage 3, and is characterised by white patches (although at times they may appear red) that can be removed with an oral spatula (Figure 21.7).

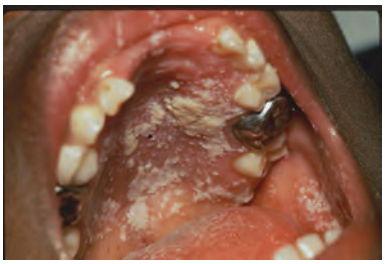


Figure 21.7 White patches in the mouth caused by oral thrush. (Photo: WHO, 2007, as in Figure 21.1)

Oesophageal thrush is a *candida* infection of the oesophagus. You can identify patients with oesophageal thrush by asking them whether they experience pain while swallowing. A patient who has white patches indicative of oral thrush, *and* who has severe pain on swallowing, may have oesophageal thrush. Oesophageal thrush is a serious infection, since it can prevent the patient from eating. The pain may be so intense that a patient is unable to swallow. Oesophageal thrush indicates a higher degree of immune suppression than oral thrush, and is a sign of clinical stage 4 (which requires an urgent referral to the nearest health centre).

Oral hairy leukoplakia appears as fine white patches (e.g. white vertical lines) on the side of the tongue, which are painless but cannot be removed. Oral hairy leukoplakia is different from oral thrush or oesophageal thrush in that it does not need to be treated. However, oral hairy leukoplakia (like oral thrush) is still a sign of clinical stage 3, and the patient should be referred to the health centre for health check-ups.

21.4.4 Pulmonary tuberculosis (PTB)

Pulmonary tuberculosis (PTB), that is, TB in the lungs, is extremely common in PLHIV. Remember from Study Session 13 that you should suspect pulmonary TB if a patient has a chronic cough for more than two weeks, whitish sputum, fever or sweating (often at night), loss of appetite, weight loss, and sometimes chest pain or spitting up blood. The presence of pulmonary TB in a person living with HIV indicates WHO HIV clinical stage 3. Note that extra-pulmonary TB (outside the lungs) is indicative of WHO clinical stage 4, and requires an urgent referral.

21.4.5 HIV wasting syndrome

A **syndrome** is actually not an opportunistic infection, but a clinical presentation in patients consisting of specific signs and symptoms**.**

- Can you recall an example of a syndrome?

- Acquired immunodeficiency syndrome, or AIDS.

As the disease progresses, the immune system of PLHIV is increasingly weakened, and this is associated with a gradual loss of weight. At WHO clinical stage 4, HIV wasting syndrome is characterised by an extreme loss of weight (more than 10%), associated with chronic fever and/or chronic diarrhoea. Patients presenting with HIV wasting syndrome require urgent clinical treatment and care, and should be urgently referred to the nearest health centre.

- A 32-year-old person living with HIV comes to your health post with unexplained weight loss of 7 kg. His normal weight was 60 kg, but he doesn't complain of other health problems. How do you explain his weight loss in terms of WHO HIV clinical staging?

- Weight loss is one sign used in WHO HIV clinical staging. In this case, the patient has lost 7 kg, which is 11.6% (7 x 100/60) of his normal body weight. Losing more than 10% of normal body weight will immediately put him at WHO clinical stage 3. This patient might have other opportunistic infections that he is not aware of, and he needs to be referred to the health centre for further investigation.

21.5 Opportunistic infections and provider-initiated counselling and testing

You should be aware that only HIV-infected people can be categorised using the WHO clinical staging system. Occasionally, a person showing signs of opportunistic infections may not know their HIV status. If you suspect an HIV-related disease, you should offer them provider-initiated testing and counselling (Study Session 24). This is particularly recommended for individuals with PGL (persistent generalised lymphadenopathy), the most common clinical presentation that leads you to suspect HIV infection. Similarly, the presence of *herpes zoster* scars, or unexplained weight loss, should be indications for you to advise individuals with unknown HIV status (especially if they also show PGL) on provider-initiated HIV testing and counselling.

■ Makeda is a 23-year-old woman who has come to your health post for a consultation. She complains about swellings under her arms and on her neck. What would you advise Makeda?

□ First, you need to verify whether the swellings appear to be PGL. If so, PGL is a good reason for you to suspect HIV infection in this patient. You may need to ask Makeda if she knows her HIV status. If she is a person living with HIV, you should reassure her that PGL will not affect her health. If she does not know her HIV status, you should offer her provider-initiated counselling and testing (Study Session 24).

21.6 Prevention of opportunistic infections

It is very important to know about measures to reduce the risk of developing opportunistic infections in PLHIV, some of which can be fatal. Prevention is carried out by giving certain drugs to PLHIV on a daily basis, before they develop symptoms of the disease, in this case, opportunistic infections. As you learnt in Study Session 1, the use of drugs for the prevention of common infectious diseases is called **chemoprophylaxis**. Good prophylaxis is not expensive or complicated, but can increase the duration and quality of life of a person living with HIV.

■ Give one example of a chemoprophylactic drug used in prevention of an infectious disease, which you learned about in Part 2 of this Module.

□ Isoniazid is a chemoprophylatic drug used to prevent TB infection in children and PLHIV (Study Session 16).

The most commonly used prophylactic drug for HIV/AIDS is **cotrimoxazole**, a wide-spectrum antibiotic that targets the pathogens causing the most common opportunistic infections. These include pneumonia, brain abscess and chronic diarrhoea caused by protozoans, as well as by some bacterial infections. Note that you do not need to memorise these infections as they need to be diagnosed at a health centre or regional hospital. However, you will need to closely monitor patients on cotrimoxazole in your community on follow-up visits or consultations, in order to check whether they are taking their drugs correctly, and/or to refer them if they experience adverse side-effects.

21.6.1 Criteria for starting cotrimoxazole prophylaxis by adult PLHIV

All HIV-positive people at WHO clinical stages 2, 3, 4, or with a CD4 count less than 350 cells/mm³, should start **cotrimoxazole prophylaxis**. Patients should first be asked if they are allergic to sulfa-containing drugs like Fansidar — if they are, these patients should *not* be given cotrimoxazole. The drug regimen for cotrimoxazole prophylaxis is two 480 mg tablets, or one 960 mg tablet daily. Note that you are not expected to either prescribe or refill prophylactic drugs. However, information about the criteria for cotrimoxazole prophylaxis will enable you to identify patients who need prophylaxis, and to refer them to the appropriate health centre.

Sulfa drugs are mainly antibiotics related to sulphonamide. Many PLHIV may develop adverse reactions to this class of drugs. Cotrimaxazole is a sulfa-containing drug.

21.6.2 Duration of cotrimoxazole prophylaxis for adult PLHIV

If a person living with HIV has no access to HIV treatment, cotrimoxazole prophylaxis should be taken for the rest of the patient's life. If the patient has access to antiretroviral therapy (ART) for HIV (Study Session 22), cotrimoxazole prophylaxis should be stopped when the CD4 count has increased to 350 cells/mm³ and remains above that level for at least six months. Note that only the healthcare provider at the health centre should stop the cotrimoxazole prophylaxis — you are not expected to stop cotrimoxazole prophylaxis.

21.6.3 Side-effects of cotrimoxazole prophylaxis

If a patient on cotrimoxazole experiences adverse side-effects, medication should be stopped and the patient should be referred to the health centre. Common side-effects include skin rashes involving the eyes or mucous membranes inside the mouth, yellow discolouration of the eyes, and paleness of the conjunctiva (the mucous membrane that lines the exposed portion of the eyeball and inner surface of the eyelids), due to anaemia and tendency to bleed easily.

21.6.4 Monitoring cotrimoxazole prophylaxis

As already mentioned, cotrimoxazole prophylaxis is prescribed by health workers at the health centre or regional hospital. You are not expected to prescribe the drug, but once these patients are referred back to the community you should make sure they are taking their drugs correctly. As a standard, you will need to follow-up patients on cotrimoxazole prophylaxis every month for the first three months. Later, if no problems occur and if the patient takes the drugs correctly, the follow-up can be done every three months.

Follow-up visits from you should include monitoring for side-effects, and education of the patient on the importance of taking the drugs correctly (this will be further explained in Study Session 23).

Summary of Study Session 21

In Study Session 21, you have learned that:

1 An opportunistic infection is caused by pathogens that usually do not cause disease in a healthy person, i.e. one with a healthy immune system.

2 The WHO HIV clinical staging system is a staging system developed for patients with HIV to help determine the degree of immune deficiency.

3 Identifying opportunistic infections and diseases will help you to categorise PLHIV in one of the four stages of the WHO HIV clinical staging. Stages 1 and 2 correspond to asymptomatic or mild disease, whereas stages 3 and 4 imply serious clinical health problems. Stage 4 is AIDS.

4 Common opportunistic infections in PLHIV may be mild (e.g. persistent generalised lymphadenopathy (PGL) at Stage 1), progressing to skin rashes and more serious infections of the mouth, throat and oesophagus at stages 2–4, tuberculosis at stages 3 or 4, and HIV wasting syndrome at stage 4.

5 The most commonly used chemoprophylaxis to prevent common opportunistic infections in HIV/AIDS is to administer cotrimoxazole, a wide-spectrum antibiotic that targets several opportunistic infections.

6 All PLHIV at WHO clinical stages 2, 3, 4, or with a CD4 count less than 350 cells/mm^3, should start cotrimoxazole prophylaxis. Monitoring adherence to the prescribed drug regimen is an important part of the Health Extension Practitioner's role.

Self-Assessment Questions (SAQs) for Study Session 21

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions (SAQs) at the end of this Module.

SAQ 21.1 (tests Learning Outcomes 21.1, 21.2 and 21.4)

Are the following statements that describe the relationship between opportunistic infections in PLHIV and their immune status true or *false*? In each case, explain your reasoning.

A The decline in the function of the immune system of a person living with HIV is associated with the onset and increasing severity of opportunistic infections.

B The onset of severe opportunistic infections usually occurs at CD4 counts between 800 and 1500 cells/mm^3.

C The occurrence of an opportunistic infection in a person who has not been tested for HIV is suggestive of HIV infection.

D PLHIV can be categorised by the WHO clinical staging system according to their most severe opportunistic infection.

SAQ 21.2 (tests Learning Outcomes 21.2 and 21.3)

A 27-year-old woman comes to the health post complaining of a painful rash over her back on the right side which started three days earlier. The pain is severe and runs along horizontally. You examine her and identify that the rash is due to vesicles.

(a) What is the possible diagnosis of this patient?
(b) What will you do to help this patient?

SAQ 21.3 (tests Learning Outcomes 21.3 and 21.4)

You are asked to provide a home visit to a 40-year-old man who has been bedridden for four months. He is extremely thin, has diarrhoea and appears feverish. He can hardly speak. His wife died one year ago and he has two children. The elder son says his father was tested positive for HIV four years earlier, but he has not gone back to the health centre since then.

(a) What is the possible diagnosis of this patient?
(b) What is his WHO HIV clinical staging?
(c) What should be done for the patient and his children?

SAQ 21.4 (tests Learning Outcome 21.5)

A 19-year-old HIV-positive woman comes to you and tells you she wants to stop the cotrimoxazole prophylaxis given to her by the nurse in the nearest health centre. She says she is feeling well and doesn't need to take the drugs any longer. What will you advise her?

Study Session 22 Introduction to Antiretroviral Therapy

Introduction

In this study session you will learn about the main therapy used to treat people living with HIV (PLHIV), and its benefits and goals, so that you will be able to help patients get the full benefits of the treatment, and maintain their health for as long as possible. The treatment used for HIV-positive people is called **antiretroviral therapy**, which can be shortened to **ART**. It consists of giving drugs termed **antiretrovirals** (**ARVs**), which work by attacking the human immunodeficiency virus (HIV) itself.

For ART to be successful, you should be aware of two things. First, ARV drugs should be given in the correct way; that means using a combination of three ARVs which act on the virus differently. Secondly, ART should be given continuously as a *lifelong* treatment. In addition to improving the quality of life for patients, ART also has the benefits of reducing stigma and discrimination, and increasing the chances of PLHIV going to HIV/AIDS services to ask for help.

Even though you are not expected to prescribe ART for patients, you need to be familiar with the basic concepts and the most common adverse side-effects of the drugs. This information will help you to provide good care for PLHIV who are being treated with ARVs. Remember that drug treatments for chronic diseases require **adherence**, which means taking medications as instructed by the prescribing health professional. It is also important for you to trace 'treatment defaulters' (PLHIV who stop taking their medications), to reduce the consequences for the patient, and for public health at large.

Adherence and defaulter tracing, in the context of HIV/AIDS, are discussed in Study Session 23 of this Module.

Learning Outcomes for Study Session 22

When you have studied this session, you should be able to:

22.1 Define and use correctly all of the key words printed in **bold**. (SAQs 22.1 and 22.2)

22.2 Explain what antiretroviral therapy (ART) is, and its goals and benefits. (SAQs 22.1, 22.2 and 22.4)

22.3 Explain why three antiretroviral (ARV) drugs are needed for effective ART and how they can be combined. (SAQ 22.3)

22.4 State the four first-line ARV regimens, their common side-effects, and describe what you should do if these side-effects occur. (SAQs 22.3 22.5)

22.1 The difference between treatment and cure in HIV/AIDS

Knowing the difference between treatment and cure is quite important in providing care to patients with chronic illnesses like HIV/AIDS. **Treatment** is the application of a medicine or a remedy to relieve symptoms and/or signs of an illness; in the context of a communicable disease like HIV/AIDS, it doesn't necessarily mean getting rid of the infectious agent from the patient's body.

On the other hand, **cure** means *eradication* of the cause of the illness — the complete removal of the pathogen from the body; for example, there is a *cure* for malaria or tuberculosis, but not yet for HIV.

You need to understand that antiretroviral therapy for HIV does not cure HIV, because it cannot eradicate the virus from the body. Even though effective treatments to *control* HIV exist now, there is still no cure. It is important that you make sure all the PLHIV in your care also understand this, for the following reasons:

- *HIV treatment is for life:* It will be easier for PLHIV to understand that, because it is not curative, HIV treatment will be for the rest of their lives, and they must continue taking the drugs even though they may have adverse side-effects (which will be covered later in this study session).
- *Drug resistance:* You will be better placed to explain to PLHIV that if treatment is interrupted, HIV may become **drug resistant**, that is, the virus in their bodies will not respond to treatment in future because the virus is no longer susceptible to the drugs. If this happens, it will be necessary to use other drugs that may not be as effective in keeping the virus levels in the blood down, or that may have more side-effects (drug resistance will be referred to again later in this study session).

You will learn more about prevention of HIV transmission for PLHIV in Study Session 26.

- *Minimising risk of transmission:* Since there is still no vaccine to prevent HIV, you will need to educate and discuss prevention strategies with PLHIV consistently. They must understand that they are still able to transmit HIV to a healthy uninfected person, even if they feel healthier because they are on ART.

22.2 The benefits of ART

The benefits of ART can be divided into three — benefits to PLHIV, benefits to the health service, and benefits to the community at large, as described below.

Benefits of ART to the patient:

- Prolongs life and improves quality of life.
- Decreased stigma surrounding HIV infection, since treatment is now available.
- Households can stay intact, because patients survive for so much longer.
- Businesses and jobs can stay intact for the same reason.
- Reduces mother-to-child transmission of HIV.
- Less money is spent on treating opportunistic infections and providing palliative care (end-of-life care).

Benefits of ART to the health service:

- Increased number of people who accept HIV testing and counselling, because treatment is available.
- Increased motivation of health workers, since they feel they can do more for PLHIV.

Benefits of ART to the community:

- Decreased number of orphans.
- Increased awareness of HIV in the community, since more people accept HIV counselling and testing.

22.3 Antiretroviral drugs (ARVs) and antiretroviral therapy (ART)

In Study Session 20, you learnt that HIV is a virus. In fact, there are many types of viruses. The classification of viruses is very complex, and explaining it here would go beyond the scope of this study session. For your work as a Health Extension Practitioner, you only need to know that HIV is a type of virus that is termed a *retrovirus*. Hence, drugs that are used to treat HIV infection are called **antiretroviral drugs**, which can be shortened to **ARVs**.

Antiretroviral therapy (HIV treatment), also known as ART, is a treatment that uses ARV drugs. The two main goals of ART are:

1 to reduce the number of viruses in the patient's blood to a very low level

2 to increase the number of CD4 lymphocytes in the patient as much as possible, to increase the body's immunity to infection, including immunity against HIV.

Lymphocytes are a type of white blood cell involved in the immune system; **CD4 lymphocytes** (or **CD4 cells**) are a specialised type of lymphocyte, which stimulate all the other defensive mechanisms in the immune system. For this reason, they are sometimes also called 'helper T cells'.

Remember from Section 20.2 that once inside the body, HIV first infects a previously uninfected CD4 lymphocyte. Then the HIV-infected CD4 lymphocyte produces many copies of the virus that are released into the blood to infect other CD4 lymphocytes, and so the process goes on, again and again. The ARV drugs work to stop this cycle by acting at different stages of the process.

22.3.1 Groups of ARV drugs

There are three big groups of ARV drugs available in Ethiopia, as listed below:

1 The *NRTI drugs*: this stands for 'Nucleoside and Nucleotide Reverse Transcriptase Inhibitors' (divided into NsRTIs and NtRTIs).

2 The *NNRTI drugs*: this stands for 'Non-Nucleoside Reverse Transcriptase Inhibitors'.

3 The *PI drugs*: this stands for 'Protease Inhibitors'.

Note that you don't need to know the complex mechanisms of action of these drugs. Likewise, you don't need to memorise the names of the drug groups.

Table 22.1 (on the next page) lists the commonly used ARV drugs in Ethiopia, arranged into the various groups, together with some rarely used drugs. But be aware that the table is not a complete list of all the ARV drugs; for example, it does not include all the rare drugs, or drugs that are not yet available in most resource-constrained settings like Ethiopia. You can use Table 22.1 as a reference in case a patient asks you about a specific drug, but remember to refer him or her to a health centre for more detailed advice than you can give at health post level. The drugs listed in the first three columns of Table 22.1 are the ones most widely used in Ethiopia, and we will say more about them later in this study session (Sections 22.3.3 and 22.4).

Table 22.1 Commonly used antiretroviral drugs (with their common abbreviations).

Nucleoside reverse transcriptase inhibitors (NsRTI)	**Nucleotide reverse transcriptase inhibitors (NtRTI)**	**Non-nucleoside reverse transcriptase inhibitors (NNRTI)**	**Protease inhibitors (PI)**
Stavudine (d4T) Lamivudine (3TC) Zidovudine (AZT or ZDV) Didanosine (ddI) Abacavir (ABC)	Tenofovir disoproxil fumarate (TDF)	Nevirapine (NVP) Efavirenz (EFV)	Lopinavir (LPV) Ritonavir (RTV) Atazanavir(ATV)

Note that you do not need to memorise the different classes and names of the drugs in Table 22.1

22.3.2 Why is the combination of three antiretroviral drugs necessary?

Combination therapy, in the context of HIV/AIDS, means prescribing three or more ARV drugs to be taken together. Combination therapy is useful for many reasons. Here are the most important ones.

Three or more drugs are needed to stop HIV

Remember that HIV makes new copies of itself very rapidly in infected CD4 lymphocytes. Given time, HIV infection/production escalates out of control, and eventually will result in high levels of viruses in the blood, and low levels of CD4 lymphocytes.

- What are the consequences of this for PLHIV?
- They are very likely to develop the opportunistic infections described in Study Session 21.

One drug, by itself, can slow down this fast rate of HIV infection and/or production. Two drugs acting at different points of the virus production cycle can slow it down more, and three drugs together have a very powerful effect. Since ARVs from different drug groups attack the virus in different ways, the standard combination in ART is to use three different ARV drugs.

Combining ARV drugs may overcome or delay drug resistance

Viruses, like bacteria, quickly adapt to their environment, so they can carry on multiplying even when the conditions change for the worse. When a person living with HIV is given ARV drugs for the first time, the environment (in this case, the human body), surrounding the billions of viruses, changes so that it is more difficult for the viruses to multiply. HIV quickly adapts to this new environment by changing its structure in ways that make ARV drugs less effective. The result of this process is that it can go on multiplying even when the drugs are present — this is called **drug resistance**.

HIV has to make only a single, small change to its structure in order to resist the effects of a particular group of ARV drugs. However, if drugs from more than one group are given in combination, HIV has to make several different changes in its structure in order to resist them all.

It takes longer for HIV to make all the changes necessary for resistance to develop to two drugs, and when three drugs are given together, it takes even longer. This means that giving a combination of three drugs will remain effective in treating HIV infection for a longer period of time than giving just a single drug (or even two).

Note that HIV/AIDS treatment programmes do not *randomly* prescribe *any three* ARV drugs. There are strict national guidelines on how to prescribe the different ARV drugs in standard combinations in Ethiopia, as in other countries, as you will see below.

22.3.3 How are antiretroviral drugs combined?

A prescribed or recommended collection of medications intended to treat a disease is called a **treatment regimen** (or simply a **regimen**). The regimens used in ART can be first line, second line, or even third line.

First-line regimens

A **first-line regimen** is a combination of drugs that will be given to an HIV-positive patient who has never taken any ARV drugs before. Most commonly, a first-line regimen will consist of two NsRTIs and one NNRTI.

Box 22.1 lists the most common first-line regimens used in Ethiopia at the present time (2010).

Box 22.1 Common first-line drug regimens for ART

- AZT-3TC-NVP
- AZT-3TC-EFV
- d4T-3TC-NVP
- d4T-3TC-EFV
- TDF-3TC-EFV
- TDF-3TC-NVP

The full names of the drugs in Box 22.1 can be found from their abbreviations by looking back at Table 22.1.

Note that 3TC is included in all of the first-line regimens in Box 22.1 (always listed in the middle of the three drugs). Some drugs are not used together in the same regimen. Note that d4T and AZT are not used together, and NVP and EFV are not used together.

Second- and third-line regimens

Many patients on ART will eventually develop **failure of therapy**, which means the first-line regimen will not be effective anymore. This is often because the drugs were not taken correctly, and this allowed HIV to become resistant to them. In that case, the doctor may decide to switch to a **second-line regimen**, which is more expensive. Usually, the second-line regimen will consist of two NRTIs and one PI drug in combination. The second-line regimen is stronger, but there are more pills to take, and this regimen sometimes has food restrictions and more side-effects. Even a second-line regimen can fail, if not taken consistently and correctly, so a third-line regimen may have to be used.

Note that if ART is interrupted, the virus levels in the patient's blood will increase, and the numbers of CD4 lymphocytes will slowly decrease, until finally the health of the patient will deteriorate. Therefore, making sure that ART is continuously maintained, or in other words, that the patient maintains the *adherence* to the treatment, is extremely important.

First-line drug regimens and fixed-dose combinations

First-line ARVs (Box 22.1) are mainly given twice a day. But there are some drugs which are given once a day, like Efavirenz (EFV) and Tenofovir disoproxil fumarate (TDF). Note that Abacavir (ABC) and TDF can also be used as first-line ARV drugs. According to the current Ethiopian ART guidelines, new adult and adolescent patients are not started on a d4T-containing regimen; instead they are prescribed AZT or TDF-containing regimens.

First-line drug regimens commonly include ARVs in **fixed dose combinations**, meaning combinations of three ARV drugs in fixed doses in the *same tablet* (e.g. AZT + 3TC + NVP in one tablet, see Figure 22.1a); this is taken twice a day (every 12 hours) except in the first two weeks of ART. There are also fixed drug combinations which contain two drugs in one tablet (e.g. AZT + 3TC), which is given with a third drug separately (e.g. Efavirenz or EFV, see Figure 22.1 b) in a different tablet.

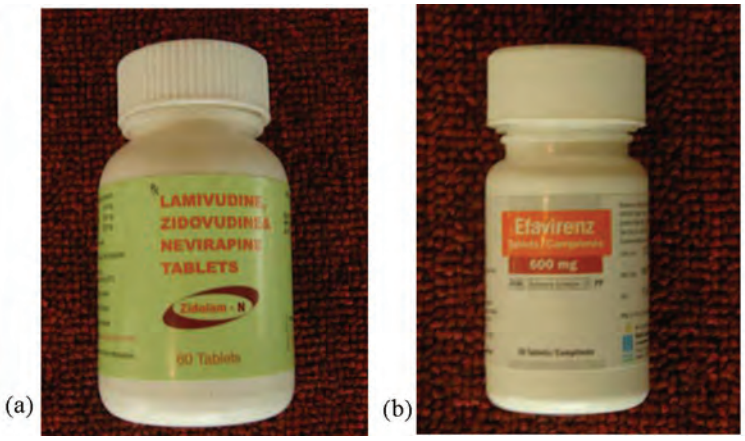


Figure 22.1 Antiretroviral drugs: (a) A fixed-dose combination of Lamivudine (3TC), with Zidovudine (AZT or ZDV) and Nevirapine (NVP) in single tablets. (b) A single drug, Efavirenz (EFV), which may be taken in addition to other ARV drugs. (Photos: Basiro Davey)

22.4 ARV side-effects and how to manage them

Every drug can have **side-effects**, which means unwanted effects that result when taking the drug for treatment. ARV drugs can have multiple side-effects, some of which are common, and others which are rare. The most common side-effects of ARV drugs are shown in Table 22.2 (on the next page). You may need to advise patients when some of these occur, or refer them to a nearby health centre or hospital if serious side-effects arise.

Table 22.2 The most common side-effects of ARV drugs used in the first-line regimen.

ARV drug	**Very common side-effects** Counsel patients about these and suggest ways they can manage them; also be prepared to help manage them when patients seek care at home.	**Potentially serious side-effects** Warn patients, and tell them to seek care *urgently* (or refer them *urgently*) if these occur.	**Side-effects occurring later during treatment** Advise patients to seek care at a health centre or hospital.
Stavudine (d4T)	• Nausea (the sensation of having an urge to vomit) • Diarrhoea	*Refer urgently:* • Severe abdominal pain; • Fatigue and shortness of breath. *Refer as soon as possible:* • Tingling (a sensation of prickling), numbness (unable to feel, or loss of sensations), or painful feet, legs or hands.	Changes in fat distribution of the body: • Arms, legs, buttocks, cheeks become *thin*; • Breasts, belly, back of neck become *fat.*
Lamivudine (3TC)	• Nausea • Diarrhoea.		
Nevirapine (NVP)	• Nausea • Diarrhoea.	*Refer urgently:* • Yellow eyes • Skin rash • Fatigue and shortness of breath • Fever.	
Zidovudine (AZT or ZDV)	• Nausea • Diarrhoea • Headache • Fatigue (a feeling of tiredness, or lack of energy) • Muscle pain.	*Refer urgently:* • Pallor (anaemia).	
Efavirenz (EFV)	• Nausea • Diarrhoea • Strange dreams • Difficulty sleeping • Memory problems • Headache • Dizziness (light-headed, feeling faint, unsteady, loss of balance).	*Refer urgently:* • Yellow eyes • Psychosis or confusion (**Psychosis** involves loss of contact with reality, usually with false beliefs about what is taking place or one's own identity (delusions), and seeing or hearing things that aren't there (hallucinations). It is discussed in detail in the Module on *Non-Communicable Diseases, Emergency Care and Mental Health*). • Skin rash.	

Note that side-effects such as nausea, vomiting and diarrhoea are very common with many ARV drugs, especially in the first 2–3 weeks of treatment. If a patient has nausea, you should advise him/her to take the tablets with food (or just after eating food). Patients who develop diarrhoea should be advised to drink more fluids, including oral rehydration salts, eat small and frequent meals, and avoid spicy foods. If the nausea, vomiting or diarrhoea worsens, the patient should be referred to a health centre or hospital as soon as possible.

Summary of Study Session 22

In Study Session 22, you have learned that:

1 Antiretroviral therapy (ART) means giving antiretroviral (ARV) drugs to people who are HIV-positive to reduce the level of viruses in their bodies and increase the number of CD4 lymphocytes.

2 There are three big groups of ARVs (NRTIs, NNRTIs and PIs).

3 The standard regimen in ART is to give a combination of three different ARV drugs for maximum possible treatment effect, and to overcome or delay the development of drug resistance by HIV. Prescribing only one ARV drug increases the risk of resistance developing quickly to that drug.

4 ART has many benefits, including improving the quality of life for patients, decreasing stigma and discrimination, prevention of transmission of the virus from mother to child, and increasing uptake of other HIV services, like counselling and testing.

5 First-line drug regimens are given to patients who have never taken ARV drugs previously. If these combinations fail, or the patient experiences severe side effects, different second-line or even third-line drug combinations can be prescribed, but these are more expensive and may be less effective.

6 The most common side-effects of ARV drugs are nausea, vomiting, diarrhoea and headaches, especially in the first few weeks of ART. Examples of serious side effects which require urgent referral are severe abdominal pain, fever, yellow eyes, tingling and numbness, fatigue with shortness of breath, yellow eyes, pallor (anaemia) and skin rash.

Self-Assessment Questions (SAQs) for Study Session 22

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions (SAQs) at the end of this Module.

SAQ 22.1 (tests Learning Outcomes 22.1 and 22.2)

Is the following statement *true* or *false*? Explain your answer.

'There are effective ARVs to treat HIV, and a vaccine which cures HIV/AIDS. But these treatments are not available in Ethiopia.'

SAQ 22.2 (tests Learning Outcomes 22.1, 22.2 and 22.3)

Which of the following statements is true? For each *false* statement, explain what is incorrect.

A ART can completely eliminate HIV from the human body.
B The two main goals of ART are to reduce the number of CD4 cells, and eradicate the virus from the blood.
C Two ARV drugs are combined in the most effective treatment for HIV.
D All of the above statements are false.

SAQ 22.3 (tests Learning Outcomes 22.3 and 22.4)

Explain why a combination of three ARV drugs will be more effective at stopping the multiplication of HIV in the human body than two drugs, or one alone.

SAQ 22.4 (tests Learning Outcome 22.2)

Is the following statement *true* or *false*? Explain your answer.

'One of the major benefits of ART is to make the patient feel healthy and to enable him or her to practise unsafe sex, because the treatment stops HIV from being passed on.'

SAQ 22.5 (tests Learning Outcome 22.4)

First read Case Study 22.1, and then answer the question that follows it.

Case Study 22.1 Abebech's story

Abebech is a 47-year-old female who is HIV-positive and living in your village. She started on ART two weeks ago at a nearby health centre. While conducting a household visit you find that she has nausea and has been vomiting one or two times per day since the start of ART. The vomiting occurs several hours after eating. Upon checking her medication you learn that she is taking AZT + 3TC + EFV. She can eat food, and has no fatigue.

What advice should you give to Abebech, and why?

Study Session 23 Adherence to HIV Care and Treatment

Introduction

In the previous study session, you were introduced to the main antiretroviral treatments (ARTs) used for people living with HIV (PLHIV) in Ethiopia. Remember that HIV treatment is a lifelong therapy that improves the quality of life of patients but does not completely eradicate HIV infection; that is, the virus persists within the infected person's body. It is therefore essential that a person living with HIV takes their medication correctly. In this study session, we turn our attention to a critical aspect in HIV treatment and care — adherence. The purpose of this study session is to describe the key concepts of adherence to HIV care and treatment in the context of the services provided for PLHIV in Ethiopia. Here, you will learn why adherence to ART is important, what factors influence adherence from both a patient's and the health facility's perspective, and how you can provide advice to HIV patients in the community and at the health post to achieve optimal adherence.

We will then describe the common barriers to adherence to HIV care and treatment that PLHIV face. This will enable you to help patients to continue their follow-up at healthcare units in order to maintain and improve their health. The knowledge gained in this study session will also help you to assess and identify patients who adhere poorly to their treatment and encounter challenges in taking their drugs properly. Hence you will be able to offer them supportive advice in the form of follow-ups at the community and/or refer them to the nearest health centre to provide additional support and treatment services, and ultimately improve the outcome of patient care.

Learning Outcomes for Study Session 23

When you have studied this session, you should be able to:

23.1 Define and use correctly all of the key terms printed in **bold**. (SAQ 23.1)

23.2 Explain the factors affecting adherence and their importance in maintaining adherence to HIV treatment. (SAQ 23.2)

23.3 Describe optimal adherence to HIV treatment and its goal. (SAQ 23.3)

23.4 Explain the consequences of poor adherence to HIV therapy and its association with drug resistance. (SAQ 23.1)

23.5 Assess the adherence status of PLHIV and advise them on how to improve it. (SAQ 23.3)

23.6 Describe the adherence support mechanisms that cover specific needs of patients on HIV therapy. (SAQs 23.2 and 23.4)

23.1 What is adherence?

Adherence to treatment in the context of any disease is essential to maintain and improve a patient's health. Similarly, adherence to HIV therapy is essential for the general improvement of quality of life of PLHIV. In the context of HIV treatment, **adherence** means that a patient takes antiretroviral (ARV) drugs correctly. Incorrect drug taking may not only be inefficient in

treating HIV infection, but it may also lead to drug resistance (Study Session 22, Section 22.3.2). Using these drugs correctly involves taking the right drug, in the right dose, in the right frequency, at the right time. We will describe the importance of each of these aspects of taking drugs in turn.

Figure 23.1 Adherence means taking the correct ARVs exactly as prescribed. (Photo: Basiro Davey)

- *The right drug*: The drug that is prescribed by the health practitioners should not be changed or replaced by any other drug. PLHIV may take various drugs at any given moment depending on their health situation. Usually, patients take ARV drugs to treat HIV infection and other drugs, such as cotrimoxazole, to prevent opportunistic infections. Therefore, it is not unusual for PLHIV to become confused, and they may find it difficult to differentiate between the many different drugs they may be taking (Figure 23.1). Your support is essential in enabling PLHIV to take the *right drugs*.
- *In the right dose*: As you learnt in the previous study session, ARV drugs have *specific dosages* for adults and children. The dose may also sometimes be different amongst adult patients depending on their health status. Therefore, if you are making follow-ups for patients who are taking drugs for HIV in your community, you have to make sure and encourage them to take the correct dose of the drugs.
- *With the right frequency* (number of times per day): Like other drugs, ARV drugs are prescribed by health practitioners at the health centre or hospital with instructions on how frequently they should be taken in a day. You have to advise patients to follow those instructions strictly.
- *At the right time*: The time at which ARV drugs should be taken is also essential, maintaining *a regular and correct time difference between doses*.

Taking the correct ARV drugs at the right doses and frequency, spaced at regular intervals, helps patients to maintain the optimum levels of drugs in their blood to prevent HIV multiplication.

■ Based on what you learnt in previous study sessions, why is it important to take ARV drugs for the duration of a patient's lifetime?

Viral replication refers to the production of new viruses by infected cells. 'Viral replication' and 'viral multiplication' can be used interchangeably.

□ ART is a lifelong treatment because it doesn't eradicate HIV infection; rather it suppresses the multiplication of the virus in the body. This prevents the destruction of CD4 lymphocytes and maintains the normal function of the immune system.

Note that adherence to HIV treatment and care not only involves the points above concerning ARV drugs, but also attendance by the patient to all scheduled visits at health centres or hospitals to undertake regular check-ups and clinical assessments. Regular clinical follow-ups may include clinic appointments, laboratory tests and prescription refills. You need to support and encourage PLHIV to regularly visit health facilities as advised by the health workers who follow their treatment and/or provide care. In fact, adherence should involve a long-lasting partnership between the patient and the whole healthcare team, including Health Extension Practitioners (Section 23.5.2).

23.2 What is non-adherence?

Non-adherence is the patient's inability to take their drugs correctly, or attend scheduled clinical visits in the prescribed manner as recommended by their healthcare providers. Non-adherence has a number of implications for the health outcome of your patients. A patient who is not taking drugs correctly will have poor health and get ill with opportunistic infections frequently. They

may also end up developing resistant strains of HIV (or other infectious agents in the case of non-adherence to treatment for opportunistic infections) that will be difficult to treat with the conventional treatments available in your settings. Therefore you need to help and actively advise patients to strictly adhere to all of the services they receive from the health facilities.

In addition to good adherence, other factors should be considered if a patient with HIV needs to be started on ART.

The health practitioners who are monitoring the patient at the health centre or hospital should check whether they are eligible to start ART. This is carried out by clinical assessment (i.e. symptoms and/or signs of disease), and by checking the CD4 cell count of the patient.

23.3 The goal of adherence to ART

From a clinical point of view, patients need to achieve optimal adherence to ART to maintain an efficient level of drugs in their bodies. The measurable goal of adherence for your patients in the community or at the health post should be 100%. Poor adherence (adherence below 100%) leads to drug resistance, increased viral load, increased sickness, and increased possibility of death. Therefore, your activity in the community consisting of follow-up visits to patients on ART or other treatments contributes significantly to the general adherence status of your patients.

Optimal means 'the most effective'.

How do you assess the adherence status of a person living with HIV on ART? Adherence is a measurable pattern of behaviour. For example, you can calculate the percentage of tablets taken correctly in a month by dividing the total taken by the total number that should be taken. Then you multiply that number by 100 to obtain the **percentage adherence** of an individual on ART. Optimal adherence is 100%, which means that a patient should take all of their drugs correctly without missing any one at any single time (Figure 23.2).

Figure 23.2 Every ARV drug should be taken at the right time for 100% adherence. (Photo: Basiro Davey)

- Calculate the monthly percentage adherence of a patient who missed six tablets out of the total he should be taking in a 30-day month. He should take two tablets every day.

- This patient takes two tablets every day, so he should take a total of 60 tablets in one month. However he missed six tablets in one month. So his monthly adherence is 54 tablets out of 60. So, by dividing 54 by 60 and multiplying the result by 100, his percentage adherence can be calculated as 90% (54/60 = 0.9 × 100 = 90).

23.4 Why is drug resistance important for ART?

Blood levels of ARV drugs have to be maintained at optimal concentrations in order to be effective against HIV. Poor adherence to ART will result in low blood levels of ARV drugs, and these low concentrations will be unable to completely suppress viral multiplication. In these conditions, the virus can change in such a way that it resists the action of the drugs, even if drug blood levels return to normal, that is, even if the patient resumes good adherence to ART. Hence, drug-resistant viruses will multiply faster in a patient with a history of poor adherence, leading to the patient becoming sicker. In addition, drug-resistant HIV can be transmitted to other individuals for whom these drugs will not work either.

Whether a person living with HIV is infected with drug-resistant HIV can be confirmed at a hospital by specific blood tests. If this is the case, the regimen of drugs taken by that individual will have to be modified and new drugs prescribed. However, drug resistance is not without problems when it comes to HIV treatment, for two reasons. First, there are limited numbers of drugs available in Ethiopia. Secondly, it may be more difficult for a patient to maintain adherence to the drugs used to replace first-line ARV drugs to which HIV has become resistant, due to their increased side-effects and the larger number of tablets to be taken.

- What are the consequences for a patient who has not adhered to their ART treatment and failed to respond to first-line drugs?
- In general if patients needing ART treatment fail to adhere to their initial treatment, then HIV within these patients may develop resistance to their ARV drugs. If this patient is not prescribed other combinations of ARV drugs (which may be more difficult to adhere to), they will eventually become sick and develop AIDS-related symptoms.

23.5 Why do people fail to take ARV drugs correctly?

In order to help patients in your community, you need to understand the common problems that people on ART encounter that may influence adherence. These are usually different from community to community, and even from individual to individual. In this section, we will give you a general overview of the factors that may affect adherence either negatively or positively. We have classified these factors as either related to the patients, or to the healthcare provider like nurses, doctors, or you working in the community.

23.5.1 What personal, family or community factors influence adherence?

Barriers to adherence arising from the patients themselves include personal, family or community factors. Examples of personal circumstances that negatively influence adherence are patients that repeatedly forget to take their medication, patients that travel away from home without medication, and patients who develop mental health issues, or who have a history of drug or alcohol abuse that may interfere with their ability to take drugs as prescribed. Economic problems, such as lack of money for transportation to the healthcare provider can also negatively affect adherence. Other issues are related to low literacy or lack of understanding of the treatments a patient should be taking.

Religious beliefs should also be taken into account in the context of adherence. For instance, fasting during daytime is a common religious practice for many Ethiopians, and may therefore interfere with the frequency of daily doses to be taken for ART.

At the family or community level, stigma and/or discrimination may make it difficult for a patient to adhere to ART due to the absence of a supportive environment. Another example involves pressure from others to comply with certain practices (i.e. travelling to Holy Water or other local rituals) that may negatively influence adherence (Figure 23.3).

In the context of HIV/AIDS, **Stigmatisation** is the negative labels or stereotypes used when referring to PLHIV. Stigmatised PLHIV often feel isolated, abused and discriminated against by other members of the community.

Figure 23.2 Travelling may influence adherence negatively. PLHIV have to plan ahead for changes in their routine to promote adherence to ART.
(Photo: Ignacio Romero)

By contrast, other factors can help your patients to take their treatments properly. The ability of your patients to make their medication a routine part of their life is the first step in good adherence practice. Most patients use reminders to take their treatment at the right time. Some may use alarms, and others may use routine activities such as prayer time as reminders. You may have to help your patients find the right reminder, based on their individual circumstances.

- What other factors involving the family and/or community may positively influence adherence to ART?
- Social support, motivation and encouragement are all helpful. Treatment supporters such as friends and partners, or members of an ART support group can contribute tremendously to adherence in ART.

23.5.2 How can healthcare providers affect patient adherence?

The role of health workers like you is essential for good adherence to ART. Good knowledge and skills about ART and issues concerning adherence, and about patient education and counselling, can provide them with practical support. Healthcare providers can help patients by providing medication alerts, charts, diaries, by giving them advice on the use of reminders, and by putting into place tracking mechanisms for their drug intake. By providing support for patients, you can create trust and maintain a fruitful partnership between the patients and the health system.

Negative attitudes towards patients' ability to adhere to ART will discourage your patients and undermine their efforts to maintain good adherence practices. By contrast, positive views about patients' attitude to treatment, and being careful to avoid patients feeling controlled, will help you to build a successful partnership with patients to promote optimal adherence (Section 23.6).

23.5.3 What other factors negatively affect adherence to ART?

There are other factors unrelated to patients or to the healthcare provider that result in poor adherence. The most common ones are the large number of tablets to be taken, high frequency of doses, and common side-effects like nausea and vomiting. Pill burden is one of the key factors that can affect adherence negatively. These factors are relatively easy to deal with — for example, patients may simply need reassurance about the treatment's side-effects, or a change in the frequency of doses (twice versus three times per day). Other factors, especially those associated with drug interactions and food restrictions towards different drugs, may require referral to a health centre or hospital for counselling and other support services. At the health centre, health workers will help your patients to find solutions related to common adherence problems.

- A patient on ART in your community tells you that he wants to stop taking his cotrimoxazole prophylaxis medication because he is also taking ARV drugs. He describes how difficult it is to take so many tablets in a day. What advice will you give him?

- Reassure the patient that drugs should be taken as prescribed by the health workers. As you are not allowed to stop any of the drugs, refer him for further support to the health centre.

23.6 Encouraging good adherence in patients on ART

During follow-up visits, you need to keep in mind several general issues when giving advice and counselling related to adherence to HIV therapy and care to PLHIV.

First, giving information to patients, and their active involvement in deciding whether to follow ART, are essential for good adherence practices and hence for treatment success. Patients should be informed beforehand of the consequences for their lifestyle of starting HIV therapy. They should realise that the decision whether to take ARV drugs or not will influence their own long-term health. Moreover, patients should be aware of the fact that ART is a lifelong commitment. In preparing patients to start ART, other factors that may affect adherence should be discussed, including those related to disclosure of their HIV-status to partners and family members, and socio-cultural issues like stigma and discrimination.

Secondly, a patient's adherence to ART may be affected by difficult life situations. The support and monitoring provided to patients by their healthcare providers is critical for maintaining good adherence throughout the patient's life. In your community, you will need to undertake follow-up and monitoring activities to ensure adherence to ART and HIV care services. This is particularly important in the instances when a patient is confronted with

difficult life situations. If adherence has not been strictly followed, patients need to be supported, not blamed, punished, made to feel guilty, or controlled in any way. In order to achieve this, you and the patient will need to work collectively as a team with the health practitioners in health centres and hospitals, including nurses, doctors, adherence counsellors, pharmacists, pharmacy technicians and voluntary health workers in the community.

Finally, it is important to discuss with patients and identify a person who is willing to escort PLHIV on ART to the health facilities as a treatment supporter. This may be the patient's partner, a friend, or a family member chosen by the patient to help them remember not only to attend clinic appointments, but also to take the drugs correctly. Similarly, PLHIV or ART support groups can encourage adherence. Support groups are good sources of information and educational resources for those who start treatment, or are already on treatment.

23.6.1 What should you do before a patient starts ART?

Starting ART is a life-changing experience for most PLHIV. As adherence is a skill that your patients learn progressively, you have to start supporting them by providing information, education and counselling about maintaining complete adherence. Before starting ART, the health workers or adherence counsellors at the health centre should ensure that the topics listed in Box 23.1 are well explained to the patient. At the community level, you may also be expected to repeat this kind of information and education for patients who are about to start ART, as the patient may feel overwhelmed by the amount of information they receive.

Box 23.1 Information that should be given to patients before they start ART

- Define antiretroviral therapy (ART) and give basic drug information.
- Define adherence and teach the goal of 100% optimal adherence.
- Discuss reasons why adherence is important and the consequences of non-adherence.
- Help patients learn what to expect from the treatment, the timing of taking their drugs, and possible side-effects.
- Tell them what to do if they miss a dose.
- Help them identify potential barriers to optimal adherence and create plans for success.

This information will enable patients to understand their treatment regimen better, and empower them to adhere to their prescriptions more successfully once they start ART. You should also help them identify potential barriers to adherence, and organise support systems in the community or at home to promote adherence. If they encounter difficulties once they start treatment, patients should be reassured that these will be solved in partnership with the healthcare team. Patients should understand that sometimes you will refer them to other support services to help address barriers like financial difficulties, transportation, housing and food support. Discuss with your patient delaying the start of ART until significant barriers are addressed.

Tailoring treatment to the patient's lifestyle and routine is a key factor for good adherence. For example, you could encourage the patient's self-confidence by helping them to identify reminder strategies like daily activity planning, pill box, diary, calendar, telephone reminder, etc. Alternatively, you could suggest they associate taking ARV drugs with regular daily events such as meals or prayer, or designate specific places and times for taking medications. Patients have to plan ahead for changes in routine lifestyle, such as travel. You need to educate them about possible side effects, and instruct patients on how to manage them, or to go to the health facilities for further care and support if they are struggling to maintain 100% adherence.

23.6.2 What should you do after a patient starts ART?

Once patients start ART, they need to get support from you and the rest of the healthcare system to maintain adherence at all times. From the perspective of a Health Extension Practitioner, you need to follow-up patients closely and frequently in the form of regular visits or appointments. At these meetings, you should be vigilant of factors that can affect adherence significantly. This is particularly important at the start of ART, as there might be side-effects that may result in poor adherence. Discuss adherence at each visit and ask patients about new symptoms or any changes in their health status. If they have new symptoms, refer them to the health centre for better management. Reinforce the information and education about adherence given previously by assessing their knowledge and skills.

Providing support for adherence to HIV treatment and care involves creating a comfortable atmosphere where exchange of information between you and the patient is encouraged on each visit or appointment (Figure 23.4). As you talk to your patient, always use simple terms and visual aids, if available. Being non-judgmental and creating a trusting environment are essential in making the patient feel comfortable. Asking open-ended questions will enable you to assess whether the patient has understood the information you have provided in the current meeting or in earlier meetings. For example, 'Sometimes it is difficult to take medications on time. Have you missed any pills since your last appointment?', or 'Why do you think you were unable to take your pills on time?'

Figure 23.4 A healthworker chatting comfortably with a person living with HIV.

Assessment of adherence should also be part of each visit as patients come for appointments, or as you visit them in the community. You should assess their percentage adherence (as explained in Section 23.3). If adherence is not 100%, try to get specific information about missed doses and work with the patient to determine why they encountered problems and which specific strategies might enable them to achieve 100% adherence. You should also attempt to recognise and acknowledge the difficulties of adherence and show a positive attitude. Patients should be regularly reminded about taking their medicine at the right time, but in a way that makes them feel motivated and encouraged to achieve 100% adherence to improve their quality of life.

If doses are missed, use the following rule to help your patients: If the drug is taken twice a day, the missed dose can be taken up to six hours later, but no later than that. For example, if the normal dose is taken at 7:00 a.m., the missed dose can be taken up to 1:00 p.m. Again, you can convey this message to the patient in simpler terms. For example, 'If you miss a dose, take the dose as soon as you remember, but not if it is almost time for your next regular dose. Never take a double dose.'

Notify an HIV/AIDS healthworker at the nearest health centre if there are adherence difficulties, and discuss it with the healthcare team. In your regular follow-ups with PLHIV, help them to identify strategies to improve adherence. These may include using a treatment supporter, more home visits, either by you or by voluntary community health workers, a referral to home-based care, or encouraging patients to participate in social support activities such as participation in a PLHIV support group.

Summary of Study Session 23

In Study Session 23, you have learned that:

1 Adherence to HIV care and treatment is essential for improving the health and quality of life of PLHIV.

2 Adherence to treatment means taking the right drugs at the right dose and prescribed frequency.

3 Adherence to ART is unique, in that for optimal treatment it requires 100% strict adherence.

4 The result of poor adherence to ART is the development of resistance to the drugs, which leads to more difficult options for future treatment.

5 There are factors relating to the patients' life circumstances, their family, their community, and the behaviour of health workers that affect adherence negatively and positively, and you need to identify them to help your patients on ART in the community.

6 Before starting ART, there are essential issues such as adherence preparation and education that need to be discussed with patients.

7 In adherence follow-up meetings, one of your responsibilities is to calculate the percentage adherence of your patients and encourage them to maintain good adherence.

Self-Assessment Questions (SAQs) for Study Session 23

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 23.1 (tests Learning Outcomes 23.1 and 23.4)

Explain what poor adherence to ART means, and why it results in drug resistance and poor health in PLHIV.

SAQ 23.2 (tests Learning Outcomes 23.2 and 23.6)

A female patient who is on ART comes to your health post and tells you that she takes her drugs in hiding from her family, as she does not want them to know about her HIV status. She says she has missed three tablets in the last two weeks, as she could not take them in front of her relatives. How can you help her?

SAQ 23.3 (tests Learning Outcomes 23.3 and 23.5)

For the patient in SAQ 23.2, ART involves taking one tablet twice per day. Based on the total number of missed tablets in a month, calculate her adherence percentage. Is her adherence percentage optimal?

SAQ 23.4 (tests Learning Outcome 23.6)

Explain what it means to form a partnership between you, as the Health Extension Practitioner, and your patient in adherence counselling.

Study Session 24 Provider-Initiated HIV Testing and Counselling

Introduction

In this study session, you will learn about the benefits of HIV testing and your role as a Health Extension Practitioner in counselling and testing for HIV infection, an important prevention measure. The focus of this study session is provider-initiated HIV testing and counselling (PITC) and rapid HIV testing, but other issues such as confidentiality and informed consent will also be addressed.

PITC is HIV testing which is *initiated by the health worker* either in the health facility or at community level, and is part of the developing role for health workers in preventing the spread of HIV and identifying those individuals at risk and in need of treatment.

All the photographs shown in this study session have been provided by the Ethiopian Health and Nutrition Research Institute.

Learning Outcomes for Study Session 24

When you have studied this session, you should be able to:

24.1 Define and use correctly all of the key words printed in **bold**. (SAQs 24.1 and 24.3)

24.2 Explain the benefits and barriers of HIV testing. (SAQ 24.2)

24.3 Explain the different modes of HIV counselling and testing. (SAQ 24.3)

24.4 Describe how to recommend HIV testing, and give pre-test counselling, including maintaining confidentiality and obtaining informed consent. (SAQ 24.4)

24.5 Describe how to perform rapid HIV testing using three different test kits, and read and interpret the test results. (SAQ 24.5)

24.6 Explain how to deliver HIV test results and post-test counselling. (SAQ 24.4)

24.1 Benefits and barriers of HIV testing

24.1.1 The benefits of HIV testing

There are several benefits of HIV testing. Firstly, it allows people infected with HIV to gain early access to HIV treatment and care; secondly, it encourages those tested to reduce their *high-risk behaviour* and avoid transmission to partners; thirdly, it helps HIV-negative people to develop a plan to remain negative; and lastly, it allows couples where one or both is HIV-positive to choose appropriate family planning methods to reduce the risk of infection.

High-risk behaviour in the context of HIV/AIDS refers mainly to sexual intercourse without the use of a condom (see Study Session 25).

In Ethiopia, HIV counselling and testing sites are a key entry point for HIV prevention, treatment, care and support services. It is important for individuals and couples to learn about their HIV status and make *informed decisions* about their future.

24.1.2 The barriers to HIV testing

In this context, a 'client' is an individual who wishes to be tested for HIV.

Barriers to HIV testing are those obstacles that prevent people from getting tested, either voluntarily or when offered a test by a healthworker. These barriers fall into three categories: client-related, healthworker-related and health facility-related. Examples of client-related barriers include fear of stigma, shame or disapproval attached to something regarded as socially unacceptable, and **discrimination** (unfair treatment of people found to be HIV-positive). Other client-related barriers include the fear of being ill and dying from a non-curable disease, if the test is positive for HIV infection; the loss of family support; and difficulties of keeping or finding a job.

Healthworker-related barriers include the fear of damaging the patient-provider relationship; the unpredictability of the patient's emotional reaction; lack of time; and fear of overwhelming the client. Examples of health facility-related barriers are lack of space, equipment and supplies.

24.2 Modes of delivering HIV counselling and testing

HIV counselling and testing is central to preventing the spread of HIV infection and identifying those individuals at risk. As discussed in Study Session 20, we can only say that a person has HIV in their blood when they are tested and found to be HIV-positive. In this section, you will learn that there are three different modes of delivering the counselling and testing service: voluntary counselling and testing (VCT), provider-initiated HIV testing and counselling (PITC), and mandatory HIV testing.

Voluntary counselling and testing (VCT) is *initiated by the clients themselves*. In other words, individuals request HIV testing without the health worker offering or recommending testing. VCT often takes more time than PITC because clients expect, and have allowed time for, additional counselling both before and after a test result. Note that you are not expected to perform VCT yourself. If individuals ask you for HIV testing voluntarily, you should refer them to a health centre that offers VCT.

Remember that under most conditions, an HIV test should only be done after obtaining the informed consent of the individual concerned.

The World Health Organization (WHO) and health services in many countries, including Ethiopia, promote a policy of **provider-initiated HIV testing and counselling** (**PITC**). This means that when trained to do so, you should offer and provide HIV testing and counselling yourself. PITC enables specific clinical decisions to be made and medical services to be offered that would not be possible without the knowledge of a person's HIV status. A period of pre-test counselling and education should always accompany testing, and people should never be forced to undergo testing against their will.

PITC is further divided into *diagnostic testing* and *routine offer*. **Diagnostic testing** is part of the clinical process of determining the HIV status of a sick person, such as someone with TB or other symptoms that suggest possible HIV infection. On the other hand, a **routine offer** of testing and counselling means offering an HIV test to all sexually active people who seek medical care for other health issues.

Unlike VCT, PITC needs only a brief period of pre-test information/education before performing the test, and can be done in a few minutes. PITC is recommended for countries like Ethiopia where HIV is *endemic* (always present in the population). PITC is not a replacement for VCT. Instead, it provides an entry point to HIV services, it helps to prevent HIV transmission in the community, and also helps people make healthier choices. Those individuals who are found to be HIV-positive can then be referred into treatment and care.

Under normal conditions, a person would only undergo HIV testing after they have given their **informed consent**, that is consent based on fully understood information about the test and what the result may mean. A signed consent form is not needed in Ethiopia for PITC (although it is for VCT), but obtaining *verbal consent* is essential.

Respecting an individual's rights is an integral part of the process of HIV counselling and testing, and this is often referred to as the *'3 Cs' — **c**onsent, **c**onfidentiality, and access to **c**ounselling.*

Mandatory HIV testing, on the other hand, does not require the consent of the individual about to be tested. It is done by force or without informed consent, and is usually performed at the request of a court in cases involving rape or other sexual assault.

24.2.1 The five steps in PITC

The flow chart in Figure 24.1 illustrates the *five* key steps involved in PITC. As PITC is central for the work of Health Extension Practitioners, we will focus on PITC for the remainder of this study session. Each step will be explained in detail.

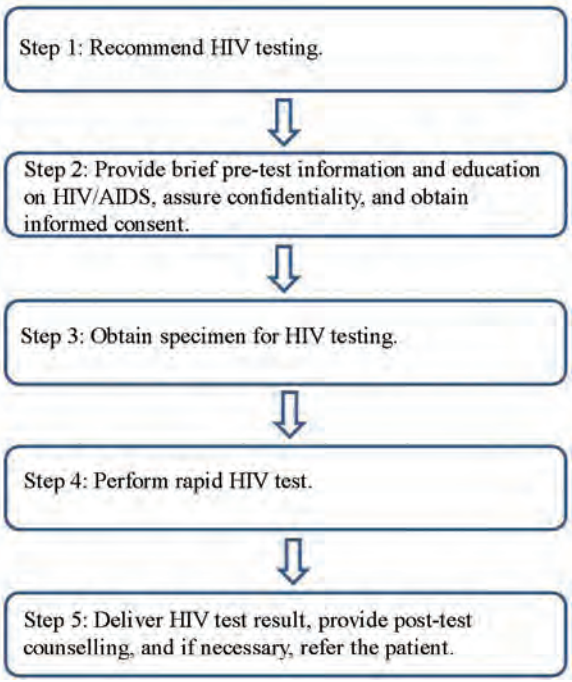


Figure 24.1 The five steps involved in provider-initiated testing and counselling (PITC).

24.3 Step 1: How to recommend HIV testing

Diagnostic testing is part of the clinical process of determining the HIV status of a sick person whom you suspect may be infected with HIV. If the person presents with symptoms consistent with HIV infection, explain that they will be tested for HIV as part of their clinical check-up.

The following is an example of how a trained health worker might recommend a *diagnostic HIV test*:

> 'As you told me, you have diarrhoea that has lasted three months and you have lost a lot of weight. I want to find out why. In order for us to diagnose and treat your illness, you need a test for HIV infection. Unless you object, I will conduct this test.'

A routine offer is made to sexually active people regardless of their initial reason for seeking medical attention.

Below is an example of how to make a *routine offer* for HIV testing:

> 'One of our guidelines is to offer everyone the opportunity to have an HIV test, so that we can provide you with care and treatment while you are here and refer you for follow-up afterwards. Unless you object, I will conduct this test and provide you with counselling and the result.'

24.4 Step 2: Pre-test counselling, confidentiality and informed consent

24.4.1 Pre-test information and education on HIV/AIDS

Before testing, you should provide the individual about to be tested with information on HIV/AIDS, and, importantly, give them enough opportunity to ask questions. You should include the basic facts about HIV, its transmission and prevention; the importance of knowing one's own HIV status and the advantages of disclosing one's own HIV status to family members, close friends and others. Also, explain about follow-up support and the services available if the test is positive for HIV. Box 24.1 summarises the key information you should provide as part of pre-test counselling and education on HIV/AIDS.

Box 24.1 Pre-test information/education as part of PITC

HIV is a virus that destroys parts of the body's immune system. A person infected with HIV may not feel sick at first, but slowly the body's immune system is destroyed. They then become ill and are unable to fight infections. Once a person is infected with HIV, they can transmit the virus to others unless they practice preventative measures and safe sex (Study Sessions 25 and 29).

HIV can be transmitted:

- through exchange of HIV-infected body fluids such as semen, vaginal fluid or blood during unprotected sexual intercourse.
- through HIV-infected blood transfusions.
- through sharing sharp cutting or piercing instruments.
- from an infected mother to her child during pregnancy, labour and delivery, and during breastfeeding.

HIV *cannot* be transmitted through:

- hugging, shaking hands, eating together, sharing a latrine, or mosquito bites.

A blood test is available that enables a person's HIV status to be determined.

If the HIV test is positive, knowing this will help you to:

- protect yourself from re-infection, and your sexual partner(s) from infection.
- get early access to chronic HIV care and support, including regular follow-up and support, treatment for HIV, and cotrimoxazole prophylaxis (preventative treatment with antibiotics).
- cope better with HIV infection and be able to make future plans. For pregnant mothers or for married couples intending to have a child in the future, it gives a chance of early access to services for the prevention of mother-to-child transmission (PMTCT) of HIV (Study Session 27).

If the HIV test is negative, knowing this will help you explore ways to remain HIV-negative.

24.4.2 How to assure confidentiality

Assure the person about to undergo testing that the result is confidential, and emphasise the following points:

- The result will only be shared with him or her.
- He/she decides to whom to disclose the result of the test.
- The result will only be provided to another person with his/her written consent. If the result of the test is needed to ensure appropriate clinical care, explain the advantages of sharing the result with the medical team.

24.4.3 How to obtain informed consent

After providing pre-test counselling on HIV/AIDS and assuring confidentiality, you need to confirm the individual's willingness to proceed with the test. You should ask them whether they agree with you and give consent for the test to be done. If they give their consent, make sure they are willing to discuss the implications of the test with you once the result is known.

Remember, informed consent can be given verbally for PITC.

24.5 Step 3: Obtaining a specimen for HIV testing

Specimens used for HIV testing include serum, whole blood, or oral fluids. In Ethiopia, whole blood is used for rapid HIV testing. The blood specimen is obtained by a finger prick (as outlined below and illustrated in Figure 24.2 on the next page).

1 Prepare a container for disposing of sharp instruments; also prepare gloves, lancet, alcohol swab, cotton swab, pipette, capillary tube, the test kits, and other necessary materials (Figure 24.2a).

2 Wash your hands with an antiseptic soap and water.

3 Wear clean gloves.

4 Position the hand of the person to be tested palm-side up. Select the softest finger; avoid those fingers that have calluses or hardened skin (Figure 24.2b).

5 Massage the chosen finger to help the blood to flow (Figure 24.2c).

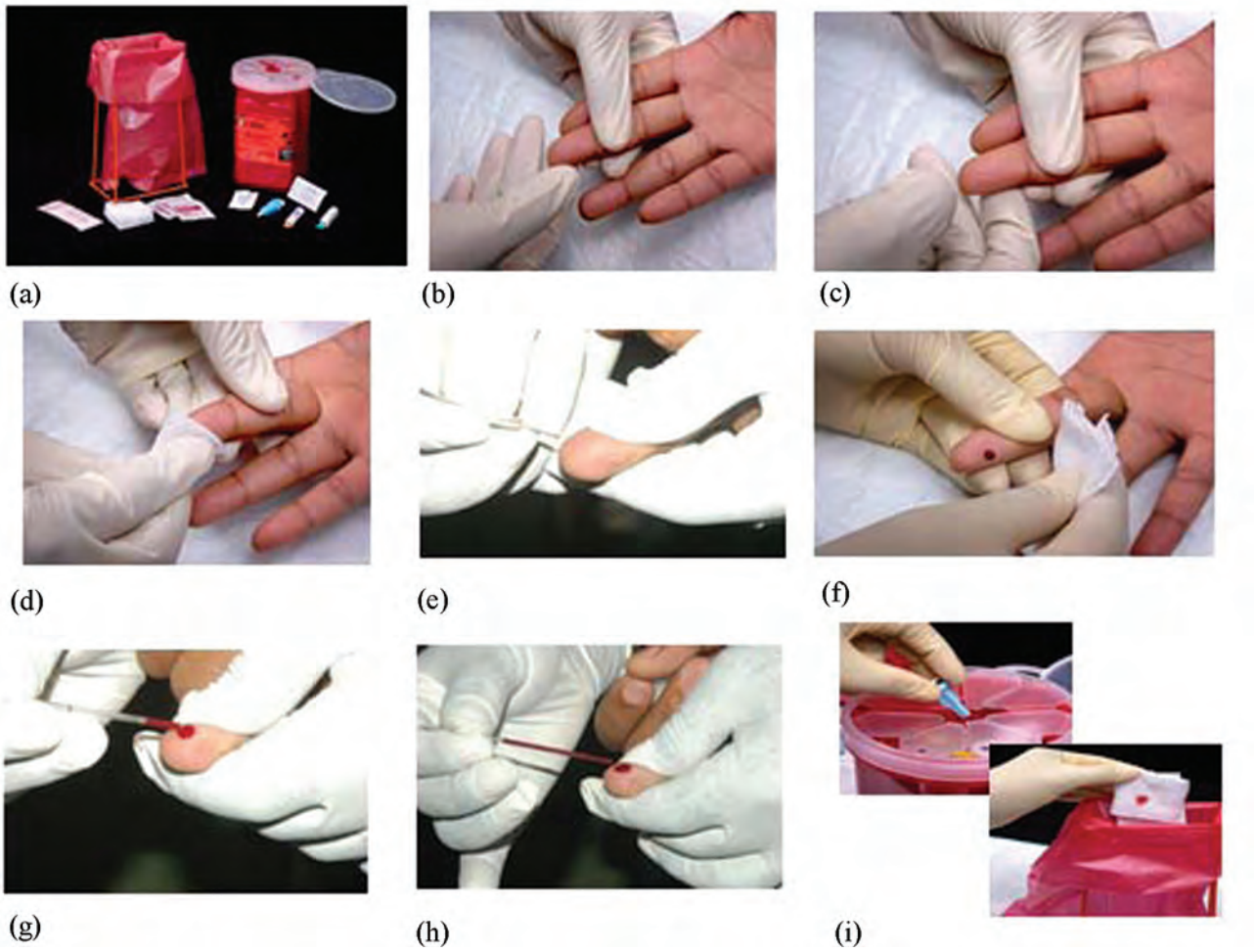


Figure 24.2 The procedure used to take a sample of blood for HIV testing.
(a) Preparation of supplies required for taking a blood sample (gloves are not shown). (b) The hand of the person to be tested is placed palm-side up. (c) The finger selected for pricking is massaged to encourage blood flow. (d) The finger is cleaned using an alcohol swab. (e) Holding the finger firmly, the sterile lancet is placed off-centre. (f) A drop of blood is squeezed out. (g) The tip of the capillary tube is placed in the drop of blood. (h) The capillary tube is filled with blood between the two marked lines on the tube. (i) All contaminated supplies are disposed of safely.

6 Clean the fingertip with an alcohol swab (Figure 24.2d). Start in the middle of the finger and work outwards; this will prevent contamination of the cleansed region. Allow the finger to dry.

7 Hold the finger and firmly place a new sterile lancet off-centre on the fingertip. Firmly press the lancet to puncture the fingertip. (Figure 24.2e).

8 Wipe away the first drop of blood with a sterile gauze pad or cotton ball. Apply intermittent pressure in the base of the punctured finger several times (Figure 24.2f).

9 Blood may flow best if the finger is held lower than the elbow. Touch the tip of the capillary tube to the drop of blood (Figure 24.2g).

10 Ensure you fill the capillary tube with blood between the two marked lines. Avoid getting air bubbles trapped in the capillary tube (Figure 24.2h).

11 Properly dispose of all contaminated supplies (Figure 24.2i).

24.6 Step 4: How to perform a rapid HIV test

Both HIV-1 and HIV-2 can be detected by rapid HIV tests. The advantages they offer over other testing technologies is that they can be performed on small amounts of blood, the results are available within minutes, and they can be done in a person's home or at a health post.

In Ethiopia we use three types of rapid HIV test kits. They are known as:

- KHB (a trade name)
- STAT-PAK (a trade name)
- Uni-gold (a trade name).

The logical step-by-step procedure for using the three rapid test kits to determine an individual's HIV status is called the **HIV testing algorithm** (Figure 24.3).

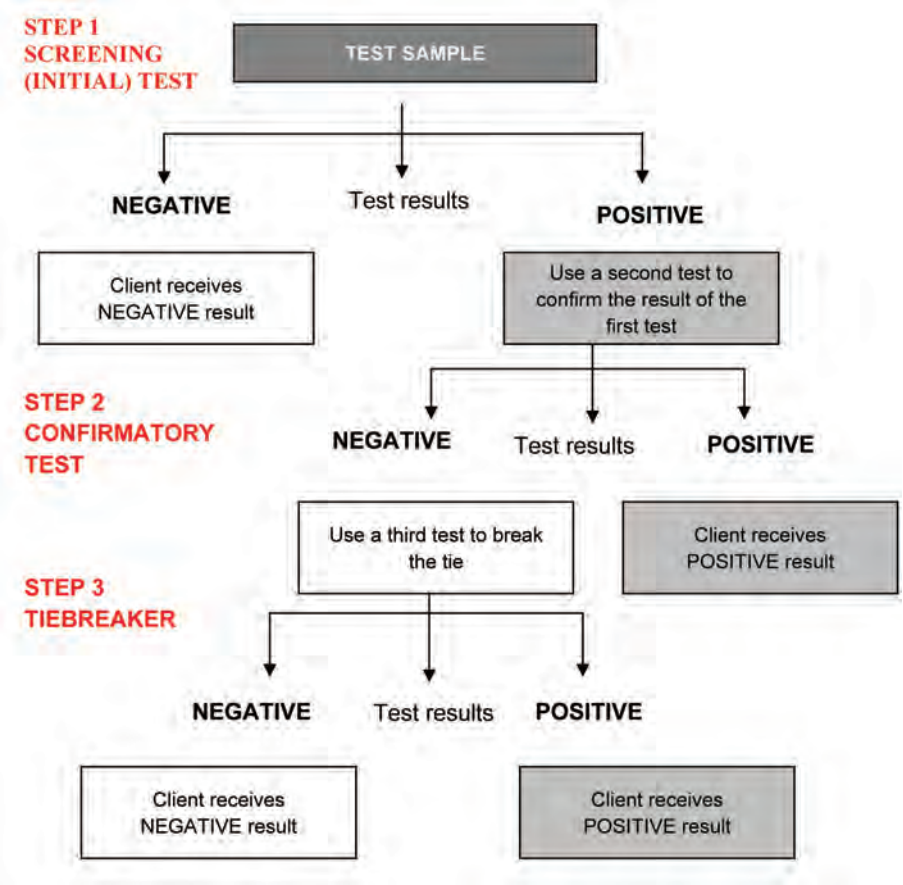


Figure 24.3 National HIV testing algorithm currently in use in Ethiopia.

The algorithm uses three types of tests — the screening test, the confirmatory test, and a tiebreaker. The **screening test** is the first test in the sequence. The **confirmatory test** is used to confirm a positive result if the first test is positive. A **tiebreaker** is the final test which is done when there is a difference between the screening and confirmatory test results. In Ethiopia, we use KHB as a screening test, STAT-PAK as a confirmatory test, and Uni-gold as a tiebreaker.

If a test is *non-reactive* when using the KHB test kit, we do not need to do another test and we report it as *negative* — the individual tested is HIV-negative.

Reactive means the test yielded a positive result. A non-reactive result is a negative result.

If the test is *reactive* with KHB, we need to perform a second test using STAT-PAK to confirm the result. If the test is also reactive with STAT-PAK, we report it as *positive* — the individual tested is HIV-positive.

If the test is *reactive* with KHB, but *non-reactive* with STAT-PAK, we need to do a tiebreaker test (Uni-gold). If the Uni-gold is *non-reactive*, we report the result as *negative*. However, if the Uni-gold is *reactive*, we report the result as *positive*.

- ■ After how many tests do you notify the client that the outcome of the testing process is that he or she is HIV-positive?
- □ You should not report a positive HIV test result after just using one test. At least two different rapid tests have to be reactive before you report a positive result.

The following sections provide guidance on how to conduct a rapid HIV test.

24.6.1 Performing an HIV test using the KHB rapid test kit

Figure 24.4 A photograph of a KHB kit showing the location of the sample port and the control and test lines. The insert shows a health worker marking the test with a code or client number.

First, collect the test items and other necessary laboratory supplies. Remove the KHB device from its packaging, and label it using a code number or a client identification number. The client is the patient or person taking the test. Code numbers should be used to ensure the test is anonymous.

The device has two parts — at the bottom there is a deep circular area where the blood sample is placed (the sample port); at the top there are two areas marked 'C' for control and 'T' for the test result line.

A photograph of a KHB test is shown in Figure 24.4. The KHB, STAT-PAK and Uni-gold kits have similar structures and parts, though the Uni-gold kit has a different shape.

Collect the specimen using a capillary tube, as described in Section 24.5 of this study session.

Add a drop of whole blood from the capillary tube, enough to cover the sample port of the device (this is shown in Figure 24.5), before adding one drop of running buffer using a pipette. (A running buffer is a liquid that contains reagents and provides optimal conditions for the test to develop).

Figure 24.5 A sample of blood is placed in the sample port of a KHB test device, using the capillary tube.

Now wait for 30 minutes for the test to develop. The control line will be the first to show, and this indicates that the test is working correctly and is valid.

Reading the result of a KHB test

After 30 minutes the test result is ready. Interpretation of the KHB test is straightforward, and examples of real test results are shown in Figure 24.6.

If both the control line and test line are seen, the result is considered to be reactive (top panel of Figure 24.6). If *only* the control line appears and *no* test line is seen, the result is considered to be non-reactive (middle panel of Figure 24.6).

If the control line is *not seen*, the test has not worked correctly (it may have been damaged) and the result is considered to be *invalid* (bottom panel of Figure 24.6). If the result is invalid, the procedure is repeated using a new KHB device. The result must be recorded on a worksheet, together with any relevant information.

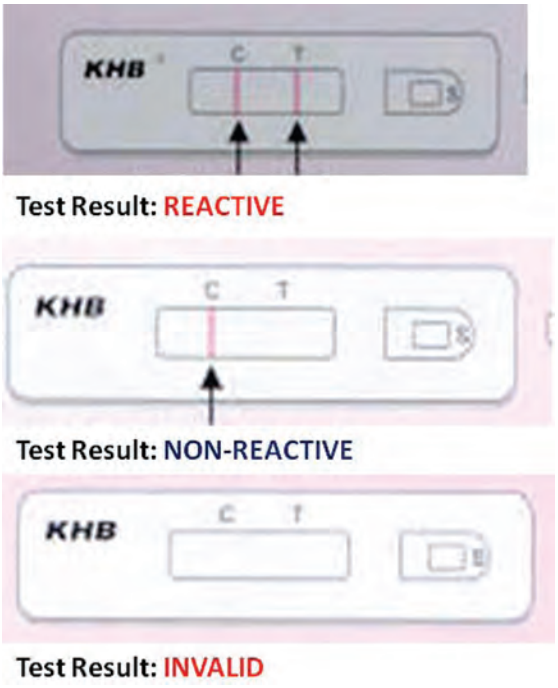


Figure 24.6 How to interpret the KHB device. The top picture shows a reactive result, the middle one is a non-reactive result; and the bottom picture has no lines showing and is therefore an invalid result.

- How would you interpret a non-reactive KHB result?

□ This indicates that the person who supplied the blood is HIV-negative and therefore there is no need to proceed to the STAT-PAK test.

- What do you do if you get a reactive result using the KHB device?

□ If you get a reactive result with the KHB device, you should proceed to the second test, which is STAT-PAK, to confirm the result.

24.6.2 Performing an HIV test using the STAT-PAK rapid test kit

The procedure for this test is very similar to that used for the KHB test. However, there are some differences. The procedure for the STAT-PAK test is outlined below.

First, collect the test items and other necessary laboratory supplies. Remove the STAT-PAK device from its packaging, and label it using a code number or a client identification number.

Like the KHB device, the STAT-PAK also has a sample port and an area where the control and test lines are read.

Collect the specimen using a capillary tube as described earlier in this study session, and place some of the blood on a microscope slide.

Using the special applicator provided with the STAT-PAK kit, collect blood from the microscope slide and then transfer it to the sample port. Now add one drop of running buffer using the bottle of reagent supplied with the kit (these steps are shown in Figure 24.7).

The STAT-PAK test only takes 10 minutes to develop, whereas the KHB test can take up to 30 minutes to produce a result.

Now wait ten minutes for the test to develop. The control line will be the first to show, and this indicates that the test is working correctly and is valid.

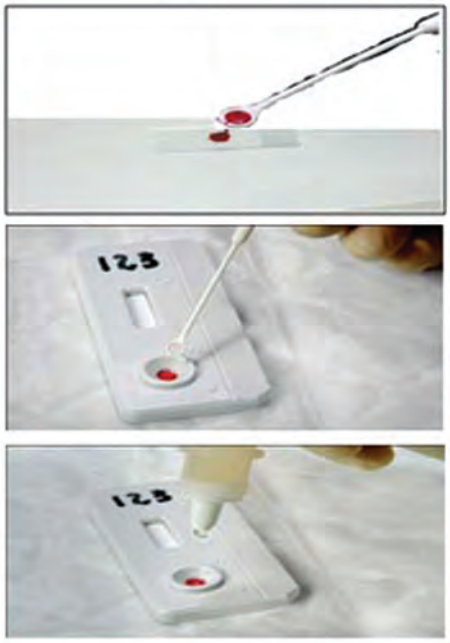


Figure 24.7 Loading the STAT-PAK device top: blood being collected from the microscope slide. Middle: blood being loaded into the sample port. Bottom: running buffer being loaded into the sample port.

Reading the result of a STAT-PAK test

After ten minutes the test result is ready. Interpretation of the STAT-PAK device is the same as for the KHB device, and this is shown in Figure 24.8. If the result is invalid, the procedure is repeated using a new STAT-PAK device. The result must be recorded on a worksheet, together with any relevant information.

Figure 24.8 How to interpret the STAT-PAK device. The picture on the far right has no lines showing and is therefore an invalid result.

- How would you interpret the results of a STAT-PAK test?

- A reactive result would indicate that the person who supplied the blood is HIV-positive. If the result was non-reactive, you would proceed to the tiebreaker test using the Uni-gold device.

24.6.3 Performing an HIV test using the Uni-gold rapid test kit

The procedure for this test is very similar to that used for the KHB and STAT-PAK tests. However, there are some differences. The procedure for the Uni-gold test is outlined below.

First, collect the test items and other necessary laboratory supplies. Remove the Uni-gold device from its packaging, and label it using a code number or a client identification number. The Uni-gold also has a sample port and an area where the control and test lines are read.

Unlike the other tests, blood is collected from the punctured finger using a pipette and then *two drops* of blood (60 µl) are placed into the sample port of the Uni-gold device (see Figure 24.9). Two drops of running buffer (60 µl) are then also added to the sample port.

µl means 'microlitre'.

Figure 24.9 Loading the Uni-gold device. Left: blood is collected using a pipette. Middle: two drops of blood are loaded into the sample port. Right: two drops of running buffer are also loaded into the sample port.

Now wait for ten minutes (and no longer than twenty minutes) for the test to develop. The control line will be the first to show, and this indicates that the test is working correctly and is valid.

Reading the result of a Uni-gold test

After ten minutes the test result is ready. Interpretation of the Uni-gold device is similar to the other devices, and this is shown in Figure 24.10. If the result is invalid, the procedure is repeated using a new Uni-gold device. The result must be recorded on a worksheet, together with any relevant information.

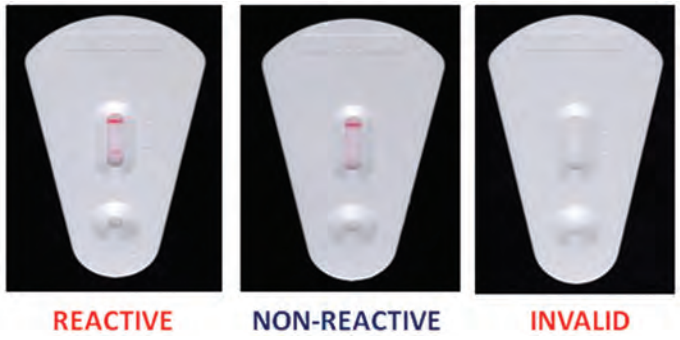


Figure 24.10 How to interpret the Uni-gold device. The picture on the left shows a reactive result. The image in the middle shows a non-reactive result. The image on the right has no lines showing and is therefore an invalid result.

■ How would you interpret the result of a Uni-gold test?

□ A reactive result indicates that the person who supplied the blood is HIV-positive, whereas a non-reactive result indicates that they are HIV-negative.

24.7 Step 5: Delivering an HIV test result, post-test counselling, and referral for treatment

The focus of post-test counselling for people with HIV-positive test results is to provide psychosocial support to help the tested person cope with the emotional impact of the test result, to facilitate (i) access to treatment, (ii) care services, (iii) prevention of transmission, and (iv) disclosure of HIV status to sexual partners.

24.7.1 Delivering the result and post-test counselling when the result is HIV-positive

During post-test counselling, you should cover the following points:

- Inform the person of the result simply and clearly, and give him or her time to consider it. You could ask 'Are you ready to hear the result?', allowing the person an opportunity to ask additional questions before you give the result. Most people are ready to hear their result and this should be delivered without undue delay.
- Ensure that the person understands the result. Avoid using technical language such as 'reactive' and 'non-reactive'.
- Allow the person time to ask questions.
- Help the person to cope with emotions arising from the test result. The emotional response to an HIV-positive result can include confusion, anger, denial, sadness, loss, uncertainty, fear of death, shame (embarrassment), fear of stigma and discrimination.
- Discuss any immediate concerns, and assist the person to determine who in their social network may be available and acceptable to offer immediate support.
- Describe follow-up services that are available in the health facility and in the community, focusing on the available treatment, prevention of mother-to-child transmission, and HIV care and support services.
- Provide information on how to prevent transmission of HIV, including provision of male and female condoms and guidance on their use (Study Sessions 25 and 29).
- Provide information on other relevant preventative health measures, such as good nutrition, cotrimoxazole (for prophylactic chemotherapy of opportunistic infections) and, in malarious areas, insecticide-treated bed nets.
- Discuss possible disclosure of the positive result, when and how this may happen, and to whom.
- Encourage and offer referral for testing and counselling of current and former partners, and children who may be at risk.
- Assess the risk of violence or suicide, and discuss possible steps to ensure the physical safety of people with an HIV-positive test result, particularly women.

You should also arrange a specific date and time for a follow-up visit or referral for treatment, care, counselling, support, and other services as appropriate, e.g. tuberculosis screening and treatment, prophylaxis for opportunistic infections, treatment for other sexually transmitted infections (STIs), family planning and antenatal care.

24.7.2 Delivering the result and post-test counselling for HIV-negative people

An HIV-negative test result can produce a range of emotional responses, including relief, excitement, or optimism (the result may feel like a new opportunity). The person may also feel confused — they may have perceived themselves as HIV-positive, and they may have an HIV-infected current or former partner.

An important issue to consider when delivering a negative HIV test result is what is termed the **window period**. The window period refers to the time between HIV infection and the time at which HIV can be detected by available tests. Rapid HIV tests detect anti-HIV antibodies in the blood, but it usually takes about three months from the original HIV infection for the immune system to develop sufficient levels of antibodies against HIV to be detected by these tests. So individuals who are within this window period (i.e. who have been recently infected by HIV) may test negative in a rapid HIV test and yet still be able to transmit the virus. Therefore, you should advise people who may have recently been exposed to HIV (by unprotected sex and/or blood-contaminated products) to have another confirmatory HIV test at least three months after exposure to the virus.

Counselling for individuals with HIV-negative test results should include the following information:

- An explanation of the test result, including information about the window period for the appearance of HIV antibodies, and a recommendation to re-test in case of a recent exposure.
- Basic advice on methods to prevent HIV transmission.
- Provision of male and female condoms, and guidance on their use.
- The health worker and the tested person should then jointly assess whether there is a need for more extensive post-test counselling or additional prevention support, for example, through community-based services.

Summary of Study Session 24

In Study Session 24, you have learned that:

1 HIV testing has several benefits — it creates early access to HIV treatment and care, it encourages reduction of high-risk behaviour, it helps people to make lifestyle changes and avoid transmission of the virus to partners; and for those found to be negative, it helps them to develop a plan to remain HIV-negative.

2 The barriers to HIV testing can be client-related, healthworker-related and health facility-related.

3 There are three different modes of delivering HIV testing and counselling — voluntary counselling and testing (VCT), provider-initiated HIV testing and counselling (PITC), and mandatory testing.

4 HIV testing and counselling should respect human rights. Informed consent should be obtained prior to testing. Mandatory HIV testing can be ordered by a court in cases dealing with sexual assault and rape.

5 There are five steps in delivering PITC:

Step 1: Recommend HIV testing.
Step 2: Provide brief pre-test information and education on HIV/AIDS, assure confidentiality, and obtain informed consent.
Step 3: Obtain specimen for HIV testing.
Step 4: Perform rapid HIV test.
Step 5: Deliver HIV test result, provide post-test counselling, and refer the patient if necessary.

6 The three rapid HIV test kits used in Ethiopia are KHB as a screening test, STAT-PAK as a confirmatory test, and Uni-gold as a tiebreaker test. Testing follows a standard set of procedures as laid out in the HIV testing algorithm.

Self-Assessment Questions (SAQs) for Study Session 24

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 24.1 (tests Learning Outcome 24.1)

Is the statement below *true* or *false*. Explain your reasoning.

'PITC is HIV testing initiated by the client.'

SAQ 24.2 (tests Learning Outcome 24.2)

Which of the following is *not* a benefit of HIV testing? Explain why.

A It creates early access to HIV treatment and care.
B It provides an opportunity to reduce high-risk behaviour.
C It helps in preventing transmission of HIV.
D It helps those found to be HIV-negative to practise sex without the need for protection.

SAQ 24.3 (tests Learning Outcomes 24.1 and 24.3)

Which of the following is *not* a mode of delivery of HIV counselling and testing that requires the client's consent? When should this method be applied?

A PITC
B VCT
C Mandatory HIV testing.

SAQ 24.4 (tests Learning Outcomes 24.4 and 24.6)

Which of the five steps of performing PITC is crucial for linking HIV patients to comprehensive HIV prevention, care, treatment and support services? Explain why.

SAQ 24.5 (tests Learning Outcome 24.5)

Is the following statement *true* or *false*. Explain your reasoning.

'We can report a positive HIV test just by doing a KHB rapid test.'

Study Session 25 Prevention of HIV Infection, and Community Mobilisation

Introduction

In this study session, you will learn about two distinct but interrelated subjects concerning prevention of HIV infection. First, we will describe general prevention measures that individuals can practise in order to avoid or minimise the risk of HIV infection, with particular emphasis on ways to avoid the sexual route of HIV transmission. Secondly, you will learn about a series of steps you should undertake to mobilise your community in the context of HIV prevention. As a result, you will become familiar with ways to facilitate and organise numerous community mobilisation activities at your *kebele*, in order to both encourage members of different groups in your society to participate actively in HIV prevention measures and, at the same time, create awareness about available services in the higher-level health facilities closest to them. We will also discuss the Ethiopian Federal Ministry of Health (FMOH)'s national strategy for HIV prevention in the context of your work in the community. At the end of this study session, you will be able to relate HIV infection preventative measures at the individual, community and national levels.

Learning Outcomes for Study Session 25

When you have studied this session, you should be able to:

25.1 Define and use correctly all of the key words printed in **bold**. (SAQs 25.1 and 25.2)

25.2 Describe the basic principles of prevention of HIV transmission. (SAQ 25.1)

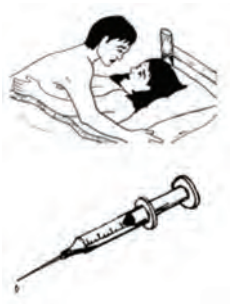
25.3 Explain the importance of safe sex as a prevention measure for HIV transmission in the community. (SAQ 25.2)

25.4 Describe the main national HIV community mobilisation strategies, and the processes and steps in community mobilisation. (SAQ 25.3)

24.5 Identify your role in community mobilisation activities related to HIV/AIDS. (SAQ 25.3)

25.1 General principles for preventing HIV infection

The goal of prevention in the context of HIV/AIDS is to avoid or minimise the risk of transmission of HIV from an infected person to an uninfected person. HIV prevention measures currently recommended at the individual and community levels are based on our knowledge of how HIV can be transmitted from person to person.



- What are the modes of transmission of HIV?
- Through sexual relations; through direct contact with contaminated blood; and from mother to child.

In this section, we will focus on prevention measures that individuals in a community should take in order to avoid HIV transmission through sexual relations and through direct contact with contaminated blood. In later study

sessions, you will learn about how to protect yourself against HIV infection in the workplace (Study Session 26) and about specific preventative measures to reduce mother-to-child HIV transmission (Study Session 27).

Provider-initiated testing and counselling for HIV are also important preventative measures for HIV transmission (Study Session 24). Note that the measures described below are aimed at all individuals within a community, whether they know their HIV status or not. Specific issues concerning the prevention of HIV transmission from people living with HIV (PLHIV) to their partners will be discussed in more detail in Study Session 29.

25.1.1 Strategies for preventing sexual transmission of HIV

Sexual transmission accounts for the majority of HIV infection cases in Ethiopia. Remember from Study Session 20 that HIV can be transmitted via blood or sexual fluids (from a man's penis or a woman's vagina) through sexual intercourse, which includes vaginal, anal and oral sex. HIV infection may then occur when infected fluids come into contact with the internal linings of someone's body (usually the vagina, mouth, or anus) through which the virus can enter the bloodstream. Thus, HIV-transmission prevention through the sexual route aims to avoid or reduce contact between blood and/or sexual fluids of an infected person and the internal linings of another person.

The most widely known strategies for prevention of HIV transmission through the sexual route are often known as the '**ABC rules**':

- '**A**' stands for 'Abstinence', which means refraining from premarital sexual intercourse.
- '**B**' stands for 'Be faithful', which means maintaining faithful relationships with a long-term partner.
- '**C**' stands for 'proper use of Condoms', which means correct and consistent use of condoms in sexual relations.

Abstinence

Abstinence in principle is the most effective way to prevent sexual HIV transmission, as there is no possibility of direct contact between infected blood and/or sexual fluids and another person's body. Abstinence is therefore a valid option for individuals who do not have a regular sexual partner, or for PLHIV. However, many sexually active people may find difficulties in maintaining abstinence for long periods of time, making it an unrealistic choice. Moreover, the 'A' rule excludes the circumstances of forced sexual relations, as in the cases of rape and coercive marriage of young girls, which unfortunately still occur in Ethiopia.

Maintaining faithful relationships

For faithfulness (the 'B' rule of Being faithful) to be successful and minimise transmission of HIV, it is essential that both partners, or the multiple partners in polygamous relationships, know whether they are HIV negative before starting unprotected sexual intercourse. Without condoms there are no barriers for the transmission of HIV between partners. **Unprotected sexual intercourse** refers to all penetrative practices (through vagina, anus or mouth) performed without a condom. Thus, an important role for health workers such as you is to provide HIV counselling and testing to partners before marriage, or before starting faithful relationships (Study Session 24). It is important for them to realise that, if either of the partners has unprotected sex outside the

relationship, it is not only they who are put at higher risk of HIV infection, but also their long-term partner.

In addition, remember that people who have recently been infected with HIV may test negative in the rapid HIV tests while they are in the 'window period', but they are still able to transmit HIV to others if they practise unprotected sex.

■ Based on your previous studies, why may some people test negative on a rapid HIV test during the first few months of infection?

□ Rapid HIV tests detect antibodies against HIV in the blood. The immune system of individuals recently infected by the virus may take a few months to produce enough antibodies to reach levels detected by HIV rapid tests. These individuals might test negative even though they are infected with HIV.

Therefore, it is important to advise individuals who are about to embark on a faithful relationship not to practise unprotected sexual intercourse before their negative HIV status is confirmed by two separate HIV rapid tests performed at least three months apart. Note also that if one or both partners is HIV positive, maintaining faithful relationships will not be sufficient to prevent HIV infection (this issue will be further discussed in Study Session 29).

Forced marriage of young girls, also known as child brides, may make them more vulnerable to HIV infection. Their future husbands may already be infected with HIV, especially if they are much older. In addition, it may be more difficult for young girls to negotiate sexual decisions with their partners such as maintaining faithful relationships, practicing safer sexual practices (see below) and/or demanding HIV testing.

Issues such as these are discussed in more detail in the Module on *Adolescent and Youth Reproductive Health*.

Safer sexual practices

As discussed above, abstinence and faithfulness to one's partner(s) are viable alternatives for some individuals to actively reduce their risk of HIV infection. However, **safer sexual practices** (also know as safer sex) should be actively encouraged for all of your clients who have an active sexual life outside a faithful relationship. Safer sex includes non-penetrative sexual activities and the correct use of condoms. The goal of safer sex is to reduce the possibility of transmitting HIV by minimising exchange of blood or sexual fluids. Practising safer sexual practices also reduces the risk of other sexually transmitted infections or STIs (Study Session 31). Remember from Study Session 20 that the presence of STIs in an individual increases the likelihood of becoming infected by HIV, so safer sexual practices target HIV transmission both directly and indirectly.

The following four points should form the basis of the education you provide in your community about preventing the further spread of HIV:

1 Individuals with multiple partners increase their chances of contracting or spreading HIV (the higher the number of partners, the more likely it is that HIV will be transmitted from person to person). Being faithful to one partner, or multiple partners in a polygamous marriage, decreases the chances of transmitting or contracting HIV.

2 Non-penetrative sexual practices constitute an alternative way to satisfy sexual needs without being at risk of HIV infection. These alternative practices to sexual intercourse include hugging, kissing, rubbing and

masturbation, which are all considered to have an extremely low risk of transmitting HIV infection.

■ What is the most common route of sexual transmission of HIV in Ethiopia? How can this be avoided?

□ Heterosexual sex is the most common route of HIV transmission in our country, that is anal and/or vaginal penetrative sex between two people of the opposite sex. There are also reports of anal transmission of HIV between men who have sex with men. Avoiding unprotected penetrative sex constitutes an important preventative measure for HIV infection.

3 If penetrative sexual intercourse is the preferred choice, advise clients on the correct and consistent use of condoms, and the importance of using them every time they have sex. Box 25.1 contains important points to remember about condom use that community members can be made aware of through health education or counselling sessions.

Box 25.1 Important points about condom use for safer sex practices

- Use only latex condoms.
- A new condom should be used for each sexual act.
- A damaged condom can allow HIV to be transmitted and should never be used.
- Many condoms have expiration dates and you should always check the package before use.
- Avoid damage to condoms by always using water-based lubricants. Oil-based lubricants, such as Vaseline or creams, can cause condoms to break and should not be used.

All sexually active individuals should be educated on the correct handling of condoms during and after sexual intercourse, as summarised in Box 25.2 and illustrated in Figure 25.1, which follows it.

Box 25.2 Instructions for using a condom during sexual intercourse

- Do not use an ‘out of date’ condom.
- Open the package carefully. Take care not to tear the condom, or damage it with your fingernails.
- Pinch the end of the condom and place it on the erect penis.
- Still pinching the end, unroll the condom right down the penis.
- If you want to use a lubricant, choose one that is water based. Oil-based lubricants can cause condoms to tear.
- After ejaculation, hold the condom and withdraw the penis before it becomes soft. Never re-use a condom.
- Wrap and dispose of the condom in the trash bin, not in a toilet.

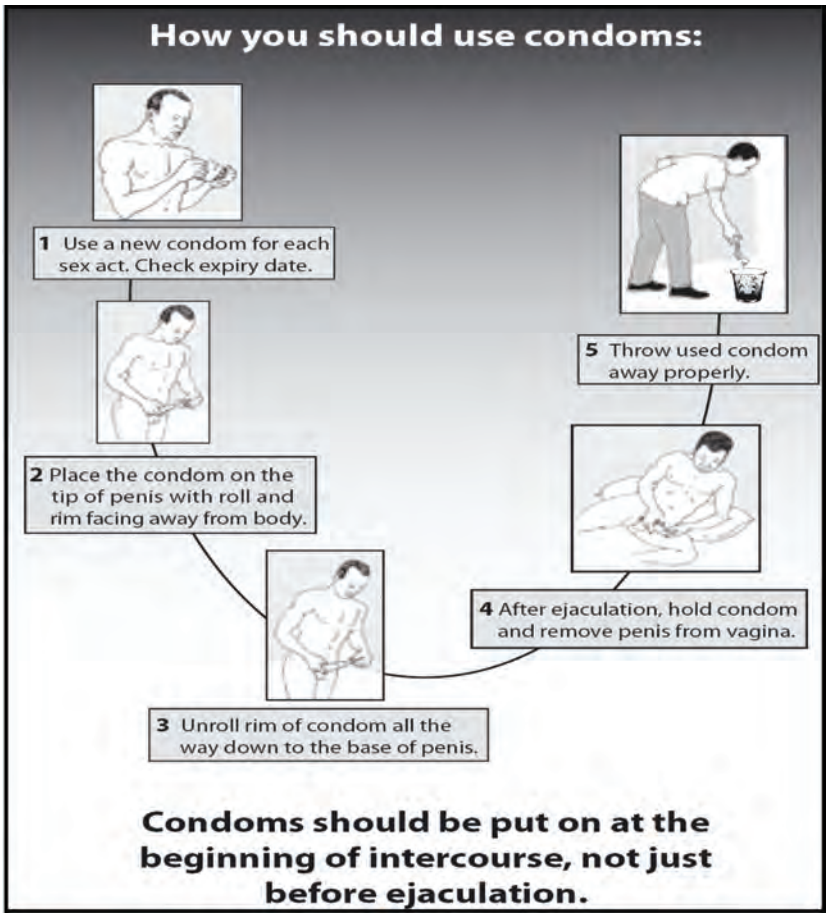


Figure 25.1 How to use a condom correctly. (Source: *Integrated Management of Adult and Adolescent Illnesses*, WHO, 2008)

Confusion or misunderstandings on how to use condoms correctly are unnecessary risks for HIV transmission. Make sure that patients and clients have clearly understood these instructions.

4. Finally, safer sex practices should be practiced regularly and consistently, that means in every sexual encounter, to prevent HIV transmission effectively.

■ Do you think it would give added protection against HIV transmission to use a double condom (two condoms, one on top of another) during penetrative sex?

□ No. Even though you may think that using double condoms would give added protection against HIV infection, there is no evidence that using them is more effective than single condoms. Rather, the use of double condoms may lead to incorrect use of condoms and increased risk of HIV transmission.

25.1.2 Strategies to prevent HIV transmission from contaminated blood

Prevention measures in the community may also be aimed at reducing personal contact with the blood of an HIV-infected person, and/or with objects contaminated with their blood. These may include avoiding the shared use of objects such as a toothbrush and/or sharps (blades, needles, etc.), either in households or in traditional healing; and avoiding harmful traditional practices (uvulectomy, tonsillectomy, milk teeth extraction, female genital mutilation).

Female genital mutilation is discussed in the Module on *Adolescent and Youth Reproductive Health.*

It is worth noting here that medical blood transfusions are potentially a route for HIV transmission. However, the FMOH has adopted an international standard of quality assurance for blood screening of HIV and other important pathogens. Hence, you need to reassure people in your community that blood transfusions are safe.

25.2 Community mobilisation for HIV prevention

Having discussed strategies that individuals can implement to prevent HIV transmission, we now turn our attention to collective HIV prevention strategies.

25.2.1 What is community mobilisation?

You learnt the basic principles of community mobilisation in the Module on *Health Education, Advocacy and Social Mobilisation*.

Community mobilisation is a capacity building process through which a community, individuals, groups and organisations plan, carry out and evaluate activities on a participatory and sustained basis to achieve an agreed-upon goal, either on their own initiative or stimulated by others. It uses deliberate, participatory processes to involve local institutions, local leaders, community groups and members of the community to organise for collective action towards a common purpose. Community mobilisation is characterised by respect for the community and its needs.

Community mobilisation for HIV is a process in which a community makes use of its own assets and capacities to prevent and control HIV/AIDS. A community takes ownership of actions with a shared sense of urgency to reduce and reverse the spread of the epidemic. It involves all relevant segments of society in order to create an enabling environment and effect positive behaviour and social change. It also brings together the community to provide care and support to infected, affected and vulnerable individuals; and to increase utilisation of HIV/AIDS services through creation of knowledge and skills at community level.

The daily routine of most people in Ethiopia is closely linked with religious, cultural and traditional values and norms. Formal and informal leaders, religious and other community leaders, have irreplaceable roles in mobilising their community due to their unique spiritual and traditional position. Hence, they have a critical role through community mobilisation, and in challenging traditional values and norms that are counterproductive to the prevention and control of HIV/AIDS.

Clearly, community mobilisation is a key intervention that brings different groups of your community together and uses community resources for shared and agreed action in the prevention and control of HIV.

25.2.2 Basic steps for community mobilisation

Community mobilisation in general involves certain basic steps that can be applied to HIV/AIDS-related community mobilisation efforts. These steps should be taken into account when preparing any type of community mobilisation to realise significant impact. At each level of the community mobilisation process, full participation of all relevant stakeholders is essential for successful community mobilisation. The basic steps of community mobilisation involve the following features:

Defining the problem

The first step in community mobilisation is to collect the basic information about the issue, in this context the HIV/AIDS epidemic in your community and/or catchment area. This will give you an idea of the extent of the problem and what the underlying causes are. In doing so, you will have a clear statement of the problem and identify the target population in the community affected by it. Traditionally, the most at-risk groups of HIV infection in Ethiopia include female sex workers, uniformed forces, long-distance drivers, migrant labourers and men having sex with men, among others. But it may also include family men who are unfaithful to their wives and will not use condoms, or cannot afford them (Figure 25.2).

Figure 25.2 Discussion of problems in preventing HIV transmission can help communities to mobilise their efforts to find solutions.

Establishing a community mobilisation group

The aim is to establish a group that can influence community mobilisation activities. It usually consists of partners that have a stake in the issue (e.g. PLHIV and/or their families), as well as influential groups and members of the community such as formal and informal leaders and religious and traditional leaders.

Designing strategies, setting objectives and selecting target groups

To achieve a planned change at community level, resources need to be mobilised from the community and other external partners. After obtaining resources, the community mobilisation group should design strategies to address the identified problem with objectives that are SMART, which means Specific, Measurable, Achievable, Relevant and Time-bound. The objectives should be assessed for their impact on the targeted groups in the community.

Developing an action plan with a time line

An action plan links the general community mobilisation plan with time lines for the actual implementation of the planned activities, and the deadlines set for goals to be achieved. This enables the progress of activities to be monitored against the targets set during the planning phase.

Building capacity

Capacity building involves identifying existing capacity resources and assessing the gaps that exist to implement the community mobilisation. The gaps identified should be supplemented by capacity building of the community groups and other relevant stakeholders in the community involved in community mobilisation.

Identifying partners

In the community there are various partners that work independently to achieve similar goals. Therefore, it is important to identify relevant partners through a simple mapping exercise. With respect to prevention and control of HIV/AIDS, for instance, the following partners may be relevant: religious institutions, local non-governmental organisations (NGOs), *kebele* forums, *maheber*, *idir*, *woreda* HIV/AIDS Prevention and Control Office (HAPCO).

Implementing the plan of activities

Based on the action plans developed with all of the relevant community level partners, implementation of the community mobilisation activities is the main task. In the implementation process, a clear role for any partners that are involved should be put in place and communicated with all of them.

Monitoring and evaluation

Monitoring and evaluation is the last, but essential, element of community mobilisation. It enables you to check whether the action plan has been implemented effectively and the specific objectives are met with respect to the issue the community is mobilised to achieve.

25.2.3 National community mobilisation strategies for HIV

The Ethiopian Federal Ministry of Health (FMOH) advocates community mobilisation approaches for the prevention, control and treatment of HIV/AIDS. In general, this involves conducting an ongoing community dialogue about HIV/AIDS-related problems. Key strategies are to enable the community to establish or strengthen groups of individuals, associations and other community organisations aimed at preventing HIV infection and improving the health and quality of life for PLHIV. Community mobilisation in HIV/AIDS serves its purpose by empowering the community, and creating an opportunity to identify and solve the community's health problems using their own resources.

The process of engaging with the community at each stage creates locally appropriate responses, and supports the creative potential of communities to develop a variety of strategies and approaches to HIV/AIDS. Bringing various groups of the community together enhances community participation in ways that recognise diversity and equity, particularly of those who are most affected by HIV/AIDS. One of its core values is preventing discrimination and stigmatisation of people infected and affected by HIV/AIDS, and providing continual support.

By utilising influential groups in the community, mobilisation creates a positive model for all behaviours and practices related to HIV/AIDS. It also fosters linking communities with external resources like NGOs and other funding institutions for technical and financial assistance. The FMOH recognises that committing enough time and resources to work with communities and partners is necessary to achieve the goals of community mobilisation for HIV prevention.

25.2.4 Respecting cultural values in community mobilisation

Different groups in the community have different values, norms and beliefs, which require different approaches to address their problems. Community mobilisation brings the community together, and helps to improve community awareness and mobilise community opinion and innovations towards a certain

issue like HIV/AIDS. It also invests in the community's capacity to apply its own resources to prevent diseases and promote better health.

■ Can you give any examples of community mobilisation activities that you may have participated in, or been aware of, for prevention of communicable diseases?

□ You may have come across Enhance Outreach Strategy (EOS) for child health, Community Conversation (CC) for HIV prevention, house to house counselling to pregnant women for prevention of maternal-to-child transmission of HIV (covered in Study Session 27), and Indoor Residual Spraying (IRS) for malaria prevention.

In HIV prevention, groups such as those involving the most 'at-risk' populations, local traditional associations and influential others, should be systematically mobilised to encourage HIV testing and counselling, and increase access to treatment services. Similarly, it helps to work with influential leaders and programme managers to improve adherence to treatment (Study Session 23).

A targeted HIV prevention programme is one of the key strategies adopted by the FMOH in Ethiopia, so one of the key activities in HIV community mobilisation is identifying the target groups.

■ Who are the most 'at-risk' population groups for HIV in Ethiopia?

□ The most 'at-risk' groups include female sex workers, uniformed forces, long-distance drivers, migrant labourers, and men who have sex with men.

Networking and partnership of all relevant stakeholders is essential, because community mobilisation is a group responsibility and it will be destined to fail if a partner does not take responsibility for their activities. So you need to coordinate and organise the various local and external groups working with you to mobilise the community on HIV control and prevention. When interacting with different influential groups of the community, you need to be politically sensitive, know cultural values, and take into consideration the gender bias that can affect the transmission of the virus. In summary, you should communicate clearly, and be able to facilitate different events together with civil societies and local associations in your community. In all your activities, you must respect cultural values that could affect HIV prevention and control.

25.2.5 Principles of community mobilisation to address HIV/AIDS

You need to recognise the key principles of HIV community mobilisation. They include the following:

- *Community ownership and leadership*. From planning to evaluating community mobilisation, the local community has to own the initiative and be involved in leadership responsibilities. This ensures sustainability of the programme, and capacity building of local managers and leaders.
- *Shared sense of urgency* by the target group and members of the community mobilisation groups.
- *Involvement of most 'at-risk' and targeted populations*. In Ethiopia, most at-risk populations include, among others, young people, commercial sex workers, construction workers, uniformed forces, men having sex with

men, long-distance truck drivers, and daily labourers migrating from other areas for a commercial work purpose. In mobilising the community for control and prevention of HIV, these groups have to be actively involved in all steps of the process.

- *Involvement of PLHIV.* Maximising the involvement of PLHIV in both prevention and care interventions is important in reducing stigma and discrimination. It also ensures that PLHIV have an active role in HIV prevention and control activities.
- *Evidence-based and result-oriented plans*. HIV prevention plans should be clear in that they should address what needs to be done, by whom, when it should be completed, and how it is done. They should be based on clearly identified problems and on evidence-based solutions. They should also be accompanied by learning from the process of activities to be implemented, through monitoring and evaluation of the overall initiative.
- *Coordinated effort and strong partnership*. Coordination of all involved, with clear roles and responsibilities of partnership, is also important. You should play a lead role in bringing community groups together, and maintaining a healthy partnership for a common goal.

25.2.6 Community mobilisation activities for preventing HIV/AIDS

Below are common community mobilisation activities that you should undertake in your community:

- Mobilise local individuals, institutions and community groups including *idir*, *maheber*, *iqub*, anti-AIDS clubs, peer support groups, women's support groups, religious groups, and other local civil society groups.
- Lead community conversation activities in your *kebele*. Community conversation is a key community mobilisation strategy advocated by the FMOH for different programmes, including the HIV prevention and care programme, and child and maternal health issues. The details of community conversation are not discussed here. You need to refer to the national guidelines for community conversation to have an in-depth insight and knowledge about how to use it in your community.

Community conversation is described in detail in the Module on *Health Education, Advocacy and Community Mobilisation*.

- Transmit HIV prevention messages through different forums like anti-AIDS clubs, student groups at schools, HIV associations, mothers' groups and other civil associations.
- Help the community share best experiences from other communities and model families in their community.
- Build the capacity of voluntary community health workers who can facilitate community conversations and refer mothers for PMTCT (Study Session 27).
- Facilitate and hold local anti-HIV/AIDS festivals and events such as coffee ceremonies.
- Mainstream your community mobilisation activities for HIV prevention in local associations and governmental organisations at different levels.
- Sign contractual performance agreements on the joint implementation of community mobilisation plans and goals with various external and local partners.

Summary of Study Session 25

In Study Session 25, you have learned that:

1 The main ways to prevent sexual HIV transmission among adults are abstinence from premarital sexual intercourse, faithfulness to a partner, and correct and consistent use of condoms, often termed the 'ABC rules'.

2 Discussion on safer sexual practices for sexually active people should include decreasing the number of partners, and consistent and regular non-penetrative sexual practices, and/or use of condoms for penetrative sex.

3 Prevention of HIV transmission via contaminated blood involves avoiding contact with objects potentially contaminated with blood, and reducing unsafe and/or harmful traditional practices.

4 Community mobilisation is a process through which community, individuals, groups and organisations plan, carry out and evaluate activities on a participatory and sustained basis to achieve an agreed-upon goal, either on their own initiative or stimulated by others.

5 Community mobilisation in general involves certain basic steps, including defining the problem, designing and evaluating strategies, setting objectives, selecting target groups, and identifying partners. These also apply to HIV/AIDS-related community mobilisation efforts.

6 The national HIV prevention strategy generally involves conducting an ongoing community dialogue about HIV/AIDS-related problems to create awareness and stimulate behavioural change.

7 Active involvement of most 'at risk' populations and PLHIV are integral in the effort to maximise community mobilisation for HIV prevention.

Self-Assessment Questions (SAQs) for Study Session 25

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 25.1 (tests Learning Outcomes 25.1 and 25.2)

Which of the following is *not* a strategy to prevent transmission of HIV? Explain your answer.

A Providing information on ABC rules of safer sex to clients.
B Providing information on prevention of mother-to-child HIV transmission.
C Provider-initiated HIV testing and counselling.
D Implementing HIV infection prevention measures at your health post.
E Not mobilising your community to reduce harmful traditional practices such as uvulectomy.

SAQ 25.2 (tests Learning Outcomes 25.1 and 25.3)

A young couple who do not know their HIV status have been using condoms for six months and then started to practise unprotected penetrative sex because they felt that they were in a faithful relationship. What would you advise them?

SAQ 25.3 (tests Learning Outcomes 25.4 and 25.5)

Read Case Study 25.1 and then answer the questions below it.

Case Study 25.1 Community mobilisation for HIV prevention

You are working as a Health Extension Practitioner in one of the rural *kebeles* but close to a semi-urban town. Though the prevalence of HIV in your *kebele* is lower than the national average, the prevalence in the small town near your *kebele* is 10%. Recently, a private road contractor has started to build the main road to Addis Ababa in your region. They have built many camps for the daily labourers working for the construction company near your *kebele*. In addition, trading women come to the camp area from the small town, as well as from other areas, to serve the daily labourers.

(a) What steps would you plan to mobilise your community to prevent an increase in HIV transmission?
(b) Who would be your target groups for the community mobilisation programme?
(c) Who are your potential partners for this community mobilisation?
(d) What HIV prevention strategies will you be implementing?

Study Session 26 Universal Precautions, Infection Prevention and Post-Exposure Prophylaxis for Health Workers

Introduction

So far, in this part of the Module, you have learnt many important topics concerning HIV and AIDS. This study session gives you the opportunity to learn about another aspect of this condition, which is especially important to you in your work as a Health Extension Practitioner. In particular, you will learn about:

- the basic principles and procedures of universal precautions
- infection-prevention methods in healthcare settings
- post-exposure HIV prophylaxis
- measures to be taken when a healthworker suffers a needle-stick injury
- referral for post-exposure prophylaxis for someone who has been raped.

You need to learn about infection prevention because the procedures to be described are very important for your daily work in the health post, and in the community at large. In particular, the guidance we give here will mean that you are unlikely to become infected with HIV and other blood-borne infectious agents through **occupational exposure** during your work as a Health Extension Practitioner.

Learning Outcomes for Study Session 26

When you have studied this session, you should be able to:

26.1 Define and use correctly all of the key words printed in **bold**. (SAQs 2.1 and 26.3)

26.2 Describe the basic principles and standard procedures of universal precautions to prevent exposure and transmission of blood-borne infectious agents. (SAQ 26.1)

26.3 Describe the standard procedures for giving safe injections to prevent occupational exposure to infectious agents. (SAQ 26.2)

26.4 Explain the principles of post-exposure prophylaxis. (SAQ 26.3)

26.5 Assess the risks of HIV infection following accidental occupational exposures. (SAQ 26.4)

26.6 Describe the measures that should be taken when a healthcare worker suffers a needle-stick injury. (SAQ 26.4)

26.7 Explain how you would refer someone who has been raped for post-exposure HIV prophylaxis. (SAQ 26.5)

26.1 Universal precautions

The term **universal precautions (UP)** refers to the standards of infection control developed to prevent exposure and transmission of blood-borne infectious agents like HIV and hepatitis virus. In some texts you will find them referred to as 'standard procedures', because they should be routine in all contacts with patients. The universal precautions that are described here should be implemented and practised at all times by all healthcare providers

Standard procedures is the term used in Part 2 of this Module in the prevention of occupational exposure to tuberculosis.

and caregivers in all settings, in particular in hospitals, health centres, health posts and community settings, as well as in the homes of your patients.

26.1.1 Why are universal precautions needed?

Universal precautions were developed because it is not possible to identify all patients with blood-borne diseases caused by microorganisms. With many of the patients you are looking after, there is no risk of HIV transmission. So, it is not appropriate to routinely test every health worker or patient for HIV. However, increased risks are faced by healthcare workers when providing care to HIV-positive patients, or those infected with other blood-borne agents such as the hepatitis virus. It was in response to such concerns that UPs were developed — the term 'universal' reflects the fact that they are intended to refer to contact with *all* patients, not just those known to have blood-borne infections.

UPs are designed to provide for the safe handling of infectious material, including amniotic fluid, cerebrospinal fluid, pleural fluid, abdominal fluid, serum, semen, vaginal fluids, blood and blood-tainted body fluids. As part of this process, barriers to infection were developed, such as gloves, gowns, masks and eye goggles to protect health workers from splashes or sprinkles of infectious materials. The procedures summarised below are designed to keep all healthcare workers safe, and to protect the public against infectious waste material that could pose a risk to them. Safety involves not just patient contact, but the management of the environment in which the patient is situated. Note that, with universal precautions, everyone is considered infectious, since it is impossible to tell ahead of time who is infected and who is not.

26.1.2 Specific universal precautions

Universal precautions include the following measures and actions:

- *Increased attention to the correct handling of sharps and all infected materials.* The safe disposal of **sharps** (e.g. needles, scalpels, lances and suture materials) is relatively easy to achieve. Home-made containers that have an open top, firm sides, and are made of durable materials, can be used as containers for used sharps (Figure 26.1).

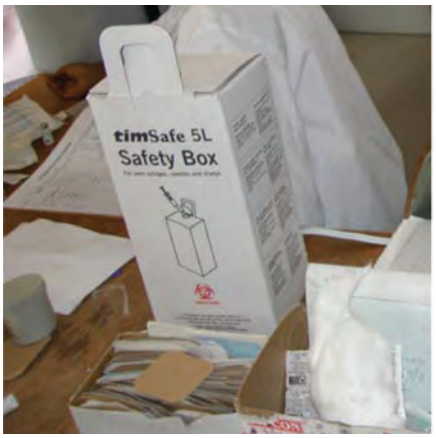


Figure 26.1 A safety box for the disposal of used sharps. (Photo: Basiro Davey)

Never fill a safety box beyond three-quarters full. Beyond this point you risk an injury when adding more sharps to the box!

- *Safe disposal of waste contaminated with blood or body fluids.* Contaminated clinical waste includes used bandages, dressings, and linens or materials contaminated with blood or body fluids; these must all be

handled with gloved hands and placed in containers for safe disposal, as shown in Figure 26.2.

Figure 26.2 Buckets are used to collect used instruments, wet waste and dry waste respectively; Zomba Mental Hospital, Malawi. (Photograph courtesy of Dr Aschalew Endale, FMOH/WHO, Ethiopia)

- *Hand washing with soap and water before and after all procedures*. This is the single most important step that all healthcare workers can take to ensure the safety of their patients and themselves. You must wash your hands before and after putting on gloves, and before and after you move from one patient to another.
- *Use of protective barriers* (personal protective equipment or PPE) when in direct contact with potentially infected body fluids. Protective barriers such as gloves, gowns, masks and goggles protect healthcare workers from occupational exposure to infectious material (see example in Figure 26.3). Gloves provide an important barrier between infectious material and the healthcare provider. Using gloves does not mean that you don't have to wash your hands.

Figure 26.3 A cleaner wearing personal protective equipment (PPE), Zomba Mental Hospital, Malawi. (Photo: courtesy of Dr Aschalew Endale, FMOH/WHO, Ethiopia)

- *Proper disinfection of instruments and other contaminated equipment*. In an effort to make universal procedures routine, more emphasis is put on preventing the transfer of infection from one patient to another by proper disinfection of instruments and contaminated equipment.

26.2 The safe injection of patients

A common source of injury for healthcare workers is poor practise when giving injections. This section shows the standard procedures for giving an injection, designed to ensure your safety and that of your patient when giving injections in the health post and in the patient's home.

26.2.1 Preparing to give an injection

Using a new sterile syringe and needle for each injection is one of the most effective ways to prevent the spread of blood-borne infections.

- Use a new packaged sterile syringe and needle for *every* injection.
- Inspect the packaging very carefully. Discard a needle or syringe if the package has been punctured, torn or damaged in any way.
- Check the expiry date on the package. Never use needles or associated injection materials that are 'out of date'.
- Prepare injections in a clean designated area or on a clean surface; in a patient's home you will need to use a clean dish or tray that you have washed in soap and water, left to air dry and then swabbed with alcohol before laying out the injection equipment.
- Prepare each dose immediately before administering; do not prepare several syringes in advance.
- Do not touch the needle. Discard a needle that has touched a non-sterile surface.

26.2.2 Avoiding needle-stick injuries

A **needle-stick injury** refers to a healthcare worker accidentally puncturing their own skin with a needle that has previously been used to inject a patient. Needle-stick injuries can occur at any time, but they happen most frequently during and immediately after an injection is given. They can also occur when needles are not disposed of in safety boxes, for example when a healthcare worker picks up contaminated waste in which a needle has been left unnoticed.

In general, the more injection equipment that is handled, the greater the risk of needle-stick injuries. *But these injuries are preventable.* Box 26.1 lists the simple steps you can follow to reduce the risk of needle-stick injuries.

Box 26.1 Steps to reduce the risk of needle-stick injuries

- Handle needles and syringes as little as possible; avoid recapping the needle after use, and do not remove a used needle from the syringe.
- Handle needles and syringes safely; ensure you wear suitable gloves, and avoid recapping needles (Section 26.2.3 gives more details).
- Set up the injection preparation area so as to reduce the risk of injury. A safe work area for a clinic is shown in Figure 26.4.
- Position the patient, especially children, correctly for injections. (You will learn how to give injections via different routes of administration in the Module on *Immunization*, and in your practical skills training.)
- Place a safety box close to where the injections are being given, so that used syringes and needles can be disposed of immediately. Practise safe disposal of all contaminated sharps and waste.

Figure 26.4 Injection area with safe injection procedures posted on the wall, (Zomba Mental Hospital, Malawi). The yellow safety box for collecting used needles and syringes can be seen in the right-hand corner. (Photo: courtesy of Dr Aschalew Endale, FMOH/WHO, Ethiopia)

26.2.3 Recapping used needles

Although you should not recap needles routinely, you may need to recap a needle to avoid carrying an unprotected sharp when immediate disposal is not possible, or if an injection is delayed because a child is agitated. If it does become necessary for you to recap a used needle, follow the *one-handed recapping* technique (also called the *single-handed scoop* method) illustrated in Figure 26.5.

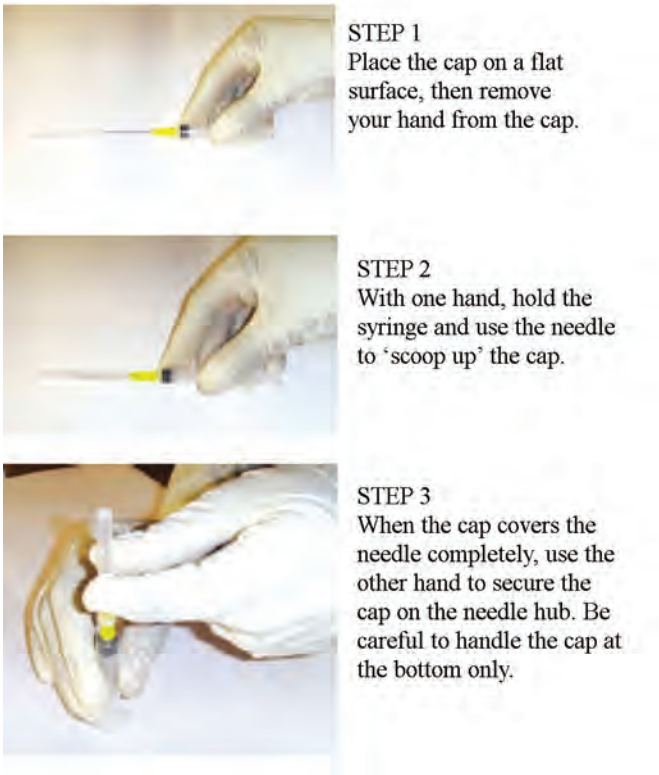


Figure 26.5 The 'one-handed' technique for recapping a needle. (Photos: courtesy of Sister Atsede Kebede and Kerry Murphy)

26.3 Post-exposure prophylaxis (PEP)

The most effective (and cheapest) way to deal with exposure to disease-causing agents is *prevention*, so the implementation of universal precautions, with appropriate training and monitoring should be your immediate priority. However, although universal precautions will decrease the occurrence of occupational exposure, 'accidents' and unanticipated exposures will sometimes occur, and it is essential to know how to deal with them.

Note that you cannot prescribe ARVs for PEP. You must refer such cases to health centres providing ARVs as a matter of urgency.

Chemoprophylaxis means using drugs to prevent a disease from developing in the first place. **Post-exposure prophylaxis (PEP)** for HIV means taking antiretroviral medication (ARVs were described in Study Session 22) as soon as possible *after* a possible occupational exposure to HIV, so that the exposure will be less likely to result in HIV infection. PEP is also provided after rape to prevent possible HIV transmission. Due to the psychosocial impact of HIV/AIDS, and the fact that the disease is not curable, PEP for HIV is made freely available in Ethiopia.

■ What does occupational exposure mean?

□ **Occupational exposure** means coming in contact with infectious agents whilst carrying out your duties as a healthcare worker.

Examples of occupational exposure to HIV are needle-stick or other sharps injuries, a splash of infected body fluid into the eyes or onto cracked skin, bites and sexual assaults by infected patients. Procedures such as gynaecological examinations, spinal taps, labour and delivery, and surgery can also place the healthworker at risk. Splash exposure carries a lower risk than a needle-stick injury, but it should be taken seriously in both the workplace and the patient's home.

For healthcare workers, PEP usually relates to exposure to HIV or hepatitis virus, but we will only deal with HIV exposure here. (Note: you learnt about hepatitis B in Study Session 4.) The risk of transmission of HIV after accidental occupational exposure is about *100 times less* than the risk of occupational transmission of the hepatitis B virus.

26.3.1 Risks of HIV infection after accidental occupational exposures

Transmission of HIV is estimated to occur in about 1 in 300 cases of occupational exposure. The factors that *increase* the risk of transmission of HIV after an occupational exposure are if:

- exposures are deeply penetrating, as opposed to superficial splashes onto mucus membranes (e.g. broken skin, mouth, eyes).
- the injury is caused by a device that was in an artery or vein in the infected person.
- blood is visible on any device involved in the exposure.
- exposure is to a large volume of blood, or other potentially infectious fluids, such as blood plasma, pus or cerebrospinal fluid (from a spinal tap).
- the injury is caused by wet instruments, which have a much higher risk of transmission than with dry instruments.
- hollow bore needles are involved in the exposure; they are more likely than solid needles to bring about transmission of HIV.
- gloves are not used while preparing and giving injections.

Hollow bore needles are used as intravenous (IV) needles or canullae, or to give drug injections. Solid needles are those used in suturing wounds.

- the 'source patient' has advanced HIV disease, taking into account factors such as the clinical stage of the illness, the extent of virus circulating in the blood, and the presence of antiretroviral drugs in their blood. The level of risk relates to the number of viruses present in the infected blood or body fluid involved in the exposure.

■ From the above list, can you identify circumstances in which the risk of HIV transmission after an occupational exposure will be reduced, relative to these higher-risk criteria?

□ The risk will be lower if the exposure is onto mucus membranes, not deeply penetrating, or involves body fluids other than blood; and also:

- if the device is dry;
- it is not previously in the patient's vein or artery,
- and/or blood is not visible on the device;
- the device is a solid (not hollow bore) needle;
- the amount of blood transferred is very small;
- gloves are worn;
- the patient is not in an advanced stage of HIV disease.

26.3.2 Immediate actions after occupational exposure to HIV

The following measures should be taken immediately after an accidental occupational exposure to a possible source of HIV infection.

Care of the exposure site

Wash the wound from a needle-stick or other sharps injury with soap and water, and let it bleed freely. The wound should be *irrigated* (flushed) with sterile saline and a disinfectant. Exposure to mucosal membranes (e.g. broken skin, mouth, eyes) should be dealt with by washing the affected area thoroughly with clean water, sterile saline or sterile eye irrigant from an eye-wash bottle.

Assessing the exposure risk

The level of risk will depend on the type of injury as described in Section 26.3.1 above.

Testing the source of the exposure

If the HIV status is unknown, a rapid HIV test should be performed on the individual or patient who is the source of the exposure, after counselling and consent has been secured. If the source is found to be HIV negative, there is no need for further assessment of the exposed healthcare worker. If the result is positive, the healthcare worker needs to be HIV tested.

Testing the healthcare worker

A rapid HIV test should be performed on the healthcare worker immediately after exposure. If the result shows that the healthcare worker is already HIV positive PEP cannot help them. If the test is negative then the healthcare worker should be administered PEP as described below. The HIV test should be repeated at six weeks, three months, and six months after exposure. If, as a consequence of these repeat tests, the healthcare worker is found to have become HIV positive, then they will be assessed for HIV care and treatment.

Following exposure to HIV, there is a need for psychosocial support and counselling on safer sexual practises. If ARVs are prescribed, close monitoring will need to follow to support adherence and identify any adverse side-effects of treatment (as described in Study Sessions 22 and 23).

- Why should the HIV test be repeated at intervals up to six months after the exposure?

- It takes up to three months before the body of a person newly infected with HIV produces enough anti-HIV antibodies to be detectable in an HIV rapid test. This is called the '*window period*'. A negative test result during this period cannot be taken as evidence that the exposure did not transmit HIV.

You must refer yourself, or any health worker you witness suffering a sharps injury from a contaminated instrument, or a splash exposure to their mucus membranes, as quickly as possible to an appropriate health facility.

Starting PEP

If you suffer an occupational exposure to blood or body fluids from *any* patient, you should seek PEP *immediately*, even before the HIV status of the source is known. To be effective, PEP has to be started as soon as possible, ideally within one to two hours after exposure. It is not worth undertaking PEP beyond 72 hours after the exposure, because by this time, if the virus has been transmitted, it will have entered the person's bloodstream. PEP cannot prevent it from circulating around the body and possibly causing HIV infection. A standard course of PEP will normally last for 28 days. It can be provided only by trained nurses, health officers or physicians at health facilities offering antiretroviral therapy (ART). Most of the health centres and hospitals offer PEP services.

26.4 Referral after rape for post-exposure HIV prophylaxis

Rape is a major crime that could happen in your community, and you need to be prepared to support the victims, both in terms of their mental health and their physical health. Cases are treated according to the Ethiopian law for rape management, and anyone who suffers a rape or other penetrating sexual assault should be referred for post-exposure prophylaxis in case the rapist was infected with a blood-borne disease such as HIV or hepatitis. Since police procedures may take time, you have to urge the raped person, and whoever is caring for them, to go immediately to a health centre or hospital that provides PEP. Currently, all ART sites provide this service, as should most of the health centres in your catchment area.

Anyone who has been raped should be counselled by the examining healthcare worker about the potential risks of HIV infection (Figure 26.6). Under these circumstances, the HIV status of the rapist should be considered as 'unknown', and therefore HIV transmission is a potential risk. Parents or guardians of traumatised children or adolescents should also be counselled and informed about the risk of HIV infection after a sexual assault.

Figure 26.6 A health worker counselling a woman who has been raped; her father is present, with her consent.

Points to be covered in counselling after a rape include:

- The precise degree of risk of HIV transmission is not known, but it exists.
- HIV testing is very important, and should be made clear to the person who has been raped and their caregivers, but explain that testing cannot give a confirmed negative result until after the window period is over.
- The raped person can choose to be tested for HIV immediately. However, if they refuse, testing can be delayed until 72 hours after the initial examination visit.
- The management guidelines on sexual assault provide for a three-day starter pack of PEP for those who prefer not to be tested immediately, or those that are not ready to receive the results immediately.

PEP is not recommended if the person presents to a health facility later than 72 hours after the sexual assault. They should be counselled about the possible risk of infection, and the possibility of transmitting infection to another person during the window period. They should be told to return after six weeks and three months for further HIV testing and counselling.

■ Why is PEP not recommended if a person presents to a health facility more than 72 hours after a sexual assault?

□ Because by this time the virus has entered the bloodstream, and PEP given more than 72 hours after exposure is not effective. Ideally, PEP has to be started within one to two hours after exposure. If this is not possible, it should be started within the first 72 hours.

A person who undergoes PEP after a sexual assault should be carefully evaluated for psychosocial support and monitored for any adverse side-effects of PEP treatment. They should also be screened for other sexually transmitted infections and referred for treatment as appropriate.

Summary of Study Session 26

In Study Session 26, you have learned that:

1 Universal precautions should be practised by all healthcare providers to reduce the risk of exposure and transmission of blood-borne infectious agents like HIV and hepatitis virus.

2 The most important infection control method is thorough hand washing with soap and water.

3 Correct handling and disposal of sharps is critical for reducing occupational exposure to blood-borne infectious agents.

4 The level of risk of HIV transmission after an occupational exposure varies depending on the source of the contamination, the type of injury, and the clinical stage of the infected individual.

5 Referral for PEP should occur immediately if a healthcare worker is exposed to blood or body fluids from *any* patient, without first waiting for the patient to be HIV tested.

6 PEP should begin ideally within 1–2 hours of exposure, or up to 72 hours afterwards. It is not effective if begun after 72 hours.

7 After a sexual assault, the victim (and/or the parents or guardians) should be counselled about the importance of HIV testing. If an HIV test is refused initially, a three-day starter pack of PEP can begin.

8 Counselling is on the risks of HIV transmission, psychosocial support, and the need to return for repeat testing after six weeks and three months; follow-up should monitor the effects of PEP.

Self-Assessment Questions (SAQs) for Study Session 26

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 26.1 (tests Learning Outcomes 26.1 and 26.2)

State if the following statement is *true* or *false*. Explain your reasoning.

'Universal precautions are used only with very sick patients.'

SAQ 26.2 (tests Learning Outcome 26.3)

Which of the following statements about the standard procedures for giving safe injections is *false*? In each case, explain what is incorrect.

A The more you handle an injection instrument, the more skilful you will become at avoiding the risk of needle-stick injury.
B Place a safety box close to the person giving injections, so used syringes and needles can be disposed of immediately.
C Do not manually remove a used needle from the syringe.
D Do not carry used syringes and needles around with you.
E Avoid recapping the needle after you have given an injection.
F Close the safety box when it is full, and start a new one.

SAQ 26.3 (tests Learning Outcomes 26.1 and 26.4)

State if the following statement is *true* or *false*. Explain your reasoning.

'If a health facility has all the personal protective equipment (PPE), the healthcare workers in that facility do not need a post-exposure prophylaxis (PEP) service.'

SAQ 26.4 (tests Learning Outcomes 26.5 and 26.6)

Read Case Study 26.1, and then answer the questions that follow.

Case Study 26.1 Ayelech's story

Ayelech is a healthcare worker trained to provide a safe and clean delivery service (this is covered in the *Labour and Delivery Care* Module). One day she was attending a delivery in a household in her catchment area. The mother had been sick for about two months before the delivery with diarrhoea on and off, but she had persistently refused Ayelech's counselling to be tested for HIV. Ayelech didn't use any personal protection equipment for the delivery except gloves. After the delivery, she injected the mother with intramuscular (IM) oxytocin to help deliver the placenta and prevent excessive bleeding. Ayelech was trying to recap the needle with two hands, when she accidentally pricked her left index finger with the needle. Her finger was bleeding and it was a deep needle-stick injury, but the placenta was coming and the baby needed attention, so she ignored the injury.

(a) Was Ayelech following universal precautions? Say why or why not.
(b) Is there a risk that Ayelech could be infected with HIV? If so, what is the degree of the exposure?
(c) Explain what she should have done immediately after the injury.
(d) Explain what Ayelech should do next.

SAQ 26.5 (tests Learning Outcome 26.7)

Read Case Study 26.2, and then answer the questions that follow.

Case Study 26.2 Fatuma's story

While working in your health post, Fatuma, a 15 year-old girl, arrives with her parents. They have brought her because six hours earlier she was raped by a man whose HIV status is not known.

(a) What do you tell Fatuma and her parents first?
(b) What will be the final advice you give to them?

Study Session 27 Prevention of Mother-to-Child Transmission of HIV

Introduction

As you will recall from Study Session 20, one of the routes of transmission of HIV is from mother to child. This occurs when an HIV-infected woman passes the virus to her baby during pregnancy, during labour and delivery, or during breastfeeding. In this study session, you will learn about **prevention of mother-to-child transmission (PMTCT)** of HIV.

Learning Outcomes for Study Session 27

When you have studied this session, you should be able to:

27.1 Define and use correctly all of the key words printed in **bold**. (SAQ 27.1)

27.2 Describe the routes and risks of HIV infection in the context of a mother and child. (SAQ 27.1)

27.3 Explain why it is important to offer counselling on HIV testing to all pregnant women, and describe the features of the 'opt out' approach to HIV testing. (SAQs 27.2 and 27.3)

27.4 Describe the drugs and regimens used for prevention of HIV transmission from mothers to children. (SAQ 27.4)

27.5 Explain counselling on breastfeeding options for preventing mother-to-child transmission. (SAQs 27.1 and 27.2)

27.1 Transmission of HIV from mother to child

The placental membrane forms a barrier between the blood of the mother and the fetus, limiting the transmission of HIV.

We know that not every baby born to an HIV-positive mother will be infected by the virus. This is because the placental membrane between the fetus and the mother remains intact during pregnancy. However, if the HIV-infected mother has problems during pregnancy, such as a lack of antenatal care (ANC), infections or poor nutritional support, she may become sick, which will further weaken her immunity. As a consequence, the number of viruses circulating in her blood will rise, and this increases the likelihood of the virus crossing the placenta and infecting the unborn child.

HIV is mostly transmitted from mother to child during delivery, at a time when the cuts and abrasions that often occur during birth increase the risk of the baby coming in contact with his or her mother's blood. Therefore, it is essential that an HIV-infected pregnant woman is supported by ANC services, and that she delivers her baby safely at a health facility, as illustrated in Figure 27.1 (on the next page). Importantly, if the baby is born in a setting where birth trauma is less likely to occur, the likelihood of transmission of HIV from mother to child is reduced.

It is part of your role as a Health Extension Practitioner to counsel and encourage a pregnant mother to come to you for antenatal care, and to give birth to her baby at a health facility.

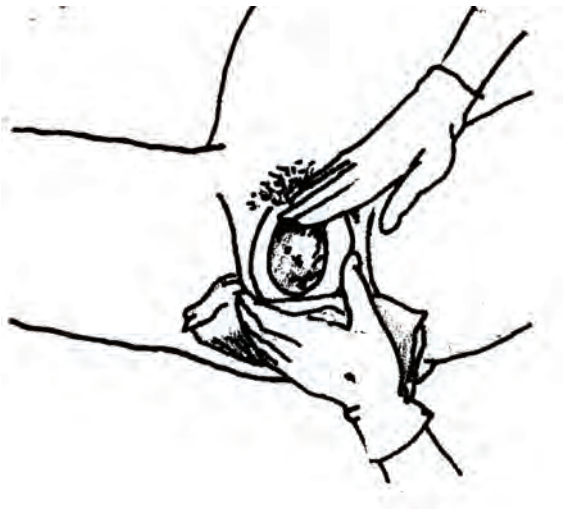


Figure 27.1 An HIV-positive mother who has her baby in a health facility reduces the risk to both mother and child. (Illustration: courtesy of Jude Melling)

After delivery, HIV may be transmitted from mother to child through breastfeeding (although the risk is not as high as that during delivery). During breastfeeding, the virus may pass through the gut wall of the baby, particularly if it is inflamed, due to infection, by bacteria causing diarrhoea.

PMTCT can reduce the chances of HIV from mother to child from 30% to 10%. This is a dramatic improvement, and HIV-positive mothers should be encouraged to seek PMTCT.

The risk of HIV transmission from mother to child for pregnant women who are not supported by ANC and PMTCT services is summarised in Figure 27.2. It has been estimated that 30 out of 100 babies (30%) born to mothers with HIV will be infected with the virus if the mothers do not attend ANC to receive PMTCT services. The outcome can be dramatically improved if the HIV-infected mother takes prophylactic drugs, which greatly reduce the chances of her baby becoming infected with HIV. The success of chemoprophylaxis depends on the drugs taken, and on good antenatal care follow-up to ensure adherence to treatment. In general, less than 10 out of 100 children will be infected by HIV if drugs for PMTCT are taken by the mother.

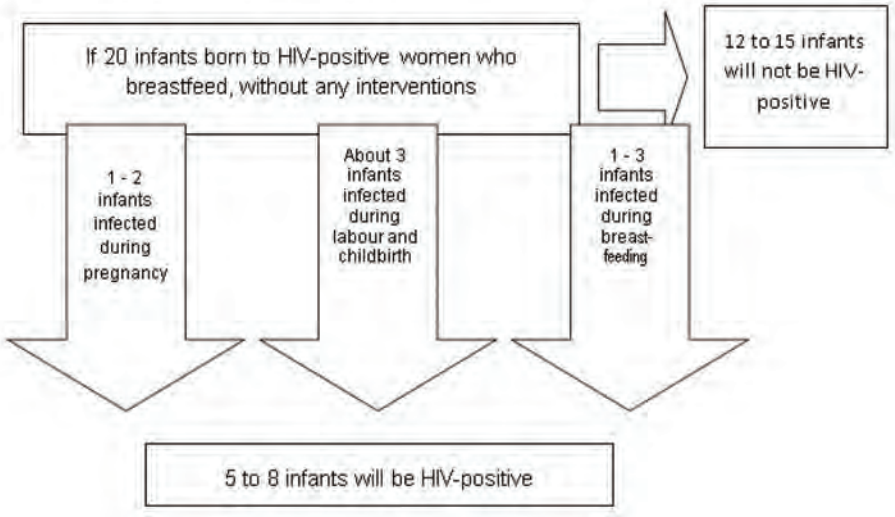


Figure 27.2 Flow chart showing the likely HIV outcome for the infant if the mother does not take any precautions to limit the transmission of the virus.

27.2 HIV testing and counselling for PMTCT

In this section you will learn about the advantages and challenges of testing and counselling HIV-infected pregnant mothers. For pregnant women, knowing their HIV status may help them to make informed decisions about their pregnancy, in particular if they are identified as being HIV positive. Your role in this process is to inform them about the advantages of receiving ANC, HIV testing and counselling services at the health post. HIV-infected pregnant mothers will then be able to decide whether to receive appropriate and timely interventions to reduce the risk of HIV transmission to their unborn baby. The interventions available to them are described in Box 27.1.

Box 27.1 Interventions for PMTCT available in Ethiopia

Antiretroviral treatment/prophylaxis

If a pregnant mother is HIV positive, the risk of HIV transmission to her baby can be greatly reduced by administering a single ARV drug, or a combination of several drugs (these were introduced in Study Session 22). For the purposes of PMTCT, ART is taken for a short period between the end of pregnancy and at early postpartum time. It is possible that the HIV-infected mother is also eligible to start antiretroviral treatment (this depends on her clinical stage; WHO HIV clinical staging was introduced in Study Session 21).

Breastfeeding

Another route by which HIV can be transmitted to the infant is through breastmilk. One of your duties is to provide counselling on safe infant feeding, and this will be discussed further in Section 27.6.

Family planning

Family planning counselling for mothers who are HIVpositive is another means of preventing the transmission of HIV to their children. This is done through preventing unwanted pregnancies. You will be expected to counsel and inform pregnant mothers about family planning in the context of HIV.

An additional advantage of PMTCT includes the fact that the mother will receive education on the importance of giving birth in a setting where standard precautions for infection prevention and safer obstetric practices are implemented. This ensures safe delivery for the mother and her child, not only in the context of HIV/AIDS, but also in case other complications arise during labour.

PMTCT counselling and HIV testing also contributes to the prevention of HIV transmission between adults, by spreading information about HIV/AIDS amongst the community. Mothers who are HIV positive and continue to receive follow-up and ongoing healthcare for themselves and their HIV-exposed infant usually transmit this information to relatives and/or friends. In order to help with dissemination of information on HIV prevention, you should encourage mothers to disclose their status to partners and family members. In addition, this helps them to get support from their family, and reduces stigma and discrimination from other members of their community.

A supportive partner and family will have a positive effect on how a pregnant mother engages with PMTCT; improving the life outcomes for both the mother and her child.

As a health worker, you may come across pregnant women who are reluctant to undergo HIV testing and counselling for PMTCT. Indeed, when confronted

with a life-changing situation (such as knowing your HIV status), women may take into account many personal and community-related factors before making a decision on whether to take a test for HIV and counselling for PMTCT.

When you discuss these intervention measures with them, you should be aware of the most common challenges associated with HIV testing and counselling programmes for women in this situation. They may experience diagnosis-related stigmatisation, or discrimination from their family and community. They will be concerned about the reaction of their partner, and this is often the main obstacle to testing and counselling. HIV testing and counselling for couples encourages mutual support and reduces the stigma and discrimination that might result from being HIV positive. Indeed, the support of the male partner is essential for a pregnant woman who is about to take advantage of PMTCT, if the new situation is to be accepted by the family.

27.3 Approaches to HIV testing in antenatal care settings

Knowing the HIV status of a pregnant woman is the cornerstone of PMTCT. You will recall from Study Session 24 that those about to be tested for HIV need to be offered appropriate pre-test education and counselling and this particularly applies to pregnant women. There are two approaches to HIV testing. Both provide information to the client about HIV, and the risks and benefits of testing in a language that is easily understood. However, the two approaches differ in the process through which consent by the client is obtained. These are known as 'opt-in' and 'opt-out' approaches.

27.3.1 Opt-in approach to HIV testing

Remember, consent can be given either in writing or verbally. Women should not be coerced into giving consent.

In this approach, you should provide information and individual counselling to the client about HIV/AIDS, about testing for HIV and about the consequences for their lives if they test positive. The pregnant woman is given the choice of either refusing or consenting to a HIV test. This option should be presented in a neutral, supportive manner. Women who 'opt in' explicitly request to be tested, and their informed consent is clearly established. The opt-in approach requires an active step by the individual woman to agree to be tested.

27.3.2 Opt-out approach to HIV testing

This approach expects you to provide information on HIV/AIDS and HIV testing in the form of group education. The opt-out approach is offered as a routine part of standard care. In this case, pregnant women are informed and routinely offered HIV testing and counselling. They are then given the opportunity to decline the test should they choose to do so or, in other words, to 'opt out' of a HIV test. The opt-out approach emphasises that HIV testing is a *routine* component of ANC.

However, you should stress to pregnant women that HIV testing is still voluntary under the opt-out approach, and that they have a right to refuse testing. You should identify and resolve issues that prevent a pregnant woman from accepting HIV testing. The Ethiopian FMOH recommends the opt-out approach and therefore you are expected to offer HIV testing and counselling to all pregnant mothers coming to your health post, or that you encounter in your community during house-to-house visits.

- A pregnant mother who is HIV positive and two months pregnant comes to you with signs and symptoms of WHO HIV stage 4 disease. What will you do?

- As you have learnt previously, WHO HIV stage 4 patients need ART, and you have to refer them to the health centre for thorough care and ART.

27.3.3 Preferred ANC testing approach in Ethiopia

The 'opt-out' strategy is the recommended approach by the Ethiopian Federal Ministry of Health for HIV testing and counselling in the ANC setting. This helps normalise HIV testing, and makes the test a routine component of ANC. Importantly, this is also likely to increase the number of women who get tested for HIV.

PMTCT programmes must adhere to the three guiding principles of testing and counselling. These are *informed consent*, *confidentiality* and the provision of post-test *counselling* and support services. Informed consent deals with asking mothers for their willingness to be tested. So you should obtain verbal or written consent after you counsel the mother about HIV testing. The mother has to make an informed decision. You also have to keep all information about the mother confidential. Information is only used to help the client to get the necessary health services, and the information has to be kept at the health facility. After counselling and testing for HIV, the provision of post-test counselling is essential for both HIV-negative and HIV-positive mothers. For services including PMTCT, you will be expected to refer the mother to the nearest health centre.

Recall the '3 Cs' introduced in Study Session 24. 'consent, confidentiality and counselling'.

- A mother comes to the health post a few days before her due date. She has never been tested for HIV. Do you think it is important to provide her with HIV testing and counselling?

- Yes, it is essential that you offer her HIV testing and counselling, and refer her to the nearest health centre for further care.

HIV testing, and PMTCT services when appropriate, are offered at several time points during the healthcare provision and management of pregnant women. PMTCT is integrated into antenatal care, labour and delivery, postnatal care, family planning, and other settings where pregnant women and women of childbearing age receive healthcare services and education.

Therefore, you need to provide comprehensive information and counselling services for all pregnant women presenting to ANC and women of childbearing age at your health post. Mothers and potential mothers should receive information on the following issues:

- Pre-test counselling, HIV testing, post-test counselling and follow-up services that should be offered to the mother and her partner for PMTCT of HIV.
- Prevention of HIV in infants and young children, including interventions for PMTCT. Prevention of HIV in infants and young children includes the use of ARVs and safe breastfeeding practices.
- Safer sex practices that would promote the prevention of transmission of HIV infection.

27.4 Steps in the HIV testing process

The steps involved in HIV testing were fully explained in Study Session 24, and will only be touched upon briefly here. You will recall that the key steps are:

1 Provide pre-test counselling and education.

2 Obtain verbal or written consent.

3 Obtain a blood test sample; at health-post level, you take a finger-prick blood sample or venous blood.

4 Process the sample using the nationally recommended rapid HIV test procedures.

5 Obtain and interpret results.

6 Keep results and all information confidential.

7 Provide results to the client.

8 Provide post-test counselling, support, and referral.

As part of this process, as mentioned earlier, you will also need to provide essential information on PMTCT. You should also discuss safer sexual practices, the importance of disclosure of the test result, and partner testing.

27.5 ARV treatment options for PMTCT

27.5.1 General considerations

Though at this time you may not be allowed to prescribe drugs for PMTCT, it may soon be available for you to provide the service for HIV-positive pregnant mothers in your own community. The type of antiretroviral drug treatment offered will depend on the clinical stage of the mother. You will therefore have to differentiate between HIV-positive pregnant mothers who need ARV drugs for PMTCT, and those who need ARV drugs for treatment of their own condition. The main criteria for PMTCT in HIV-infected pregnant women who still do not need ART for themselves are outlined below. You should be aware though that all options of PMTCT using ARV drugs significantly reduce HIV transmission to the child.

Pregnant mothers should take ART if they fulfil the following criteria:

Remember that the CD4 count refers to the number of CD4 lymphocytes per cubic millimetre (mm^3) of blood.

1 If their CD4 count is available:
   - WHO clinical stage 4: Regardless of the CD4 count, they have to receive ART for treatment.
   - WHO stage 3: They need treatment with ART if their CD4 count is less than 350/mm^3.
   - WHO clinical stage 1 or 2: They need treatment with ART if their CD4 count is less than 200/mm^3.

2 If their CD4 count is not available:
   - All women who are in WHO clinical stage 3 or 4 need ART.
   - Women who are in WHO clinical stage 2 need ART if they do not have a CD4 count, but their total lymphocyte (white blood cells) count is less than 1200/mm^3.

You should note that the above criteria are used to identify HIV-infected pregnant mothers who need ART treatment. If an HIV-positive pregnant mother is taking ART treatment, she doesn't need to take any additional ARV drugs for PMTCT. HIV-positive pregnant mothers will be screened at health-centre and hospital level, and if they fulfil one of the above criteria they will

be advised to start ART treatment. If they do not fulfil the criteria, they will be counselled for PMTCT using ARV drugs.

Therefore, if you find pregnant mothers who are HIV positive at your health post or in your community, refer them to have their CD4 count checked at the nearest health centre. If they are referred back to you from the health centre, you need to make a proper follow up of them in the community.

27.5.2 Single-dose Nevirapine, and other ARV options for PMTCT

The simplest drug regimen used to prevent HIV transmission is a single dose of *Nevirapine* given to the mother at the onset of labour, and a single dose given to the baby after delivery. It is estimated that this regimen reduces the rate of HIV transmission by half. As it is given only once to the mother and baby, it is relatively cheap and easy to administer. Consequently, it has been the mainstay of many PMTCT programmes in Ethiopia and other resource limited countries. You may be expected to use this simple intervention at your level for PMTCT.

Because of concerns about drug resistance, and that a single-dose regimen may not be as effective as combination drug therapies, there is now general agreement that single-dose Nevirapine should be used only when no alternative PMTCT drug regimen is available. Whenever possible, women should receive a combination of drugs to prevent HIV resistance problems, and to decrease mother-to-child transmission rates even further.

Nevirapine, however, is still the only single-dose drug available for PMTCT. Other treatments require women to take drugs during and after pregnancy, as well as during labour and delivery. This means they are much more expensive and more difficult to implement, unlike Nevirapine, which can be used with little or no medical supervision at all. For the moment, single-dose Nevirapine remains the only practical choice for PMTCT in areas with minimal medical resources.

In addition to single-dose Nevirapine, two other options are available, but these are beyond the scope of this study session (some of these drugs were introduced in Study Session 24):

1 Combining AZT with single-dose Nevirapine and Lamivudine.

2 Three full-dose combination of ARVs.

At this point it should be emphasised that short-term ARV prophylaxis for PMTCT does not treat maternal HIV immunosuppression, and therefore does not provide long-term benefits for the health of the mother. For this reason, women should be regularly assessed for ART eligibility. And if a pregnant mother is eligible to start ARV drugs, she should be referred to the nearest health facility to start the treatment.

■ Explain the difference between using ARV drugs for ART or PMTCT.

□ When ARVs are used for treatment purposes, usually patients take three or more combined drugs, and they are taken for life. In PMTCT, ARVs are taken as prophylaxis for a short duration, with the aim of preventing the transmission of the HIV from the mother to the child. In addition, in PMTCT a single drug, or a combination of drugs, can be taken.

27.6 Breastfeeding options for PMTCT

Exclusive breastfeeding is defined as feeding *only* breastmilk to the infant for the first six months of its life (the mother's milk is the sole source of nourishment). Exclusive breastfeeding is NOT recommended for HIV-infected women. However, the alternatives, using formula or animal milk, are not always a viable option and in such cases breastfeeding should be used. Exclusive breastfeeding should be avoided if the following criteria, established by the WHO and called the **AFASS criteria**, can be met:

- **Acceptable**: replacement feeding for breast milk should be acceptable by the family and others who are close to the family.
- **Feasible**: the mother has access to clean and safe water for cleaning utensils such as feeding bottles and teats.
- **Affordable**: the family has to be able to buy formula milk or animal milk.
- **Sustainable**: the mother is able to prepare feeds for the child as frequently as recommended.
- **Safe**: the formula milk should be safe for the health of the infant.

Figure 27.3 illustrates the AFASS decision pathway used to determine how an HIV-infected mother should feed her baby.

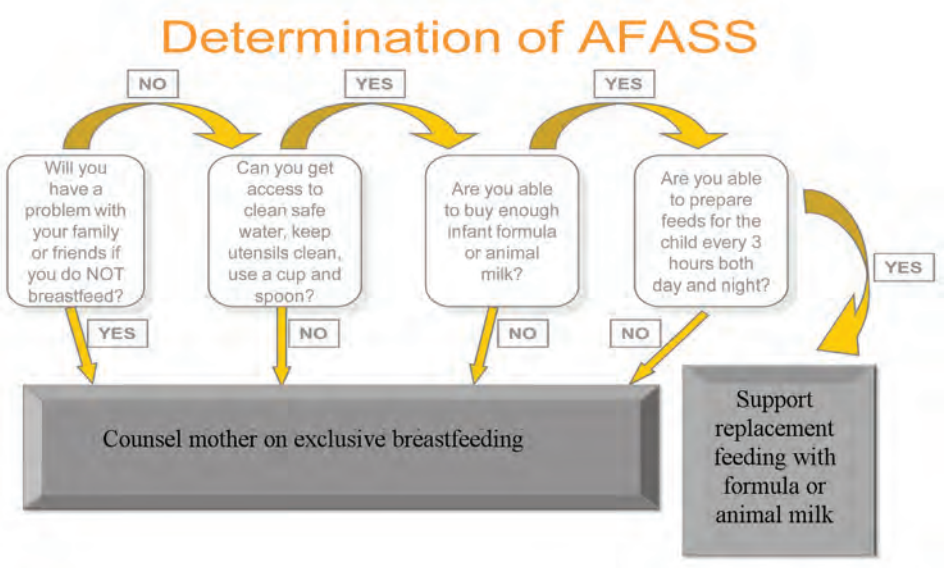


Figure 27.3 AFASS criteria used to determine if a mother should use replacement milk to feed her baby, or use exclusive breastfeeding. (WHO recommendations)

When replacement feeding fulfils AFASS criteria, avoidance of *all* breastfeeding by HIV-infected women is recommended (Figure 27.4). At six months, if replacement feeding is still not *acceptable*, *feasible*, *affordable*, *sustainable* and *safe*, continuation of breastfeeding with additional complementary foods is recommended, while the mother and baby continue to be regularly assessed. All breastfeeding should stop once a nutritionally adequate and safe diet without breastmilk can be provided.

Figure 27.4 An HIV-infected mother is feeding her baby with replacement formula milk using a bottle. She is able to meet the AFASS criteria and has chosen this option to feed her child; by doing so, she has reduced further the risk of her child being infected with HIV. (Illustration: courtesy of Jude Melling)

27.7 Four interventions for PMTCT in the community

In this section you will be introduced briefly to the four intervention strategies associated with PMTCT. In your work as a Health Extension Practitioner you have to keep in mind these interventions aim to increase the number of mothers willing to use PMTCT services.

Component 1: Prevention of new HIV infections in parents-to-be

This intervention targets young women and their partners, and promotes the use of condoms, and voluntary counselling and testing (VCT) before marriage, and during pregnancy. You should ensure that all women know that they have access to family planning and counselling, and you should encourage open discussions on reproductive health issues. This intervention also emphasises the early treatment of sexually transmitted infections (STIs), and encourages a sensible attitude towards sexual activity – strategies that will help prevent HIV transmission.

Component 2: Prevention of unwanted pregnancies in HIV-infected women

Contraceptive methods are fully explained in the *Family Planning* Module.

Here you should give information and counselling to HIV-infected women on family planning methods. You will also have to explain access to family planning counselling, and services that promote the correct and consistent use of condoms.

Component 3: PMTCT using ARV drugs

This intervention aims to encourage all HIV-positive women who are pregnant or who have recently delivered a baby and their newborns to receive ARV drugs in order to minimise the risk of HIV transmission during pregnancy, labour or during the postnatal period.

Component 4: Care and support of HIV-positive mothers and their families

This intervention seeks to provide clinical care and prophylaxis for opportunistic diseases that HIV-infected mothers (or their HIV-positive family members) may acquire. This strategy includes social, financial and psychological support for both HIV-infected pregnant women and their family members.

Summary of Study Session 27

In Study Session 27, you have learned that:

1 PMTCT is one of the key strategies to prevent the transmission of HIV.

2 PMTCT significantly reduces the risk if HIV transmission from mothers to their infants and helps establish a link to other HIV-related comprehensive services.

3 Community mobilisation to increase attendance of pregnant women for antenatal care and institutional delivery increases the coverage of PMTCT services in Ethiopia.

4 HIV testing and counselling services using the ‘opt out’ approach are provided routinely to pregnant mothers as an entry point for HIV care.

5 There are three ARV options for PMTCT, but the most widely used at community level is the single-dose Nevirapine regimen.

6 When the AFASS criteria for replacement feeding are not met, then exclusive breastfeeding is the nationally recommended strategy for HIV-positive mothers in Ethiopia. Ideally, HIV-positive mothers should not breastfeed their babies if a replacement feeding option is available.

7 The interventions implemented by the FMOH for PTMCT target four components: prevention of new HIV infections, prevention of unwanted pregnancies in HIV-infected women, the use of different ARV drug regimens for PMTCT, and care and support services for HIV-positive mothers and their families.

Self-Assessment Questions (SAQs) for Study Session 27

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 27.1 (tests Learning Outcomes 27.1, 27.2, 27.3 and 27.5)

Can a pregnant woman transmit HIV to her baby during pregnancy, delivery or breastfeeding? What should you recommend to her?

SAQ 27.2 (tests Learning Outcome 27.3)

Can women with HIV have normal healthy babies? What are the most important ways of reducing the risk of mother-to-child transmission of HIV?

SAQ 27.3 (tests Learning Outcome 27.3)

Why should a pregnant mother be tested for HIV? Explain the advantages of HIV testing and counselling for PMTCT.

SAQ 27.4 (tests Learning Outcome 27.4)

Which of the following statements is *false*? In each case, explain what is incorrect.

A Less than 10 out of 100 children will be infected by HIV if drugs for PMTCT are taken by the mother.

B All pregnant women who are HIV-positive and in WHO clinical stage 3 or 4 need antiretroviral therapy (ART).

C A pregnant woman who is taking ARV drugs to treat her own HIV infection also has to take additional ARV drugs for PMTCT.

D PMTCT with single-dose Nevirapine means giving one dose of this drug to the newborn baby.

Study Session 28 HIV in Children

Introduction

In Study Session 27, you learnt that mother-to-child transmission of HIV during pregnancy, delivery and labour, and breastfeeding are the main sources of HIV infection in children. In this study session, we will focus on the consequences of HIV infection in children. You will first learn about the key differences in chronic HIV care between adults and children. The immune system in young children is still developing, and as a consequence HIV-infected children suffer from many more opportunistic and common infections, and also progress more rapidly to AIDS than HIV-infected adults. For these reasons, early diagnosis and treatment of HIV infection is particularly important in children.

Within your health post, you will have to establish a link between your own family-focused care and HIV care services. To do so, you will need to learn how to routinely discuss and recommend HIV testing for children born to HIV-infected mothers, and when it is appropriate to refer them. Finally, we will briefly describe important issues concerning the care of HIV-infected children, namely their nutritional status and psychosocial needs. You will learn more on the diagnosis of HIV in children, and the care for HIV-exposed infants and HIV-infected children in the *Integrated Management of Newborn and Childhood Illness* (IMNCI) Module.

Learning Outcomes for Study Session 28

When you have studied this session, you should be able to:

28.1 Define and use correctly all of the key words printed in **bold**. (SAQ 28.1)

28.2 Describe the key differences in diagnosis of HIV status and chronic HIV care between adults and children. (SAQs 28.1 and 28.2)

28.3 Explain when to refer HIV-exposed infants born to HIV-positive mothers for early diagnosis. (SAQ 28.3)

28.4 Describe the nutritional and psychosocial needs of children with HIV. (SAQ 28.3)

28.1 Critical issues in HIV infection and progression to AIDS in children

There are important differences in HIV infection and progression to disease between adults and children. These have implications for the care needed by HIV-infected children (explained further in Section 28.3). We will describe here the main issues related to HIV/AIDS and children that will help you provide the best care for HIV-infected children in your community.

28.1.1 Minimising risk of infection in children

Remember the AFASS criteria. It is not always possible for a mother to give her child replacement milk; sometimes breastfeeding is the only viable option.

The most important thing for you to remember in the context of HIV prevention in children is that mother-to-child transmission is the main source of HIV infection. Children at any age who continue to be breastfed from HIV-positive women are at risk of acquiring HIV infection through contaminated breastmilk throughout the time they are breastfed. You should provide feeding advice to mothers according to the national guidelines on infant feeding (this is covered in detail in the *Integrated Management of Newborn and Childhood Illness* Module). Where one child is HIV positive, it is possible that other family members, including **siblings** (brothers and sisters), are already infected. Therefore, you should always encourage HIV testing of parents, and young, siblings of HIV-exposed infants and HIV-infected children. You should appreciated that unless an HIV test result is confirmed, infants born to HIV-positive mothers are called **HIV-exposed infants**, and **HIV-infected children** are those whose HIV test results are confirmed as being positive.

■ What is the main route of HIV transmission among adults?

□ The main route of HIV transmission among adults is sexual intercourse.

28.1.2 Early diagnosis of HIV

There are differences in disease progression and diagnosis of HIV infection between adults and children. The main differences in disease progression and diagnosis are listed below:

- Young children have immature immune systems and thus are more susceptible to common childhood infections, as well as opportunistic infections.
- Early diagnosis of HIV infection in children is essential, as the infection in infants and children progresses faster than that of adults Although HIV-infected infants are generally symptom-free at birth, in the absence of any intervention, most of them develop severe symptoms in the first two years of life, and die. Therefore, early diagnosis and management of HIV-exposed and HIV-infected children is key to ensure maximum benefit from ART, and to reduce AIDS-related morbidity (the presence of an illness or disease) and death in children.

The antibodies the mother makes against her HIV can cross the placenta and get into the fetal bloodstream. After birth, these antibodies can show up when the baby is HIV-tested.

- In HIV-exposed infants, maternally acquired antibodies make the diagnosis of HIV challenging. The antibodies present in the blood of an HIV-exposed infant may originate from the mother and not the infant itself. Therefore**,** a positive rapid HIV test is not definitive for the diagnosis of HIV infection in children below the age of 18 months. However, a rapid test, done six or more weeks after the complete cessation of breastfeeding, which gives a negative result, is more useful, because it excludes HIV infection in HIV-exposed infants.

28.1.3 Differences in the management of children and adults with HIV

The management of HIV in children, especially the young ones, differs from that of adults. Below are some of these differences:

- Normal CD4 counts are higher in young children than in adults, and decrease with age to reach adult levels around the age of six years. In children younger than six years, it is better to use the percentage of CD4

cells in the blood as a criterion to start ART. This is more stable than the CD4 cell count used in adults.

- Once started on ART, children need to be followed-up more frequently than adults. Their response to ART should be checked by regular monitoring of growth and development (Figure 28.1 illustrates the profound improvement that can be seen in HIV-positive children given ART).
- ARV drug dosages need to be adjusted regularly to account for changing body weight and growth as children develop.
- Communication with children can be challenging. This regards issues related to disclosure, counselling and explaining the need for long-term treatment, particularly adherence to the treatment regimen.

Figure 28.1 A South African child living with HIV. The image on the left was taken immediately prior to ART and the photo on the right shows the marked improvement achieved after only six months of therapy. (http://www.tac.org.za/community/taxonomy/term/49)

28.2 Providing care for HIV-exposed infants and HIV-infected children

Routine childhood services, e.g. immunization, nutrition, OPD (out-patient department) and in-patient (hospital ward) services, are entry points for HIV-exposed and infected children. Health workers should use these services as opportunities to provide access to early diagnosis of HIV for families with children at risk.

As we discussed above, HIV-exposed infants/children should be enrolled into HIV care services and receive a regular follow-up at a health centre or hospital. They should also be given cotrimoxazole prophylaxis to prevent severe infections such as *pneumocystis* pneumonia (a fungal infection of the lungs), which can cause death in HIV-infected children. Cotrimoxazole prophylaxis is given to HIV-exposed children starting from four to six weeks of age, until a diagnosis of HIV infection is definitely excluded. Those who present late to a health facility should also be given cotrimoxazole prophylaxis.

Cotrimoxazole prophylaxis is also protective against opportunistic bacterial infection, as you learnt in Study Session 21.

Remember that a rapid HIV test is not a reliable test to diagnose HIV infection in children under the age of 18 months. This is because there are maternally acquired antibodies in the blood of the child, and these antibodies

can give a false positive HIV test result. Therefore, the best test for diagnosing HIV infection in children less than 18 months of age is a **DNA PCR** test (see Figure 28.2 on the next page). This test detects the presence of viral components in blood. However, you are not required to know the details of this test.

Figure 28.2 Blood samples are collected from a baby for a DNA PCR test. The samples are collected as a series of 'dry blood spots' which will then be tested for the presence of the virus.
(Photo: courtesy of UNICEF UK, Lesotho 2007/Gideon Mendel)

DNA PCR does not rely on the detection of antibodies – remember, these could come from either the mother or baby. Instead, this test looks for DNA molecules that can only come from the virus. If the test is positive, it means the virus is in the baby's blood.

The Federal Ministry of Health of Ethiopia has already started a DNA PCR service at several regional laboratories, where blood samples can be sent for analysis to aid *early infant diagnosis*. DNA PCR can be done as early as six weeks of age. Therefore, you, as a health worker, should encourage the family of an HIV-exposed infant/child to take the infant/child to a nearby health centre for early diagnosis.

When you encounter such children, either when visiting a household or at the health post, you should inform the family or caregiver about the importance of follow-up care and cotrimoxazole prophylaxis for the HIV-exposed child. The caregiver might not easily recognise the importance of cotrimoxazole prophylaxis and follow-up care, particularly if the child appears to be healthy. Your role is to coordinate the care of the HIV-exposed child with that of the mother.

28.3 Nutritional and psychosocial support for children with HIV

HIV-exposed infants and HIV-infected children need special nutritional and psychosocial support, both at the level of the health facility and the community. Below we will discuss why they need this special support.

28.3.1 Nutritional needs of HIV-infected children

The nutritional status of a child will significantly affect the incidence and severity of **HIV-related illnesses**, such as tuberculosis and diarrhoea. In addition, HIV-related illnesses also have severe nutritional consequences that commonly precipitate appetite loss, weight loss and wasting. Clinical situations that may impair the nutrition of HIV-infected children are recurrent or chronic infection, fever, intestinal infections, oral or oesophageal lesions, and persistent diarrhoea. Box 28.1 (on the next page) summarises some of the key issues that need to be considered when thinking about the nutritional needs of HIV-infected children.

Box 28.1 Nutritional management of HIV-infected children

- Increase energy intake by 50% to 100% over normal requirements in children experiencing weight loss.
- Identify local foods that are available and affordable, and provide advice for the caregiver on energy requirements. For the type of local foods that are available, you may find it useful to refer to a local food adaptation table.
- HIV-infected children from the age of six months should receive vitamin A supplements every four to six months (100,000 IU for infants up to 12 months, and 200,000 IU for children above 12 months.) This level is consistent with the current WHO recommendations for the prevention of vitamin A deficiency in all children.
- For persistent diarrhoea, refer to the *IMNCI* Module.
- Feeding and increased fluids should continue during illness. The child may develop nausea and vomiting as a result of ARV drugs. Encourage small, frequent fluids, and give foods that the child likes. Let the child eat before medication. For a child with sores in the mouth, give soft and mashed food, or give paracetamol half an hour before solid feeding.

Note: you will also learn more on this topic in the *IMNCI* Module.

The Module on *IMNCI* includes the treatment of diarrhoea and HIV diseases in children.

28.3.2 Providing psychosocial support to children infected with HIV

Beyond disease management, children infected with HIV face a number of problems that impact upon their social, educational and emotional development and wellbeing. These children require psychosocial support, which includes a range of interventions that enable individuals and families to cope with the overwhelming feelings that result from their experiences with long-term disease and death. Providing psychosocial support may include addressing self-esteem**,** adaptation to illness and its consequences, communication, social functioning and relationships — these topics will be discussed in more detail in Study Session 30 (Providing Palliative Care for people living with HIV.)

Health facility-based and home-based stimulation of children improves their mental, social and emotional development. Remember, encourage family members to play and talk with the children. This will help provide an enriching and stimulating environment that will greatly enhance and support the children's psychosocial development.

For those children who are also malnourished, combining psychosocial stimulation with food supplementation has been shown to produce better outcomes and growth for the children.

Children's development will flourish when they form secure attachments to a responsive caregiver. Furthermore, children need to be provided with psychological (relating to both the mental and social aspects of life) and emotional support within their family or through other caregivers, and to be able to communicate openly about their own or their family member's condition, so as to give relief to deep fears that may be difficult to share.

You may need to provide psychosocial support to HIV/AIDS orphans (children who have lost their parents through HIV/AIDS).

For caregivers to provide this support to children, they must themselves be provided with psychosocial support. This can be done when you do home visits, or through community-based organisations or peer support groups. It is important for you to ensure adequate linkage of families with these groups, and to pay attention to the psychosocial needs of the whole family on each visit.

Summary of Study Session 28

In Study Session 28, you have learned that:

1 There are differences between HIV infection in adults and children. The main differences are the mode of transmission of HIV, disease progression, diagnosis of HIV infection, especially among children less than 18 months of age, and that CD4 counts are higher in children compared with adults.

2 ARV drugs are handled differently in children's bodies, affecting the doses that are needed. Dosages in children need to be adjusted to the child's weight as the child grows.

3 Communication, adherence and disclosure in children are challenging.

4 Infants and children born to HIV-positive parents should be tested for HIV as early as possible. If not, they may die of common childhood illnesses and opportunistic infections in a shorter time. You need to refer such infants/children to a nearby health centre/hospital for early infant diagnosis.

5 HIV-infected children need special psychosocial and nutritional support.

Self-Assessment Questions (SAQs) for Study Session 28

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 28.1(tests Learning Outcomes 28.1 and 28.2)

What is meant by the term 'HIV-exposed infant'? How is the child's HIV status diagnosed?

SAQ 28.2 (tests Learning Outcome 28.2)

Which of the following statements is *false*? In each case, explain what is incorrect.

A The progression of HIV infection in children is slower than that of adults because they have fewer viruses in their body.

B Rapid HIV testing can confirm HIV infection in a six-months-old infant born to an HIV-positive mother.

C ARV drug dosages should be adjusted as the child gains weight or grows.

D Young children normally have higher CD4 counts than adults, and it is better to use the CD4 percentage (instead of the CD4 cell count) as a criterion of whether to start them on ART.

SAQ 28.3 (tests Learning Outcomes 28.1, 28.3 and 28.4)

Read Case Study 28.1, and then answer the questions that follow it.

Case Study 28.1 Kebede's story

Kebede is a one-year-old male child who is the last of three siblings. All of the three live with their grandmother who is 65 years old. You hear from the grandmother that the mother of the children died of AIDS six months after giving birth to Kebede, and their father died in an accident 10 months ago. The grandmother also explains to you that Kebede is not feeling well, and has had diarrhoea on and off for two months. He has also lost weight. The grandmother needs your help.

(a) What do you say about Kebede's HIV status?
(b) Explain what you should do for Kebede.
(c) Will screening his siblings for HIV help the family?

Study Session 29 Positive Living and Prevention of HIV Transmission for PLHIV

Introduction

In previous study sessions, you have learnt about the basic biology of HIV and opportunistic infections associated with AIDS. You have also learnt about the treatment used by people living with HIV (PLHIV) to prevent and/or slow down progression to AIDS. Remember that patients infected with HIV need to follow their treatment correctly and strictly in order to maintain a healthy life. In this study session we will be discussing *positive living*, which means a lifestyle for PLHIV that is aimed at maintaining their quality of life for as long as possible. To encourage a positive living lifestyle, PLHIV should actively sustain the following practises: be informed about health issues; take medications as prescribed; work as their energy allows; avoid stress; maintain good nutrition; prevent infections; practise regular exercise; and seek regular medical care. Most importantly, positive living for PLHIV also involves playing an active role in preventing the spread of HIV, and you should stress the importance of safer sex practises in this context.

After studying this session, you will be able to advise PLHIV in your community to adopt a 'positive living' lifestyle and to make them aware of the fact that, even if they are on antiretroviral therapy (ART), they can still transmit the virus. In this way, you will also be able to provide information to patients who have misconceptions about HIV, its transmission and treatment. In addition, you may consider referring patients to the nearest health centre if you determine that they should receive additional clinical services and psychosocial support. In brief, by helping PLHIV to adopt positive living practises, you will be able to encourage them to live a healthy and good quality life.

Learning Outcomes for Study Session 29

When you have studied this session, you should be able to:

29.1 Define and use correctly all of the key words printed in **bold**. (SAQ 29.1)

29.2 Explain that people taking antiretroviral therapy can still transmit HIV, and can still be re-infected with another strain of HIV. (SAQs 29.1 and 29.2)

29.3 Explain how you would advise PLHIV on positive living and good nutrition. (SAQ 29.1)

29.4 Explain how you would advise PLHIV about the importance of seeking regular medical care at the health centre or hospital. (SAQ 29.3)

29.1 What is positive living?

Positive living is a lifestyle adopted by an HIV-infected person in order to live life as fully as possible while slowing progression to AIDS. Adopting positive living practises improves the quality of life of PLHIV remarkably. Important aspects of positive living for PLHIV include making positive choices to care for one's mental and physical health, having a positive outlook on life, and avoiding risky behaviours.

In this context, **risky behaviours** refer to situations in which there is an increased risk of transmission of HIV and/or other infections such as STIs for the patient or for their partners (e.g. unsafe penetrative sex).

Your role as a Health Extension Practitioner consists in promoting positive living practises for PLHIV in the community. In doing so, you will maintain the continuity of care patients receive from the health centres and hospitals at the level of their own community. Your role in supporting PLHIV to practise positive living includes the following key tasks:

- Becoming familiar with different aspects of positive living, as you may need to provide information to patients about them.
- Understanding what 'positive living' means for PLHIV. Positive living includes many topics that can help a person living with HIV to live a healthier life, and postpone progression to AIDS.
- You may provide referrals, if necessary, to guide patients to services that will help them live positively. These services might be available at healthcare service delivery points, or other social and economic support organisations existing in your community.

The points listed in Box 29.1 should form the basis of your discussions with PLHIV to promote the adoption of positive living practises. In the following sections we will be discussing these specific issues in more detail.

Box 29.1 Points of discussion for advising PLHIV on positive living practises

1 Prevent the spread of HIV.
2 Be informed about your health.
3 Take medications as prescribed by the healthcare worker.
4 Work as your energy allows.
5 Avoid stress.
6 Maintain good nutrition.
7 Prevent infections.
8 Get regular exercise.
9 Seek regular medical care.

29.2 PLHIV and prevention of HIV transmission

In Study Session 25, you learnt about preventative measures that individuals — whether they know their HIV status or not — may take into consideration in order to reduce risks of HIV infection via the sexual route, and by direct contact with objects contaminated with infected blood. In this section, we are going to discuss specific issues that relate to sexual transmission of HIV, and to a lesser extent transmission by contact with infected blood, in the context of HIV treatment, care and support provided to PLHIV.

Patients who are on antiretroviral therapy (ART) should be informed that HIV transmission to other people is still possible, even if treatment has been effective and they are informed by health workers that they have undetectable levels of HIV in their blood. Very low levels of HIV can still be present in the

blood and/or sexual fluids of PLHIV undergoing ART, and these may be sufficient for the virus to infect another person.

29.2.1 Re-infection with HIV

Another subject that PLHIV should consider is **re-infection**, which refers to the situation in which a person already living with HIV is infected with a new strain of HIV from another PLHIV. Re-infection can accelerate progression to AIDS in two ways. First, re-infection can increase the **viral load** (i.e. the levels of HIV in the blood) of a person living with HIV, as it may take some time for either the patient's immune system (whose function is already impaired), or antiretroviral (ARV) drugs to be effective against the new type of virus. This will result in further damage to the immune system, making the person with a re-infection more vulnerable to opportunistic infections.

Secondly, a PLHIV may be re-infected with another type of HIV that is already resistant to the ARV drugs they are taking, which may ultimately lead to treatment failure. The consequence of ART failure of first-line drugs is replacement with second-line ARV drugs, which may be less effective in controlling HIV infection (Study Session 23). Thus, it is always advisable for PLHIV not only to minimise risks of HIV transmission to other people, but also to avoid re-infection by HIV from another person.

29.2.2 Strategies to minimise HIV transmission

Having established that PLHIV can still transmit the virus to uninfected individuals or to other PLHIV, we shall now discuss ways that PLHIV can minimise the risks of HIV transmission via the sexual route.

- What are the most widely known strategies for prevention of HIV transmission through the sexual route?

- These are known as the 'ABC Rules'. 'A' stands for 'Abstinence', which means refraining from premarital sexual intercourse; 'B' stands for 'Be faithful', which means maintaining faithful relationships with a long-term partner; and 'C' stands for 'proper use of Condoms', which means correct and consistent use of condoms in sexual relations (Study Session 25).

Abstinence

Abstinence is certainly a choice for PLHIV with the aim to eliminate the risks of transmitting HIV to uninfected people or other PLHIV. However, it is still possible for PLHIV to engage in a rich and satisfying, active sex life, and we will discuss this topic in the context of the 'B' (maintaining faithful relationships) and 'C' (safer sex practises) rules.

Maintaining faithful relationships

In general, maintaining faithful relationships is an effective measure for individuals to reduce the risk of HIV infection. Remember the linear relationship between HIV transmission and the number of sexual partners that is; the higher the number of partners, the higher the risk of HIV transmission (Study Session 25). This particularly applies to PLHIV — the more partners they have, the more likely it is that they transmit the virus to other people and/or that they become re-infected.

However, for the 'B' rule to be effective, both partners need to be confirmed as HIV negative. It is not sufficient to maintain a faithful relationship in order to prevent HIV transmission where PLHIV are concerned, whether their

partner(s) are HIV negative (as it would lead to HIV infection of a previously uninfected person) or HIV positive (as it would lead to re-infection of a person living with HIV).

Safer sex practises

In this context, it is critical that you stress the importance of consistent and correct safer sex practises to PLHIV (whether they have opted for faithful relationships or for multiple sex partners).

- What are the safer sex alternatives to unprotected penetrative sex?
- Non-penetrative sex practices, or penetrative sex with a condom (Study Session 25).

Thus, to reduce the risk of HIV transmission or re-infection, sexually active PLHIV should be advised to ALWAYS engage with a partner using either non-penetrative sex practises, or penetrative sex practices with a correctly used condom. If condoms are correctly used they can prevent the transmission of HIV by more than 98% (the remaining 2% reflects incorrect use of condoms). Refer to Study Session 25 for information on the correct use of condoms. In this context, safer sexual practises are also beneficial in the prevention of other sexually transmitted infections (STIs), a topic that will be further discussed in Study Session 31.

Engaging the sexual partners of PLHIV

When providing information to PLHIV about general and specific issues on prevention of HIV transmission via the sexual route, it is also important to engage their partner(s) in the discussion, whether they know their HIV status or not. This is important so that all partners involved play an active role in the prevention of HIV transmission (or re-infection). However, you should discuss with PLHIV the benefits (e.g. good adherence to ART) and/or problems of disclosing their status to their partners before they decide to do so.

- Biruk and Hiwot are a young married couple in your community. Biruk is HIV-positive, so for the duration of their marriage they have engaged in safer sex practises to reduce the risk of HIV transmission to Hiwot (who has remained HIV-negative). They now want to have a baby. What issues would you discuss with them?
- You should make sure that they understand that unprotected penetrative sex will greatly increase the risk of HIV infection for Hiwot. This may have consequences for the health of Hiwot and for the health of the child, should she become pregnant. If they are still intent on having a baby, refer them to the nearest health centre for further care and support.

Finally, you should also advise PLHIV (and their partner(s) and close family) on issues related to HIV transmission via contact with blood-contaminated objects. PLHIV and their close family should be particularly attentive to sharing common objects that may have been contaminated with blood. These include utensils such as needles, razor blades and toothbrushes (Figure 29.1).

Figure 29.1 Each member of a household with a person living with HIV should have their own easily-identifiable toothbrush to avoid exposure to contaminated blood. (Photo: Basiro Davey)

It is also important to emphasise that PLHIV should never give blood for transfusion, as this could result in HIV transmission to other patients that receive their blood or blood-related products.

29.3 PLHIV should be informed about their health

Informing the PLHIV in your care about their health status builds up their confidence, thereby encouraging their active involvement in improving their own health. At each visit, you should inform patients about how they are progressing health-wise, and provide them with health information materials that are available from your health post to build their ability to manage their own health issues. When working with patients, you should ask them if they have any questions about HIV/AIDS and/or their specific health issues in a relaxed and non-confrontational manner. It is advisable to encourage PLHIV to attend their visits accompanied by members of their family or treatment supporters, especially if this helps them express any concerns they may have about their health status (Figure 29.2).

Figure 29.2 Clear information about HIV/AIDS and positive living is vital for PLHIV.

You should encourage your patients to learn, to the best of their abilities, about HIV infection, AIDS and related health problems. Understanding more about HIV may lessen a patient's fear of HIV, and help them identify and maintain strategies to stay healthy. Knowing more about HIV may also help your patients remember to take their medications correctly and at the prescribed times, hence promoting good adherence to ART.

29.4 PLHIV should take medication as prescribed

In Study Session 23, you learnt about the importance of adherence to ART for PLHIV. Remember that 100% adherence is the goal for patients who are on ART so that HIV replication is suppressed (Figure 29.3).

- What are the consequences of poor adherence for the health of a person living with HIV?
- Poor adherence may lead to drug resistance, increased viral load, decreased levels of CD4 lymphocytes, higher incidence of opportunistic infections and faster progression to AIDS, and increased possibility of sickness and death.

Figure 29.3 Strict adherence to drug regimens is essential for PLHIV. (Photo: Basiro Davey)

Therefore, educating patients about essential points of good adherence to treatment at regular visits is essential to promote health for PLHIV, and to strengthen positive living. For example, you should make sure that HIV-positive patients understand that HIV has no cure, that HIV infection is at present a lifelong condition, but also that medications can help a patient live a healthier and longer life.

Adherence is not restricted to ARV drugs, and should include medication (such as cotrimoxazole) for prevention of opportunistic infections. The message given to patients should be concise and clear. Here is an example:

> 'You may feel well now but, if you want to stay healthy, you should take all your medications regularly and consistently.'

In addition, medications may be available to help manage some side-effects of ART, such as pain, vomiting and diarrhoea. Although strict adherence to these treatments is not as critical for the long-term health of PLHIV as it is for adherence to ART and opportunistic infection prophylaxis, all medications should be taken in the proper doses and on time for them to be effective in improving a patient's health.

Lifestyle and unprescribed medications may influence the outcome of ART. Many herbal/traditional medications can interact with ARV or prophylactic drugs and render them less effective. Thus, patients should not take any medication without first consulting their respective health worker. Alcohol, cigarettes, and chewing 'khat' may also interfere with ART or prophylactic medication, and these should be avoided. In addition, these lifestyle choices will have a negative effect on the overall health (in particular, the function of the immune system) of the patient, who will then become more susceptible to opportunistic infections.

29.5 PLHIV should work as their energy allows, and avoid stress

Being able to work, either full- or part-time, and/or being involved in daily routines are important assets for maintaining a positive attitude and a healthy lifestyle. When discussing positive living practises with PLHIV, you should emphasise that work provides income, stability, satisfaction, friendships and fulfilment to many people, and may therefore promote their psychological and physical wellbeing. You should encourage your patients to continue working for as long as they are able to reasonably manage their workloads. In the event of episodes of ill health, it may be quite difficult to continue regular work, and PLHIV should determine whether they are fit enough for work. However, they should keep in mind that returning to work after illness may help improve their quality of life.

Avoiding stress and dealing with worries in a positive manner is also important for PLHIV to maintain their health. Specific strategies on how to deal with stress, anxiety and depression are discussed in detail in the Module on *Non-Communicable Diseases, Emergency Care and Mental Health*. For example, they may need to find positive ways to deal with stress such as talking with friends or family members, and avoid negative ways of dealing with stress such as abusing alcohol, chewing khat or taking other recreational drugs. It is important to emphasise that alcohol or chewing khat may make them forget their problems for a short while, but may lead them to be involved in risky behaviours such as unsafe sex.

29.6 PLHIV should maintain good nutrition

Maintaining a good nutritional status is essential for improving the quality of health of people presenting with any disease, including HIV and AIDS, as sick people have more nutritional needs than healthy ones. HIV infection by itself, in particular at the late stages of the disease, and/or the presence of opportunistic infections, have been associated with poor nutritional status and extreme weight loss. Poor nutrition in PLHIV may lead to further impairment in the function of an already damaged immune system and favour an increased incidence of opportunistic infections.

Other contributing factors to weight loss are the presence of diarrhoea and vomiting (common in patients with AIDS), which impair nutrient absorption through the gut, and loss of appetite, sometimes related to difficulties in eating. In addition, nausea and vomiting are common side-effects of ARV drugs, and may also play a role in the poor nutritional status observed in many PLHIV. You should advise PLHIV in your community to adhere to the following recommendations if they feel nauseated or they lose their appetite — eat small frequent meals, eat bland foods (e.g. porridge), do not eat oily or spicy foods, and take ARV drugs with or soon after meals.

Also remember that the nutritional requirement of people who are sick is greater than that of healthy people. This is because additional energy is needed to compensate for the increased energy needs of the body due to illness. PLHIV who are also coping with opportunistic or other infections will need to eat more nutritious food in order to help their immune system fight the infectious agents.

PLHIV, in particular those diagnosed with AIDS, should eat a well-balanced diet consisting of regular meals (even when they do not feel hungry). Meals should include protein, fat, carbohydrates and vitamins in the recommended proportions, as described in the *Nutrition* Module, and illustrated in Figure 29.4. In addition, a well-balanced diet involves drinking plenty of clean water, up to two litres per day. You should discuss with patients about how to incorporate a well-balanced diet into their life routines, and about factors such as lifestyle and economic status that may negatively affect it. If needed, suggest they ask for help when preparing meals and cooking. You may also need to refer patients to food support services at your nearest health centre.

Figure 29.4 A well-balanced diet should include a variety of foods. This is particularly important for vegetarian diets such as the one shown. (Photo: Tom Heller)

29.7 PLHIV should avoid getting infections

As you already know, since HIV affects the function of the immune system, a person with HIV is more susceptible to opportunistic infections. People with HIV should take effective actions to prevent communicable diseases which may have important consequences for their health. Here, we will briefly discuss some preventative measures to reduce the risks of some common infections, but you should refer to the more detailed discussion of prevention in other study sessions in this *Communicable Diseases* Module when giving advice to PLHIV.

- Can you give any examples of common infectious diseases that PLHIV may contract due to improper handling of food and unclean water?

- You may have thought of giardiasis, amoebiasis and diarrhoeal diseases caused by bacteria or viruses.

To prevent the occurrence of **faeco-oral diseases**, caused by transmission of infectious agents from the faeces to the mouth (usually on the hands or in food and water), your advice should include instructions on clean preparation of food and water before consumption. For example, vegetables and fruits

You will learn about specific faeco-oral diseases in Study Sessions 32 to 34 of this Module.

should be washed with clean water. Drinking water should be cleaned by boiling it vigorously for a few seconds, then cooling it. Advise your patients to eat only well-cooked food. For example, cooked meat should be brown and have no traces of blood in it, and soups should always be boiled before being eaten.

Another very important hygienic measure used to prevent faeco-oral diseases includes frequently washing hands with soap, in particular after using the toilet and before preparing food or eating.

Prevention of sexual transmission of HIV (Section 29.2) and sexually transmitted infections (STIs) (Study Session 31) should be actively encouraged. Remember that PLHIV can still transmit HIV if they are involved in unsafe sexual practises, even if they are on ART.

- What are the main preventative measures to reduce the risk of STIs and HIV re-infection?

- Abstaining from sex, being faithful to a long-term partner, and adopting safer sex practices, such as the use of condoms.

If your community is in a malaria-endemic area, you should educate PLHIV to use bed nets regularly at night, to prevent being bitten by mosquitoes (Study Session 9). This is because PLHIV are particularly susceptible to malaria.

Finally, common hygienic measures to reduce the risk of infections from minor injuries or wounds include thorough cleaning and wound care. You should actively encourage PLHIV to attend the nearest health post or health centre as soon as possible in the event of a minor injury or wound.

29.8 PLHIV should get regular exercise and rest

Exercise is a good and low-cost way of maintaining the health of your clients. You should encourage PLHIV to practice regular exercise and to find time for adequate rest to improve and maintain their health. Regular exercise includes any sort of activities that fits into the daily routine life of your clients. These activities may range from moderate exercise (being more active around the house), to active team sports or jogging. There are many ways in which PLHIV may improve their regular exercise routine, such as walking to and from work; walking to the church or the mosque; and indoor regular exercise routines (for example, work-outs early in the morning before bathing). The benefits of regular exercise include increased energy levels, increased appetite and decreased nausea, which will also help your patients to maintain a good nutritional status. Exercise also helps to maintain muscle tone, which may be beneficial to prevent weight loss.

In the same way you advised your patients to continue working as long as they are able to reasonably manage it, PLHIV should not exert themselves by regular exercise to the extent that it becomes detrimental to their health. You should advise your patients to take sufficient rest and sleep between exercise routines. In the event of episodes of ill health, PLHIV should determine whether they feel fit enough to continue regular exercise. However, they should keep in mind that returning to regular exercise routines after illness may help improve their quality of life.

29.9 PLHIV should seek regular medical care

PLHIV should be given information about when and how to seek medical care. These situations may include their regular scheduled visits at the health centre or hospital, or new appointments at your health post or at the clinic when they feel ill.

Attending regular scheduled visits at the health centre or hospital helps PLHIV to monitor their health status. For example, all patients on ART will be assigned a clinic appointment schedule. This schedule will include regular follow-ups and medication refills at the health centre and hospital, regardless of whether the patient feels healthy or not. Patients should be encouraged to strictly adhere to all appointments at the health centre and hospital. A way you can help them is by reminding them when their next appointment is scheduled.

Patients should attend a clinic promptly and regularly during episodes of ill health. Early treatment of infections can prevent further illnesses and slow down progression to AIDS. During your regular visits or appointments, you should ask PLHIV to describe any new symptoms they may have experienced since your last visit, and encourage them to get prompt treatment for any health problems that cannot be managed at home or at your health post. If this is the case, refer them to the health centre without delay.

Summary of Study Session 29

In Study Session 29, you have learned that:

1 Positive living is a lifestyle choice for PLHIV that includes preventing the spread of HIV, being informed about their health, taking medication as prescribed, working as their energy allows, avoiding stress, maintaining good nutrition, preventing infections, getting regular exercise, and seeking regular medical care.

2 It is essential that PLHIV put measures into place to reduce the risks of sexual HIV transmission, even if they are on ART. These may include abstinence, maintaining faithful relationships, and/or safer sex practises.

3 Complete adherence to all HIV treatment, care and support is critical to maintaining the health of PLHIV.

4 Giving clear information about HIV/AIDS and positive living to PLHIV helps their active participation in managing their own health, and seeking advice in episodes of ill health.

5 PLHIV need to eat more food than normal to help their immune system to fight infections.

6 Personal hygiene is particularly important for PLHIV to avoid infections, and they should keep minor wounds clean.

7 Regular exercise is recommended for PLHIV, as long as their energy allows. They also need plenty of rest.

Self-Assessment Questions (SAQs) for Study Session 29

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the notes on the Self-Assessment Questions at the end of this Module.

SAQ 29.1 (tests Learning Outcomes 29.1, 29.2, and 29.3)

Which of the following statements in relation to positive living and PLHIV are *false*? In each case explain what is incorrect.

A A Person living with HIV who is on ART cannot transmit HIV to other people.

B The correct use of condoms prevents the transmission of HIV by about 50%.

C The nutritional needs of PLHIV who have an opportunistic infection are higher than that of uninfected people.

D Hand washing with soap and water is important to prevent faeco-oral diseases.

SAQ 29.2 (tests Learning Outcome 29.2)

In your community a couple who are both HIV-positive come to your health post asking for advice on their sexual life. Both consider they should not be using condoms as they are already HIV-positive. What will your advice to them be?

SAQ 29.3 (tests Learning Outcome 29.4)

A 30-year old man comes to the health post. He tells you he was diagnosed HIV-positive six months earlier. He says he is not feeling well these days. He barely sleeps at night and sometimes thinks he will be dying very soon. He feels so anxious that he has stopped working. What will you advise him?

Study Session 30 Providing Palliative Care for People Living with HIV

Introduction

In this study session you will learn what palliative care means; how to obtain information, grade pain and provide pain relief; how to advise patients on home-based methods for controlling pain; and on home-based and end-of-life care for people living with HIV (PLHIV). You will also learn how to provide psychosocial and nutritional support. In the future you may be involved in providing community-based palliative care services for PLHIV.

Palliative care is care given to chronically ill people to improve their quality of life and that of their families. It involves prevention and relief of suffering, pain and other physical problems, and attention to psychosocial and spiritual issues. Palliative care is also provided for terminally ill patients with conditions such as cancer, heart disease and stroke. The four components of palliative care in Ethiopia which you will learn about in this session are symptom management, including pain management; psychosocial and spiritual support; home-based care, and end-of-life care.

Learning Outcomes for Study Session 30

When you have studied this session, you should be able to:

30.1 Define and use correctly all of the key words printed in **bold**. (SAQ 30.1)

30.2 Explain what palliative care means, its importance, and its four components. (SAQ 30.1)

30.3 Describe how to provide pain management, with and without medication, and assess when to refer patients for further pain treatment. (SAQs 30.2 and 30.3)

30.4 Describe how to prevent and manage the common symptoms of HIV/AIDS using home-based care. (SAQ 30.3)

30.5 Describe how to provide psychosocial and spiritual care at home for chronically ill people with HIV/AIDS. (SAQ 30.3)

30.6 Describe how to provide preventative home-based care services for bedridden patients with AIDS. (SAQ 30.4)

30.7 Describe how to provide end-of-life care, especially bereavement care. (SAQ 30.5)

30.1 Palliative care and its significance in chronic illness

Palliative care aims to improve the quality of life for chronically ill patients and their families, by preventing and giving relief for pain and other physical, psychosocial and spiritual problems. It is also an essential part of comprehensive HIV care and support services. Palliative care is provided for patients from the time the chronic disease is diagnosed until the end of life. It regards dying as a normal process, and affirms life. It also offers support to help the patient and family cope during the illness and in the **bereavement period**, the time of grief due to the loss of a loved one through death.

Note that palliative care does not only mean the terminal care given to people dying from an incurable chronic illness.

Cancer, diabetes, heart disease and chronic lung disease are described in the *Non-Communicable Diseases, Emergency Care and Mental Health* Module.

Palliative care is not only useful for patients with HIV/AIDS, but also for people with chronic communicable and non-communicable diseases who require long-term care at home. It is also important for people with a curable illness with symptoms that last a long period of time (e.g. many months) before they are cured.

■ Can you think of a curable chronic communicable disease whose patients may benefit from palliative care?

□ Treatment for tuberculosis may involve long-term care at home.

The palliative care needs of patients increase with time, particularly in a situation where the underlying disease is getting worse rather than better. In areas where patients present late for medical care, the need for palliative care is high. With good treatment and support, palliative care can help many patients live comfortably with a chronic disease for many years. For those who have advanced disease in a terminal phase, palliative care focuses on promoting quality of life by providing good symptom management. This can help patients continue to function and enjoy life at home for as long as possible.

■ What are the four major components of palliative care in Ethiopia?

□ They are: symptom management, including pain management, psychosocial and spiritual support, home-based care and end-of-life care.

Below we will discuss each of the four components of palliative care for PLHIV in detail. Remember that these components are inter-related.

30.2 Symptom management, including pain management

In palliative care for PLHIV, the aim is to manage symptoms arising from:

- AIDS itself and associated opportunistic infections, like headaches and other pains, nausea, vomiting, diarrhoea, fever, weight loss, anxiety, fatigue, depression, skin and mouth problems, neurological disorders, etc.
- the side-effects of antiretroviral drugs to treat HIV disease and chemoprophylactic drugs to treat opportunistic infections.

30.2.1 Management of pain in PLHIV

Pain is one of the most common symptoms in HIV/AIDS patients with advancing disease. If your patients complain of pain, they should be assessed carefully (as described below); severe cases should receive urgent referral for specialist consultation and treatment.

How to assess pain

First, ask the patient 'Where is the pain?' and 'What makes it better or worse?' 'What type of pain is it, and what medication (if any) is being taken for the pain?' Note that pain could result from severe opportunistic infections, and this may need urgent referral to a health centre or hospital.

Secondly, determine the type of pain. Is it a familiar pain (such as bone or mouth pain), or a special and unusual pain (such as shooting nerve pain or muscle spasms)?

Thirdly, check if there is a psychological or spiritual component to the pain. Does it feel worse when the patient is depressed or anxious? Does it feel better when the person is doing something interesting that takes their attention away from the pain?

Fourthly, grade the pain from 0 to 5 with the faces chart (especially when working with children), as illustrated in Figure 30.1, or using your hand with different numbers of fingers raised (no fingers being no pain, and five fingers the worst possible pain).

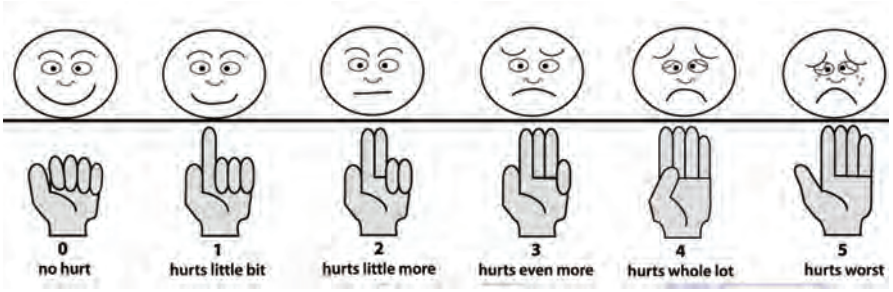


Figure 30.1 Pain grading scales. (Courtesy of the FMOH, Ethiopia, *Palliative Care Module, Ethiopian National Comprehensive HIV Care/Antiretroviral Therapy Training Package*)

How to manage pain at community level

Manage the pain with paracetamol if it is at grade 1 or grade 2. Paracetamol is the anti-pain medication that you are allowed to give at community level. Refer patients with pain at grades 3, 4 and 5 to the nearest health facility.

- Why do you think you should refer patients with grade 3 pain or above?

□ You should refer such patients quickly because the pain may be indicating severe disease, which needs better diagnosis and management with anti-pain drugs that can only be given by a doctor.

Pain can also be managed without the use of modern medication. Indeed, spiritual and emotional support and counselling should always accompany pain medication. This is because pain can be harder to bear when there is guilt, fear of dying, loneliness, anxiety or depression. Likewise, answering questions and providing information on HIV/AIDS health-related issues is important to relieve fear and anxiety, which in turn makes pain more bearable. The other ways to relieve pain are deep breathing and relaxation techniques (unless the patient has severe mental health problems); or distracting the patient's attention using music, conversation, or imagining a calm scene.

- In your catchment area, how do people treat pain without using modern medication? Give two examples of local pain treatments which are *not* effective in relieving chronic pain.

□ Local pain remedies vary in different parts of the country, but you may have thought of tying the painful area with a scarf or other cloth to treat headache or back pain; or burning the skin of the painful area using very hot wooden or metal sticks, sometimes to treat headaches, but mainly for pains in the hands and feet. These treatments are not effective and can make the pain worse. Burning the skin creates a wound that could become infected.

Traditional medication for pain relief may interfere with ARV drugs. Refer patients to the nearest health centre for advice on this topic.

30.2.2 How to manage other common symptoms of HIV/AIDS

Study Session 22 has already described how to manage the adverse side-effects of drugs used to treat HIV disease. In this section we summarise the advice you should give to help someone manage the symptoms of advanced HIV disease.

Note that persistent vomiting needs medical treatment, and you must refer the patient urgently.

Nausea and vomiting

Advise the sick person to:

- seek locally available foods which he or she likes (tastes may change with illness), and which cause less nausea.
- eat small but frequent locally available foods such as roasted potatoes.
- let the patient drink what he/she likes, e.g. water, tea, ginger drink, etc.
- avoid being near the person who is cooking.
- use effective local remedies for nausea.
- seek help from the health facility if vomiting occurs more than once a day, or if dry tongue, or passing little urine, or abdominal pain is present.

Diarrhoea

Advise the sick person to:

- drink fluids frequently in small amounts, preferably oral rehydration solution (ORS). If ORS is not available, give home-made fluids such as rice soup, porridge, weak tea, water (with food), and other soups.
- avoid sweet drinks, milk, coffee, strong tea and alcohol.
- continue eating. For persistent diarrhoea, suggest a supportive diet, like carrot soup, which helps to replace vitamins and minerals, soothes the bowels and stimulates the appetite. Other foods that may help to reduce diarrhoea are rice and potatoes.
- avoid eating raw foods (like bananas and tomatoes), cold foods, high-fibre foods, and foods containing fat. Tell them to avoid milk and cheese, but yogurt is better tolerated.

Refer patients with diarrhoea to a health centre if:

- there is vomiting with fever.
- blood is seen in the stool.
- diarrhoea continues for more than five days and the patient becomes even weaker.
- there is broken skin around the rectal area.

30.3 Psychosocial and spiritual support

Psychosocial support is a fundamental part of palliative care, and includes a range of interventions that enable the person who needs palliative care, and their caregivers and families, to cope with the overwhelming feelings that result from their experiences with long-term disease and the threat of death. Providing psychosocial support may include supporting their **self-esteem** (self-respect or confidence in oneself), helping them to adapt to the illness and its consequences, and helping them to improve their communication with each other and with you, and their social functioning and their relationships.

Spiritual support involves taking into account not only the patient's religious or faith beliefs and practices, but also their understanding of the purpose and meaning of life.

30.3.1 Support for the patient

PLHIV often feel unhappy, and even depressed at times. They will be calmer if they accept the illness as much as they are able to, and realise that it is possible to live a healthy life and be productive if they take their medication correctly. You can help by introducing them to a nearby PLHIV association, or a community-based organisation which provides support to PLHIV (if available).

Psychosocial support for PLHIV should also address practical aspects of care, such as finances, housing, and assistance with daily living. Regarding spiritual support, you may want to discuss spiritual beliefs, cultural issues and personal values. The following tips will help you to provide spiritual support to patients:

- Be prepared to discuss spiritual matters if patients would like to. Some useful questions you may use are:
  - What is important to you in life?
  - What helps you through difficult times?
  - Do you have a faith that helps you make sense of life?
  - Do you ever pray?
- Learn to listen with empathy.
- Understand reactions to the losses in their life (the different stages of grief).
- Be prepared to 'absorb' some reactions, for example, patients may express anger towards you, but this is only because they are afraid and anxious.
- Connect the patient's needs with a spiritual counsellor or religious leader, according to their religion and wishes.
- Do not impose your own views. If you share religious beliefs, praying together may be appropriate.
- For some patients, it is better to talk about the meaning of their life, rather than directly about spirituality or religion.

30.3.2 Support for the caregivers

Caregivers in the family frequently feel anxious or depressed, or have problems with sleeping, as the person they care for comes closer to the end of life. You can encourage caregivers to share their feelings with you by asking questions about their perception of the patient's illness and its impact on their life. Mild **psychological distress** (mental suffering caused by grief, anxiety or unhappiness) is usually relieved by emotional support from health workers who have effective communication skills. By explaining the patient's physical and psychological symptoms, and challenging false beliefs about death and dying, you can bring a reasonable hope to caregivers and to the patient, and reduce the sense of isolation they may feel. Empower the family to provide care by explaining that as human beings, we know how to care for each other. Reassure them that they already have much of the capacity needed, and that you can give them more information and support their skills.

30.4 Home-based care

Home-based care is the care of people affected by HIV/AIDS, cancer, and other chronic diseases, that is based in the patient's home. In the case of HIV/AIDS, the need for home-based care largely corresponds to late HIV disease (stage 3) or AIDS (stage 4). Home-based care involves the community (depending on available resources) and healthcare workers in supporting the care provided by the family at home. Patients receiving home-based care may have been treated earlier in hospital, and may continue to receive some care from the health facility nearest to their home. Some of the preventative home-based care services for PLHIV are described below.

30.4.1 Support for oral hygiene

For patients able to self-care, advise them that twice a day they should use a soft toothbrush (or a piece of soft stick or clean cloth if a toothbrush cannot be obtained; see Figure 30.2) to gently brush their teeth, tongue, palate and gums to remove debris. Use toothpaste if affordable and available. Rinse the mouth with diluted salt water after eating and at bedtime (usually three to four times daily). For patients who cannot do this for themselves, tell the caregivers to provide oral care to the patient two to three times every day, as described above.

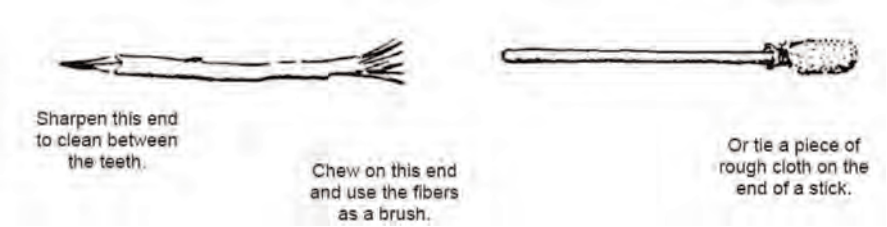


Figure 30.2 A soft toothbrush and a piece of wooden stick used to clean the teeth. Oral hygiene can prevent mouth infections in PLHIV.

30.4.2 Preventing bedsores in bedridden patients

A **bedridden patient** is one who is too sick to get out of bed at all, or only for short periods.

To prevent bedsores, you should do the following:

- Help the patient to sit out in a chair from time to time if possible. (We will show you how to do this later.)
- Lift the patient up off the bed slowly — do not drag the person's body as it breaks the skin. Ask a family member to help you — two people can do this much more easily, with less discomfort for the patient. (Later we will show you how to do it if you are on your own.)
- Encourage the patient to move around in the bed as much as they are able to. If they cannot move, change their position on the bed frequently, if possible every one or two hours (Figure 30.3). Use pillows or cushions beside the patient to help them keep the new position.
- Keep the bed sheets clean and dry. Put extra soft material, such as a soft cotton towel, under the patient.
- Look for damaged skin (change of colour) on the patient's back, shoulders and hips every day. Massage the back and hips, elbows, heels and ankles every day with petroleum jelly if available, or any other soothing cream or oil. This helps to prevent 'bed sores' from developing.

Figure 30.3 A caregiver and Health Extension Practitioner changing the body position of a bedridden patient.

30.4.3 Moving a bedridden patient

You or the patient's caregiver need to know how to move a bedridden patient if you are on your own. If the patient is unconscious or unable to cooperate, it is better to have two people to help with moving the patient, but this is not always possible. When transferring the patient from the bed to a chair, use the procedures shown in Figure 30.4. This will help to protect you and the patient from strain and injury.

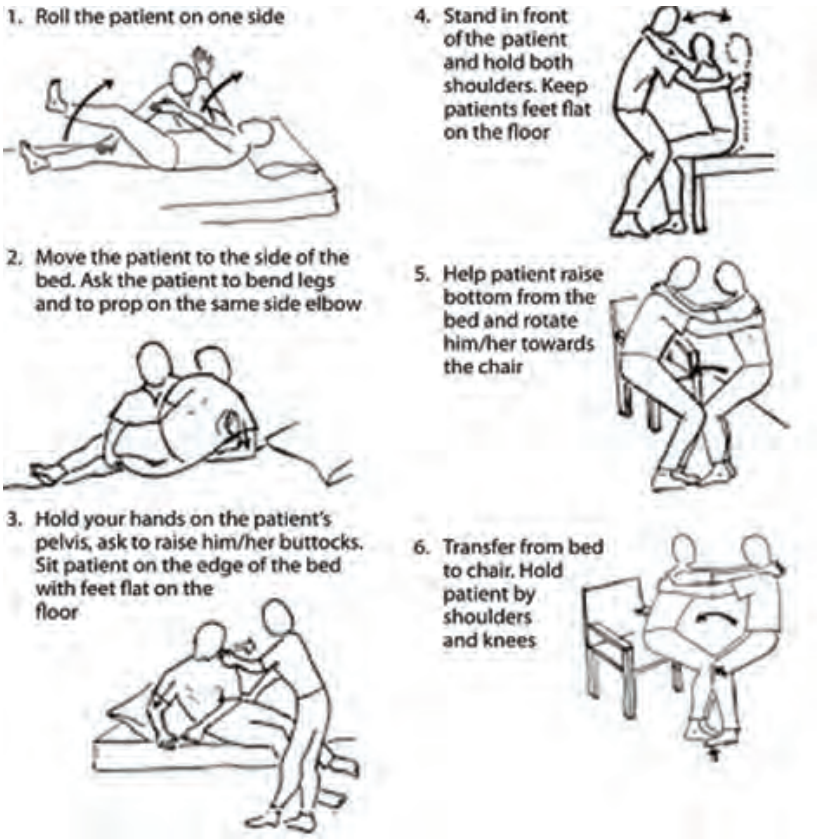


Figure 30.4 How to transfer a bedridden patient from the bed to a chair in six stages. (Source: As Figure 30.1)

30.4.4 Hygienic care of the body

Remember to provide privacy for the patient during bathing, which is necessary every day to give hygienic care of the body and skin. Show the caregivers how to follow these procedures:

- Dry the skin gently after washing with a soft clean towel or cloth.
- Oil the skin with cream or body oil if available; if not, you can use a vegetable oil.
- Use plastic sheets under the bed sheets to keep the bed dry, if the patient cannot control urine or faeces.
- If there is leakage of urine or stools, protect the patient's skin with petroleum jelly applied around the genital area, anus, back, hips, ankles and elbows.
- Support the sick person over the container when passing urine or stools to avoid injury and wetting the bed.

30.4.5 Preventing stiff joints and muscles

Figures 30.5 to 30.8 illustrate some of the ways you and the caregivers can help a patient to exercise their joints and muscles to prevent stiffness and contraction due to pain, or lying still for a long time.

Figure 30.5 Exercise the elbow by gently bringing the hand as close as possible to the shoulder.

Figure 30.6 Exercise the wrist by moving it around in circles.

Figure 30.7 Exercise the shoulder by lifting the arm up and bringing it behind the head and gently laying it back as far as possible.

Figure 30.8 Exercise the knee by lifting the thigh up and bringing it close to the chest as far as possible.

30.5 End-of-life care

The end of life is the **terminal phase** in the advanced stages of disease when the patient is expected to die in a matter of days. **End-of-life care** aims to recognise that life and death are normal. It neither hastens nor postpones death, it achieves the best quality of life in the time remaining, and provides good control of pain and other symptoms. It helps the dying patient and loved ones to adjust to the many losses they face, and ensures a dignified death with minimal distress. It also provides support and help for the family to cope with bereavement.

A major challenge you will face is to decide when the patient has reached the terminal phase of the illness and needs end-of-life care. A **terminal illness** is one for which no cure is available, and from which the patient is expected to die relatively soon.

Patients with terminal illness are usually treated with palliative care at home rather than in hospital.

Once a patient has been declared terminally ill, management of some conditions will change, and some medications may stop altogether. You may need to consult your supervisor or a nurse to help you decide when an HIV/AIDS patient is terminally ill.

30.5.1 Preparing for death

Encourage communication within the family. Discuss worrying issues and offer practical support in resolving concerns such as making a will, custody of children, family support, future school fees, old quarrels, or funeral costs.

Tell the patient that he/she is loved and will be remembered. Talk about death if the person wishes to, but keep in mind cultural taboos if you are not in a close relationship with the patient. Help the patient accept his/her own death. Ask him/her how they wish to die, for example with pastoral or religious leaders present, or with family only.

Make sure that what the patient wants is always respected.

Respond sensitively to the patient's grief reaction to realising they are dying. This may include denial, disbelief, confusion, shock, sadness, anger, humiliation, despair, guilt, and finally acceptance. Make sure the patient gets help with feelings of guilt or regret. Keep communication open — if the dying person does not want to talk, ask 'Would you like to talk now or later?'

30.5.2 A checklist for end-of-life care

Here are some points for you to bear in mind when you are caring for a person at the end of his/her life.

Presence

- Be present with compassion.
- Visit regularly.
- Move slowly and quietly.

Caring and comfort

- Moisten the lips, mouth and eyes. Offer sips of liquid to drink.
- Keep the patient clean and dry, and prepare for leakage from the bowel (faeces) and bladder (urine).
- Provide physical contact by light touch. Hold the person's hand, listen and converse if they want to talk.
- Reassure the patient that eating less is alright; don't make them eat if they don't want to.

Medication and symptom control

- Only give essential medication — anti-diarrhoeal remedies, and paracetamol to treat pain or fever. Make sure pain is controlled.
- Help the patient control other symptoms by ensuring that medical treatment prescribed by the doctor is taken at the right times and in the right dosages.
- Skin care requires the patient to be turned every two hours, or more frequently, as already described in Section 30.4.2.

30.5.3 Recognising signs of death

When a patient is very close to death, watch for these signs:

- Decreased social interaction — the person sleeps more, they may act or speak with confusion when awake, and they may slip into a coma (become unconscious).
- Decreased food and fluid intake — the person no longer feels hunger or thirst.
- Decreased urine and bowel movements, or incontinence.
- Respiratory changes — irregular breathing or 'death rattle' (a rough gurgling noise that sometimes comes from the throat when a person is close to death, caused by breath passing through mucus).
- Circulatory changes — the hands and feet may feel cold and appear greyish or purple as the heart slows and can no longer pump blood to these extremities. You may notice a decreased heart rate and blood pressure.

When the patient dies, you can confirm death by checking that:

- breathing stops completely.
- heartbeat and pulse stop completely.
- the person is totally unresponsive to shaking or shouting.
- the eyes are fixed in one direction, with eyelids open or closed.
- the skin changes tone and becomes pale.

30.5.4 Bereavement counselling

Provide bereavement counselling for the patient before death (as described above) and for the family after death of their beloved. They may also feel denial, disbelief, confusion, shock, sadness, anger, humiliation, despair and guilt about the dead person and the care they received before death. Help the family accept the death of the loved one. Share the sorrow — encourage them to talk and share their good memories. Do not offer false comfort — offer simple expressions and take time to listen.

Remember to offer practical help. For example, try to see if friends or neighbours can help with cooking, cleaning, running errands, child care, etc. for a few days after the death. This can help in the midst of grieving. Ask the family if they can afford the funeral costs and future school fees, and help in finding a solution if possible.

Encourage patience — it can take a long time to recover from a major loss. Say that they will never stop missing their loved one, but the pain will ease and allow them to go on with life.

Summary of Study Session 30

In Study Session 30, you have learned that:

1 Palliative care is an essential part of comprehensive care and support for PLHIV. It is care given to chronically ill patients to improve their quality of life and that of their families by preventing and relieving suffering.

2 The four components of palliative care for PLHIV in Ethiopia are symptom management, including pain management, psychosocial and spiritual support, home-based care and end-of-life care.

3 Pain is one of the most common symptoms in HIV/AIDS. If patients complain of pain, they should be assessed carefully, and in severe cases urgent referral and consultation is needed.

4 Common but mild symptoms of HIV/AIDS, like nausea, vomiting and diarrhoea, can be managed at home by giving advice on diet, fluids, hygiene, skin care and other home-based interventions.

5 Chronically ill patients who are bedridden need oral, skin and body care, with frequent repositioning to prevent development of bed sores. Simple exercises/movements can ease stiffness of joints and muscles.

6 Psychosocial support and bereavement counselling is an essential part of palliative and end-of-life care. It includes communication, caring and practical skills that enable individuals and families to cope with the often overwhelming feelings that result from their experiences with long-term disease and death.

Self-Assessment Questions (SAQs) for Study Session 30

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 30.1 (tests Learning Outcomes 30.1 and 30.2)

Which of the following statements regarding palliative care for PLHIV is *false*? In each case, explain what is incorrect.

A Palliative care is only given to patients who are near to death.

B Palliative care is provided only to PLHIV because HIV/AIDS is not curable.

C Palliative care is an essential part of care for patients with cancers.

D Patients with chronic illnesses like diabetes or stroke may need palliative care.

E Palliative care includes prevention and relief of suffering, pain and other physical problems, as well as attention to psychosocial and spiritual issues.

SAQ 30.2 (tests Learning Outcome 30.3)

Is the following statement *true* or *false*? Explain your reasoning.

'Relieving pain is not a routine part of palliative care, since it is not treating the chronic disease that caused the pain.'

SAQ 30.3 (tests Learning Outcomes 30.3, 30.4 and 30.5)

Read Case Study 30.1, and then answer the questions that follow it.

Case Study 30.1 Ato Aytenfisu's story

Ato Aytenfisu is a 45-year-old man living with HIV who started antiretroviral medication two weeks ago. During your home visit you find that he is feeling ill. He has had a mild headache and watery diarrhoea two to three times per day for the past four days. He looks very unhappy. He has no vomiting, fever, neck stiffness or other symptoms.

(a) What should you do first for Ato Aytenfisu?
(b) What should you do regarding the headache?
(c) What should you give him for the diarrhoea? What advice should you give him about managing the diarrhoea?
(d) How can you help him relieve his unhappiness?

SAQ 30.4 (tests Learning Outcome 30.6)

Which of the following is *not* part of the preventative home-based care you will give to bedridden patients with AIDS? Explain why it is not included.

A Frequent repositioning of a bedridden patient and skin care to prevent bed sores
B Providing oral care
C Providing hygienic care of the body
D Exercising the joints to prevent muscle stiffness and contraction
E Treating infection of the lungs.

SAQ 30.5 (tests Learning Outcome 30.7)

Is the following statement *true* or *false*? Explain your reasoning.

'Since terminally ill patients will die soon, it is a waste of a health worker's time to provide them with end-of-life care.'

Study Session 31 Prevention and Control of Sexually Transmitted Infections

Introduction

In this study session you will be learning about prevention and control of **sexually transmitted infections** (STIs) or in other words, infectious diseases that are transmitted primarily (although in some cases not exclusively) by the sexual route. You will also be studying about the relationship between HIV and other STIs. This session also describes **syndromic management of STIs**, that is a diagnosis based on the identification of the symptoms the patient reports and the signs the health care provider observes. Syndromic management of STIs is the standard approach for diagnosis and management of these communicable diseases recommended by the WHO and adapted by the FMOH for use at both health centre and hospital level. After studying this study session you should be able recognise patients who have STIs in the community. This will help you to refer patients with STIs to the nearest health facility. Treatment and care for STIs includes HIV testing and counselling, prevention and treatment of other STIs, and couple counselling and treatment. Note that at the moment you are not expected to treat or manage patients with STIs at the health post or in the community. You are expected to recognise cases of STIs in your community or at the health post and refer them to the health centre for further care.

Learning Outcomes for Study Session 31

When you have studied this session, you should be able to:

31.1 Define and use correctly all of the key words printed in **bold**. (SAQ 31.1)

31.2 Explain the routes of transmission and risk factors for the common sexually transmitted infections (STIs). (SAQ 31.1)

31.3 Describe the signs and symptoms of common STIs. (SAQ 31.2)

31.4 Briefly describe the importance of syndromic management of STIs. (SAQs 31.3 and 31.2)

31.5 Explain the importance of STIs in the prevention of HIV transmission. (SAQ 31.4)

31.6 Describe how you would identify and offer provider-initiated testing and counselling for people with STIs and refer them to the nearest health centre for treatment. (SAQ 31.2)

31.1 Introduction to sexually transmitted infections (STIs)

Sexually transmitted infections (STIs) is a term used to describe more than 20 different infections that are transmitted mainly through sexual contact via the exchange of semen, vaginal fluid, blood and other fluids; or by direct contact with the affected body areas of people with STIs. Sexually transmitted infections are also called sexually transmitted diseases (STDs) or venereal diseases. In this study session, we will be talking about STIs in general, with particular emphasis on their impact on individual health. You will also

appreciate the implications of preventing STIs in reducing HIV transmission, and the complications resulting from untreated STIs.

STIs are very common. The most widely known are gonorrhoea, chlamydia, syphilis and HIV. STIs can cause serious and permanent complications in infected people who are not treated in a timely and effective way. In people with untreated STIs, the complications and long-term consequences can be devastating. The social and economic burden of STIs can be enormous. Untreated STIs can lead to loss of employment and broken marriages. STIs can place a heavy financial burden on families, communities and health services.

Prevention campaigns in order to reduce the incidence of STIs have a marked impact on the general health of the population. Effective prevention of STIs reduces complications that are life threatening for the infected individual, and decreases economic and psychosocial problems associated with the complications arising from STIs.

The uterus and fallopian tubes form part of the female reproductive system. You have learned about the female reproductive system in Study Session 3 of the *Antenatal Care* Module, Part 1.

Fewer STIs means fewer complications like **pelvic inflammatory disease** (**PID**), inflammation of the uterus and fallopian tubes due to bacterial infection or other pathogens), infertility, **ectopic pregnancy** (pregnancy outside of the uterus), etc. as well as decreased rate of HIV transmission during unprotected sexual contacts.

For patients who are HIV-negative, or who have not been tested, the presence of an STI is an important indication to trigger testing (or repeat testing). Because STIs and HIV infection frequently co-exist and are transmitted together, anyone seen for an STI should be offered HIV testing and counselling. So you should refer any patient presenting with STIs for HIV counselling and testing services.

31.2 Transmission and risk factors for STIs

31.2.1 Transmission of STIs

Now you are going to learn about how STIs are transmitted from one person to another person. As the name implies, by far the most common mode of transmission of STIs is sexual transmission. The modes of transmission could be vaginal or anal sex. In Ethiopia, most STIs in relation to sexual transmission are through the vaginal route (though cases of anal transmission are also common). **Heterosexual** (sexual intercourse with an individual of the opposite sex) transmission is the most common mode of transmission of STIs. Another mode of transmission is mother-to-child during pregnancy (e.g. HIV and syphilis), at delivery (e.g. gonorrhoea and chlamydia), and during breastfeeding (e.g. HIV). Rarely STIs can also be transmitted through unsafe use of unsterile needles or injections, or coming in contact with contaminated blood or blood products (e.g. syphilis, HIV and hepatitis).

- From your previous studies, what are the common modes of transmission of HIV in Ethiopia?

- Sexual transmission is by far the most common mode of transmission; next comes transmission of HIV from mothers to children.

31.2.2 Risk factors for STIs

There are a number of factors that increase the risk of transmission of STIs, including biological, behavioural and socio-cultural factors. In this section we will be discussing the major risk factors that are associated with the transmission of STIs. Understanding these factors will help you in identifying the factors that promote STIs and their relation to the most 'at risk' groups of the population affected by STIs. In your daily assessment you will utilise this knowledge to assess patients and give them health education and counselling support in order to prevent STIs.

Biological factors

Biological factors are related to the age, sex and immune status of an individual. Certain age groups of the population are known to have a high prevalence of STIs.

Women in general are at greater risk of HIV transmission than men due to the larger vaginal surface area that comes in contact with the penis during sexual intercourse. In particular, young women between 15 and 24 years old, and women going through the menopause, are at high risk of acquiring STIs. Young women also may not have a comprehensive knowledge of STIs transmission. In addition, the risk of transmission of STIs is high in these groups due to immature or weakened vaginal mucosal lining of young and menopausal women, respectively.

The immune status of an individual also determines the risk of STIs. People with weak immunity have a greater risk of acquiring STIs than individuals who have a healthy immune system.

Behavioural factors

Behavioural factors are associated with actions of individuals towards a certain situation, in this case their sexual behaviour. It is well known that certain risky behaviours expose people to the transmission of STIs. These factors include having more than one sexual partner or having sex with 'casual' partners, for instance sex workers or their clients. One of the main risk behaviours that promotes transmission of STIs is unprotected sexual intercourse, that is sex without using a condom. Proper use of condoms effectively prevents the transmission of STIs; hence you should educate your clients at health post level, or in the community, about the proper use of condoms (Study Session 25). Changing sexual partners frequently is also a behavioural risk factor.

The use of alcohol, stimulants like 'khat' or illegal drugs may negatively affect the proper use of condoms. They usually affect our ability to weigh up risky situations and may result in involvement in unsafe sexual acts.

Socio-cultural factors

These are factors that indirectly affect the ability of individuals to take an independent responsibility for their behavioural actions. For example, factors like gender bias of a community, women's economic dependence on men, and young marriage, affect women indirectly to be exposed to the transmission of STIs more than men. Harmful traditional practices like tattoos and unsterile circumcisions are also associated with contracting of STIs directly from the sharp materials that are used for that purpose.

31.2.3 Epidemiology of STIs in Ethiopia

There is little information on the incidence and prevalence of STIs in Ethiopia. The prevalence of HIV has been mentioned in Study Session 20 and that of syphilis is thought to be about 2.7% (FMOH, 2006). There is no actual information or estimate on other STIs in Ethiopia. This is because reports often under-represent the true number of people infected with STIs. As you can imagine the reasons are many, but a major contributing factor is that people with STIs who have minor or no symptoms do not seek treatment at public health facilities. They usually tend to take self-prescribed drugs or go to private pharmacies to buy treatment without consulting trained health workers.

Another contributing factor to the lack of information on STIs is also irregular access to treatment; that is health facilities offering treatment for STIs may be too far away from clients who present with STIs. Stigma associated with attending public STI clinics is also a factor in that clients tend to shy away from being seen at STI clinics. As noted above, many patients may then choose to go to alternative providers like pharmacies and traditional healers that do not report formally to the Federal Ministry of Health.

The formal public health facilities also do not report all STI cases properly and comprehensively for data to be compiled nationally. Last but not least some patients also do not attend formal STI clinics due to economic factors and they would rather go to traditional healers that provide services for free or with cheap costs.

31.3 Presentation of common STIs

All the photos in Figures 31.1 to 31.5 are taken from the Ethiopian Adaptation, 2007, of the WHO/IMAI Guidelines acknowledged at the front of this Module.

In this section you will study the clinical presentations of common STIs caused by bacteria, viruses or protozoa. The clinical signs and symptoms of common STIs described below will help you to reasonably identify STIs. Now let us describe them.

31.3.1 STIs caused by bacteria

Gonorhoea

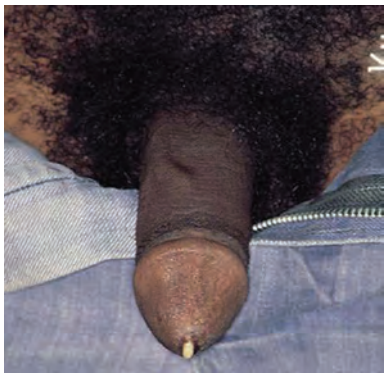


Figure 31.1 Gonorhoeal urethral discharge.

Gonorhoea is one of the most common STIs and is caused by bacteria called *Neisseria gonorrhoeae*. Men with gonorrhoea may present with a burning sensation while urinating and a discharge from the urethra (Figure 31.1), whereas women may present with vaginal discharge and lower abdominal pain. A **discharge** is a yellowish or whitish substance released from the opening of the reproductive tract in both men and women. Most men infected with gonorrhoea have symptoms, but in women gonorrhoea is commonly asymptomatic (i.e. they do not have any symptoms). Women who have gonorrhoea (with or without symptoms) can transmit the bacteria to infants during birth. In newborn babies, gonorrhoea usually presents with eye disease (termed neonatal conjunctivitis) and can lead to blindness.

- What can you see in Figure 31.1? What could be the possible cause?
- A whitish discharge from the opening of the penis can be seen; the likely clinical diagnosis is gonorrhoea.

Chlamydia

Chlamydia is also one of the most common (if not the commonest) STIs, and is caused by bacteria called *Chlamydia trachomatis*. In men it usually presents with discharge from the urethra and in women it presents with cervicitis (inflammation of the neck of the womb or cervix) and lower abdominal pain. The discharge is generally less 'sticky' and lighter in colour than for gonorrhoea. Chlamydia, like gonorrhoea, can also be asymptomatic, but in this case in both men and women. In addition, pregnant women with chlamydia can also transmit the STI to their babies during childbirth and cause neonatal conjunctivitis.

Syphilis

Syphilis is caused by bacteria called *Treponema pallidum*. Syphilis has four stages: primary, secondary, latent and tertiary syphilis, with different signs and presentations according to the time passed from the initial infection. The different stages can be described as follows:

- **Primary syphilis** is characterised by a painless ulcer (known as chancre) in the genital or anal area resulting from direct sexual contact with a person with syphilis. The chancre has obvious edges, and the lymph nodes in the groin may also appear swollen. Primary syphilis takes 10 to 90 days to develop from initial exposure to the bacterium.

■ Describe what you see in Figure 31.2. What could be the most likely diagnosis?

□ A solitary ulcer with clear edges on the penis. The possible diagnosis is primary syphilis.

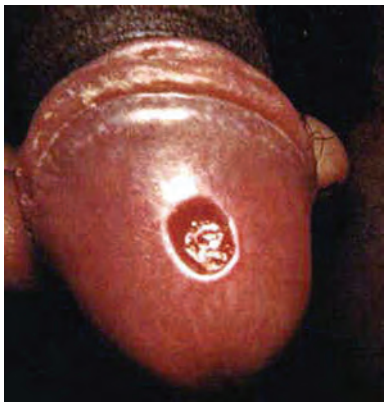


Figure 3.2 Primary syphilitic chancre.

- **Secondary syphilis** is characterised by a non-itchy rash over the trunk and the extremities, arising 1 to 6 months after primary syphilis.
- **Latent syphilis** is the stage between secondary and tertiary syphilis in which an infected patient shows few or no symptoms.
- **Tertiary syphilis** is a rare phenomenon characterised mainly by soft tumour-like balls of inflammation under the skin, or on bones, that may appear anywhere in the body. Some individuals with tertiary syphilis may show serious neurological (nervous system) or cardiovascular problems (heart and blood vessels). Tertiary syphilis takes 1 to 10 years to develop, but it can take up to 50 years.

Chancroid

Chancroid is caused by bacteria termed *Haemophilus ducreyi* and in the majority of cases it presents with painful ulcers and sores in the genital area (particularly in the foreskin of the penis). Many patients also develop a bubo, an enlargement of the lymph nodes on one side of the groin that exudes liquid. By contrast, most infected women do not show any symptoms.

Granuloma inguinale

Granuloma inguinale is caused by an infection with bacteria called *Calymmatobacterium granulomatis*. It presents initially with small lesions in areas surrounding the anus and/or genitals, which are difficult to differentiate from chancroid, but then turn into ulcerative lesions and lead to painless raised solid bumps in both sides of the groin area (Figure 31.3).

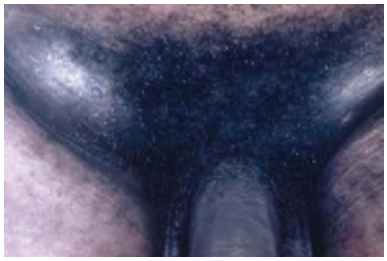


Figure 31.3 Raised solid bumps on both sides of the groin caused by granuloma inguinale.

31.3.2 STIs caused by viruses

HIV, the virus that causes AIDS, has been dealt with extensively in previous study sessions. Here we will focus on other STIs caused by viruses.

Herpes genitalis

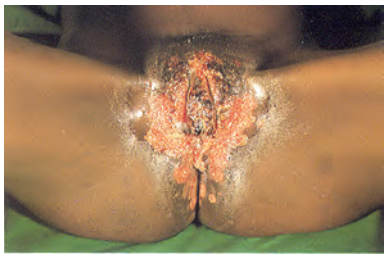


Figure 31.4 Extensive ulcers and sores caused by Herpes genitalis.

Herpes genitalis is the most common STI caused by a viral infection. The pathogen responsible for genital herpes is *Herpes simplex virus type 2 (HSV-2)*. Genital herpes usually presents with blisters that, when they break, lead to painful sores and ulcers in the outer surface of the genitals and in areas surrounding the anus. Following initial infection, it may take around 2–4 weeks for the lesions to heal, but symptoms usually recur weeks or months after the first outbreak. Although geneital herpes may affect anyone, if it involves an extensive area of the genitals and persists for longer than a month as seen in Figure 31.4, you should suspect an HIV-related opportunistic infection. Hence you should offer or refer these patients for provider-initiated HIV testing and counselling if their HIV status is unknown.

Genital warts

Cancers (including cervical cancer) are covered in Study Session 3 of the *Non-Communicable Diseases, Emergency Care and Mental Health* Module.

Genital warts is a viral STI caused by *human papilloma virus (HPV)* and commonly presents with small fleshy growths of skin on the genital area or around the anus (Figure 31.5). HPV has also been shown to be the causative agent of cervical cancer in women. However, the types of HPV that cause genital warts are not the same as the types that can cause cancer, which is usually asymptomatic for years.

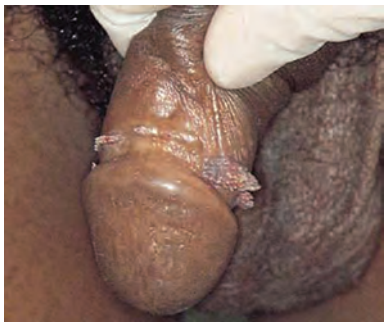


Figure 31.5 Small fleshy growths on the penis caused by HPV.

31.3.3 STI caused by a protozoan

Trichomoniasis is a STI caused by a protozoan that is usually found in vaginal and urethral tissues. It presents in women with profuse and frothy vaginal discharge. Although this condition is most often treated in women, men can also be infected but often show no symptoms.

31.3.4 STI caused by a fungus

Vaginal candidiasis is a vaginal infection caused by a fungus termed *Candida albicans*. The main symptoms of candidiasis in women are a curd-like vaginal discharge, vaginal itching and sometimes a burning sensation.

- From Study Session 21, which opportunistic infection in PLHIV is caused by the same organism that causes vaginal candidiasis?
- Oral thrush in HIV-positive people is also caused by *Candida albicans*.

31.4 Syndromic management of STIs

A **syndrome** is a group of symptoms that patients describe, combined with classic signs that health workers observe during clinical assessment. A number of different organisms that cause STIs give rise to a limited number of syndromes.

Now that you have studied about how common STIs present, in this section you will learn about how to group similar STI together and manage them. You should identify and classify patients into syndromes for effective management of their condition.

31.4.1 Classification of patients into syndromes

Using the syndromic approach, health workers at health centres and hospitals can identify one of these syndromes and treat accordingly. The objective of introducing you to **syndromic management** of STIs is to help you identify and refer cases to the nearest health centre. At this moment you are not expected to treat STI cases either at the health post or in the community. In the health centre the patient will receive all necessary services including testing for HIV. Table 31.1 shows a modified summary version of syndromic management of the common STIs described in Section 31.3 and others. For detailed reading you can refer to the Ethiopian National Syndromic Management of STIs Guideline.

Table 31.1 Main sexually transmitted infection syndromes.

Syndrome	Signs and symptoms	Most common causes	Management
Vaginal discharge	Unusual vaginal discharge, vaginal itching, **dysuria** (pain on urination and pain during sexual intercourse)	Trichomoniasis Bacterial vaginosis	Refer to health centre
		Candidiasis	Refer to health centre. Consider HIV-related illness if it is recurrent
		Gonorrhoea Chlamydia	Refer to health centre Counsel and refer for HIV and syphilis testing Include partner tracing
Urethral discharge	Urethral discharge, dysuria, frequent urination	Gonorrhoea Chlamydia	Refer to health centre Offer HIV testing and counselling and refer for syphilis testing Consider HIV-related illness Consider partner tracing
Genital ulcer	Genital sore	Syphilis, Chancroid	Refer to health centre Promote and provide condoms Consider HIV-related illness; offer HIV testing and counselling Educate on STIs, HIV and risk reduction
		Genital herpes	Refer to health centre
Lower abdominal pain	Vaginal discharge, fever, lower abdominal pain and tenderness	Gonorrhoea Chlamydia,	Refer to health centre. Consider HIV-related illness Consider partner tracing
Scrotal swelling	Pain and swelling of the scrotum	Gonorrhoea Chlamydia	Refer to health centre. Consider HIV-related illness Consider partner tracing
Inguinal bubo	Painful enlarged lymph nodes on the groin	Lymphogranuloma venerum (LGV) Chancroid	Refer to health centre Consider HIV-related illness; offer HIV testing and counselling Educate on STIs, HIV and risk reduction
Neonatal conjunctivitis	Swollen eyelids, eye discharge in newborns and infants	Gonorrhoea Chlamydia	Refer to the nearest health centre for management

31.4.2 Treatment and management of STI syndromes

The aim of syndromic management is to identify the seven syndromes listed in Table 31.1 and manage them accordingly. While clinical diagnosis is based on identifying just one specific causative agent, syndromic diagnosis leads to immediate treatment for all of the most important *possible* causative agents. This is important because mixed infections occur frequently in STIs. Besides, syndromic management of STIs can effectively treat cases in settings with limited laboratory capacity like health posts and health centres. This means that, if necessary drugs are available and affordable, syndromic treatment can quickly render the patient non-infectious.

Therefore the key features of **syndromic case management of STIs** are first that it is problem-oriented, i.e. it responds to the patient's symptoms; second, it is efficient in identifying the causes of STIs; and third, it does not miss multiple infections caused by different pathogens.

Syndromic management also makes treatment and control services for STIs more accessible to patients as it can be implemented at health centre level. For example, syndromic management offers a good opportunity to provide health education and HIV testing and counselling during any encounter with STI cases.

In managing STI cases using syndromic management, the health worker is guided through logical steps of clinical decision-making. The following four steps are to be followed:

1 Assessing patients for symptoms, signs and risk factors.

2 Syndromic diagnosis and treatment.

3 Education and counselling on HIV testing and safer sex, including condom use, promotion and provision.

4 Management of sexual partners, in your case tracing sexual partners.

- A patient complains of a discharge from the penis. Upon examination, you notice a discharge from the urethra. What syndrome does the sign and symptoms suggest? What action should be taken, and why?

- Urethral discharge syndrome is suggested. It is commonly caused by gonorrhoea and/or chlamydial infection. Not only can these cause serious complications, but also they can facilitate the transmission and acquisition of HIV. It is therefore essential that we treat the patient for both.

- A young woman complains of a sore on her vulva. Upon examination you notice an ulcer on the outer labia. What syndrome does the sign and symptoms signify? What are the possible causes?

- This indicates the syndrome of genital ulcer. There are two main bacterial causes of genital ulcer: chancroid and syphilis.

31.5 Common complications of STIs

In this section we will just briefly describe the common complications of STIs. You have to note that complications of STIs have huge health, social and economic implications. Therefore your active identification and referral of STIs cases in the community greatly reduces the burden associated with them. Table 31.2 summarises the common complications of STIs with their respective causes.

Table 31.2 Common complications resulting from STIs.

STI infection	Complication
gonococcal (gonorrhoea) and chlamydia infection	• Infection of the testis in men that may lead to infertility • Ectopic pregnancy (pregnancy outside of the uterus) due to damage to fallopian tubes in women • Pelvic and generalised peritonitis • Infertility in women
gonocchocal infection (gonorrhoea)	Conjunctivitis and blindness in infants
human papilloma virus	Genital or cervical cancer
chlamydia, gonorrhoea, herpes virus and trichomoniasis bacteria	Increased transmission of HIV from genital inflammations due to the cuts, tears, abrasions that would expose the genital mucosa to HIV.

31.6 STIs and HIV

Remember that you have learned that HIV is sexually transmitted in Study Session 20. HIV infection is therefore a STI but due to its high priority as a general health concern it has been dealt with separately in this module. In this section you will learn about the relationship between HIV and other STIs. It is important that you remember that HIV is transmitted in the same ways as any other STIs. There are strong links between having an STI and becoming HIV-positive. STIs increase the risk of HIV transmission and HIV infection may make people more susceptible to other STIs and even make other STIs more difficult to treat. These observations make it even more urgent to prevent and control STIs.

31.6.1 The link between STIs and HIV/AIDS

Certain STIs facilitate the spread of HIV. The following three points generally describe the relationship between HIV and other STIs:

- Certain STIs facilitate the transmission of HIV through the small cuts and inflammations they cause around the genitalia.
- The presence of HIV can make people more susceptible to the transmission of STIs. This is because HIV weakens the immunity that can protect us from other infections like STIs.
- The presence of HIV increases the severity of some STIs and makes them more difficult to treat than in HIV-negative individuals. This is also related to the poor immunity of PLHIV.

31.6.2 Which STIs facilitate the transmission of HIV?

A person with open sores in the genital area is much more likely both to contract and to transmit HIV. Chancroid and syphilis are the main bacterial causes of sores: if they are correctly diagnosed and treated, these routes of HIV transmission can be reduced. Genital herpes also facilitates HIV transmission. Genital herpes causes recurrent genital ulcers. An ulcer in the genital area provides an open door, through which HIV can easily pass. Chlamydia, gonorrhoea and trichomoniasis can also facilitate the transmission of HIV although they do not cause sores. This may be due to the fact that

genital inflammation associated with these STIs can cause microscopic cuts in genital tissues, creating potential sites where HIV can enter the body.

31.6.3 HIV increases the risk of infection with other STIs

It is also true that people infected with HIV are more vulnerable to getting multiple infections. This is because changes in their body's immunity make them more vulnerable to infection by pathogens in general.

31.6.4 Key issues regarding STIs and HIV infection

You need to keep in mind the following essential points about the relationship between HIV and STIs. Firstly, an obvious point in common between STIs and HIV is behavioural. For example, unprotected sexual behaviour exposes people to both HIV and other STIs as you learned in Section 31.2.1 and elsewhere in this Module. Equally, the consistent use of condoms can prevent both kinds of infection. So, you need to educate and counsel your clients about the proper and consistent use of condoms to reduce the risk of transmission of both HIV and other STIs.

Secondly, STI control is also important for preventing the spread of HIV from PLHIV, which you learned in Study Session 29 on positive living. PLHIV are more likely to transmit HIV to others if they also have another STI. PLHIV should thus be taught how to recognise STI symptoms and be encouraged to seek care promptly if they think they may have an infection.

Note that all STI cases that you identify at your health post and in your community have to be referred to the nearest health centre for treatment. In the health centre, STI treatment should be provided along with the following key interventions:

- Educating clients about the transmission, treatment and control of STIs and HIV
- Providing risk reduction counselling by focusing on the prevention of STIs and HIV
- Condom promotion and provision for all clients
- Consideration of HIV-related illness and offering provider-initiated counselling and testing
- Partner counselling and treatment: management of partners for STIs is an essential component of STIs to stop further recurrent infection among partners
- Encouragement for HIV testing through provider-initiated counselling
- Referral of patients and their partners to counselling units and laboratories for HIV and syphilis testing, or to higher health care if they do not respond to syndromic treatment of STIs.

■ Why do STIs increase the risk of HIV transmission? List three STIs that can increase the risk of HIV transmission.

□ It is due to the fact that genital inflammation associated with STIs can cause small cuts in genital tissues, creating potential sites where HIV can enter the body. Examples of STIs that increase the transmission of HIV are genital herpes, syphilis and gonorrhoea.

Summary of Study Session 31

In Study Session 31, you have learned that:

1 STIs are very common communicable diseases in the community.

2 The transmission of STIs is greatly affected by demographic, social, biological, economic and behavioural factors.

3 Syndromic management of STIs is an important tool to simplify the diagnosis and treatment of STIs. It involves treating all possible causes, even though the specific infectious agents have not been identified.

4 HIV testing and counselling is an essential component of STI management.

5 The risk of HIV transmission increases when an individual has concurrent and untreated STIs. The presence of HIV increases the severity of some STIs and makes them more difficult to treat.

Self-Assessment Questions (SAQs) for Study Session 31

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 31.1 (tests Learning Outcomes 31.1 and 31.2)

(a) List all routes of transmission of STIs and give two examples for each.
(b) Explain why the risk of transmission of STIs is greater in women than in men.

SAQ 31.2 (tests Learning Outcomes 31.3, 31.4 and 31.6)

A 22-year-old young man came to the health post complaining of a yellow urethral discharge with burning pain on urination. He has had these complaints for the past five days.

(a) What syndrome does this young man present with?
(b) What will you do?

SAQ 31.3 (tests Learning Outcome 31.4)

Explain why syndromic management of STIs is a feasible intervention in settings like Ethiopia.

SAQ 31.4 (tests Learning Outcome 31.5)

Explain how the presence of HIV can increase the risk of transmission of other STIs and vice versa.

Notes on the Self-Assessment Questions (SAQs) for *Communicable Diseases*, Part 3

Study Session 20

SAQ 20.1

A is true. HIV is more prevalent among young sexually active people than among elderly people.
B is true. In Ethiopia, more females than males are infected with HIV.
C is *false.* In most cases, an HIV infection leads to AIDS in 5–10 years, and only if the person does not get antiretroviral therapy.
D is true. In the early course of HIV infection, people may not know that they are infected with the virus because they feel healthy (have no symptoms and signs).
E is *false.* HIV mostly infects CD4 lymphocytes, which are a type of *white* blood cell in humans.
F is *false.* HIV can be transmitted through sexual intercourse with an infected person, but also by transfusion of infected blood, or blood products sharing — or accidental puncture with — sharp objects contaminated by infected blood; and from mother to child.
G is *false.* HIV *can* be transmitted through oral sex; the virus can get in through microlesions in the mucosa lining in the mouth.
H is *false.* Unprotected anal sex has a *higher* risk of transmission of HIV than unprotected vaginal sex.
I is true. Eating and shaking hands with PLHIV *cannot* transmit HIV to uninfected individuals.

SAQ 20.2

(a) A CD4 lymphocyte is a special type of white blood cell in the immune system, which circulates in the body and 'helps' other lymphocytes to function in the immune response, e.g. by making antibodies, or attracting killer cells to destroy virus-infected cells.

(b) HIV infection of the CD4 lymphocytes determines the natural course of HIV disease progression to AIDS, because the number of CD4 lymphocytes in the body gradually declines over time. They die when they shed millions of new viruses, made in every infected CD4 lymphocyte under instructions from the HIV that originally infected it. As the CD4 lymphocyte numbers fall, they can no longer 'help' the immune system to function effectively, and PLHIV begin to develop more and more infections and other health problems. These ultimately progress to the worst stage — AIDS — unless the person gets antiretroviral therapy.

(c) The progress of HIV infection is faster in children and infants when compared to adults.

SAQ 20.3

These diseases are called *opportunistic infections* because the infectious agents that cause them only have the 'opportunity' to multiply in the body because the CD4 lymphocytes are being destroyed by HIV. This leaves the immune system unable to protect the person from infection he or she would otherwise have been able to fight off.

Study Session 21

SAQ 21.1

A is true: As the immune system's ability to defend against infectious diseases declines in PLHIV, various and more severe opportunistic infections appear.

B is *false*: The appearance of severe opportunistic infections usually occurs when the CD4 count falls to below 450 cells/mm^3.

C is true: Patients with opportunistic infections who have not been tested for HIV may be unknowingly HIV-positive. You should counsel and refer the patient for HIV testing. However, you should not classify a patient according to the WHO clinical staging system unless they have tested positive for HIV.

D is true: To classify a patient on the WHO HIV clinical staging system, the patient has to be HIV-positive, and specific diagnoses of opportunistic infections and diseases are required. PLHIV are classified into different stages according to their most severe opportunistic infection.

SAQ 21.2

(a) The vesicles suggest it may be a *herpes zoster* rash.

(b) You need to know first whether the patient is HIV-positive or whether she has ever been tested. If the patient doesn't know her HIV status, advise her on provider-initiated counselling and testing for HIV. In either case, refer the patient to the health centre for treatment.

SAQ 21.3

(a) He may have HIV wasting syndrome.

(b) This is classified as WHO HIV clinical stage 4.

(c) The patient has to be referred to the nearest health centre urgently. He needs urgent treatment for his wasting syndrome as well as antiretroviral therapy for HIV. His children also need to be tested for HIV, as it is possible that the mother died of AIDS-related illnesses.

SAQ 21.4

You need to tell the patient that cotrimoxazole prophylaxis has to be taken continuously unless she is told to stop by her nurse at the health centre. You need to encourage her to take the drugs, and explain that they are helping her to avoid some of the common infections associated with HIV infections such as those that can cause diarrhoea, lung and brain disease. If she needs more help, refer her to the health centre for further support and care.

Study Session 22

SAQ 22.1

The statement is *false*. Even though effective treatments to *control* HIV exist now, there is still *no cure* for HIV/AIDS anywhere in the world, and no vaccine to prevent it.

SAQ 22.2

The answer is (D). All of the statements are *false* because:

A ART cannot completely eliminate HIV from the human body.
B The two main goals of ART are to *reduce* the number of viruses in the blood to a very low level (they cannot be eradicated by current treatments), and to *increase* the number of CD4 lymphocytes as much as possible, to boost immunity.
C Combining only two ARV drugs is less effective than treating HIV with a combination of three ARV drugs from different groups.

SAQ 22.3

One ARV drug can slow down the fast rate of new HIV production in the body, but two drugs acting at different points of the multiplication cycle can slow it further, and three drugs together have an even more powerful effect. This is because ARV drugs from different drug groups attack the virus in different ways. HIV would have to make several different changes in its structure in order to develop resistance to all three drugs.

SAQ 22.4

That is absolutely *wrong*! HIV can still be transmitted from a person on ART to an uninfected sexual partner if they practise unsafe sex. Remember that ART *does not cure* HIV/AIDS.

SAQ 22.5

First, start by reassuring Abebech that nausea and vomiting are common side-effects of most ARV drugs, especially in the early weeks of treatment. Then advise her to take the drugs with food, and drink plenty of fluids. Tell her that if the vomiting worsens, she should go back to the health centre for further assessment and management.

Study Session 23

SAQ 23.1

Poor adherence to ART means not taking drugs as prescribed by the health workers. It results in low levels of drugs in the blood so that multiplication of HIV is not completely suppressed, thereby inducing resistance to drugs. As a result of increased multiplication of the virus, CD4 lymphocytes will be destroyed, which results in various opportunistic infections that damage the patient's health.

SAQ 23.2

One of the barriers of adherence is stigma and discrimination resulting from patients not disclosing their HIV status to people around them. In this patient's case, counselling about disclosure is essential, and you should try to find someone in the family or the community who will support the patient in taking ART. Otherwise, refer the patient to the health centre for further support.

SAQ 23.3

If she is taking two tablets per day, then a total of 28 doses are expected in 14 days. If she misses three tablets, then she has taken 25 out of 28 tablets. Therefore, her adherence level is $25 \times 100/28 = 89\%$. Her adherence is not 100%; therefore you need to counsel her about strict adherence.

SAQ 23.4

In adherence counselling, a partnership between the patient and the healthcare team is vital. It means you should treat your patients as an active agent of their own health. Your relationship with them shouldn't be like a boss who tries to control their behaviour. An equal partnership greatly helps in building trust with your patients.

Study Session 24

SAQ 24.1

The statement is *false* because PITC is HIV testing initiated by the healthworker either in the health facility or at community level.

SAQ 24.2

Statement D is not a benefit of HIV testing because individuals found to be HIV-negative should have a plan to remain HIV-negative. They should plan to avoid sexual behaviour and practices that increase the possibility of being exposed to HIV. As part of this plan, they should practise safe sex.

SAQ 24.3

The answer is C. Mandatory HIV testing is only used when requested by a court in rape or other sexual assault cases.

SAQ 24.4

It is the fifth step. HIV-positive people may not be linked to these services unless you do proper post-test counselling, referral and follow-up of the referral.

SAQ 24.5

The statement is *false* because you have to perform a second test using STAT-PAK before reporting a positive test. A third test using a Uni-gold device may be required if the STAT-PAK test is non-reactive.

Study Session 25

SAQ 25.1

E is incorrect. Harmful traditional practices such as uvulectomy promotes sharing of sharp objects contaminated with blood, and hence facilitates HIV transmission. All the other statements are good ways to prevent HIV transmission.

SAQ 25.2

You should inform them that maintaining faithful relationships is effective for HIV prevention only if both partners are confirmed HIV-negative. You should provide counselling for HIV testing and inform them about the consistent use of safer sex practices, including the correct and regular use of condoms in every sexual encounter for couples who are not tested for HIV.

SAQ 25.3

(a) You may use the standard steps of community mobilisation, though you can modify or skip some of them depending on the availability of time and resources. You should consider the following:

- Clearly define the problems, including the causes, by gathering information about ways that HIV transmission could increase.
- Identify and establish community mobilisation groups from the community, *kebele* and *woreda* offices, and local charity organisations if they exist.
- Design your HIV prevention strategies.
- Plan the list of activities that you will implement in a certain time period.
- Identify all of your partners and their roles, including community mobilisers, target groups and other external partners.
- Implement your activities based on your designed HIV prevention strategies.
- Monitor and evaluate your implementation results, comparing it to your plan.

(b) The target groups for your community mobilisation could be:

- sex workers
- trading women
- daily labourers
- clients of sex workers
- the construction company workers.

(c) Your potential partners could be:

- formal and informal *kebele* leaders
- *woreda* HAPCO
- local associations of PLHIV support groups
- HIV/AIDS clubs
- charity organisations
- the construction company management team
- Ethiopian roads authority.

(d) HIV prevention strategies at community level may include:

- behavioural change communication using health education and other methods
- community condom distribution
- HIV prevention campaigns
- outreach peer education
- life skills training for vulnerable women.

Study Session 26

SAQ 26.1

The statement is *false* because universal precautions are standard procedures used when we manage *all* patients. Universal precautions should be implemented and practised by all healthcare providers and caregivers in all settings, in particular in hospitals, health centres, health posts and community settings, as well as the homes of your patients.

SAQ 26.2

A is *false.* The more you handle an injection instrument, the *more likely* you are to suffer a needle-stick injury.
B is true. Place a safety box close to the person giving injections, so used syringes and needles can be disposed of immediately.
C is true. Do not manually remove a used needle from the syringe.
D is true. Do not carry used syringes and needles around with you.
E is true. Avoid recapping the needle after you have given an injection.
F is *false.* Safety boxes should be closed when they are *three-quarters* full; you risk a sharps injury if you try to add needles or other instruments to a full safety box.

SAQ 26.3

The statement is *false.* Remember that although universal precautions will decrease the occurrence of occupational exposure, there are 'accidents' and unanticipated exposures, which necessitate PEP for HIV. Even if a health facility has all the PPE, it needs a PEP service for its healthcare workers to prevent HIV transmission through accidental occupational exposure. If PEP is not available in a health facility, or when there is nobody trained in how to manage such cases, referral of the exposed health worker to a nearby health facility which has a PEP service should be arranged as soon as possible.

SAQ 26.4

(a) No, Ayelech was not following universal precautions, because she didn't use PPE except for wearing gloves. She also recapped the needle with two hands, instead of with one hand.
(b) Yes, Ayelech is at risk of being infected with HIV. The HIV status of the mother is not known, but the fact that she was sick makes the possibility of HIV infection more likely. It is a high-risk exposure since the needle-stick was a deep injury with a hollow needle, and the mother was sick.
(c) Immediately after the injury, Ayelech should wash the wound with soap and water and let it bleed freely. There should be antiseptic or disinfectant in the bag she takes to deliveries, and she should flush the wound with it.
(d) Ayelech should call for help for the mother and newborn, and go to the nearby health centre/hospital as soon as possible to begin PEP immediately. Ayelech should also be tested for HIV. If she is found to be positive, she doesn't need the PEP and should be enrolled for HIV care at the health centre.

SAQ 26.5

(a) You should first tell Fatuma and her parents about the potential risk of HIV infection from the sexual assault, and explain that Fatuma should get PEP quickly, which you don't have in your health post.
(b) You should *refer* Fatuma *immediately* to the nearby health centre or hospital for physical examination, PEP, and other necessary investigations and medications. You need to convince Fatuma and her parents that the legal process is a lower priority, as she has to take the PEP within 72 hours of the assault.

Study Session 27

SAQ 27.1

An HIV-infected pregnant woman can pass the virus on to her unborn baby, either before or during birth, so she should give birth in a health facility. HIV can also be passed on during breastfeeding. Exclusive breastfeeding is therefore not recommended but will be necessary if the AFASS criteria cannot be met. If a woman knows that she is infected with HIV, there are drugs she can take to greatly reduce the chances of her child becoming infected.

SAQ 27.2

Women who are infected with HIV are able to have normal and healthy pregnancies if they use ANC services and PMTCT to improve the chances of having an HIV-negative baby.

- It is important that HIV-infected pregnant women attend antenatal care to decrease the risk of transmitting the virus to their infants during pregnancy.
- Because of the risk of HIV transmission from mother to baby during labour and delivery, HIV-infected mothers should plan to deliver their baby in a healthcare facility, where there are safer delivery practices.
- It is also critical that the baby and mother continue to receive ongoing care in the post-delivery period to reduce the likelihood of transmission through breastfeeding, and to monitor the infant's health, growth and development.

SAQ 27.3

There are a number of reasons why a pregnant woman should be tested for HIV:

- Knowing her HIV status can help her make informed decisions about her current and future pregnancies.
- If she is infected, knowing her status can help her to access other HIV care and treatment services.
- If she is infected, she can learn how to prevent HIV transmission to her baby.
- If she is infected, she can learn how to reduce the risk of infecting other people.
- If she is not infected, it will help her to stay uninfected, and keep her family safe from HIV infection.
- Whether she is infected or not, testing can help to plan for the future.

SAQ 27.4

A and B are true.

C is *false*. A pregnant woman who is taking ARV drugs to treat her own HIV infection does *not* need additional ARV drugs for PMTCT.

D is *false*. Single-dose Nevirapine for PMTCT is given to the *mother* at the onset of labour, as well as to the newborn baby.

Study Session 28

SAQ 28.1

HIV-exposed infants are infants born to HIV-infected mothers. The HIV status of such infants is regarded as unknown until a definitive rapid diagnostic test is carried out at the proper age and conditions (e.g. cessation of breastfeeding for longer than 6 weeks before the test), or until a DNA PCR test (that measures directly viral components in the blood) is performed. If the test confirms the presence of HIV in the infant's blood, we considered the infant to be infected by HIV.

SAQ 28.2

Statements C and D are true.

A is *false*. Compared to adults, HIV infection progresses *more* rapidly in children, due to their immature immune system.

B is *false*. In children under the age of 18 months we do not use a rapid HIV test to confirm HIV infection, because maternally acquired antibodies can give a false positive test result. The definitive diagnosis of HIV at this age is done by using DNA PCR testing.

SAQ 28.3

(a) Kebede is an HIV-exposed infant, since he was born to an HIV-positive mother. Remember that unless their HIV test result is confirmed, infants born to HIV-positive mothers are called HIV-exposed infants.

(b) You should teach the grandmother about HIV transmission and prevention. You should stress that HIV might have been transmitted to Kebede from his mother. Hence, you should advise the grandmother to take Kebede to a nearby health centre or hospital for management of the diarrhoea and early infant diagnosis of HIV infection. You should provide her with oral rehydration salts (ORS) and tell her how to give it to the infant until he arrives at the health centre. Remember that she should continue feeding him with locally available foods recommended for children with chronic diarrhoea.

(c) Screening Kebede's siblings for HIV is also important to provide early care for them if they are HIV-infected.

Study Session 29

SAQ 29.1

A is *false*: Even if patients are taking ART they can transmit HIV to other people if they engage in unprotected penetrative sex. This is because ARV drugs do not eliminate HIV from the body; they suppress viral replication.

B is *false*: If condoms are correctly used, they can prevent the transmission of HIV by more than 98%. The remaining 2% transmission usually results from incorrect use of condoms by the user.

C is true: The nutritional requirement of sick people is higher than that of healthy people. This is because additional energy is needed to compensate for the increased metabolic needs due to illness.

D is true: Handwashing with soap and water is very important in preventing faeco-oral diseases.

SAQ 29.2

Even when both partners are HIV-positive, they have to practise safer sex alternatives such as the consistent and correct use of condoms. If they are involved in unsafe sex, re-infection may occur and different strains of HIV will be passed from one person to the other. This will result in the replication of new viruses that may have different sensitivity to the drugs currently taken by the patient.

SAQ 29.3

In the early periods after being diagnosed as HIV-positive, patients may have different psychological reactions. In this case, the patient might be suffering from mental illness associated with the life-changing news of being HIV-positive. You should encourage him to take a more positive mental attitude, and reassure him about the effectiveness of ART. Refer him to the health centre for further psychological and/or psychiatric evaluation and management. You also need to encourage him to come to your health post or to the health centre for any issues related to his health and/or psychological and physical wellbeing.

Study Session 30

SAQ 30.1

C, D and E are true.

A is *false.* Palliative care is not terminal care (care given to dying patients only); it is the care provided to patients with a chronic illness, from the time the disease is diagnosed until the end of life. It regards dying as a normal process, and affirms life. This is well described in statement E, which is true.

B is *false.* Palliative care is also needed for patients with other non-curable chronic diseases like cancer, diabetes and strokes, as described in the true statements C and D.

SAQ 30.2

The statement is *false*. Even though the disease causing the pain is not curable, we have to manage pain properly. The reason for doing this is because pain makes patients suffer a lot, which in turn affects their quality of life. Treating pain is relieving patients from this suffering, and hence giving them a better quality of life. Pain management should be an integral part of managing non-curable chronic illnesses.

SAQ 30.3

(a) First, you reassure Ato Aytenfisu that his symptoms could be adverse side-effects from the ARV drugs he is taking, and that he will be alright after some days. But make sure he knows that if the headache and diarrhoea get worse, or if blood is seen in stools, he should visit the nearby health centre as soon as possible.

(b) For the headache you should give him paracetamol, as it is a mild symptom.

(c) Regarding the diarrhoea, you should give him oral rehydration solution (ORS) and advise him to drink it frequently in small amounts. If there is no ORS, you can advise him to take home-made fluids such as rice soup, weak tea or just plain water, but avoid taking sweet drinks, milk, strong tea or alcohol. Tell him to continue eating as usual. If the diarrhoea worsens, he should go to the nearby health centre for better management.

(d) With respect to the unhappiness, you could advise him to accept the illness as much as he can, and that it is possible to live a healthy life and be productive if he takes the antiretroviral drugs correctly. If available, you need to introduce him to a nearby PLHIV association, or a community-based organisation which provides support to PLHIV. You also need to arrange a follow-up visit.

SAQ 30.4

E (treating infection of the lungs) is not part of preventative home-based care for bedridden patients. First, it is a treatment, not palliative care. Secondly, if the patient develops a lung infection, he/she has to be referred to a nearby health facility for specialist treatment as soon as possible. All the other statements (A to D) are part of preventative home-based care for bedridden patients.

SAQ 30.5

This statement is absolutely *false*, because end-of-life care is very important for patients with a terminal illness. Indeed, it helps us to recognise that life and death are normal events. It helps the dying patient and loved ones to adjust to the many losses they face, and tries to ensure that a dignified death occurs with minimal distress.

Study Session 31

SAQ 31.1

(a) The following are the common routes of transmission of STIs, together with two typical examples.

1 Sexual: e.g. HIV, gonorrhoea

2 Mother to child: e.g. HIV, chlamydia

3 Unsafe injections and blood transfusion: e.g. HIV, syphilis.

(b) The risk of transmission of STIs is higher in women than men mainly due to biological and socio-cultural factors. Specifically, young women 15 to 24 years old and menopausal women are at higher risk of STIs. This is because young women usually lack comprehensive knowledge of STIs transmission. In addition, the risk of transmission of STIs is higher due to immature and weakened vaginal mucosal lining of young and menopausal women respectively. Also the surface area of the vagina that comes in contact during sexual intercourse is larger than that of the penis and this is associated with an increased risk of transmission. Socio-cultural issues like gender bias, economic dependence, societal values relating to sexuality and harmful traditional practices like female genital mutilation also contribute significantly to the increased risk of STIs in females.

SAQ 31.2

(a) The syndrome that this patient appears to have is urethral discharge.

(b) You need to refer him to the health centre urgently for further care and support. Provider-initiated testing and counselling can also be offered for HIV. You need to ask him about past sexual partner(s) so that they can be traced and encouraged to access screening for HIV or other STIs at the health centre.

SAQ 31.3

Syndromic management of STIs enables health workers to treat similar causes all together. Syndromic diagnosis leads to immediate treatment for all of the most important causative agents of an STI. This is important because infections by multiple pathogens occur frequently in STIs. Besides, syndromic management can be implemented to effectively treat cases in settings with limited laboratory capacity such as health centres in Ethiopia.

SAQ 31.4

The following points explain the relationship between HIV and other STIs:

1 Certain STIs facilitate the transmission of HIV through the small cuts and inflammations they cause around the genitalia.

2 The presence of HIV can make people more susceptible to the transmission of STIs. This is because HIV weakens the immunity that can protect us from other infections like STIs.

3 The presence of HIV increases the severity of some STIs and makes them difficult to treat. This is also related to poor immunity in PLHIV.

Federal Democratic Republic of Ethiopia
Ministry of Health

Communicable Diseases

Part 4 Other Diseases of Public Health Importance and Surveillance

Blended Learning Module for the Health Extension Programme

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Contents

Study Session 32 General Features of Faeco-Orally Transmitted Diseases

Introduction

In Parts 1 to 3 of this Module, you have learned the general principles of how communicable diseases are transmitted, the specific features of the bacterial and viral vaccine-preventable diseases, and about malaria, leprosy, tuberculosis (TB) and HIV/AIDS. In Part 4, you will learn about other diseases of major public health importance in Ethiopia, beginning with **faeco-orally transmitted diseases**, i.e. diseases in which the infectious agents are found in faeces (stool) and enter the body through the mouth (oral route). The mode of transmission may be in contaminated food water, on the hands, or on objects such as bowls, spoons and cups. For simplicity, we will sometimes refer to these diseases as **faeco-oral diseases**.

In this study session, you will learn about the general features of faeco-oral diseases: the main types commonly found in Ethiopia, their general symptoms and signs, how to treat mild cases and when to refer patients with severe conditions for specialised treatment, or laboratory tests to confirm the diagnosis. You will also learn about the importance of giving effective health education to your community on ways to prevent and control faeco-oral diseases. This general understanding forms the basis for the more detailed discussion of specific faeco-oral diseases in Study Sessions 33 and 34.

Learning Outcomes for Study Session 32

When you have studied this session, you should be able to:

32.1 Define and use correctly all of the key words printed in **bold**. (SAQs 32.1, 32.3 and 32.4)

32.2 Name the common types of faeco-orally transmitted diseases in Ethiopia, the infectious agents that cause them, and the main routes of transmission. (SAQs 32.1, 32.2 and 32.4)

32.3 Describe the characteristic symptoms and signs of faeco-oral diseases, and explain why diarrhoea can be life-threatening. (SAQ 32.3)

32.4 Describe how you would treat mild cases of faeco-oral disease, and when you would refer severe cases for laboratory investigation and/or specialised treatment. (SAQ 32.3)

32.5 Suggest effective ways to prevent and control faeco-oral diseases at the community level. (SAQs 32.2 and 32.4)

32.1 Classification of faeco-oral diseases and their infectious agents

Faeco-oral diseases can be caused by a wide range of infectious agents, including bacteria, viruses, **protozoa** (single-celled parasites) and **helminths** (parasitic worms). All human parasites, whether they are single-celled or many-celled, live inside the human body: some are harmless, but others cause disease. In this study session, we are concerned with infectious agents which are transmitted via the faeco-oral route.

■ Can you think of a viral disease that you learned about in Part 1 of this Module which is transmitted faeco-orally?

□ Poliomyelitis (polio) is a viral faeco-orally transmitted disease that was described in detail in Study Session 4.

You already know about polio, which has become rare in Ethiopia thanks to the immunization programme, so we will not discuss it again here. Table 32.1 lists the common faeco-oral diseases and where they are described in detail later in this Module. You may already know about some of them from your own experience in your community.

Table 32.1 Common faeco-orally transmitted diseases in Ethiopia and their causal infectious agents.

Faeco-oral disease	Infectious agent	Study Session
Bacteria:		
• Cholera	*Vibrio cholerae*	33
• Shigellosis (bacillary dysentery)	*Shigella* species	33
• Typhoid fever	*Salmonella typhii*	33
Viruses:		
• Viral diarrhoeal diseases	Rotavirus (most cases)	33
Protozoa:		
• Amoebiasis (amoebic dysentery)	*Entamoeba hystolica*	34
• Giardiasis	*Giardia intestinalis*	34
Helminths:		
• Ascariasis	*Ascaris lumbricoides*	34
• Hookworm	*Necator americanus* or *Ankylostoma duodenalis*	34
• Taeniasis (tapeworm)	*Taenia saginata* (most cases)	38

Amoebiasis is pronounced 'am-mee-bya-sis'; giardiasis is 'jee-arr-dya-sis'; ascariasis is 'ass-kar-rya-sis'; and taeniasis is 'tee-nya-sis'.

32.2 Direct and indirect faeco-oral transmission

Figure 32.1 Contaminated hands can easily transmit infectious agents directly to the mouth. (Photo: Basiro Davey)

As we mentioned in the Introduction to this study session, faeco-oral transmission means 'from faeces to mouth'. But the route can either be **direct transmission** from contaminated hands touching the mouth and transferring the infectious agents directly; or **indirect transmission** through consumption of food or water, or using utensils, contaminated with the infectious agents.

■ How could a person's hands become contaminated with faeces?

□ You may have thought of several ways, including:

- Using the toilet and not washing the hands afterwards
- Cleaning a child's bottom after defaecation
- Shaking hands with someone whose hand is already contaminated (Figure 32.1)
- When flies rest on the hand after they have crawled on faeces
- Accidentally touching faeces in the soil where people or animals have defaecated in the open fields.

Faeces can also contaminate food or water, indirectly transmitting the infectious agents when a person eats the food, or drinks the water, or some gets into the mouth during washing. Diseases transmitted indirectly by food or water are called **foodborne diseases** and **waterborne diseases** respectively (see Box 2.2 in Study Session 2).

■ Can you suggest some ways that food could become contaminated with faeces?

□ You may have thought of several ways, including:

- Contaminated hands touching food during preparation or eating
- Using contaminated water to prepare food (e.g. washing fruit)
- Using contaminated utensils (knife, spoon, bowl, etc.) to prepare or eat food
- Feeding a baby with contaminated milk, or using a contaminated bottle
- Flies resting on food after crawling over faeces
- Serving inadequately cooked fruit and vegetables grown in soil contaminated with faeces.

■ How could water become contaminated with faeces?

□ You may have thought of several ways, including:

- Sources of water (streams, wells, etc.) can be contaminated with faeces washed out of the soil by heavy rain if people defaecate in open fields, or in poorly constructed latrines
- Hands or utensils for eating or drinking may be washed in contaminated water
- Contaminated containers may be used to fetch or store water.

The correct construction of latrines is taught in the *Hygiene and Environmental Health* Module.

The examples given above illustrate faeco-oral transmission via the **six Fs**: food, fingers, flies, fluids, faeces and fomites. Figure 32.2 illustrates the different ways that faeco-oral transmission can occur.

Fomites ('foh-mytz') is the term given to non-living things (e.g. bowls, water containers, soil) that can transmit infection indirectly.

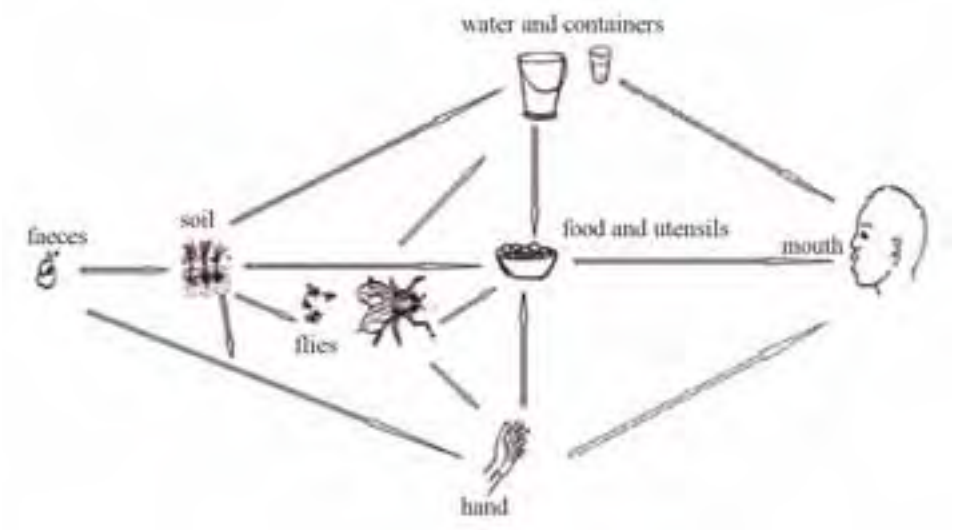

Figure 32.2 Different ways that faeco-oral transmission of infectious agents can occur. (Source: adapted from AMREF, 2007, *Communicable Diseases Distance Education Program*, Unit 11)

32.3 Symptoms and signs of faeco-oral diseases

Most – but not all – faeco-oral diseases have diarrhoea as their main symptom, and for this reason these conditions are also known as **diarrhoeal diseases**. Other common symptoms are vomiting, abdominal pain, and sweating or shivering. A high-grade fever is a sign of some faeco-oral diseases, i.e. a temperature of 38.5°C or above, measured with a thermometer. Of the diseases listed in Table 32.1 earlier, all *except* typhoid fever, ascariasis and taeniasis are characterised by diarrhoea. As it is such a common symptom of so many faeco-oral diseases, we will focus on diarrhoea in more detail.

32.3.1 Diarrhoea

Diarrhoea is the passage of loose faeces (liquid stool) three or more times a day, or more than is normal for the individual. If the diarrhoea continues for less than 14 days, it is referred to as **acute diarrhoea**; if it lasts for more than 14 days it is said to be **chronic** or **persistent diarrhoea**. Diarrhoea is also distinguished into **acute watery diarrhoea** (sometimes abbreviated to AWD), which typically occurs in cases of cholera, and **bloody diarrhoea** (also known as **dysentery**), which typically occurs in cases of shigellosis and amoebiasis.

Severe or some dehydration in a child is life-threatening. Refer the child urgently to the nearest health centre or hospital, telling the carer to feed sips of fluid to the child on the way.

Diarrhoea results in **dehydration** – the rapid loss of body fluids and important salts required for proper control of body functions, particularly in the brain, nerves and muscles. Children are highly susceptible to dehydration if they have diarrhoea, even after only one day; they can quickly die if the fluid loss is continuous and cannot be replaced by drinking fluids. A sign of some degree of dehydration in a child with diarrhoea is if it seems restless and irritable (easily upset), and drinks eagerly if offered fluids. If the dehydration is severe, the child may be too lethargic to drink, the eyes often appear sunken, and if you pinch the skin on the child's abdomen it may take two seconds or more for the pinched skin to go back to the normal position.

32.3.2 How common are diarrhoeal diseases?

Diarrhoeal diseases are the second largest cause of death globally among children aged under five years – only pneumonia and other acute respiratory infections (ARIs, the subject of Study Session 35) account for more child deaths worldwide. The World Health Organization (WHO) estimates that 1.5 million children in this age group die from diarrhoeal diseases every year, almost half of them in Africa. The most vulnerable children are the youngest ones, particularly before their second birthday. In Ethiopia, 23% of deaths in children aged under five years is due to diarrhoeal diseases – around 73,000 such deaths every year. Diarrhoeal diseases kill more children than malaria, HIV/AIDS and measles *combined*.

- Why do you think children are especially likely to be infected with the organisms that cause diarrhoeal diseases?

- There are many reasons, but you may have suggested that children are less likely than adults to wash their hands after defaecating, and more likely to put their fingers or dirty objects into their mouths, and also more likely to play in soil where they may come into contact with faeces.

32.4 Diagnosis and treatment of faeco-oral diseases

32.4.1 Diagnosis

To be certain that the cause of a faeco-oral disease has been correctly diagnosed, identified the infectious agent can only be done using laboratory techniques. However, identification of the infectious agent is not needed for the correct treatment of most cases of children with mild episodes of watery diarrhoea, which is evident in the majority of the faeco-oral diseases you will come across in your work.

The diagnosis of diarrhoeal diseases in children is further discussed in the Module on the *Integrated Management of Newborn and Childhood Illness (IMNCI)*.

For adults, laboratory examination is required to diagnose faeco-oral diseases accurately. At Health Post level, you should base your diagnosis on the specific symptoms and signs, for example, whether there is diarrhoea and (if yes) is it watery or bloody, and does it have a foul smell? Is the patient vomiting or complaining of abdominal pain? Does the patient have a fever? If your diagnosis is ascariasis, you can treat the adult patient as described in Study Session 34. But if you suspect other types of faeco-oral diseases (e.g. cholera, typhoid fever), refer the patient to the nearest higher level health facility, sending a referral note stating that further diagnosis is needed before specific treatment can begin. How to make or suspect a diagnosis of specific faeco-oral diseases will be discussed in Study Sessions 33 and 34, when we talk in more detail about types that you may encounter in your community.

32.4.2 Treatment

The treatment of any faeco-oral disease depends on whether the patient has diarrhoea or not. Patients without diarrhoea are treated depending on the type of infectious agent responsible, and you will learn more about the specific treatments for each condition in Study Sessions 33 and 34.

For patients with diarrhoea, especially children, the core measure in the treatment is rapid and adequate **rehydration** – fluid replacement – usually by drinking fluids. In the most severe cases the fluid has to be given intravenously (directly into a vein). Rehydration is the most important component of treatment for diarrhoea and it should be started as soon as possible and continued for as long as necessary. The best fluid to use to avoid the dangers of dehydration is a solution of **oral rehydration salts** (**ORS**) – a packet containing sugar and salts in the correct amounts, which the caregiver dissolves in clean drinking water. The sugar and salts are absorbed into the child's body, replacing what it has lost in the diarrhoea; the salts also help water to be absorbed across the inflamed lining of the gut, where it has been damaged by the action of infectious agents. WHO *Guidelines on the Treatment of Diarrhoea* now also emphasise the importance of giving zinc supplements to young children with diarrhoea, in addition to ORS.

For children with diarrhoea, the measures that you need to undertake during treatment are briefly summarised in Box 32.1 (on the next page). However, the WHO estimates that less than 40% of children with a diarrhoeal disease receive the correct treatment.

Figure 32.3 (a) The most important part of the treatment for diarrhoea is rehydration with ORS. (b) Breastfeed infants as often as the child wants. (c) Additional nourishing meals help to regain the child's strength. (Source: WHO, 2007, *Diarrhoea Treatment Guidelines for Clinic-Based Health Care Workers*)

Box 32.1 Summary of the main measures to treat a child with diarrhoea

In order to treat a child with diarrhoea effectively, you have to learn the detailed descriptions of each of these measures, which are discussed in the *IMNCI* Module, Study Session 5.

- First, you have to assess the degree of dehydration and classify the child as having 'no', 'some' or 'severe' dehydration, depending on specific symptoms and signs.
- Select and apply the appropriate treatment for the degree of dehydration.
- Check for other general danger signs indicating other major health problems, such as malaria, malnutrition or pneumonia, and treat them; e.g. if the child has malaria, give appropriate antimalarial drugs (refer back to Study Session 8 of this Module).
- Counsel the mother on how to give ORS at home (Figure 32.3a); if she does not have ORS, the child should be encouraged to drink as much clean fluids as possible.
- If the child is breastfed, the mother should go on breastfeeding during diarrhoea episodes (Figure 32.3b); weaned children need additional nourishing meals to help them recover their strength (Figure 32.3c).

For adults with diarrhoea, assess whether the patient can take fluids orally, and if they cannot, refer them immediately to the nearest higher level health facility. If the patient is able to take fluids orally, give ORS and tell them to drink 200–400 ml after each loose stool. You should also advise the patient to take other fluids in addition to ORS and to continue eating. For most cases of diarrhoea in adults, additional treatment (other than rehydration) is generally required – mainly giving an antibiotic or other medication appropriate for the specific infectious agent. However, laboratory examination of stool samples is required before making the diagnosis, which can't be carried out at Health Post level. Therefore, give ORS to adults with diarrhoea and refer them. Advise the patient that early treatment is important because the disease could worsen rapidly.

32.5 Prevention and control of faeco-oral diseases

Effective prevention and control measures can interrupt faeco-oral transmission of infectious agents by targeting the different routes of transmission mentioned earlier and summarised in Figure 32.2. As you remember, the sources and modes of transmission to be targeted are: hands, food, water, utensils, soil and flies contaminated with faeces. Most of the prevention and control measures are relatively simple and easy to apply. You have an important role in educating your community by explaining what simple steps can be taken to reduce the risk of faeco-oral diseases. So, in addition to the effective treatment of cases, you need to help families put into effect the measures outlined below.

32.5.1 Prevention of faeco-oral transmission

Give clear health education messages in ways that motivate people in your community to undertake the prevention and control measures described below. Each measure has been given a distinguishing letter, so you can relate it to the questions that follow the descriptions.

Ways to prevent faecal contamination of hands

A Wash hands with soap and clean water:
- A1 After defaecation, or cleaning the bottom of a child, or changing an infant's nappy (diaper).
- A2 After working with soil, or after children have been playing on soil, where there has been open defaecation by people or animals.
- A3 Before preparing food or eating.

B Cut fingernails and avoid putting fingers into the mouth.

Ways to prevent contamination from unsafe food

C Prepare and eat food safely:
- C1 Observe thorough hand hygiene before and during any contact with food
- C2 Ensure that all utensils are completely clean; allow them to 'air dry' after washing (don't wipe with a cloth)
- C3 Wash raw vegetables and fruits thoroughly in clean water
- C4 Cook other food items thoroughly, particularly meat and fish
- C5 Eat cooked food while it is hot and reheat food thoroughly if it has cooled
- C6 Cover food so it cannot be exposed to flies.

D Promote exclusive breastfeeding of infants under six months old:
- D1 If babies or young children are fed animal milk or formula, the bottle and teat, or cup and spoon, should be thoroughly washed with clean water and soap before every feed
- D2 Animal milk should be boiled and cooled before drinking
- D3 Formula milk should be mixed with boiled cooled water.

E Control flies:
- E1 Cover food to prevent contamination by flies
- E2 Dispose of faeces and other wastes safely, so flies cannot land on sewage.

Ways to prevent contamination from unsafe water

F Protect water sources from contamination with faeces:
- F1 Use a properly constructed latrine and safe disposal of faeces
- F2 Avoid open defaecation in the fields (Figure 32.4)
- F3 Avoid direct contact of hands with drinking water
- F4 Install protected water sources, such as covered wells with pumps

G Boil water before drinking, or using in preparation of food or fluids

H Use clean drinking cups and clean covered containers for storing water.

Figure 32.4 Sign celebrating the achievement of Fura in the Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia as the first 'open-defaecation free' village in the region. All households have a latrine. (Photo: accessed from http://www.susana.org/docs_ccbk/susana_download/2-297-open-defecation-free-environment-ethiopia-en.pdf)

■ Which of the measures described above will help to prevent the transmission of infectious agents by flies? Use the letters assigned to each measure to indicate your answers.

□ Measures C6, E1, E2, F1 and F2 will all reduce the risk of faeco-oral diseases transmitted by flies.

■ Which of the measures described above are most important when preparing milk for feeding to young children?

□ Measures A1, A2, A3, B, C1, C2, D1, D2, D3, G and H.

32.5.2 Other ways to reduce the risks of faeco-oral diseases

Feeding young children before, during and after illness is described in detail in the *Nutrition* Module.

In addition to interrupting the direct and indirect transmission of infectious agents, the risk of faeco-oral diseases can be reduced by other ways of protecting and promoting general health, particularly of children. Malnutrition increases the susceptibility of children to develop severe symptoms if they are exposed to infection. Therefore, exclusive breastfeeding until the age of six months and good nutrition after weaning can help to protect children from infection and increase their resistance to the most severe symptoms if they become ill. Eating additional nourishing meals also aids recovery after illness.

Immunization is described in Study Sessions 3 and 4 of this Module, and in the *Immunization* Module

Immunization against all the vaccine-preventable diseases also promotes the general health of children and helps to protect them from faeco-oral diseases (Figure 32.5). A child who is suffering from a condition such as measles or pneumonia is also more vulnerable to develop a faeco-oral disease, because their immune system is overloaded by infection. Giving vitamin A supplements with the measles vaccine at the age of nine months, and every six months thereafter until the age of five years, also helps to promote health and increase resistance to infection. So, ensuring that parents and other caregivers know about and follow all these good practices can help to reduce the risks to children from faeco-oral diseases. A vaccine to protect children against rotavirus infection – the main cause of viral diarrhoeal disease – is expected to be added to the routine Expanded Programme on Immunization (EPI) in the near future.

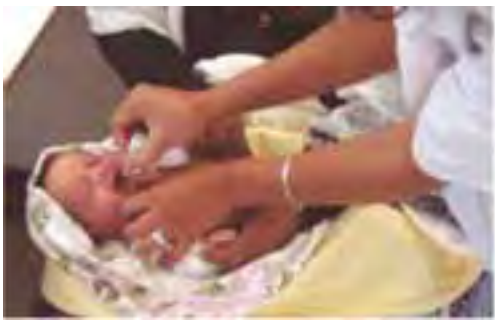

Figure 32.5 Immunization and vitamin A supplements help to protect children from infection. This baby is receiving oral polio vaccine. (Photo: Dr Kalid Asrat)

In the next two study sessions, we will discuss specific types of faeco-oral diseases caused by bacteria and viruses (Study Session 33) and protozoa (Study Session 34); helminths that cause faeco-oral diseases are described in Study Sessions 34 and 38.

Summary of Study Session 32

In Study Session 32, you have learned that:

1 Faeco-oral diseases are caused by infectious agents whose route of exit from the body is in the faeces, and whose route of entry to new hosts is via the mouth.

2 Faeco-oral diseases can be caused by bacteria, viruses, protozoa and helminths.

3 Transmission of the infectious agents that cause faeco-oral diseases can be by the direct route, when hands contaminated with faeces make contact with the mouth. Indirect transmission is via contaminated food, water, soil, utensils or flies.

4 The common symptoms and signs of most faeco-oral diseases can include diarrhoea, vomiting, abdominal pain and fever or shivering.

5 Diarrhoea in different faeco-oral diseases may be acute or persistent (chronic), watery or bloody.

6 Young children are particularly vulnerable to dehydration (loss of body fluids and salts) due to diarrhoeal diseases. Diarrhoea is the second most important cause of death among children aged under five years.

7 The key to the treatment of diarrhoeal diseases is rehydration with oral rehydration salts (ORS), which should be given to the patient until all diarrhoea has ceased. Zinc supplements for affected children are also recommended by the WHO.

8 Prevention and control measures include handwashing with soap and clean water; safe preparation and serving of food; thorough cleaning of all cooking, drinking and eating utensils, and containers for drinking and storing water; safe disposal of faeces and other wastes, use of latrines, and protection of water sources from contamination (e.g. by avoiding open defaecation in fields); and control of flies.

9 Other protective measures include exclusive breastfeeding for all infants until the age of six months, feeding children adequate nourishing food to prevent malnutrition and immunization against vaccine-preventable diseases.

Self-Assessment Questions (SAQs) for Study Session 32

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 32.1 (tests Learning Outcomes 32.1 and 32.2)

Which type of infectious agent is the cause of each of the following faeco-oral diseases?

A Poliomyelitis

B Shigellosis

C Giardiasis

D Ascariasis

E Cholera

F Taeniasis

G Amoebiasis

SAQ 32.2 (tests Learning Outcomes 32.2 and 32.5)

Suppose that in the community you are working in, most people defaecate in the open fields.

(a) How will this increase the transmission of faeco-oral diseases?
(b) What prevention measures would you encourage this community to apply to reduce the risks?

SAQ 32.3 (tests Learning Outcomes 32.1, 32.3 and 32.4)

A mother brings a two-year-old boy to your Health Post and tells you that he has been passing loose watery stools several times a day for the last ten days. She has not seen any blood in the stools. The child appears lethargic, his eyes are sunken, he is not interested in drinking and when you pinch the skin of his abdomen it takes more than two seconds for the skin to return to the normal position.

(a) How should this child's condition be classified?
(b) What actions should you take?
(c) What will you explain to the mother about her child's condition?

SAQ 32.4 (tests Learning Outcomes 32.1, 32.2 and 32.5)

A village proudly installs a protected pump to improve the safety of its water source. What other measures could they take to reduce the indirect transmission of faeco-oral diseases via contaminated water?

Study Session 33 Bacterial and Viral Faeco-Oral Diseases

Introduction

In the previous study session you learnt about the general features of faeco-oral diseases. With that introduction in mind, we will now discuss the common faeco-oral diseases caused by bacteria and viruses. In Study Session 34, you will learn about faeco-oral diseases caused by protozoa and intestinal worms. The conditions covered in this study session are divided into two groups: bacterial and viral faeco-oral diseases characterised by diarrhoea, and those characterised by high fever.

We begin with three **diarrhoeal diseases**: cholera, shigellosis and rotavirus infections. In each case, you will learn about their specific infectious agents, occurrence, modes of transmission, symptoms and signs. Then we remind you of the common features of the diagnosis and treatment, prevention and control of diarrhoeal diseases, which you already studied in general terms in Study Session 32. Finally, we describe the **febrile illness**, typhoid fever, which is also transmitted by the faeco-oral route. The focus of discussion in this study session will be on aspects that will be especially important to you in your daily work as a Health Extension Practitioner.

Learning Outcomes for Study Session 33

When you have studied this session, you should be able to:

33.1 Define and use correctly all of the key words printed in **bold**. (SAQs 33.1, 33.2 and 33.4)

33.2 Describe the most common types of bacterial and viral faeco-oral diseases, their causative infectious agents and their occurrence in the population. (SAQs 33.1 and 33.3)

33.3 Describe the main modes of transmission of each of the bacterial and viral faeco-oral diseases, and the age groups that are most susceptible to them. (SAQs 33.3 and 33.4)

33.4 Explain how you would diagnose and treat cases of bacterial and viral faeco-oral diseases, and when and why you would refer them to a higher-level health facility. (SAQs 33.2 and 33.4)

33.5 Describe how you would apply prevention and control measures against bacterial and viral faeco-oral diseases, and what actions you would take to prevent epidemics of cholera or shigellosis. (SAQs 33.2 and 33.4)

33.1 Cholera

We begin by discussing cholera – its infectious agent, occurrence, symptoms and signs. Knowing about the nature of cholera will help you to diagnose, treat, prevent and control this disease, as described in Sections 33.5 and 33.6, together with measures against all the other bacterial and viral diarrhoeal diseases.

33.1.1 Infectious agents and occurrence of cholera

What comes to your mind when hear the word **cholera**? It is an acute diarrhoeal disease that affects the intestines and can kill vulnerable patients within a few hours if they are not treated quickly. The WHO estimates that there are 3 to 5 million cases of cholera every year around the world, and between 100,000 to 120,000 deaths. It can affect people in all age-groups. Cholera is caused by the bacteria named *Vibrio cholerae* (Figure 33.1), which occur naturally in the environment in shallow water around coasts, particularly where rivers flow into the sea. However, people infected by cholera bacteria can rapidly spread the organisms anywhere in a country, particularly where faeces leak into waste water collections.

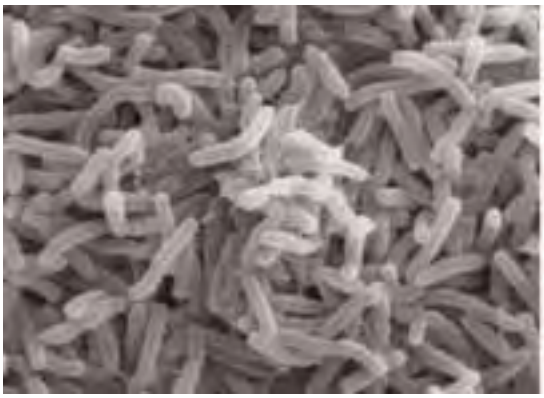

Figure 33.1 *Vibrio cholerae* bacteria magnified thousands of times. (Photo: Wikimedia Commons)

33.1.2 Cholera epidemics

Cholera can spread very easily from person to person, because even a few bacteria are enough to cause the disease if the person is already vulnerable, e.g. due to malnutrition or other infections. Although about 75% of people infected with the bacteria do not develop any symptoms, they can still pass on the infection in their faeces for up to two weeks, so epidemics can develop very quickly.

- Do you remember the definition of an epidemic? (Think back to Study Session 1 in Part 1 of this Module.)

- An **epidemic** is defined as a sudden rise in the number of cases of a condition, which go on increasing for weeks or months before being brought under control; sometimes the numbers affected in an epidemic can continue rising for years (e.g. HIV/AIDS).

There have been epidemics of cholera in Ethiopia; in 1970, several thousand deaths occurred in the eastern, central and southern regions of the country. Conditions leading to epidemics include the consumption of unsafe water, poor hygiene, poor sanitation and crowded living conditions. Cholera often follows after natural disasters involving flooding, and when large numbers of refugees live in camps (Figure 33.2). Consideration of these factors is important for the prevention and control of epidemics of cholera. In Section 35.2 of this study session, we mention the actions that should be taken to prevent a single case from leading to an epidemic. The details of epidemic investigations and management more generally are the subject of Study Session 42.

Figure 33.2 Cholera can spread quickly and cause epidemics in refugee camps, like this one in the Democratic Republic of the Congo.
(Photo: Ahu2, Wikimedia Commons)

33.1.3 Symptoms and signs of cholera

Knowledge of the typical symptoms and signs of cholera will help you to suspect cases and undertake further epidemic investigation measures. Cholera usually manifests after an **incubation period** of one to five days (i.e. the time between the bacteria entering the person's body and the first symptoms appearing), but it can begin within a few hours after the infection. In about 80% of cases, the disease presents with relatively mild symptoms, but about 20% develop acute watery diarrhoea with severe sudden onset. The stools are painless and voluminous, with the appearance of water in which rice has been boiled (*rice-water stools* are a characteristic sign of cholera). The patient also experiences nausea, vomiting (Figure 33.3), fever and rapid progression to experiencing extreme weakness and shock. In such cases, death may occur within hours after the start of the illness.

Figure 33.3 Profuse vomiting and rice-water stools are characteristic symptoms of cholera.

Shock in cholera results from rapid dehydration and loss of essential salts in the voluminous diarrhoea and vomit. You learned about shock as a result of haemorrhage during and after childbirth in the Modules on *Labour and Delivery Care* and *Postnatal Care*. The signs are the same in shock due to severe dehydration caused by cholera.

■ What are the typical signs of shock in an adult patient?

□ The typical signs of shock are systolic blood pressure dropping below 90 mmHg and/or diastolic blood pressure dropping below 60 mmHg, with a rapid pulse rate above 100 beats per minute. A person in shock will often appear confused and may lose consciousness. You must act quickly to save their life.

If you see a person with the characteristic symptoms and signs of cholera, you must manage the patient immediately and begin effective control measures in the community (as described below in Sections 33.4 and 33.5). The risk of a cholera epidemic developing from a single case is high, so you must also undertake epidemic investigation and management procedures, which will be described for all epidemic conditions in Study Session 42.

■ Suppose you were called to see an adult with acute watery diarrhoea and profuse vomiting of two days' duration. What other evidence would suggest a diagnosis of cholera in this person?

□ In addition to the rapid onset and progression of the illness, the following symptoms and signs would support the diagnosis of cholera:

- Painless diarrhoea and rice-water appearance of his stool
- Fever
- Extreme weakness
- Shock (low blood pressure and rapid pulse rate)
- Similar cases in the household or nearby.

33.2 Shigellosis (or bacillary dysentery)

The word **dysentery** refers to diarrhoea containing blood and mucus. There are two main types of dysentery, caused by different infectious agents. The one that we are going to describe here is **bacillary dysentery**, or shigellosis. The other type is amoebic dysentery, which is discussed in Study Session 34. However, in this section we will mention some of the main differences between the two types of dysentery, to help you diagnose them correctly.

33.2.1 Infectious agents and occurrence of shigellosis

The infectious agents causing **shigellosis** are different species of *Shigella* bacteria. Although these bacteria may cause mild cases of acute watery diarrhoea, dysentery is the real threat in shigellosis. The bacteria infect and destroy cells lining the patient's large intestine (colon), causing ulcers and bleeding, which results in the characteristic appearance of blood and mucus in the stool.

As you may recall from Study Session 1 of this Module, dysentery is common in Ethiopia, ranking among the top ten causes of outpatient visits (refer to Table 1.1). Although *Shigella* infection can occur at any age, it is rare in infants less than six months of age and most common in children aged two to three years. This age-distribution is unlike amoebic dysentery, which is rare in children less than five years of age. Two-thirds of the cases of shigellosis and most of the deaths are in children below ten years, and (like all diarrhoeal diseases) the effects are most severe in malnourished children.

Shigella bacteria can be easily transmitted from person to person and rapidly cause epidemics, particularly under conditions of overcrowding, where personal hygiene is poor, such as in prisons, institutions for children, and refugee camps. Small doses of the infectious agent – as few as ten organisms – are enough to transmit the infection, which means it can be transmitted easily to close contacts. Another reason for the rapid spread is that after recovery, infected individuals can transmit the bacteria in their faeces for up to four weeks after the illness. By contrast, epidemics of amoebic dysentery rarely occur. Therefore, if an epidemic of dysentery occurs in your community, you should suspect the most likely cause is bacillary dysentery due to *Shigella* bacteria.

33.2.2 Symptoms and signs of shigellosis

Symptoms of shigellosis usually appear after an incubation period of one to three days. The diarrhoea may be watery and of a large volume initially, but then changing into frequent, small-volume episodes of bloody and mucoid (mucus-containing) diarrhoea. The onset of the disease is sudden, with fever, abdominal pains, straining during defaecation and an irresistible urge to defaecate, but only small quantities of blood and mucus come out, without any formed solid stools. The person may complain of abdominal cramps and pain in the rectum, and is often too ill to leave their bed. Dehydration can progress quickly and may lead to shock and death if not rapidly treated.

33.3 Rotavirus infection and other viral diarrhoeal diseases

In this section, we will briefly mention the viruses that cause diarrhoeal diseases. The most prevalent infectious agents in this category are the **rotaviruses**. The WHO estimates that about 40% of all cases of severe infant diarrhoea worldwide, and at least 500,000 deaths in childhood from diarrhoeal diseases, are due to rotavirus infections – making these viruses the single biggest cause of diarrhoeal deaths. Most cases occur between the ages of three months and two years. Other viruses responsible for diarrhoeal diseases include the noroviruses.

The main manifestations of viral diarrhoeal diseases include acute, very watery diarrhoea, nausea and projectile vomiting, often (but not always) with fever and abdominal pain. Vomiting is called 'projectile' when the person cannot control the rapid emergence of vomit, which is projected forwards from the mouth with great force. Dehydration can occur rapidly in children and is the most common cause of death.

Individuals at highest risk from viral diarrhoeal diseases are malnourished children, weanlings and bottle-fed infants. To help prevent rotavirus infections, encourage exclusive breastfeeding under the age of six months; if the mother cannot breastfeed, or after weaning, encourage feeding with a very clean cup and spoon instead of a bottle. If bottles have to be used, show the parents how to wash the bottles and teats frequently and very thoroughly with clean warm water and soap.

33.4 Modes of transmission of diarrhoeal diseases

All three types of diarrhoeal diseases discussed so far are transmitted directly or indirectly by faeco-oral routes, as already described in detail in Study Session 32.

- Briefly distinguish between direct and indirect modes of faeco-oral transmission of infectious agents.
- Direct transmission occurs through contact between hands contaminated with faeces and the person's mouth; indirect modes of transmission are through ingestion of contaminated food or water, contact with infected soil, utensils, etc., and transmission by flies that have crawled on faeces (Figure 33.4).

Figure 33.4 Flies are a major source of indirect transmission of diarrhoeal diseases. (Photo: CDC Image Library, image 5452)

The main modes of transmission for cholera, shigellosis and viral diarrhoeal diseases are summarised in Table 33.1 and Figure 33.5.

Table 33.1 Main modes of transmission for bacterial and viral diarrhoeal diseases.

Diarrhoeal disease	**Main modes of transmission**
Cholera	Contaminated water or food (summarised in Figure 33.5)
Shigellosis (bacillary dysentery)	Person-to-person contact, e.g. while caring for a sick person, or via contaminated water or food
Viral diarrhoeal diseases	Contaminated water or food, particularly when feeding infants with milk or other nutritious fluids in a contaminated bottle

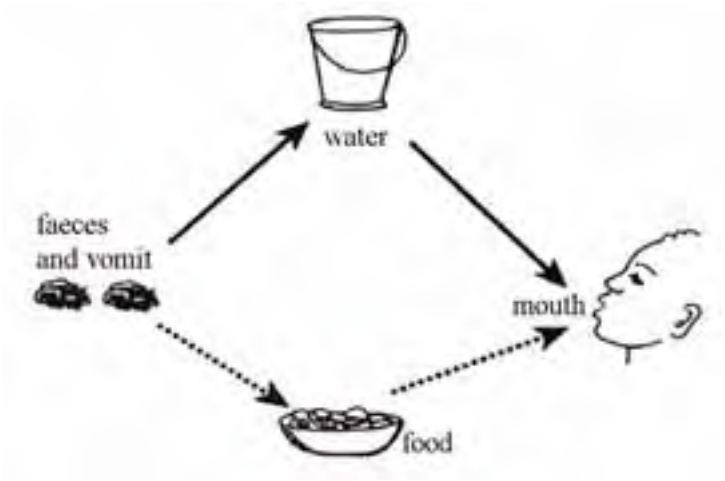

Figure 33.5 The main modes of transmission for most diarrhoeal diseases are by ingestion of contaminated food and water. (Source: adapted from AMREF, 2007, *Communicable Diseases Distance Education Programme*, Unit 11)

33.5 Diagnosis, treatment and control of bacterial and viral diarrhoeal diseases

You have already learned the general features of the diagnosis and treatment of diarrhoeal diseases in Study Session 32, so the discussion below will remind you of the main points in your role as a Health Extension Practitioner.

33.5.1 Diagnosis of diarrhoeal diseases

Accurate diagnosis of a specific type of diarrhoeal disease is only possible with laboratory identification of the infectious agents, mainly from stool samples. This can be essential in determining the type of treatment if antibiotics are required, and can also help to target prevention and control measures most effectively. However, **laboratory diagnosis** of the infectious agent takes time and is not needed for the treatment of most cases of acute watery diarrhoea among children. You can begin treating most children immediately on the basis of your **clinical diagnosis**, i.e. your knowledge of the characteristic symptoms and signs of acute watery diarrhoea described earlier in this study session, without the need for identifying the specific infectious agent.

Laboratory diagnosis *is* required for:

- children with dysentery (which could be bacillary or amoebic)
- all adults with severe diarrhoea, however caused.

Even in cases where laboratory diagnosis is required, you should not wait for the results of the investigation before starting rehydration as described below (Section 34.4.2) and referring the patient to the nearest health centre or hospital. Explain to the adult patient or caregiver (if the patient is a child) that referral is needed for further diagnosis, because treatment varies depending on the specific cause of the disease. Ensure that the patient seeks treatment urgently, as the disease could worsen rapidly and lead to serious outcomes.

Although you can't be sure of the diagnosis yourself, if you suspect dysentery or cholera, ask whether anyone else in the patient's household, or their neighbours, have a similar illness. This helps you to identify and report suspected cases, which is essential to prevent an epidemic from spreading.

33.5.2 Treatment of bacterial and viral diarrhoeal diseases

As you already know, for all patients with diarrhoea (watery or bloody), the core measure in treatment of all cases is rapid and adequate **rehydration** – fluid replacement. This is usually achieved by the patient drinking plenty of fluids, but in the most severe cases the fluid has to be given intravenously (directly into a vein). Rehydration should be started as soon as possible and continued for as long as the diarrhoea persists. The best fluid to prevent or treat dehydration is a solution of **oral rehydration salts** (**ORS**) – a simple mixture of sugar and salts in the correct proportions mixed with boiled and cooled water (Figure 33.6).

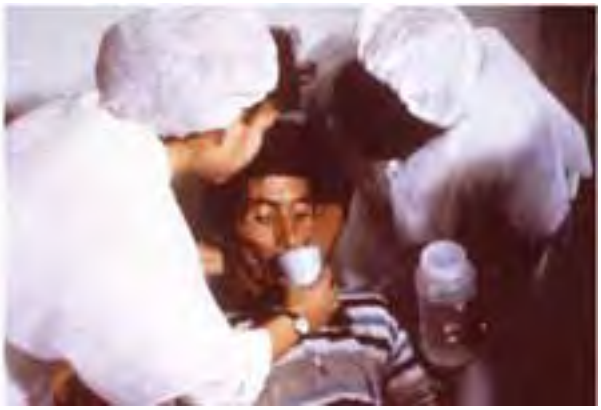

Figure 33.6 A man with cholera is helped to drink oral rehydration salts. (Photo: CDC Image Library, image 5301)

In addition to rehydration, other interventions might also be necessary depending on the type of disease and the age of the patient. For children with diarrhoea, the measures that you should undertake during treatment were summarised in Box 32.1 in the previous study session. However, before you can treat a child with diarrhoea correctly, you first need to learn how to assess and classify the danger signs and the level of dehydration; this is taught in detail in the Module on the *Integrated Management of Newborn and Childhood Illness* (IMNCI) in this curriculum.

A patient in shock due to severe diarrhoeal disease will die without adequate and rapid rehydration.

For adults with severe diarrhoea, assess if the patient is able to take fluids orally. If they are too weak or nauseous to take fluids orally, or they are showing signs of shock, refer them immediately to the nearest health centre or hospital. Advise the patient or caregiver that immediate treatment is necessary to save the patient's life.

If the patient is able to take fluids orally, give ORS and tell them to drink 200–400 ml of ORS after each loose stool. Advise the patient to drink other fluids as much as possible and to continue eating. Adults with severe diarrhoea due to bacteria may also need an antibiotic treatment appropriate for the specific disease, after first determining the type of bacteria from laboratory examination of a stool sample. This is one reason why adults with severe diarrhoea are given ORS and referred to a higher health facility.

33.6 Prevention and control of bacterial and viral diarrhoeal diseases

Prevention and control measures for all diarrhoeal diseases, whatever the infectious organism, aim at interrupting faeco-oral transmission from contaminated hands, water, food and other sources. Look back at Study Session 32 to remind yourself of the key points to emphasise when you educate people in your community on how to protect themselves and their children from developing diarrhoeal diseases. Figure 33.7 illustrates some important strategies that everyone should know.

Figure 33.7 Poster showing actions to reduce the transmission of diarrhoeal diseases: (top right) build a latrine with a water container for handwashing; (bottom left) give an affected child ORS to drink and take him to a health facility; (bottom right) bury faeces in a safe place. (Photo: Ali Wyllie)

33.6.1 Controlling epidemics of diarrhoeal diseases

What else should you do if there is an outbreak of a diarrhoeal disease, which threatens to spread in the community?

- Which bacterial or viral diarrhoeal diseases are most often associated with epidemics? Do you remember two reasons why?

- Cholera and shigellosis (bacillary dysentery) can rapidly spread and cause an epidemic. The two main reasons are that very small numbers of bacteria (fewer than ten) can result in the illness if they get into a susceptible person, and people who have recovered from the illness can go on shedding the bacteria in their faeces for weeks afterwards.

Suspected cases of cholera or shigellosis (bacillary dysentery) should be immediately reported to the *woreda* Health Office.

Whenever you suspect there may be a single case of cholera or shigellosis in your community, you must take swift action to investigate and report it, and apply measures to control the source of infection before it can spread. Epidemic investigation techniques will be discussed in detail in Study Session 42, so here we will briefly summarise the main points.

■ Why do you think it is important to report suspected cases of cholera or shigellosis to the *woreda* (District) Health Office?

□ You cannot prevent an epidemic from developing on your own. Reporting suspected cases enables the *woreda* Health Office and other higher bodies to start epidemic investigation and laboratory diagnosis as soon as possible, and collaborate with you in taking action to control the outbreak before it spreads.

You should try to identify everyone who has been in close contact with the **source patient** (i.e. the first case in your community) by asking the patient, the family and neighbours about what the patient has been doing recently and who he or she has seen. It is particularly important to locate everyone who has been eating the same food or drinking water from the same place as the patient. Give these individuals advice to seek early treatment if the illness starts and to report it immediately.

33.6.2 Epidemic control measures for cholera

In addition to the points described above, you should take action to prevent the spread of cholera bacteria in water, food or on the hands of people who have been caring for patients.

- Ensure that everyone in contact with the patient knows that they must be especially careful to wash their hands very thoroughly with soap and water after touching the patient, as well as at all the usual times (after defaecation, before preparing food or eating, etc.)
- Make sure that faeces or vomit from the patient cannot contaminate sources of drinking water, for example, when washing the patient's soiled clothes, bedding or drinking cups. Do not wash any articles that may be carrying cholera bacteria in streams, pools or water containers that people use to collect drinking water (Figure 33.8). Infected water is one of the main transmission modes for cholera bacteria. In a cholera epidemic, everyone in the community must use protected water sources for drinking, and either boil the water or disinfect it by adding chlorine.
- Disinfection of clothes contaminated with faeces and vomit, and articles used by patients, is essential; they should be boiled or scrubbed with a disinfectant solution such as chlorine bleach.
- Interruption of foodborne transmission includes cooking food thoroughly before eating, preventing contamination of food by flies and avoiding eating raw vegetables and fruits.

Figure 33.8 Clothes from someone with cholera should not be washed in water that people use for bathing or drinking. (Photo: Basiro Davey)

33.6.3 Epidemic control measures for shigellosis

Shigella bacteria are particularly likely to be passed directly from one person to another, for example when shaking hands, so people who are caring for a patient with bacillary dysentery are at high risk of infection. Educate carers that a very small number of organisms can cause infection and that strict hygiene precautions are needed when handling the faeces of patients. In addition, patients and carers should understand that anyone with a *Shigella* infection should not prepare food for others to eat, or care for a young child or a sick person, until a month after recovery. This is because the bacteria continue to be shed from the person in their faeces for several weeks, and can easily be transmitted to vulnerable contacts.

■ What measures would be most important in preventing transmission of shigellosis?

□ The measures to be given priority include:

- frequent and very thorough handwashing with soap and water (Figure 33.9)
- avoiding direct contact with faeces if possible, and disposing of faeces safely
- disinfection of clothing and articles contaminated with faeces.

Figure 33.9 Handwashing with soap and water is the single most important measure to control a shigellosis epidemic. (Photo: Basiro Davey)

33.6 Typhoid fever

In the final section of this study session, we turn to **typhoid fever** – a bacterial faeco-oral disease caused by *Salmonella typhi* bacteria, which is classified as a *febrile illness* (not a diarrhoeal disease). The incubation period is usually one to two weeks. Although typhoid fever can cause diarrhoea in children, it is rare in children of less than five years of age. In adults, diarrhoea may be present in the early stage of the illness, but this quickly turns to constipation. The main distinguishing feature is a very high fever (39°C to 40°C), with headache, lethargy, loss of appetite, and sometimes rose-coloured spots on the chest. If you are trained to palpate the abdomen, you may be able to feel an enlarged liver and spleen.

Typhoid fever is a major health problem in poor communities and is **endemic** (always present at a relatively constant rate) in Ethiopia. The WHO estimates that there are about 17 million cases worldwide every year. Transmission of typhoid fever can occur by the direct faeco-oral route, but it is mainly transmitted indirectly through contaminated water and food.

■ What other febrile diseases have you learned about so far in this Module, i.e. with high fever as one of their main manifestations?

□ Malaria and meningococcal meningitis are febrile diseases. (In Study Session 36, you will learn about two more: louse-borne relapsing fever and typhus.)

You can suspect a case of typhoid fever based on your clinical diagnosis, but because the symptoms of typhoid fever are similar to that of malaria, you should first use the malaria rapid diagnostic test (RDT) if you are in an area where malaria is endemic (Figure 33.8). Even after ruling out malaria, you can't be sure of the diagnosis of typhoid fever, because meningitis and relapsing fever can also present with similar symptoms and signs. Therefore, if you suspect typhoid fever, refer the patient to the nearest higher level health facility for laboratory diagnosis and specialist treatment.

As with other faeco-oral diseases, your role in the prevention and control of typhoid fever is giving health education to your community on measures that aim to interrupt faeco-oral transmission. In the next study session, we will focus on faeco-oral diseases caused by single-celled parasites and helminths (worms).

Figure 33.8 Malaria Rapid Diagnostic Test (RDT) kit. The technique for conducting the test was described in Study Session 8 of this Module. (Photo: Ali Wyllie)

Summary of Study Session 33

In Study Session 33, you have learned that:

1 Common faeco-orally transmitted diseases caused by bacteria and viruses include cholera, shigellosis (bacillary dysentery), viral diarrhoeal diseases (rotavirus infection is the most prevalent), and typhoid fever.

2 Cholera is a bacterial disease, which manifests with painless, acute watery diarrhoea that resembles rice-water, and profuse vomiting.

3 Shigellosis or bacillary dysentery is an acute diarrhoeal disease characterised by blood and mucus in the stool, with urgency and straining during defaecation.

4 Viral diarrhoeal diseases are the commonest type of diarrhoeal disease, particularly in children. Their manifestation is mainly acute watery diarrhoea.

5 The transmission of cholera bacteria and rotaviruses is mainly via contaminated water and food, whereas shigellosis is mainly spread via person-to-person contact.

6 Cholera and shigellosis are prone to epidemics, because small numbers of bacteria can cause the illness, and bacteria continue to be shed for some time after the patient recovers.

7 Epidemic control measures include swift case reporting, identification of contacts of the source patient, frequent thorough handwashing with soap and water, safe disposal of faeces, and disinfection or boiling of clothes, bedding and utensils used by the patient.

8 You can treat most cases of children with acute water diarrhoea at Health Post level, without the need for laboratory diagnosis of the causative infectious agent. However, adults with severe diarrhoea and children with dysentery should be referred urgently after starting rehydration with oral rehydration salts (ORS).

9 Typhoid fever is a febrile illness, characterised by high continuous fever, with constipation (rather than diarrhoea) in most adult patients. The disease is spread faeco-orally via infected water and contaminated food. If you suspect typhoid fever, you should refer the patient quickly.

Self-Assessment Questions (SAQs) for Study Session 33

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. One question also tests some of the Learning Outcomes of Study Session 32. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 33.1 (tests Learning Outcomes 33.1, 31.2, 31.3 and 33.4)

Which of the following statements is *false*? In each case, state why it is incorrect.

A Typhoid fever is transmitted mainly indirectly by contaminated food or water.
B The characteristic manifestations of cholera include bloody diarrhoea.
C Shigellosis is transmitted mainly by direct person-to-person contact.
D Diarrhoeal diseases can lead to severe dehydration and shock.
E Viruses are the commonest cause of diarrhoea in children.
F Typhoid fever is a common cause of diarrhoea in adults.

SAQ 33.2 (tests Learning Outcomes 31.1, 33.4 and 33.5)

If you see an adult patient with bloody diarrhoea, what actions should you take:

(a) To treat the patient?
(b) To prevent the disease from spreading?

SAQ 33.3 (tests Learning Outcomes 33.2, 33.3 and 33.4)

Complete the missing details from Table 33.3 below.

Table 33.3 Incubation periods and most affected age-groups for common bacterial and viral faeco-oral diseases.

Disease	Incubation period	Age group for most cases
Cholera		
Shigellosis		
Rotavirus infection		
Typhoid fever		

SAQ 33.4 (tests Learning Outcomes 32.3, 32.4, 33.1, 33.3, 33.4 and 33.5)

(a) Rotaviruses are endemic in all developing countries and the major cause of diarrhoeal diseases in young children. What does endemic mean?
(b) How are bacterial and viral diarrhoeal diseases transmitted?
(c) A nine-month-old baby has had three episodes of watery diarrhoea in the last three days. The mother says the child is still partly breastfed, and is eating and drinking normally. It does not appear to be dehydrated. What actions should you take and what should you advise the mother?

Study Session 34 Intestinal Protozoa, Ascariasis and Hookworm

Introduction

In the previous study session, you learned about the most common faeco-oral diseases caused by bacteria or viruses. In this study session, we will describe the main **intestinal parasitoses** (pronounced 'para-sit-oh-seez'), i.e. diseases caused by parasites living in the intestines. You will learn about the **intestinal protozoa** (single-celled organisms) causing *amoebiasis* and *giardiasis*, and the **intestinal helminths** known as *ascaris worms* and *hookworms*. There are other, much larger, intestinal parasites in addition to those described here, such as the tapeworms, which you will learn about in Study Session 38.

It is important for you to know about these diseases so that you can treat or refer cases and apply prevention and control measures in your community. The prevention and control measures for these conditions are the same as you have already learned in earlier study sessions in relation to other faeco-oral diseases. However, you will notice that there are significant differences in the symptoms and treatment of the parasitic diseases described here.

Learning Outcomes for Study Session 34

When you have studied this session, you should be able to:

34.1 Define and use correctly all of the key words printed in **bold**. (SAQs 34.1, 34.2 and 34.3)

34.2 Identify the common causative agents, occurrence and modes of transmission of the common faeco-oral diseases caused by intestinal protozoa and roundworms. (SAQs 34.2, 34.3 and 34.4)

34.3 Explain how you would diagnose and treat cases of amoebiasis, giardiasis, ascariasis and hookworm infection, based on their symptoms and signs, and when and why you would refer them to a higher-level health facility. (SAQs 34.1, 34.2, 34.3 and 34.4)

34.4 Describe how you would apply prevention and control measures against these common intestinal parasitoses. (SAQs 34.2 and 34.5)

34.1 Intestinal protozoal diseases

The two commonest types of faeco-oral diseases caused by intestinal protozoa are *ameobiasis* (or *amoebic dysentery*) and *giardiasis*. Both conditions are also classified as diarrhoeal diseases based on the characteristic symptom of diarrhoea. The prevention and control measures against both diseases are the same as for other faeco-oral diseases described previously (refer back to Study Session 32, Section 32.6). Our focus here will be on the unique features that enable you to suspect cases of these diseases, and refer patients after starting rehydration with oral rehydration salts (ORS).

34.1.1 Amoebiasis

Amoebiasis is a disease resulting from infection of the large intestine (colon) by a protozoan parasite called *Entamoeba histolytica*.

The distribution of this single-celled parasite is very widespread – the WHO estimates that around 500 million people around the world are infected with these amoebae (Figure 34.1). It is endemic in Ethiopia, and research studies have shown a prevalence of amoeba infection ranging from 4% to 19% in the Ethiopian population.

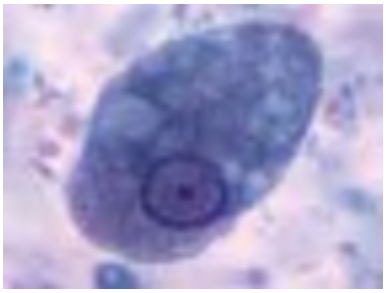

Figure 34.1 *Entamoeba hystolica* magnified over 1,000 times and stained blue to reveal its large nucleus. (Photo: CDC Image Library, image 607)

The plural amoebae is pronounced 'amm-ee-bee'.

However, most people with amoebae in their intestines show no symptoms, but they can pass on the amoebae to others and are an important reservoir of infection. Individuals who develop amoebiasis, experience bloody diarrhoea (so the disease is also known as *ameobic dysentery*), fever and abdominal cramps, sometimes alternating with periods of constipation. Unlike in cases of bacillary dysentery, the blood and mucus is mixed with solid stool and patients are not usually bedridden. Very rarely, amoebiasis can lead to serious complications, including abscesses in the liver, lungs or brain.

Another difference between dysentery caused by ameobae and dysentery caused by *Shigella* bacteria is that amoebiasis mainly affects young adults; it rarely occurs below the age of five years. By contrast, dysentery in children under ten years is mainly due to *Shigella* species. Also, amoebiasis does not usually produce epidemics, so an epidemic of dysentery is most probably due to cases of shigellosis.

Some amoebae in an infected person's intestines transform and become encased in a round protective membrane called a **cyst**. The cysts pass out of the body in the faeces. They are highly resistant to damage and can be transmitted by direct and indirect faeco-oral routes, mainly via contaminated food or water. They hatch out in the new person and the protozoa rapidly increase in number by cell division.

For accurate diagnosis, laboratory identification of the cysts in the patient's stool is necessary to differentiate it from shigellosis. Therefore, you should start any patient with dysentery on rehydration with ORS and refer them to the nearest higher level health facility for further investigation and specialist treatment. Advise the patient or caregiver that further investigation is needed for diagnosis and that early treatment is important because the disease could lead to serious outcomes.

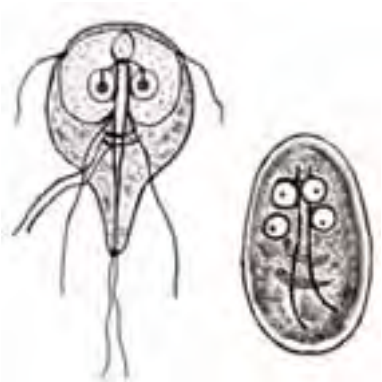

Figure 34.2 Diagrams of *Giardia intestinalis* parasites: (left) the free-swimming adult form found in the intestines; (right) cyst found in the faeces of an infected person. (Source: CDC Public Health Image Library, image 3394)

34.1.2 Giardiasis

Giardiasis is a faeco-oral disease which results from infection of the small intestine by protozoa called *Giardia intestinalis*, also known as *Giardia duodenalis.* (Note: the same protozoa are called *Giardia lamblia* in older textbooks.) Studies have shown the prevalence of *Giardia* infection in Ethiopia ranges from 2.0% to 11.4% of the population. Like the parasitic amoebae described in the previous section, *Giardia* form resistant cysts in the person's intestines (Figure 34.2) that pass out in the faeces. The cysts can be

easily transmitted in water contaminated by faeces, from person-to-person through hand-to-mouth transmission and in food. They hatch out in the new person and the protozoa rapidly increase in number by cell division.

The commonest clinical manifestation of giardiasis is foul-smelling, pale, greasy diarrhoea, without blood or mucus (mucoid). The diarrhoea can be acute and resolve by itself within a few days, or it may be persistent (lasting for more than 14 days). Other symptoms of giardiasis include nausea, vomiting, abdominal cramps and abdominal distension (swelling).

You should suspect giardiasis in children if the diarrhoea is persistent, but not bloody or mucoid. For children with mild non-bloody or non-mucoid diarrhoea, the management does not require identification of the infectious agent; cases are managed with oral rehydration as already described for simple acute watery diarrhoea (refer back to Section 32.4.2). If a child has persistent or severe diarrhoea, and giardiasis is one of the causes you suspect, treatment is carried out at a higher-level health facility on a case-by-case basis, taking into account the presence of other symptoms and/or malnutrition. Therefore, you should start ORS treatment and refer the child.

Details of the specific management of children with persistent or severe diarrhoea are taught in the Module on the *Integrated Management of Newborn and Childhood Illness*.

In adults, you should suspect a diagnosis of giardiasis in cases with acute or persistent, non-bloody or non-mucoid diarrhoea. However, as other diseases could also have similar manifestations, confirmation of the diagnosis is needed through detection of the parasite in laboratory examination of stool samples. Therefore, start all adult patients on rehydration with ORS and refer them for further diagnosis and treatment.

- Amoebiasis and giardiasis both present with diarrhoea. What is the difference in the type of diarrhoea resulting from the two diseases?

- The main difference in the type of diarrhoea is that in amoebiasis it is bloody or mucoid (contains mucus), whereas in giardiasis it is pale, greasy and foul smelling.

34.2 Intestinal roundworms

In this section, you will learn about diseases caused by roundworms living in the intestines. **Helminths** is the collective name given to parasitic worms. They have complicated lifecycles, and some helminths require transmission between humans and other host animals before they mature. There are three main groups of helminths: the roundworms, the tapeworms and the flatworms (or flukes). Here we focus on **intestinal roundworms** (helminths that are round in cross-section), which live in the person's intestines and exit from the body in the faeces. The two commonest intestinal roundworms in Ethiopia cause the diseases known as *ascariasis* and *hookworm* infection. Neither of these conditions is characterised by diarrhoea, so they are not classified as diarrhoeal diseases.

34.2.1 Ascariasis

Like other faeco-oral diseases, you need to know the main features of ascariasis: its infectious agent, occurrence, modes of transmission, symptoms and signs, diagnosis and treatment. Prevention and control measures are similar to those for other faeco-oral diseases, described in earlier study sessions. However, ascariasis requires specific drug treatment based on its symptoms and signs.

Figure 34.3 A female adult ascaris worm (*Ascaris lumbricoides)*, with measuring scale. (Photo: CDC's Parasites and Health page, at http://www.dpd.cdc.gov/dpdx/HTML/Ascariasis.htm)

Ascariasis results from infection of the small intestine with a helminth parasite called *Ascaris lumbricoides*. It is the largest of the intestinal roundworms; mature worms can measure 15–35 cm in length (Figure 34.3). It is the commonest of all the faeco-oral diseases caused by parasitic helminths. It mainly affects children, particularly between three to eight years of age. In Ethiopia, around 37% of the population is estimated to be infected with *Ascaris lumbricoides*.

The complicated lifecycle of ascaris worms is shown in Figure 34.4 and is essential for their full development into egg-laying adults. In the descriptions that follow, the numbers relate to the numbers on each stage shown in Figure 34.4. Adult *Ascaris lumbricoides* worms in the intestines (1) lay eggs which pass out with the faeces (2). The eggs are transmitted faeco-orally by ingestion of contaminated food, water, etc. (stages 2 to 4). The eggs hatch and develop into larvae (immature stage) in the intestines (5). The larvae are carried in the bloodstream to the lungs, where they develop further (6). They migrate upwards from the lungs into the throat (7), where they are swallowed – returning once again to the person's intestines. Male and female worms mate and the females lay eggs in the intestines (1), which pass out in the faeces (2), and are ingested by new hosts – beginning the lifecycle all over again.

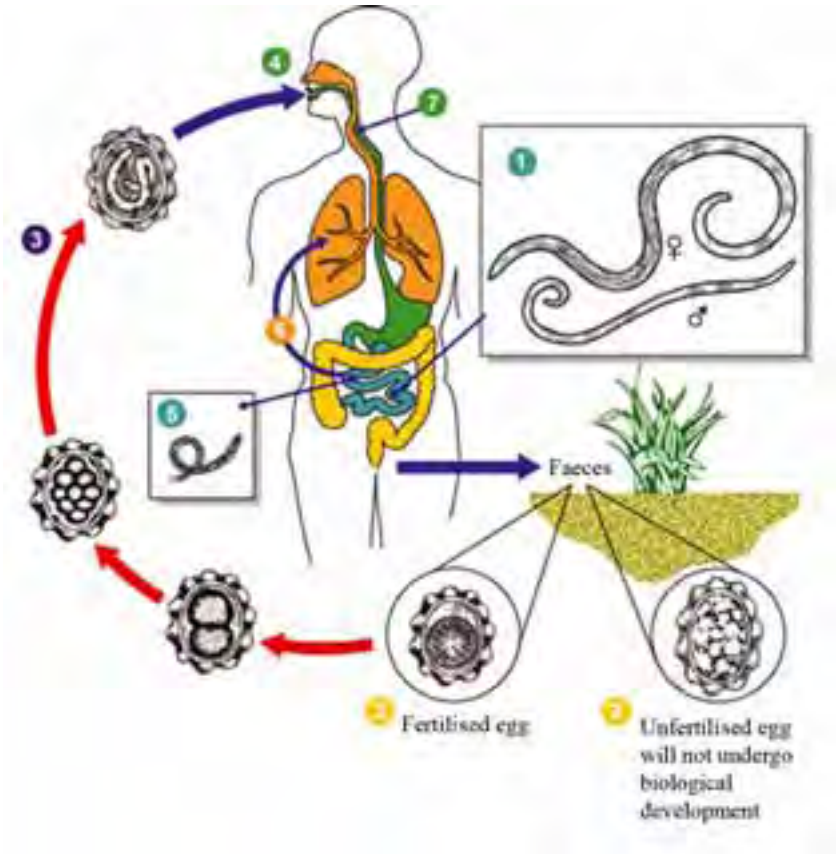

Figure 34.4 The life cycle of ascaris worms. (Source: adapted from: CDC's Parasites and Health page, at http://www.dpd.cdc.gov/dpdx/HTML/Ascariasis.htm)

Cases of ascariasis manifest with abdominal discomfort, and live worms may be seen in the stools, vomit or occasionally emerging from the nose. You can make a clinical diagnosis of ascariasis if the patient or the caregiver of a child tells you that long worms have passed with the stool or vomit, or if you are able to see the worms yourself. Eggs in the faeces are too small to see with your eyes, and although they can be identified by laboratory diagnosis of stool samples, there is no need to send samples for investigation or refer the patient

– unless there are obvious signs of anaemia (see Box 34.1 in the discussion of hookworm infection later in this study session). You can treat mild cases yourself, and you should also give *all* children aged between two to five years routine treatment to kill intestinal worms, as described next.

Treatment for ascariasis and routine deworming

If you diagnose ascariasis, the treatment schedule is as given in Table 34.1. There are two drugs (albendazole and mebendazole), both available in either liquid or tablet form. However, even if there are no signs of worm infection, **routine deworming** is recommended for all children aged 24 months or older who have not been treated in the previous six months. Give every child that you see in this category the appropriate dose of albendazole or mebendazole *every six months* to treat intestinal worms. Chewable deworming tablets that taste good are available. For children who find swallowing a tablet difficult, you can crush it between two spoons and mix it with a little water to help them to take the dose. This regimen kills hookworms as well as ascaris worms.

Do not give either albendazole or mebendazole to pregnant women who are in their first 14 weeks of pregnancy.

Table 34.1 Deworming schedule for ascariasis or hookworm, depending on the age of the child.

Drug	**Age 0 to 2 years**	**Age 2 to 5 years**
Albendazole (400 mg tablet)	None	1 tablet (400 mg)
Medendazole (100 mg or 500 mg tablets)	None	1 × 500 mg tablet (or 5 × 100 mg tablets)
Mebendazole oral suspension (Figure 34.5)	2.5 teaspoons (250 mg)	None

Figure 34.5 Bottles of oral mebendazole suspension in a Health Post store. (Photo: Basiro Davey)

34.2.2 Hookworm infection

Hookworm infection is transmitted via contact with faeces, but it is not actually a faeco-oral disease, because the infection does not enter through the mouth, as you will see below in our discussion of its transmission process. However, it is appropriate to discuss hookworm infection with other faeco-oral diseases because the infectious agents exit from the body in the faeces, the routine deworming regimen is the same as for ascariasis (Table 34.1 above), and prevention and control includes the measures already described for other faeco-oral diseases (see Study Sessions 32 and 33).

Hookworms live in the small intestine and suck blood from blood vessels in the intestinal walls. The main infectious agents are called *Necator americanus* and *Ancylostoma duodenale.* Hookworm infection is endemic in Ethiopia, especially in areas where people walk barefooted and sanitary conditions allow faeces to contaminate the soil. In Ethiopia the prevalence of hookworm infection is estimated to be around 16% of the population.

During the transmission process (Figure 34.6), immature parasites (larvae) in the soil enter the body by penetrating the skin, usually through bare feet. The larvae then migrate to the small intestine, after passing through different body systems. In the small intestine, the adult worms mate and the females lay eggs which are excreted with the faeces. The eggs develop in the soil into larvae, which can then be transmitted to new individuals through the skin.

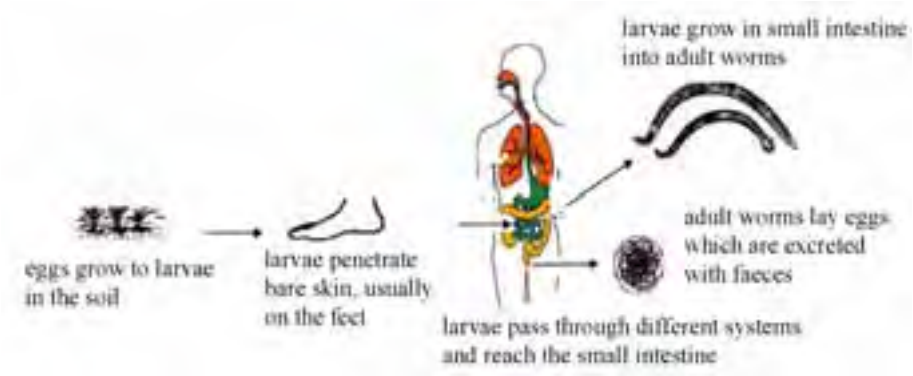

Figure 34.6 The transmission cycle of hookworms. (Source: adapted from CDC's Parasites and Health page, at http://www.dpd.cdc.gov/dpdx/HTML/Hookworm.htm)

- What preventive measure should you advise people in your community to apply to protect themselves from hookworms?

- In addition to all the measures involving personal hygiene after defaecation, before food preparation and when eating etc., you should specifically educate your community to interrupt the transmission of hookworms by:
  - Wearing shoes to prevent the parasites from entering through skin while walking barefooted.
  - Using latrines, disposing of faeces safely and stopping open defaecation in fields, to prevent contamination of soil with the parasites.

Diagnosis and treatment of hookworm infections

Cases of chronic hookworm infection manifest with abdominal pain and the symptoms and signs of anaemia (see Box 34.1), due to blood loss caused by the blood-sucking worms. It is very important that you treat worm infestations routinely in children aged from two to five years, because persistent hookworm infections (like ascariasis) causes a significant loss of **micronutrients** (minerals and vitamins) from the body. Infected individuals may develop anaemia, which can be life-threatening. Anaemic children fail to grow properly and their school performance will be negatively affected.

Box 34.1 Anaemia: a common sign of ascariasis or hookworm infection

Anaemia refers to a deficiency of haemoglobin in the blood. **Haemoglobin** is the red, iron-rich protein that gives red blood cells their colour and enables them to pick up oxygen and transport it around the body. Symptoms and signs of anaemia include becoming easily tired; pallor (paleness) inside the eyelids, gums, nails and palms of the hands (Figure 34.7); shortness of breath; and a fast pulse rate, which an anaemic person may notice as their heart beating fast even when they are quietly resting. Therefore, routine deworming of children aged between two to five years, every six months, according to the dosages given in Table 34.1 earlier, is essential to kill hookworms as well as ascaris worms.

Figure 34.7 Paleness inside the eyelids and gums are signs of anaemia.

In the next study session, we turn to the largest single cause of mortality among children under the age of five years: acute respiratory tract infections.

Summary of Study Session 34

In Study Session 34, you have learned that:

1 Parasitic infection of the intestines could be due to protozoa or helminths.

2 Common types of intestinal protozoal infections in Ethiopia include ameobiasis and giardiasis.

3 Ameobiasis presents with dysentery (stools containing blood and mucus). Amoebic dysentery is rare in children, in contrast to shigellosis (bacillary dysentery) which mainly affects young children. Suspected cases of amoebiasis should be started on rehydration with ORS and then referred for laboratory diagnosis and treatment.

4 Giardiasis presents with pale, greasy and foul-smelling diarrhoea. For children with mild cases, treat as for acute watery diarrhoea, by rehydrating with ORS. For persistent or severe cases in children, and all adults with suspected giardiasis, start rehydration and then refer them for laboratory diagnosis and treatment.

5 Common diseases caused by intestinal helminths in Ethiopia include ascariasis and hookworm infection.

6 Ascariasis is the commonest intestinal helminth infection in children. Cases present with abdominal discomfort and you may see the passage of live worms with the faeces or vomit. Treat cases with albendazole or mebendazole according to the schedule in Table 34.1.

7 Hookworm infection is a common cause of anaemia in areas where walking barefooted is common and sanitary conditions are poor. Refer suspect cases for laboratory confirmation and educate the community on shoe wearing, use of latrines and proper disposal of faeces.

8 All children aged between two to five years should be routinely dewormed every six months, using the dosages in Table 34.1, to kill ascaris and hookworms.

Self-Assessment Questions (SAQs) for Study Session 34

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the questions below. Some questions also test some Learning Outcomes of Study Sessions 32 or 33. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 34.1 (test Learning Outcomes 33.1, 33.4, 34.1 and 34.3)

Suppose a 30-year-old man came to you complaining of diarrhoea. You asked about the type of diarrhoea and the patient described it to you. Which diseases do you suspect, if he describes the diarrhoea as:

(a) Bloody with mucus?
(b) Watery?
(c) Pale and greasy?

How should you manage the patient in each of the above cases?

SAQ 34.2 (test Learning Outcomes 34.1, 34.2, 34.3 and 34.4)

A mother brought her five-year-old child complaining of long round worms coming out with the child's stool.

(a) What is your diagnosis and how should you manage the child's condition?
(b) What measures do you undertake at community level to decrease such infections?

SAQ 34.3 (test Learning Outcomes 34.1, 34.2 and 34.3)

Abebe is a farmer who came to you with symptoms of anaemia.

(a) What possible causes of anaemia do you consider?
(b) What evidence would suggest hookworm infection?
(c) How do you manage Abebe's illness?

SAQ 34.4 (tests Learning Outcomes 33.3, 33.4, 34.2 and 34.3)

List the main differences between amoebiasis and shigellosis in terms of their occurrence, symptoms and signs.

SAQ 34.5 (tests Learning Outcome 34.4)

How are the prevention and control measures for ascariasis and hookworm infection:

(a) the same?
(b) different?

Study Session 35 Acute Respiratory Tract Infections

Introduction

In this study session, you will learn about acute respiratory tract infections (ARIs). The **respiratory tract** (or 'airways') includes all the parts of the body that enable us to breathe. ARIs are infections of the respiratory tract by either bacteria or viruses, and the term 'acute' indicates that the illness is of short duration (less than two weeks). ARIs are the leading cause of illness and death among young children everywhere in the developing world (Figure 35.1). Ethiopian children suffer four to eight episodes of ARI on average every year, with the highest occurrence in urban areas in overcrowded living conditions. In rural Ethiopia, 20% of the deaths of children aged under five years and more than 30% of the infant deaths under one year are due to ARIs. A better knowledge of ARIs will enable you to detect children with an ARI more quickly and give appropriate treatment, or refer them if the disease is severe.

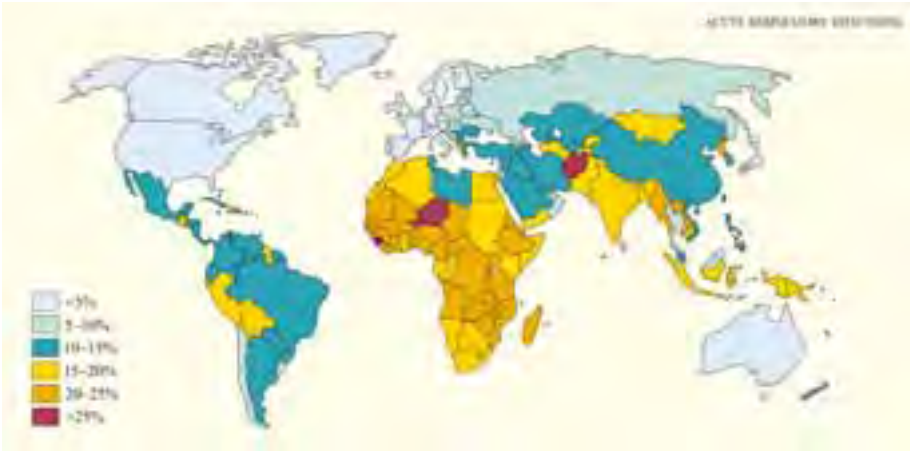

Figure 35.1 Estimates of the percentage of deaths in children aged under five years from ARIs in the year 2000. (Source: The Open University, *Pathogens and People* (S320 Book 1), Figure 1.13, p.32, based on data from Williams, B.G. *et al.* (2002), *The Lancet Infectious Diseases*, 2)

Learning Outcomes for Study Session 35

When you have studied this session, you should be able to:

35.1 Define and use correctly all of the key words printed in **bold**. (SAQs 35.1, 35.2, 35.3 and 35.5)

35.2 Identify the common causative agents, modes of transmission and risk factors for the common acute respiratory tract infections (ARIs): acute otitis media, pharyngitis and pneumonia. (SAQs 35.1, 35.2 and 35.5)

35.3 Describe the clinical presentations and complications of ARIs, and the danger signs of severe pneumonia, and explain how these conditions should be managed. (SAQs 35.2, 35.3 and 35.4)

35.4 Explain the most effective ways to prevent and control ARIs, including through community education. (SAQs 35.2 and 35.5)

35.1 What are acute respiratory tract infections?

Acute respiratory tract infections (**ARIs**) are bacterial or viral infections of the respiratory tract leading to breathing difficulties, fever and other complications, including infections in the ear and the membranes surrounding the brain. ARIs are classified according to whether they affect the upper or lower respiratory tracts (Figure 35.2). The **upper respiratory tract** consists of the airways from the nostrils to the vocal cords in the larynx (voice box), and includes the pharynx (back of the throat) and part of the internal structure of the ear (the middle ear). The **lower respiratory tract** refers to the continuation of the airways below the larynx and the branching airways throughout the lungs.

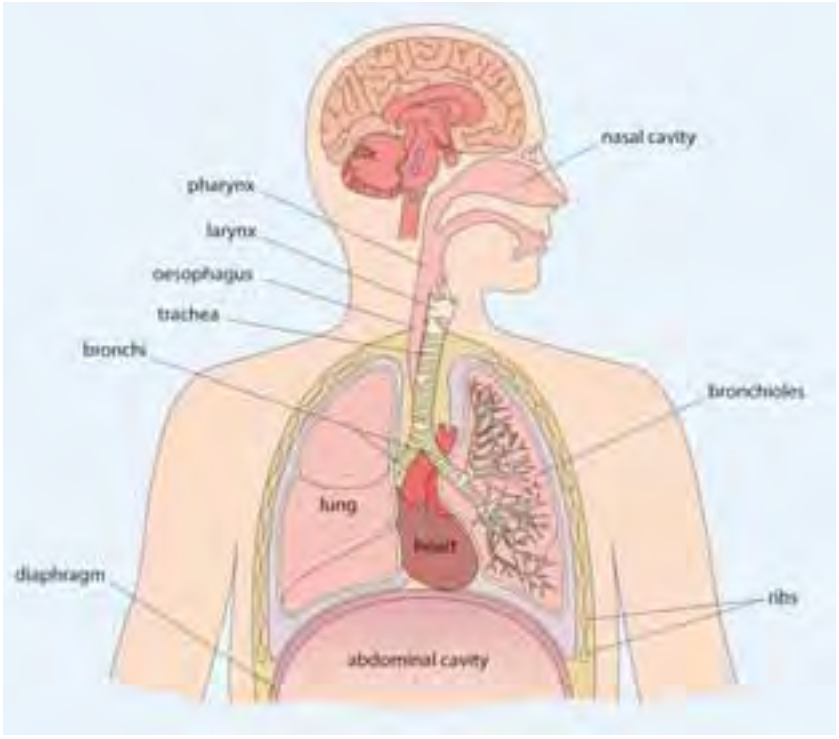

Figure 35.2 Anatomy of the upper and lower respiratory tract.
(Source: The Open University, 2008, *Chronic Obstructive Pulmonary Disease* (SDK125 Case Study 5), Figure 3.3, p.36)

Rhinitis is pronounced 'riy-niy-tiss'; otitis is pronounced 'oh-tiy-tiss'; pharyngitis is pronounced 'fah-rin-jiy-tiss'.

Upper respiratory tract infections (**URIs**) are the most common of all communicable diseases. They are transmitted from one person to another by airborne droplets spread through coughing or sneezing. URIs include mild self-limiting infections such as the common cold (rhinitis), and more severe acute infections in the ear (acute otitis media), or in the pharynx (pharyngitis). **Lower respiratory tract infections** (**LRIs**) are the leading cause of pneumonia, which will be described in Section 35.4 of this study session. First, we discuss acute otitis media and then pharyngitis, both of which can cause severe complications in children.

35.2 Acute otitis media

Acute otitis media (**AOM**) is a severe infection of the middle ear (Figure 35.3), lasting less than two weeks. It is very common in babies and young children, but is rarely seen in adults. Studying this section will help you to prescribe the necessary treatments to a child with AOM, and know when to make a referral of more complicated or persistent cases for further investigation and specialist treatment at a higher level health facility.

It may surprise you to learn that infection inside the ear is classified as a URI. The explanation can be found in Figure 35.3. In each ear, the middle and inner ear are connected to the upper respiratory tract by a tube called the *Eustachian tube*, which leads to the pharynx. You can sometimes hear a soft 'pop' in your ears when you swallow as the pressure wave created by swallowing travels up the Eustachian tubes. Upper respiratory tract infection in the pharynx and tonsils can reach the middle ear if the infectious agents spread upwards along the Eustachian tubes.

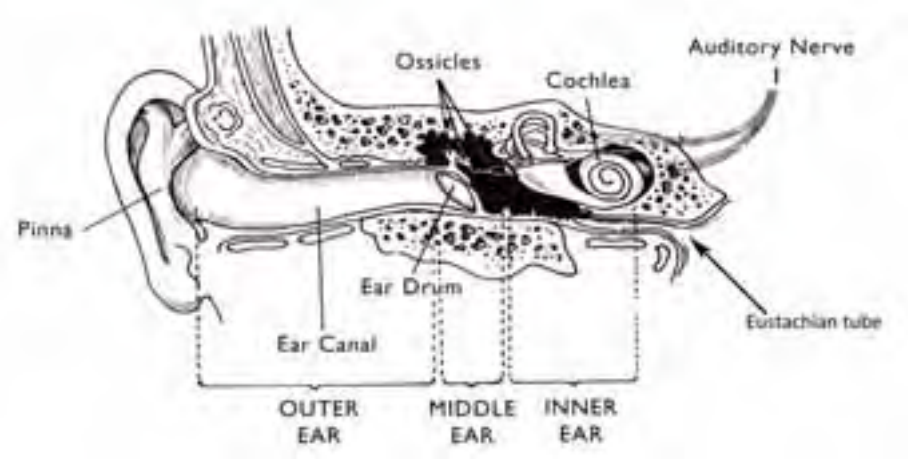

Figure 35.3 Anatomy of the ear and its connection with the upper airways. (Source: WHO, 2006, *Primary Ear and Hearing Care Training Resource: Trainer's Manual – Intermediate Level*, p.16)

35.2.1 How does acute otitis media affect hearing?

In normal situations, the middle ear is filled with air, which transmits sounds from the outside world to tiny bones (called the *ossicles*, see Figure 35.3), causing them to vibrate. The vibration generates signals which the auditory nerve transmits to the brain. This process enables us to hear the sounds. If infection reaches the middle ear, the lining becomes red and inflamed, and it leaks sticky tissue fluid (mucus) into the ear. As the infection builds up, white blood cells crowd into the area to fight the infectious agents and the middle ear becomes filled by **pus** – a thick whitish-yellowish fluid, formed by mucus packed with living and dead bacterial cells and debris from damaged tissue in the ear.

- What effect do you think pus in the middle ear will have on normal hearing, and why?

- It is likely to impair hearing, because the thick, sticky pus stops the ossicles from vibrating properly, so sounds are not transmitted to the brain in the normal way.

35.2.2 Causes, transmission and risk factors for acute otitis media

Immunization against bacterial infections caused by *Haemophilus influenzae* type b is included in the routine EPI schedule for all children in Ethiopia; immunization against *Streptococcus pneumoniae* infection will become available soon.

The two predominant bacteria that cause otitis media include *Streptococcus pneumoniae* and *Haemophilus influenzae* type b, both of which can be prevented by immunization. It can also be caused by a viral vaccine-preventable disease, which you learned about in Study Session 4 of this Module.

■ Can you recall which vaccine-preventable disease is transmitted by airborne droplets and may lead to acute otitis media (AOM) as one of its complications?

□ Measles is associated with several complications in young children, including AOM and pneumonia.

AOM is transmitted by airborne spread of the causative infectious agents in droplets, sprayed into the air when a sick person coughs or sneezes. The infection in the new host usually begins with a common cold, sore throat or measles.The presence of certain risk factors makes babies and young children more vulnerable to developing AOM (see Box 35.1).

Box 35.1 Risk factors for acute otitis media

- Age: most cases are below five years of age
- Family history of otitis media
- Winter season
- Living in overcrowded conditions where other children have coughs or runny noses
- Indoor air pollution from cooking fires (Figure 35.4) and/or tobacco smoke
- Bottle-feeding a baby (breastfeeding offers some protection from URIs)
- Poor nutrition, particularly when the child is not exclusively breastfed
- HIV-infection in the child.

Figure 35.4 Smoke from indoor cooking fires escapes from these traditional Ethiopian round houses (*tukul*); indoor smoke pollution increases the risk of pneumonia and AOM. (Photo: Basiro Davey)

35.2.3 Clinical manifestations, diagnosis and complications of acute otitis media

The symptoms and signs of AOM are highly variable, especially in infants and young children. As a health worker in the community, you should check the following symptoms in children with upper respiratory tract infections:

- Ear pain, often manifested by irritability (the child is easily upset) and occasionally holding or tugging at the ear
- A change in sleeping or eating habits
- Symptoms associated with upper respiratory tract infection, such as a runny nose and sneezing typical of the common cold
- Hearing loss, which may manifest as changes in speech patterns; however, this often goes undetected if hearing loss is mild or in one ear only, especially in younger children.

You can diagnose AOM by careful history-taking and physical examination. Ask the child's caregiver about any history of the above symptoms of AOM. Examine the ear thoroughly for redness or pus discharging from the ear canal (Figure 35.5).

Acute otitis media may progress to produce other complications. These include **chronic otitis media**, manifested by pus discharging from the ear for more than two weeks, which can lead to permanent deafness.

■ What is the complication called if the bacteria that cause otitis media infect the membranes surrounding the brain? How serious is this complication?

□ You learned in Study Session 3 in Part 1 of this Module that **bacterial meningitis** is a potentially life-threatening infection of the brain, which can also spread and cause an epidemic.

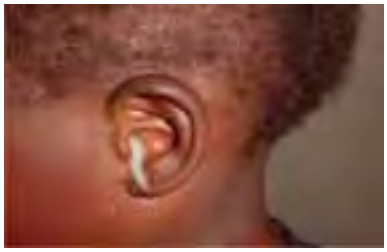

Figure 35.5 Pus discharge as a result of chronic otitis media. (Photo: WHO, 2006, *Primary Ear and Hearing Care Training Resource*: *Student's Workbook – Intermediate Level*, p.53)

35.2.4 Treatment of acute otitis media

As a Health Extension Practitioner you need to know how to treat acute otitis media. Treat the child as an outpatient in the Health Post or at home. Give oral *co-trimoxazole* or *amoxicillin* for five days. The dose of these antibiotics in tablets or syrup preparations depends on the age or weight of the child, as given in Table 35.1. These dosages also apply to the treatment of pneumonia, which will be discussed in Section 35.4 of this study session.

Table 35.1 Antibiotic drug dosages for the treatment of acute otitis media and pneumonia.

Age (weight)	**Co-trimoxazole (give twice per day for five days)**			**Amoxicillin (give three times per day for five days)**
	Adult tablet (80 mg trimethoprim + 400 mg sulphamethoxazole)	Paediatric tablet (20 mg trimethoprim + 100 mg sulphamethoxazole)	Syrup (80 mg trimethoprim + 400 mg sulphamethoxazole /5 ml)	Syrup (125 mg/5 ml)
2–12 months (4–10 kg)	½ tablet	2 tablets	5 ml (1 teaspoon)	5 ml (1 teaspoon)
12 months to 5 years (10–19 kg)	1 tablet	3 tablets	7.5 ml (1.5 teaspoons)	10 ml (2 teaspoons)

The assessment and treatment of ear infections in children is described in more detail in the module on *Integrated Management of Newborn and Childhood Illness (IMNCI)*.

If the child has ear pain or high fever (equal to or above 39°C or 102.2°F), which is causing distress, give 5 ml of *paracetamol* syrup up to three times per day.

If there is pus draining from the child's ear, show the mother or another caregiver how to dry the ear by wicking (cleaning the ear using a twist of very clean cotton). Advise her to wick the ear three times daily, until there is no more pus (Figure 35.6). Tell the mother not to place anything in the ear between wicking treatments. Do not allow the child to go swimming or get water in the ear. If the pus continues to discharge from the ear after five days, refer the child to a health centre for further assessment and treatment.

Figure 35.6 Wicking pus from the ear of a child with acute otitis media.
(Diagram: Dr Radmila Mileusnic)

Strategies for the prevention and control of acute otitis media, pharyngitis (the subject of the next section) and pneumonia (described in Section 35.4) are the same, and will be described at the end of this study session.

35.3 Pharyngitis

Pharyngitis refers to infection and **inflammation** (becoming hot, swollen and red) of the structures in the pharynx. In most cases, the tonsils are affected and become inflamed and ulcerated (tonsillitis). In this section, we will describe the clinical manifestations, complications and treatment of pharyngitis. A better understanding of these points will help you to identify a child with pharyngitis and know that you should refer them to a higher level health facility. Pharyngitis can be caused by viruses or bacteria, but the most important causes are bacteria of the type known as Group A *Streptococci*. Infection with Group A *Streptococci* is common among Ethiopian children. It can lead to severe complications, including heart disease.

Figure 35.7 Sore throat and swollen tonsils due to pharyngitis. (Photo: CDC/PHIL, Strep Throat Picture 1, Hardin Library for the Health Sciences, University of Iowa, accessed from http://www.lib.uiowa.edu/hardin/md/cdc/strepthroat.html)

35.3.1 Clinical manifestations and complications of pharyngitis

Pharingitis generally begins with the sudden onset of fever (temperature above 37.5°C, measured with a thermometer in the armpit), and a sore throat, with redness and swelling of the tonsils at the back of the throat (Figure 35.7). Other symptoms include headache, cough, runny nose and pain during swallowing.

Infection of the pharynx by Group A *Streptococci* has many complications, which include otitis media and throat abscesses (swelling containing pus). In a minority of severe cases, a form of heart disease – called **rheumatic heart disease** – can develop as a result of the body's attempt to fight the infection. The immune system recognises Group A *Streptococci* as 'foreign' and produces antibodies that attack the bacteria. **Antibodies** are specialised proteins made by specific white blood cells as part of the body's defence against infection. However, in rare cases, the antibodies produced to fight

Group A *Streptococci* can attack the heart muscle of the infected child. As a result, these children can develop rheumatic heart disease later in life.

35.3.2 Referral of children with pharyngitis for treatment

Educate mothers and other caregivers about the symptoms of acute otitis media and pharyngitis, and advise them to bring their child to you, or go to a health centre, if they suspect either of these conditions. Early diagnosis and correct treatment greatly improve the outcomes and reduce the risk of complications. Pharyngitis due to Group A *Streptococci* should be treated by doctors using a drug called *Benzathine penicillin*. This drug is given in the form of an injection, which is not authorised for use at Health Post level.

If you identify children with pharyngitis, you should refer them to the nearest health centre or hospital for specialised assessment and treatment.

35.4 Pneumonia

A better understanding of pneumonia will help you to save many lives through early diagnosis and treatment or referral of cases, especially among children, and educating your community on effective prevention and control measures.

35.4.1 What is pneumonia and what causes it?

Pneumonia is a lower respiratory tract infection that mainly affects the lungs. The lungs are made up of small sacs called *alveoli*, which are filled with air when a healthy person breathes in. When an individual has pneumonia, the alveoli are filled with pus and fluid, which makes breathing painful and limits the amount of oxygen they can take into the body. Pneumonia is caused by a number of infectious agents, mainly by certain bacteria and viruses (Box 35.2). In children or adults whose immunity is weak, other organisms such as fungi can cause a rare form of pneumonia, which may be responsible for at least one quarter of all pneumonia deaths in HIV-infected infants.

Box 35.2 Major bacterial or viral causes of pneumonia

Bacterial causes (the major causes of death from pneumonia)

- *Streptococcus pneumoniae* – the most common cause of bacterial pneumonia.
- *Haemophilus influenzae* type b (Hib) – the second most common cause of bacterial pneumonia.

Viral causes

- Respiratory syncytial virus – the most common viral cause of pneumonia.

Pneumonia is the number one cause of death among children in Ethiopia and worldwide: globally, it causes an estimated 1.6 million child deaths every year. It is also among the top five causes of illness and death in adults in Ethiopia. The Ethiopian Demographic and Health Survey (DHS, 2005) estimated that 13% of children had pneumonia during the survey year, and infants (children up to one year old) were more likely to have pneumonia than older children under the age of five.

Viral infections often come on gradually and may worsen over time. The common symptoms include cough, fever, chills, headaches, loss of appetite and wheezing.

■ Which of the bacterial causes of pneumonia can be prevented by immunization?

Details of vaccines in the Expanded Programme on Immunization (EPI) in Ethiopia are given in the *Immunization* Module.

□ You learned in Study Session 3 (in Part 1 of this Module) that vaccines exist to protect children from bacterial pneumonia caused by *Haemophilus influenzae* type b (Hib) or *Streptococcus pneumoniae*. The Hib vaccine is already routinely given to infants in Ethiopia, and the pneumococcal vaccine will be added to the routine EPI schedule in the near future.

As we mentioned earlier, immunization against measles also helps to protect children from complications, which include pneumonia and AOM.

35.4.2 Pneumonia transmission and risk factors

The infectious agents causing pneumonia may reach the person's lungs through different routes. The most common modes of transmission are:

- Airborne droplets spread when the sick person coughs or sneezes, and inhaled into the lungs (breathed in) by a susceptible person;
- Direct oral contact with someone who has pneumonia (e.g. through kissing).
- During or shortly after birth, babies are also at higher risk of developing pneumonia from coming into contact with infectious agents in the birth canal, or from contaminated articles used during the delivery.

These modes of transmission help to explain why certain risk factors increase the probability that children or adults will develop pneumonia. Box 35.3 summarises the common risk factors, some of which also increase the patient's susceptibility to fatal complications if pneumonia occurs.

Box 35.3 Common risk factors for pneumonia

- Under-nutrition/malnutrition, which weakens the immune system and reduces resistance to infection
- Inadequate breastfeeding or formula feeding of infants under six months old, which predisposes them to malnutrition and infection
- Lack of immunization against vaccine-preventable diseases that affect the respiratory system
- Infection with HIV and/or tuberculosis
- Living in overcrowded homes, where airborne infection is easily transmitted
- Exposure to indoor air pollution, especially smoke from cooking fires burning vegetable and animal waste (e.g. dried cow dung), which irritates the lungs and makes it easier for bacteria and viruses to gain a hold.

35.4.3 Diagnosis and classification of pneumonia

Children with pneumonia may have a range of clinical presentations, depending on their age and the cause of the pneumonia. Children who have bacterial pneumonia usually become severely ill and show the following symptoms:

- Fast or difficult breathing (see Table 35.2)
- Cough
- Fever and chills
- Loss of appetite
- Wheezing.

Adults with pneumonia also have fever, cough, and fast or difficult breathing.

Table 35.2 Estimating 'fast breathing' in children in different age groups.

If the child is aged:	The child has fast breathing if you count:
2 months to 12 months old	50 breaths or more per minute
12 months to 5 years old	40 breaths or more per minute

In severe cases of pneumonia, children under five-years-old may struggle to breathe and usually show **chest in-drawing**, which you can observe as drawing inwards or retracting of the lower chest (red arrows in Figure 35.8) during *inhalation* (taking air into the lungs).

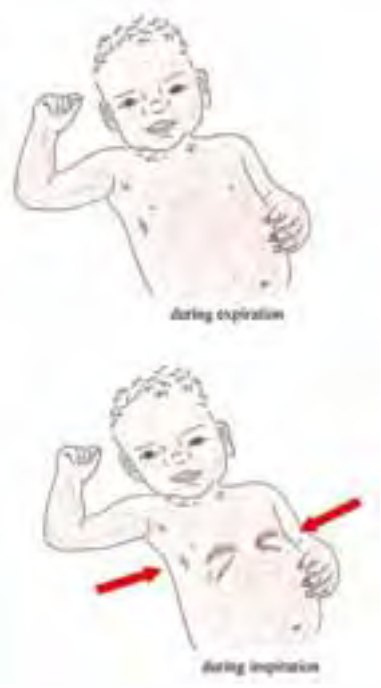

Figure 35.8 Chest in-drawing during inspiration: the lower chest wall moves in sharply as the child breathes in. (Diagram: Dr Radmila Mileusnic)

Pneumonia in children and adults is classified into non-severe and **severe pneumonia** based on the features of the condition summarised in Box 35.4. This classification is very important because it determines what treatment is given to the patient (as you will see in Section 35.4.4).

Box 35.4 Severe signs of pneumonia in children and adults

Children

- Age less than 2 months
- Presence of general danger signs (unable to drink or eat, lethargic or unconscious)
- Chest in-drawing
- **Stridor** (a harsh noise made during inhalation)
- Respiratory rate exceeding the limits in Table 35.2.

Adults

- Age 65 years or older
- Respiratory rate equal to or greater than 30 breaths per minute
- Presence of confusion.

A child with fast breathing, chest in-drawing or stridor should be immediately referred to hospital.

If a child with pneumonia has fast breathing (Table 35.2), but no general danger signs, or chest in-drawing, or stridor, classify him/her as having *non-severe* pneumonia. Adults with pneumonia who do not have the severe signs given in Box 35.4, are also classified as having *non-severe* pneumonia.

Infants less than two months old with pneumonia may have serious complications such as meningitis and may die soon. Refer them urgently!

35.4.4 Treatment of pneumonia

Severe pneumonia in children and adults is diagnosed if they exhibit the signs summarised in Box 35.4. You should refer all patients with severe pneumonia immediately to the nearest health centre or hospital, where appropriate drugs can be prescribed by doctors or health officers.

For adults with non-severe pneumonia, give amoxicillin tablets, 500 mg three times a day for seven days. Details of the treatment of severe and non-severe pneumonia in children are given in a separate Module on the *Integrated Management of Newborn and Childhood Illness* (IMNCI). Here we remind you of the oral antibiotics you can give children with non-severe pneumonia without any other danger signs. The course of treatment is for five days with either co-trimoxazole (the preferred antibiotic drug), or if co-trimoxazole is not available, give amoxicillin. The doses of co-trimoxazole or amoxicillin depend on the age or weight of the child, and were summarised earlier in Table 35.1. Look back at it now, and then answer the following question.

■ Suppose you saw a three-year-old girl with non-severe pneumonia. What dose of co-trimoxazole syrup would you give this child, and for how many days?

If any of your non-severe patients do not improve with the drug treatments you give them, or if their condition gets worse, immediately refer them to the nearest health centre or hospital.

□ She is between 12 months and five years, so you should give her 7.5ml (one and a half teaspoons) of co-trimoxazole syrup (containing 80 mg trimethoprim + 400 mg sulphamethoxazole), twice a day for five days (look back at Table 35.1).

Co-trimoxazole for HIV-positive children should be prescribed by doctors as prophylaxis against opportunistic infections with bacteria, viruses and fungi that cause pneumonia. Part 3 of this Module includes a detailed discussion of the prevention and treatment of pneumonia in people living with HIV infection.

■ If a one-month-old child comes to you with symptoms of fever and a respiration rate of 70 breaths per minute, what should you do?

□ The child is less than two months old and may have pneumonia, so it is at high risk of serious complications (e.g. meningitis and death). Therefore, refer the baby immediately to the nearest hospital or health centre.

35.5 Prevention and control of acute respiratory tract infections

Finally, we turn to the methods of prevention and control of acute respiratory tract infections (ARIs). You need to know about them so you can teach members of your community how they can protect their children and vulnerable adults from acute otitis media, pharyngitis and pneumonia.

■ Do you remember the difference between prevention and control?

□ **Prevention measures**, such as immunization, are applied *before* the occurrence of a communicable disease to reduce the risk that it will develop. **Control measures**, such as the treatment or isolation of cases, are applied *after* the occurrence of the disease, with the aim of reducing the transmission of the infectious agents to new susceptible people.

Prevention measures for ARIs include:

- Feeding children with adequate amounts of varied and nutritious food to keep their immune system strong.
- Breastfeeding infants exclusively (no other food or drinks, not even water) for the first six months (Figure 35.9); breastmilk has excellent nutritional value and it contains the mother's antibodies which help to protect the infant from infection.
- Avoiding irritation of the respiratory tract by indoor air pollution, such as smoke from cooking fires; avoid the use of dried cow dung as fuel for indoor fires.
- Immunization of all children with the routine Expanded Programme on Immunization (EPI) vaccines in Ethiopia (Box 35.5).

Figure 35.9 Exclusive breastfeeding helps to protect babies from communicable disease, including pneumonia. (Photo: UNICEF Ethiopia)

Box 35.5 EPI vaccines that protect against acute respiratory tract infections

Immunize all children with:

- *Haemophilus influenzae* type b (Hib) vaccine at 6, 10 and 14 weeks; Hib is one of the five vaccines in the pentavalent vaccine used in Ethiopia.
- Measles vaccine at nine months of age.
- *Pneumococcal* vaccine, when it becomes available in the EPI, to protect them against *Streptococcus pneumoniae* bacteria.

The dosages, schedules and vaccination routes for Hib, measles and pneumococcal vaccines are taught in the *Immunization* Module.

You can help to control the spread of respiratory bacteria by educating parents to avoid contact as much as possible between their children and patients who have ARIs. You should also teach people with ARIs to cough or sneeze away from others, hold a cloth to the nose and mouth to catch the airborne droplets when coughing or sneezing, and disinfect or burn the cloths afterwards. Immunization also increases control, by reducing the reservoir of infection in the community and increasing the level of *herd immunity* (described in Study Session 1 in Part 1 of this Module).

Summary of Study Session 35

In Study Session 35, you have learned that:

1 Acute respiratory tract infections (ARIs) may affect the upper or lower respiratory tracts and are major public health problems in Ethiopia.

2 Malnutrition, under-nutrition, lack of exclusive breastfeeding, lack of immunization, indoor air pollution and HIV infection are the major risk factors for ARIs.

3 Acute otitis media is a common upper respiratory tract infection in young children, which is manifested by fever, ear pain, pus discharging from the ear and irritability. Children with symptoms of acute otitis media should be identified as soon as possible and treated by 'wicking' the pus from the ear, and giving antibiotics to prevent complications such as deafness, meningitis and pneumonia.

4 Pharyngitis is another common upper respiratory tract infection, which is manifested by fever, sore throat and swollen inflamed tonsils. Children with symptoms of pharyngitis should be referred to a higher level health facility for assessment and treatment.

5 Pneumonia is the major killer of children in Ethiopia and is among the top five causes of illness and death among adults.

6 Severe pneumonia in children is manifested by the presence of danger signs, which include fast breathing, fever, chest in-drawing and stridor. Children with severe pneumonia are at high risk of death, and should immediately be referred to a higher level health facility to save their lives.

7 Co-trimoxazole or amoxicillin are the antibiotics authorised at Health Post level to treat acute otitis media and non-severe pneumonia. Dosages are based on the patient's age and weight.

8 Prevention and control of acute respiratory tract infections include adequate nutrition, exclusive breastfeeding for infants under six months of age, immunization, protection from indoor smoke pollution, keeping children away from patients with pneumonia, teaching people to cough and sneeze away from other people, and co-trimoxazole prophylaxis for adults and children with HIV infection.

Self-Assessment Questions (SAQs) for Study Session 35

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 35.1 (tests Learning Outcomes 35.1 and 35.2)

Imagine that you see a 67-year-old man at a rural village with cough, fever and fast breathing. What is your diagnosis and what action should you take?

SAQ 35.2 (tests Learning Outcomes 35.1, 35.2, 35.3 and 35.4)

Which of the following statements is *false*? In each case, explain why it is incorrect.

A A 40-day-old infant who has fast breathing can be treated at home.
B Acute otitis media and pneumonia can be caused by the same bacteria.
C Rheumatic heart disease is the result of the heart becoming infected with bacteria.
D Bacterial pneumonia in children is usually more severe than viral pneumonia.
E Pharyngitis can be prevented by immunization.

SAQ 35.3 (tests Learning Outcomes 35.1 and 35.3)

State at least three clinical signs that you might expect to find in a four-year-old child with severe pneumonia.

SAQ 35.4 (tests Learning Outcome 35.3)

Which one of the following is the preferred drug for treating acute otitis media or non-severe pneumonia in children at Health Post level?

(a) Arthemeter-lumefantrine
(b) Paracetamol
(c) Co-trimoxazole
(d) Quinine
(e) Amoxicillin

SAQ 35.5 (tests Learning Outcomes 35.1, 35.2 and 35.4)

Complete Table 35.4 by placing a cross in the appropriate boxes to indicate whether each of the actions in the first column is a prevention or a control measure against ARIs – or both.

Table 35.4 Prevention and control measures against ARIs.

Action	Is it prevention?	Is it control?
Early diagnosis and treatment		
Adequate nutrition		
Immunization against respiratory tract infections		
Reduction of indoor smoke pollution		
Coughing or sneezing into a cloth, or turning away from other people		

Study Session 36 Louse-Borne Diseases: Relapsing Fever and Typhus

Introduction

You already learned about the most widespread vector-borne disease in Ethiopia – malaria, transmitted by mosquitoes (Study Sessions 5–12 in Part 1 of this Module). Two other vector-borne diseases of public health importance in Ethiopia are the subject of this study session. They are caused by different bacteria, but are transmitted by the same vector – the human body louse (plural, lice). The diseases are louse-borne *relapsing fever* and louse-borne *typhus*, which are classified as **febrile illnesses** because the symptoms always include high fever. In this study session, you will learn about the causes, modes of transmission, symptoms and methods of prevention of these diseases. This will help you to identify patients and quickly refer them to the nearest health centre or hospital for specialist treatment. You are also expected to report any cases of these louse-borne diseases to the District Health Office, so that coordinated action can be taken to prevent an epidemic from spreading in your community.

Learning Outcomes for Study Session 36

When you have studied this session, you should be able to:

36.1 Define and use correctly all of the key words printed in **bold**. (SAQs 36.1 and 36.3)

36.2 Describe the vector and the modes of transmission of relapsing fever and typhus, and the conditions in which epidemics are most likely to occur. (SAQs 36.1 and 36.3)

36.3 Describe the symptoms of relapsing fever and typhus, and the actions you should take if you identify a suspected case. (SAQs 36.3 and 36.4)

36.4 Explain how you would apply effective methods to prevent and control relapsing fever and typhus. (SAQs 36.2, 36.3 and 36.4)

36.1 The human body louse

Before we discuss relapsing fever and typhus, it is first helpful to describe the vector of both these diseases. The human body louse (species name, *Pediculus humanus humanus*) is commonly found in the clothes, bedding and on the bodies of people living in overcrowded and insanitary conditions, where there is poor personal hygiene. When body lice are found, for example in clothes, the articles are said to be **louse-infested**. (Note the term is *infested*, not infected.)

■ Can you suggest examples of places where louse infestation is more likely to occur because of overcrowding and lack of sanitation?

□ You may have suggested refugee camps (Figure 36.1), badly maintained prisons or army camps during times of war.

Figure 36.1 Overcrowding and poor sanitation create perfect breeding sites for body lice.

Male and female lice mate and the female lays eggs (known as nits), which she attaches to body hairs or fibres in clothing and bedclothes where people sleep (Figure 36.2). The eggs hatch into small immature lice (called nymphs), which bite their human hosts to suck blood, nourishing their growth and development into adult lice (Figure 36.3). They have a lifespan of only a few weeks, and feed at frequent intervals. The bites cause an allergic reaction in the person's skin, which becomes inflamed and itches, causing the person to scratch the area. Lice are transmitted from person to person during close contact and when sharing bedding in which eggs have been laid. They can survive for only a few days off the human host.

Figure 36.3 An adult female body louse, *Pediculus humanus humanus*. (Photo: CDC Image Library, image 9202)

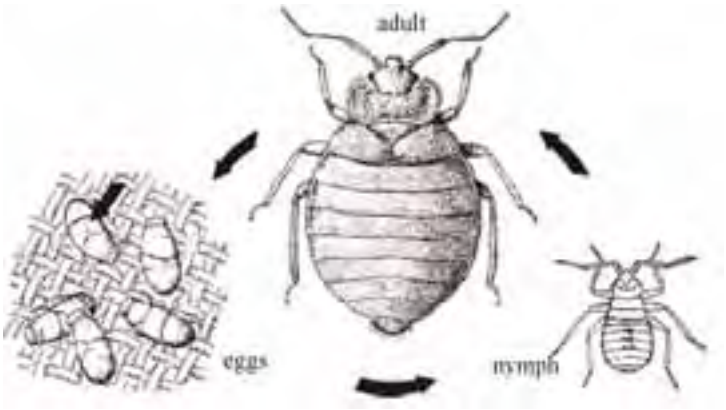

Figure 36.2 Life cycle of the human body louse, *Pediculus humanus humanus*. (Source: WHO, 1997, *Vector Control*: *Methods for use by Individuals and Communities).*

Although human body lice can transmit relapsing fever and typhus, the modes of transmission are somewhat different in these two diseases, as you will see in the following sections.

36.2 Louse-borne relapsing fever

Louse-borne relapsing fever (RF) is caused by spiral-shaped bacteria called *Borrelia recurrentis.* RF is common in Ethiopia, Sudan and Rwanda. It is one of the **epidemic-prone diseases** that can cause small, or large-scale epidemics anywhere in Ethiopia, with an estimated 10,000 cases annually. RF is more common in the highlands, where it occurs mainly in the rainy seasons, but in south west Ethiopia it occurs in dry and rainy seasons equally. Epidemics of RF are often associated with epidemics of typhus, since both are transmitted by the body louse in similar conditions of overcrowding and lack of hygiene.

36.2.1 Mode of transmission of relapsing fever

The bacteria that cause RF infect body lice when they take a blood meal from an infected person (Figure 36.4). The bacteria multiply in the gut of the louse, but the infection is *not* transmitted to new hosts when the louse bites a healthy person. Instead, humans acquire the infection when they scratch their bites and accidentally crush a louse, releasing its infected body fluids onto their skin. The bacteria enter through breaks in the skin, typically caused by scratching the itchy louse bites. After entering into the skin, the bacteria multiply in the person's blood and they can also be found in the liver, lymph glands, spleen and brain.

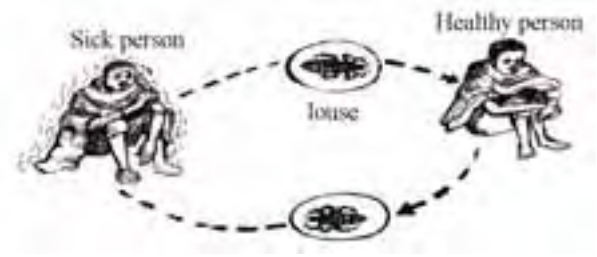

Figure 36.4 Body lice carry the bacteria that cause relapsing fever from an infected person to a healthy person.

36.2.2 Symptoms of relapsing fever

The incubation period between the infection and the start of symptoms is typically five to ten days. The common clinical manifestations of RF include the sudden onset of episodes of high fever, up to 40°C, with periods of shivering and chills, accompanied by headache, joint pain, dry cough and sometimes bleeding through the nose. About one third of patients develop tiny red or purple spots on the skin. The symptoms continue for three to nine days, while the immune system of the patient makes antibodies that attach to the bacteria and clear them from the blood, and the patient appears to recover. However, not all of the bacteria are destroyed. The numbers of bacteria gradually increase, and four to seven days after recovering from the first episode of fever, the patient 'relapses', i.e. the symptoms begin all over again. Almost all the organs are involved and there will be pain in the abdomen and an enlarged liver and spleen, in addition to the other symptoms. Without treatment with special antibiotics, 30% to 70% of cases can die from complications such as pneumonia and infection in the brain, leading to **coma** (a state of deep unconsciousness) and death.

■ What other disease that you have already learned about has similar episodes of fever, headache and chills, with periods of recovery and then relapse?

□ Malaria has similar symptoms to relapsing fever.

36.2.3 Actions if you suspect relapsing fever

The similarity between the clinical manifestations of malaria and RF mean that you should first consider whether a diagnosis of malaria can be ruled out. If your community is in a malaria-endemic area, perform a malaria rapid diagnostic test (RDT) on the patient's blood, as described in Study Session 7 of this Module. If there is no malaria in your area, or the RDT is negative, you should immediately refer a patient suspected of having RF to the nearest health centre or hospital.

Immediately refer all patients with suspected relapsing fever.

The good news is that RF can be easily and successfully treated with special antibiotics, but these can only be prescribed by a doctor. You are not expected to prescribe drugs for relapsing fever. The symptoms usually begin to improve within 24 hours of starting the treatment. Make sure that the patient and the family know that RF can be life-threatening without treatment, but that it can be cured with the right medicine.

Lice carrying the bacteria that cause RF are very easily transmitted between close contacts of the infected person. Therefore, you should also do **active case finding** – searching actively for other cases of RF by asking about anyone with the characteristic symptoms in the patient's family or village to detect if there could be an epidemic spreading. Precautions should be taken by you and by health workers in the hospital or health centre, to avoid close contact with a patient with relapsing fever, to prevent acquiring the infection.

36.3 Louse-borne typhus

You learned about typhoid fever in Study Session 33.

Typhus should not be confused with *typhoid fever*. Although there are some similarities between these two febrile illnesses, they are caused by different bacteria and typhoid is transmitted mainly in infected food, not by body lice. **Louse-borne typhus** (also known as *epidemic typhus*, 'jail fever' or *tessibo beshita* in Amharic) is similar in many ways to relapsing fever. Like RF, it is a bacterial infection transmitted by the human body louse, but the causative bacteria are different. They are extremely small bacteria called *Rickettsia prowazekii* (named after two doctors who died of typhus when they were researching into the disease). These bacteria quickly have to get inside the cells of their human host in order to survive and multiply – unlike the bacteria that cause RF, which circulate in the blood and don't live inside the host's body cells.

Louse-borne typhus has caused major epidemics over many centuries, resulting in millions of deaths during war, famine and mass displacement. The WHO estimates that globally in recent years around 1,400 people die from typhus every year. Like RF, outbreaks occur in situations of overcrowding in unhygienic conditions where body lice can easily breed and spread. Outbreaks of the disease have occurred in Ethiopia from time to time. Typhus is more common in the highlands, in places such as Gondar, Shewa, Bale, Arsi, Gojam and Tigray.

36.3.1 Mode of transmission of louse-borne typhus

There is one difference in how the *Rickettsia* bacteria that cause typhus, and the *Borrelia* bacteria that cause RF, are transmitted by body lice to new human hosts. The *Rickettsia* bacteria acquired during a blood meal from an infected person multiply in the gut of the louse and pass out of its body in the louse's faeces, which are deposited on the person's skin. These bacteria can survive for several days in the faeces. The louse bites are itchy and when the person scratches them, the louse faeces are rubbed into breaks in the skin. This is how the typhus bacteria are transmitted to healthy people when an infected louse gets into their clothes or bedding. They quickly enter the new host's body cells and begin to multiply.

36.3.2 Symptoms of louse-borne typhus

The clinical manifestations of louse-borne typhus are similar to other common febrile illnesses in Ethiopia, including relapsing fever. After an incubation period of about one to two weeks the symptoms begin suddenly, with severe headache and fever rising rapidly to 38.8°C to 40.0°C. But unlike RF, the high temperature in typhus is sustained throughout the illness and the symptoms do not spontaneously improve and then relapse. A prominent cough is very common, occurring in 70% of patients. They also experience very severe muscle pain, sensitivity to light, lethargy and falling blood pressure. If untreated, the most severe cases end in coma and death.

36.3.3 Actions if you suspect louse-borne typhus

If you suspect a case of typhus, your actions should be exactly the same as already described for suspected cases of RF.

■ What should you do?

□ Test for malaria if you are in a malaria endemic area. Refer patients suspected of having typhus to the nearest health centre or hospital, where they will be treated by doctors with special antibiotics. You are not expected to prescribe these drugs. Typhus is an epidemic-prone disease, so search actively for other people locally with a similar illness and report all suspected cases to the District Health Office.

In addition to the above actions, you should also educate your community about how to prevent these louse-borne diseases. This is the subject of the final section of this study session.

36.4 Prevention of louse-borne relapsing fever and typhus

Let us now focus on the common prevention aspects of relapsing fever and typhus. As we said earlier, these diseases are associated with overcrowding and insanitary conditions – in other words, they are associated with poverty. They are best prevented by addressing the underlying socioeconomic circumstances that promote louse infestation: overcrowding, poverty, homelessness and population displacement. However, you should also educate people in your community to take the following preventive actions:

- Maintain good hygienic practices, such as washing the body, clothes and bedding regularly, and drying clothes and bedding in direct sunlight, which damages the lice and their eggs to some extent
- Change clothes and bedding at frequent intervals to reduce the number of body lice
- Treat louse-infested clothes and bedding with chemicals to kill the lice and their eggs (this is called **delousing**). In infested situations like those in refugee camps, clothes and bedding should be deloused by trained personnel with appropriate insecticides, such as 0.5% permethrin dust or DDT. You are not expected to apply these chemicals. Treating clothing with liquid permethrin can provide long-term protection against louse infestation.

Note that close contact with patients should be avoided and delousing of the patient's clothes and bedding should be done immediately, to prevent transmission of infected body lice from the patient to healthy people – including the health workers who are caring for them.

If there is an outbreak of relapsing fever or typhus, the spread of infection can be controlled by active case finding and effective treatment of infected persons and their close contacts with the correct antibiotics. These drugs have to be prescribed and monitored by doctors – you are not expected to give any drugs to patients with RF or typhus. Early treatment controls the spread of infection by reducing the reservoir of bacteria in the local population.

In the next study session, we complete the discussion of vector-borne diseases by describing four that are of significant public health importance in Ethiopia.

Summary of Study Session 36

In Study Session 36, you have learned that:

1 Louse-borne relapsing fever (RF) and typhus are major epidemic-prone diseases in Ethiopia. They are vector-borne febrile illnesses caused by bacteria and transmitted by the human body louse.

2 RF and typhus are diseases of poverty and overcrowding, which are most likely to occur in refugee camps, prisons and other places where large numbers of people live in crowded conditions, with poor sanitation and lack of personal hygiene, which promote infestation with body lice.

3 RF and typhus have similar symptoms, including high fever, headache, and joint and muscle pain. Patients with typhus often also have a persistent cough. The symptoms of RF typically occur in cycles of a few days, resolving spontaneously for a few days before the patient relapses with another episode of symptoms. Typhus symptoms tend to be sustained over time.

4 Patients with RF or typhus should be referred immediately for antibiotic treatment in higher health institutions; both diseases are life-threatening if not treated, but respond well to the correct antibiotics.

5 When you suspect a case of RF or typhus, you should conduct active case finding in the community to locate any similar cases; you can control the spread of an epidemic by referring all patients for early treatment, reporting cases to the District Health Office and seeking help to apply prevention measures.

6 Regular washing of clothes, bedding and bodies, delousing using chemicals such as permethrin and DDT, and treatment with antibiotics are the major prevention and control methods during epidemics of RF or typhus.

Self-Assessment Questions (SAQs) for Study Session 36

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 36.1 (tests Learning Outcomes 36.1 and 36.2)

(a) What are the similarities in how relapsing fever (RF) and typhus are transmitted from person to person?

(b) Can you describe one difference?

SAQ 36.2 (tests Learning Outcome 36.4)

During your visit to a rural area, you observe that many people in a particular village wear dirty clothes and do not change their clothes for several weeks. What educational messages do you give the families in that village and what is your health education aiming to prevent?

SAQ 36.3 (tests Learning Outcomes 36.1, 36.2, 36.3 and 36.4)

Which of the following statements is *false*? In each case, explain what is incorrect.

A It is possible to distinguish between relapsing fever and typhus at Health Post level by identifying differences in their symptoms.
B Relapsing fever and typhus occur only in the rainy seasons in Ethiopia.
C Treatment with the correct antibiotics is sufficient to control epidemics caused by relapsing fever or typhus.
D The correct antibiotics can effectively treat relapsing fever and typhus if the patient is referred immediately.
E Health workers should protect themselves from developing relapsing fever or typhus by avoiding close contact with patients with these diseases.

SAQ 36.4 (tests Learning Outcomes 36.3 and 36.4)

Estifanos is a 30-year-old farmer who came to your Health Post with fever, severe headache and extreme muscle pain. He tells you that there are many similar illnesses in his village.

(a) What are the possible diagnoses for Estifanos?
(b) What action do you take?

Study Session 37 Other Vector-Borne Diseases of Public Health Importance

Introduction

Three important vector-borne diseases have been discussed previously in this Module: malaria in Study Sessions 5–12 and relapsing fever and typhus in Study Session 36. In this study session, you will learn the causes, modes of transmission, clinical manifestations, prevention and control of four other vector-borne diseases of public health importance in Ethiopia: schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis. A better understanding of these diseases will help you to identify patients and refer them quickly to a health centre or hospital for specialist treatment.

You will also learn about the health education messages that you need to communicate to members of your community, so they can reduce their exposure to the vectors of these diseases and apply appropriate prevention measures. As you will see in this study session, prevention of all of these diseases includes controlling the vectors with chemicals and/or environmental management, using personal protective clothing or bed nets to reduce exposure to the vectors, and rapid case detection and referral for treatment. Early treatment prevents serious complications and can save lives, and it also reduces the reservoir of infectious agents in the human population.

Learning Outcomes for Study Session 37

When you have studied this session, you should be able to:

37.1 Define and use correctly all of the key words printed in **bold**. (SAQs 37.1 to 37.5)

37.2 Identify the vectors and modes of transmission of schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis. (SAQs 37.1, 37.2 and 37.3)

37.3 Describe the distribution and impact of schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis in Ethiopia. (SAQs 37.1, 37.3, 37.4 and 37.5)

37.4 Describe the symptoms of schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis, and how you would diagnose and refer cases to a higher level health facility. (SAQs 37.3 and 37.4)

37.5 Describe how you would apply prevention and control measures against schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis. (SAQs 37.1, 37.3 and 37.5)

37.1 Schistosomiasis

Schistosomiasis is a chronic communicable disease caused by parasitic flatworms (also known as trematodes, or blood flukes), which affect the blood vessels in the intestines or in the urinary tract of infected people. In some places, the disease is known by its alternative name – bilharzia. Two species of *Schistosoma* parasites are common in Ethiopia: *Schistosoma mansoni* (Figure 37.1 on the next page), which causes disease mainly in the intestines, and *Schistosoma haematobium*, which causes disease mainly in the bladder and sometimes also in other parts of the urinary tract such as the kidneys.

Schistosomiasis is pronounced 'shy-stoh-soh-my-assis'. It is described as chronic because the symptoms develop gradually, become progressively more serious, and last for a long time unless treatment is given.

Figure 37.1 A mating pair of *Schistosoma mansoni* flatworms, magnified and viewed through a microscope; the thin female worm is curled partly inside and below the much larger male worm. Adult worms measure 12 to 20 mm in length. (Photo: CDC Image Library, image number 11194, Dr Shirley Maddison)

The WHO estimates that more than 207 million people worldwide are infected with *Schistosoma* parasites – and 85% of them are in Africa. Approximately 200,000 people die every year in Africa as a result of the complications caused by these parasites. Rural communities living near water bodies such as rivers, lakes and dams may be highly affected by the disease, because the worms have a complex lifecycle in which they spend part of their development living in freshwater snails. You will learn more about their lifecycle later in this section. First, as a Health Extension Practitioner, you need to know where the disease is common in Ethiopia.

37.1.1 Where is schistosomiasis common in Ethiopia?

Schistosoma mansoni is widespread in several parts of Ethiopia, usually at an altitude of between 1,200 to 2,000 metres above sea level. Some of the common places include Ziway (Figure 37.2), Hawassa, Bishoftu, Wonji, Haromaya, Jimma, Bahir Dar and some places in Gojam, Dessie and Tigray. In many of these locations, more than 60% of schoolchildren are infected with *Schistosoma mansoni*. A high burden of the disease in children has severe adverse effects on their growth and performance at school.

Figure 37.2 Lake Ziway, Ethiopia. Washing, swimming or standing in infected water exposes people to the risk of infection with *Schistosoma* parasites. Children are especially vulnerable. (Photo: Basiro Davey)

Schistosoma haematobium is limited to some lowland areas, including the swampy land and floodplains of the Awash and Wabe Shebele valleys and along the Ethiopian–Sudan border.

37.1.2 Mode of transmission of schistosomiasis

Let us now focus on the mode of transmission of schistosomiasis. The major reservoirs of *Schistosoma* parasites are infected humans (the primary hosts) and freshwater snails (the intermediate hosts).

- What do you understand about the term *reservoir* in the context of communicable diseases? (Think back to Study Session 1 of this Module.)

- A **reservoir** is any location where infectious agents live *before* they infect new human hosts, and which is important for the survival of the disease-causing organism. Reservoirs can be living (e.g. infected humans or other animals, such as dogs, cows, insects or snails), or non-living things in the environment (e.g. water, food).

Figure 37.3 shows how *Schistosoma* parasites are transmitted from infected people to new human hosts, via the intermediate hosts – freshwater snails. Figure 37.4 shows the lifecycle of the parasites in more detail, highlighting the immature forms that can be found in the water.

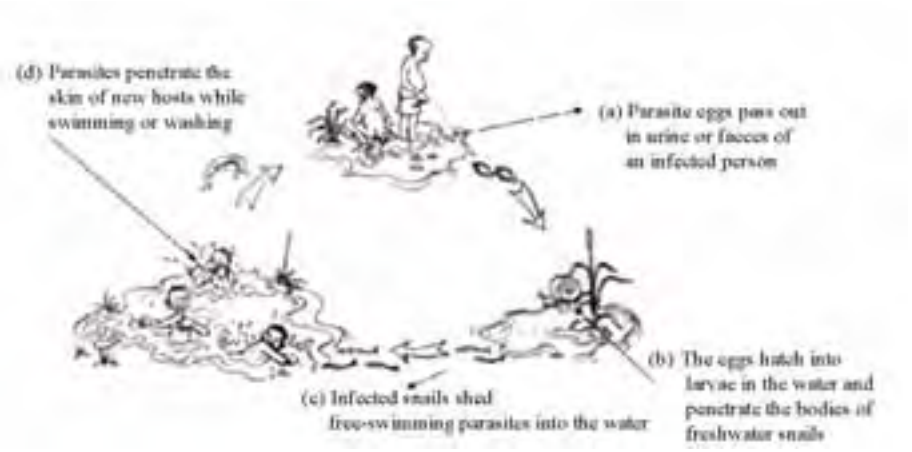

Figure 37.3 How schistosomiasis is transmitted from infected humans to new human hosts, via freshwater snails. (Source: Adapted from http://www.who.int/schistosomiasis/epidemiology/en/)

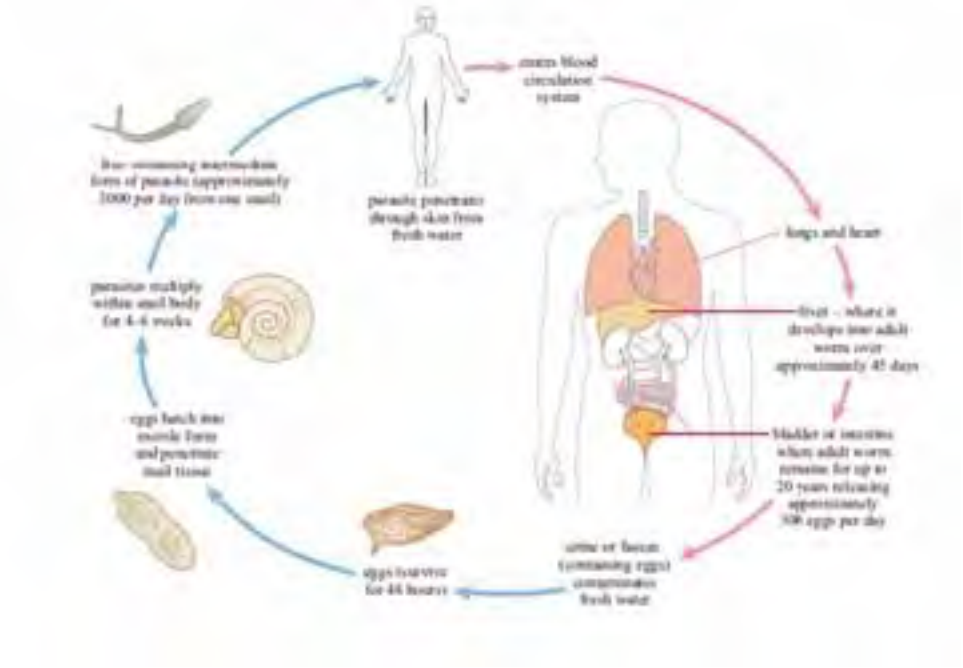

Figure 37.4 Lifecycle of *Schistosoma* parasites as they pass through human hosts and freshwater snails. (Source: The Open University, *Environment: Journeys Through a Changing World,* U116, Block 3, Figure 1.13)

The immature form of the parasite penetrates the skin of a new host when he or she is swimming, washing or standing in infected water. They pass to the liver, where they mature into adult worms. Male and female adult worms mate (look back at Figure 37.1) and deposit their eggs in the blood vessels of either the intestine (*Schistosoma mansoni*) or bladder (*Schistosoma haematobium*). The eggs pass out into the water in either the faeces or urine, to continue the infection cycle.

37.1.3 Clinical manifestations and diagnosis of schistosomiasis

The infected person's immune system reacts against the parasites' eggs in their blood vessels, which are recognised as 'foreign bodies'. The immune reaction causes an acute inflammation around the eggs, which can lead to chronic symptoms (see Box 37.1). Note that the clinical manifestations of schistosomiasis are mainly related to the immune response against the eggs in the intestine or bladder – the symptoms are not due to the worms themselves. The adults can survive in the person's body for up to 20 years, releasing around 300 eggs every day.

Box 37.1 Clinical manifestations of schistosomiasis

- Dermatitis (itching) where a parasite has penetrated the person's skin. This so-called 'swimmer's itch' occurs most often with *Schistosoma mansoni*, manifesting two or three days after invasion as an itchy rash on the affected areas of the skin.
- The main symptoms of *Schistosoma mansoni* infection of the intestines are abdominal pain and bloody diarrhoea. A blood test usually reveals signs of anaemia and the abdomen may be swollen due to enlargement of the liver. If the infection remains untreated it can lead to permanent liver damage in advanced cases.
- The main symptoms of *Schistosoma haematobium* infection of the bladder are pain during urination, frequent need to urinate, and blood in the urine. If the infection remains untreated it can lead to chronic bladder diseases, including cancer, and permanent kidney damage. It may also lead to infertility in men, and pain during sexual intercourse and vaginal bleeding in women.

The clinical manifestations (described above) should lead you to suspect cases of schistosomiasis. Asking children if they have seen any blood in their urine is an important way of detecting whether *Schistosoma haematobium* is common in the area. The diagnosis of schistosomiasis is confirmed in a laboratory by direct observation of the parasite eggs in samples of faeces or urine examined under the microscope (Figure 37.5).

Figure 37.5 An egg from a *Schistosoma* parasite, magnified and viewed under a microscope, confirms the diagnosis of schistosomiasis. (Photo: CDC Image Library, image number 4841)

37.1.4 Prevention and control of schistosomiasis

Several prevention and control strategies should be integrated to reduce the burden of schistosomiasis. You have an important role as a Health Extension Practitioner to teach community members in affected areas how to apply the major prevention and control measures, which can be described in five general categories:

You will meet these prevention and control categories again when we discuss the other vector-borne diseases later in this study session.

- **Integrated vector control (IVC) measures**, aimed at reducing the number of vectors; in areas affected by schistosomiasis, these measures involve using the chemical 'Endod' to kill the snails, and environmental management to destroy snail habitats by improving irrigation and farming practices; this could involve removing vegetation and draining and filling swampy areas or shallow pools wherever possible.
- **Parasite control measures**, aimed at reducing the number of parasites, e.g. treating water for washing with chlorine or iodine to kill the eggs and immature *Schistosoma* organisms.
- **Personal protection** against exposure to the parasites, e.g. farmers, fishermen and others who have to stand in infected water should wear rubber boots to protect their skin from penetration by the swimming forms of the *Schistosoma* parasites.
- **Rapid case detection and referral** to the nearest health centre for effective treatment; the drug used to treat schistosomiasis is called praziquantel, which is administered orally at a dosage of 40–60 mg per kg of body weight, given in two or three doses over a single day. You are not expected to prescribe praziquantel, which must be given at the health centre.
- **Education in the community** about the causes and modes of transmission of schistosomiasis.

■ What actions would you educate community members to take to protect themselves and their children from schistosomiasis?

□ In particular, you should encourage people to build and use latrines and avoid urinating or defaecating in water, in order to reduce contamination by *Schistosoma* eggs. Also they should wear protective clothing when standing in infected water, and seek early diagnosis and treatment for any suspected cases.

37.2 Leishmaniasis

Leishmaniasis is pronounced 'lye-sh-man-eye-assis'. Visceral is pronounced 'viss-urr-al' and cutaneous is pronounced 'kute-ay-nee-ous'.

Leishmaniasis is a chronic parasitic disease, which exists in two forms: *visceral leishmaniasis* (also known as kala-azar), which affects the internal organs such as the liver and spleen, and *cutaneous leishmaniasis*, which affects the skin. The infectious agents are protozoa (single-celled organisms, Figure 37.6). There are four major species of *Leishmania* protozoa in Ethiopia:

- *Leishmania donovani*, which causes visceral leishmaniasis
- *Leishmania aethiopica, Leishmania major* and *Leishmania tropica*, all of which cause cutaneous leishmaniasis.

Figure 37.6 *Leishmania* protozoa, stained blue and magnified by viewing under a microscope. (Photo: CDC Image Library, image 11068)

Around 12 million people in 88 countries around the world are currently thought to be infected with *Leishmania* parasites and the WHO estimates that one to two million new cases occur each year. The vectors (and intermediate hosts) for these parasites are sandflies. The lifecycle will be described later in this section.

37.2.1 Where is leishmaniasis common in Ethiopia?

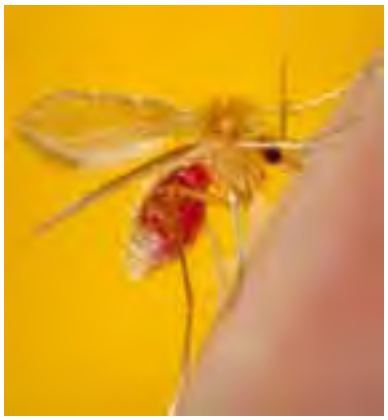

Figure 37.7 A female phlebotomine sandfly taking a blood meal from a person's arm. Note the human blood in its transparent abdomen. (Photo: CDC Image Library, image 10276/James Gathany)

During your work in the community, you should know the common places where leishmaniasis is present. Visceral leishmaniasis affecting the internal abdominal organs such as the liver and spleen is widely distributed in the lowlands of Ethiopia. Important endemic locations include Konso *woredas* (Lake Abaya and Segen Valleys), the Lower Omo plains, the Metama and Humera plains and Adiss Zemen. Cutaneous leishmaniasis occurs in Meta-Abo, Sebeta, Kutaber in Wello, and in some places in South West Ethiopia such as Jimma Zone.

37.2.2 Mode of transmission of leishmaniasis

Leishmaniasis is transmitted through the bite of female phlebotomine sandflies (Figure 37.7), which bite humans and some animals, and take blood meals to feed the development of their eggs. Phlebotomine means 'blood-sucking' and is pronounced 'fleb-otto-meen'. There are about 30 species of sandflies that can transmit *Leishmania* parasites to humans found throughout the tropical and temperate regions of the world. The females lay their eggs in many locations, including the burrows of rodents, old tree bark, cracks in buildings and rubbish heaps – anywhere that is warm and humid enough for their eggs to develop into flies.

When sandflies take blood meals from an infected person, they also become infected with the protozoa that cause leishmaniasis. The protozoa develop inside the sandfly and are passed on when the sandfly takes a blood meal from a healthy person. The *Leishmania* protozoa multiply inside the white blood cells of the healthy person and cause disease (Figure 37.8).

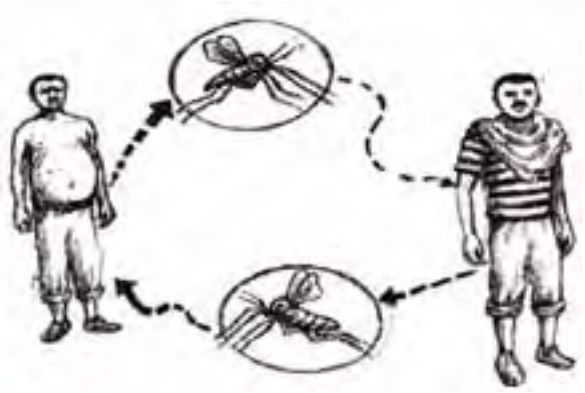

Figure 37.8 Transmission of *Leishmania* parasites from a sick person to a healthy person by a sandfly. The enlarged abdomen of the sick person on the left indicates visceral leishmaniasis affecting the internal organs.

37.2.3 Clinical manifestation and diagnosis of leishmaniasis

The clinical presentation of the two forms of leishmaniasis are very different. **Cutaneous leishmaniasis** normally produces skin ulcers on the exposed parts of the body such as the face, arms and legs (Figure 37.9). The disease can produce a large number of ulcers – sometimes up to 200 – which may result in physical disability (e.g. in using the hands). The visible ulcers are a source of social stigma, which can leave the patient suffering mental distress and rejection in their community.

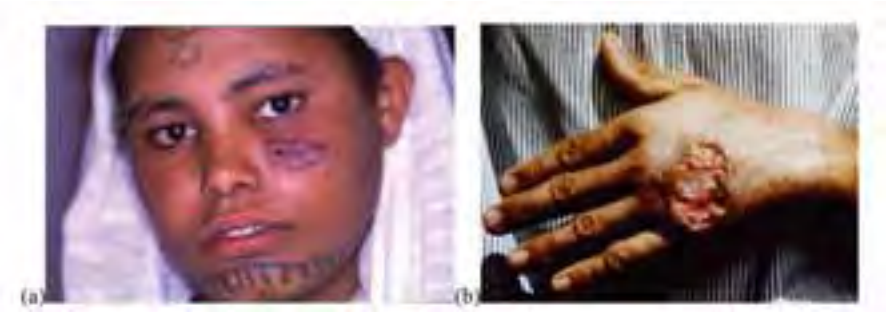

Figure 37.9 Ulceration due to cutaneous leishmaniasis (a) on the face, (b) on the hand. (Photos: (a) WHO TDR Image Library, image 03061531/Crump; (b) CDC Image Library, image 352)

Visceral leishmaniasis (also known as *kala azar*, which means black fever in Hindu) is a life-threatening disease characterised by irregular episodes of fever, rapid and extensive weight loss, huge swelling of the spleen and liver (Figure 37.10 on the next page), and anaemia. If left untreated, up to 100% of patients die within two years of infection. For this reason, visceral leishmaniasis is said to have a high **case-fatality rate**.

If you suspect a case of visceral leismaniasis, the patient should be immediately referred to a higher health facility.

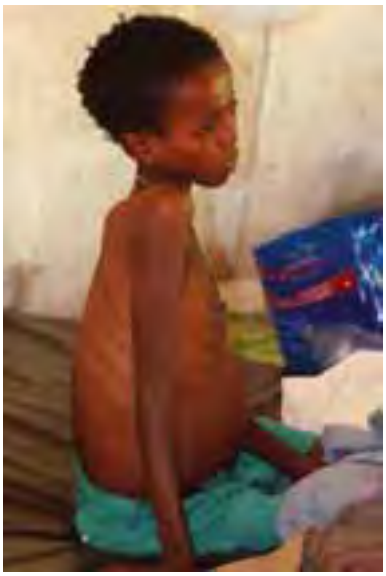

Figure 37.10 A child with severe weight loss and an enlarged abdomen with a huge liver and spleen due to visceral leishmanisis. (Photo: WHO at http://www.who.int/leishmaniasis/visceral_leishmaniasis/en/index.html)

You can identify patients with leishmaniasis by the clinical manifestations of the disease. For confirmation of the diagnosis, laboratory investigations should be done in health centres or hospitals, where the protozoan parasites can be detected in blood smears viewed with a microscope (look back at Figure 37.6).

37.2.4 Prevention and control of leishmaniasis

Several prevention and control measures are available for leishmaniasis. The general principles will already be familiar to you from the earlier discussion of schistosomiasis.

- **Integrated vector control (IVC) measures**, aimed at reducing the numbers of sandflies by indoor residual spraying of the inside and outside walls of houses, doorways, animal houses, and possible breeding sites of the sandflies (Figure 37.11); use of insecticide treated bed nets (ITNs) for sleeping under at night; and environmental management to reduce the breeding sites of sandflies.
- **Rapid case detection and referral** to the nearest health centre or hospital prevents the transmission of the parasite to others. Cases of leishmaniasis will be treated using intravenous or intramuscular drugs such as pentostam or amphotericin B. You cannot prescribe these drugs, which must be given under medical supervision.
- **Investigate and control epidemics in epidemic-prone areas**: early identification and management of epidemics of leishmaniasis helps to control the disease from spreading to the wider population.
- **Education in the community** about the causes and modes of transmission of leishmaniasis.

Figure 37.11 Spraying breeding sites of sandflies with insecticides.

- What actions would you educate community members to take to protect themselves and their children from leishmaniasis?

□ You would encourage them to use ITNs at night and not to sleep unprotected out of doors, so as to avoid sandfly bites; they should welcome spraying teams to treat their houses with insecticide, and eliminate rubbish heaps and other locations where sandflies like to lay their eggs. They should seek early diagnosis and treatment of any suspected cases.

37.3 Onchocerciasis

Onchocerciasis is a parasitic vector-borne disease caused by a worm that affects the skin, lymph nodes and the eyes of infected people. It is also called *river blindness*. The WHO estimates that worldwide there are about 500,000 people who are blind due to onchocerciasis. The disease is caused by a tiny worm called *Onchocerca volvulus* (Figure 37.12), which is transmitted from person to person in the bite of blackflies.

Onchocerciasis is pronounced 'onk-oh-serk-eye-assis'.

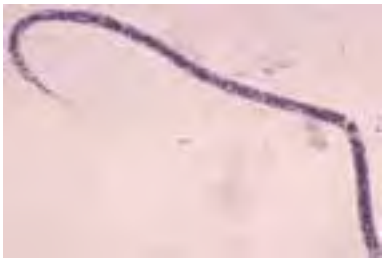

Figure 37.12 An *Onchocerca volvulus* worm, stained blue and magnified by viewing with a microscope. (Photo: CDC Image Library, image 1147)

37.3.1 Where is onchocerciasis common in Ethiopia?

Onchocerciasis is found in the western part of Ethiopia, where there are many rapidly flowing rivers and streams, with vegetation along the banks that provide good habitats for the blackflies that transmit the parasite. The most affected areas include Keffa, Illubabor, Gambella and Wollega. Cases of onchocerciasis have been also reported from Pawe, Humera and Metema.

37.3.2 Mode of transmission of onchocerciasis

The parasites that cause onchocerciasis are transmitted from human to human through the bites of blackflies, which belong to *Simulum* species (Figure 37.13). Blackflies breed in fast-flowing rivers and streams, with good vegetation nearby. Unlike mosquitoes and sandflies, they bite during the day when people are active in the area.

Figure 37.13 A blackfly feeding on the skin of a human host. (Photo: WHO at www.who.int/onchocerciasis)

- What type of water does the blackfly need to breed? How does this differ from the water required by the mosquito vectors of malaria?

□ Blackflies need fast-running water to breed, unlike *Anopheles* mosquitoes, which breed in shallow stagnant water collections.

The adult worms mate in the infected person, and the eggs hatch into microscopic worms called microfilaria, which burrow through the body tissues. The person's immune system attacks the microfilaria, causing inflammation and damage in the surrounding tissues. Sight defects and eventually blindness develops when the microfilaria are embedded in the

person's eye. When a female blackfly bites an infected person during a blood meal, the microfilaria are transferred from the person to the fly (Figure 37.14a). Over the course of one to three weeks, the microfilaria develop inside the blackfly to form infective larvae (Figure 37.14b). These are then passed on to other people when the blackfly takes another blood meal (Figure 37.14c). The microfilaria migrate to the skin, lymph nodes and eyes of the infected person, causing inflammation and tissue damage.

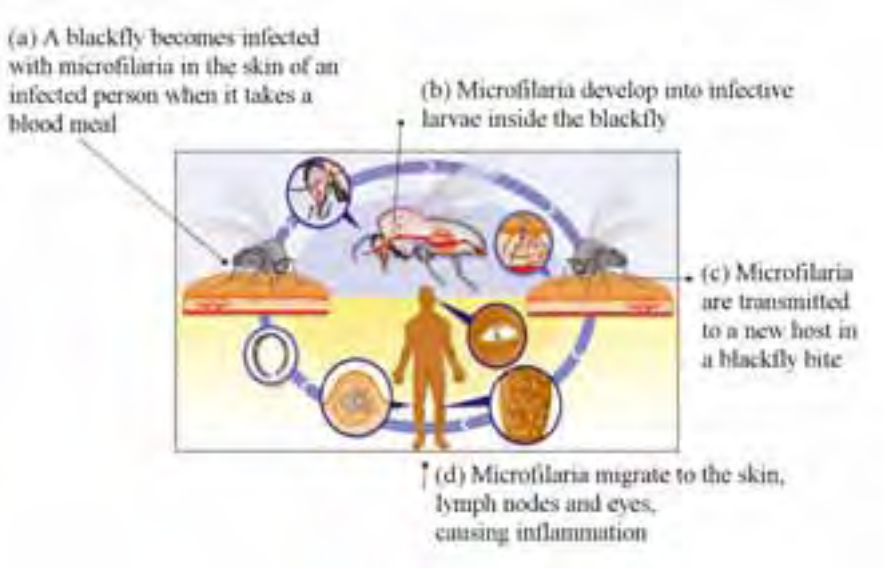

Figure 37.14 Transmission of *Onchocerca volvulus* from person to person by blackflies. (Source: www.who.int/onchocerciasis)

In the human host, the larvae migrate into the skin, and nodules (swellings) form around them. They slowly mature into adult worms, which can live for 15 years in the human body. After mating, the female worm releases around 1,000 microfilaria a day into the surrounding tissue. Microfilaria live for one to two years, moving around the body. When they die, they cause an inflammatory response which leads to the clinical manifestations and complications such as blindness.

37.3.3 Clinical manifestations and diagnosis of onchocerciasis

The clinical manifestations of onchocerciasis are the result of inflammation against the dead microfilaria. The most common clinical manifestations include skin rashes, lesions, intense itching, loss of the colour of the skin, and nodule formation (Figure 37.15a). Microfilaria also migrate to the eye, and causes scarring of the cornea (the covering of the eyeball), which leads to sight defects and ultimately blindness (Figure 37.15b).

The itching and disfiguring nodules and blindness are sources of great distress to patients, who may be stigmatised and rejected by their communities.

Figure 37.15(a) Nodules on the legs and loss of pigmentation in the skin of a man with cutaneous onchocerciasis. (b) Blindness due to onchocerciasis. (Photos: (a) WHO at www.who.int/onchocerciasis; (b) WHO/TDR image 9703913/ Crump)

Diagnosis of onchocerciasis is made by clinical examination. If you suspect that a patient may be infected, you should make a referral for laboratory confirmation and treatment. Microscopic investigation of a skin snip (taking samples from the skin) can identify the microfilaria and confirm the diagnosis.

37.3.4 Prevention and control of onchocerciasis

The WHO believes that onchocerciasis can be eliminated through the application of effective prevention and control methods, which are summarised below:

- **Integrated vector control measures** to reduce the population of blackflies, through application of insecticides in vegetation where vectors breed, and environmental management to reduce vegetation around fast-flowing rivers where people live.
- **Personal protective clothing** to avoid the bite of blackflies by covering exposed skin with clothing and wearing headgear in endemic areas.
- **Community-directed mass drug administration (MDA) with ivermectin**, i.e. mass drug treatment of everyone in communities where the diseases is endemic with the drug ivermectin, which kills the microfilaria, every 6 to 12 months (Figure 37.16). This is the most successful intervention at community level. Community members fully participate in the programme and the drugs are delivered by trained village drug distributors, supervised by Health Extension Workers and Practitioners like you. Community-directed MDA is being implemented in endemic areas of Ethiopia such as Pawe, Jimma, Illubabor and Keffa.

Figure 37.16 Mass drug administration with ivermectin successfully prevents onchocerciasis in affected communities. (Photo: WHO TDR Image Library, image 9703979/Crump)

- **Rapid case detection and referral**, particularly for complicated cases involving sight loss
- **Education in the community** about the causes, mode of transmission and prevention measures against onchocerciasis (Figure 37.17). Encouraging acceptance of the mass drug administration programme is an important health education message that you can deliver in affected communities.

Figure 37.17 Women at a health education session on how to protect themselves and their children from onchocerciasis. (Photo: WHO/Crump/image 97031009)

37.4 Lymphatic filariasis

In this final section, you will learn about the definition, mode of transmission, clinical manifestations, and methods of prevention and control of **lymphatic filariasis**. It is also known as *elephantiasis* because of its effects on the legs of infected people. Lymphatic filariasis is a parasitic disease caused by a worm that invades the **lymphatic system** – the network of vessels that exists throughout the body, connecting the lymph nodes, spleen and other organs, and where white blood cells are primarily found (Figure 37.18).

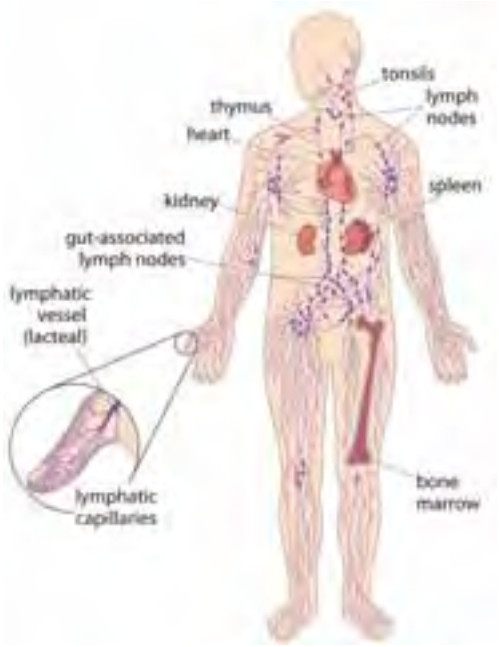

Figure 37.18 The human lymphatic system. (Diagram: The Open University, *SXR376 Preparatory Reading,* Figure 1.2)

The WHO estimates that over 120 million people worldwide are currently infected with the worm (species name *Wuchereria bancrofti*, Figure 37.19) which is responsible for 90% of all cases.

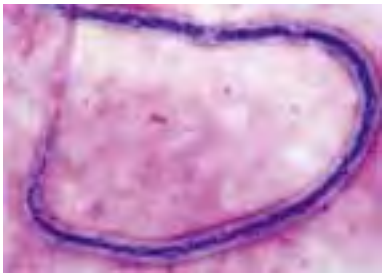

Figure 37.19 A *Wuchereria bancrofti* worm, stained blue and magnified by a microscope. (Photo: CDC Image Library, image 3009)

37.4.1 Where is lymphatic filariasis common in Ethiopia?

Like onchocerciasis, lymphatic filariasis is common in western Ethiopia, such as Illubabor, Keffa, Jimma, Wollega, Gambella and Pawe. Though the disease is not fatal, it is responsible for considerable disability and distress, causing social stigma among men, women and children. You will learn more about the social consequences of lymphatic filariasis and a non-infectious cause of swelling in the legs (podoconiosis) in Study Session 39.

37.4.2 Mode of transmission of lymphatic filariasis

The parasites that cause lymphatic filariasis are transmitted from human to human through the bites of *Culex* and *Anopheles* mosquitoes. The female mosquitoes take the microscopic forms of the parasitic worm (microfilaria) from an infected person during a blood meal (Figure 37.20a). The microfilaria develop into larvae, and when the mosquito feeds on another person, the larvae enter the skin punctured by the mosquito bite (Figure 37.20b). The larvae travel via the lymphatic vessels, where they develop into adult worms all over the body (Figure 37.20c). After mating, the females lay millions of eggs which develop into microfilaria, completing the lifecycle.

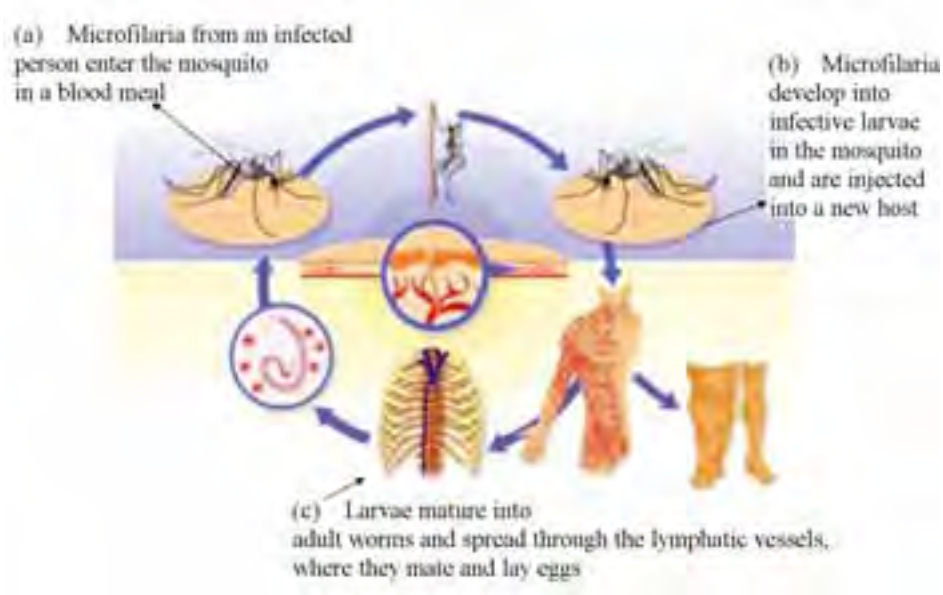

Figure 37.20 Life cycle of lymphatic filariasis. (Source: WHO at http://www.who.int/lymphatic_filariasis/en/)

37.4.3 Clinical manifestations of lymphatic filariasis

The clinical manifestations of the disease are as a result of the inflammation and damage to the lymphatic vessels caused by the person's own immune response trying to reject the worms, and when vessels become blocked by clusters of worms. The overall effect is to disrupt the lymphatic system, which normally collects tissue fluids draining from the body's cells and returns the fluid to the blood stream. If the lymphatic drainage is blocked, the lower limbs and sometimes also the genitals become hugely swollen with fluid – a condition called *lymphoedema* (pronounced 'limf-ee-deem-ah'). Most infections do not produce symptoms, but in people where the lymphatic drainage is badly damaged the common symptoms include *hydrocele* (swelling of the scrotum, pronounced 'hy-droh-seel'), swelling of the legs and feet, and thickening of the skin into folds (Figure 37.21). Infection of the swollen skin folds by bacteria is a frequent cause of very painful attacks. Patients suffer from episodes of fever and around 40% develop kidney damage.

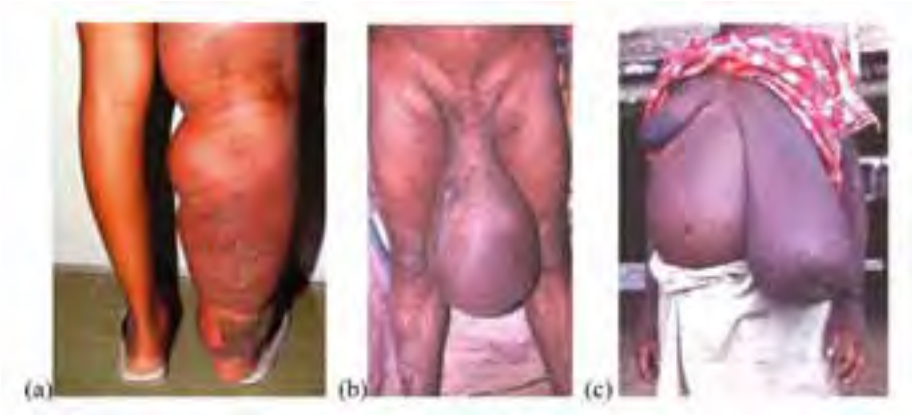

Figure 37.21 Lymphatic filariasis causing swelling and tissue damage in (a) a leg; (b) the scrotum; (c) a breast. (Photos: WHO TDR Image Library, images (a) 94022625, (b) 9502756, (c) 9502760/Andy Crump)

Suspected cases of lymphatic filariasis should be referred to the health centre.

37.4.4 Diagnosis of lymphatic filariasis

You can suspect lymphatic filariasis from the clinical manifestations, but the diagnosis can only be confirmed by laboratory tests to reveal the microfilaria in blood smears viewed with a microscope. Adult worms blocking the lymphatic vessels or nodes are difficult to reach. Therefore, if you live in an endemic area and you suspect a case of lymphatic filariasis, you should refer the patient to the nearest health centre for further testing and treatment.

37.4.5 Prevention and control of lymphatic filariasis

Lymphatic filariasis is one of the few communicable diseases that the WHO believes could be **eradicated** (totally removed from all populations in the world, never to return) with the currently available prevention and control measures. These are:

- **Integrated vector control (IVC) measures** to reduce the mosquito population, including indoor residual spraying, use of insecticide treated bed nets (ITNs), and environmental management such as drainage and filling of breeding sites for the mosquitoes.

- **Community-directed mass drug administration** (**MDA**). The WHO recommends a two-drug regimen of albendazole and diethylcarbamazine (or ivermectin in areas where onchocerciasis is also endemic), which is administered to the entire at-risk population once every year for four to six years. These drugs are prescribed by staff at health centres.
- **Personal protective clothing** to reduce exposure of skin to mosquito bites, and use of ITNs.
- **Rapid case detection and referral** to prevent cases from spreading.
- **Education in the community** about the causes and modes of transmission of lymphatic filariasis, and ways to protect themselves from mosquito bites. Encouraging acceptance of the mass drug administration programme is an important health education message that you can deliver if your community is affected. You also have a key role in educating patients about how to prevent and alleviate disabilities and pain due to lymphatic filariasis, as described in the final part of this study session.

37.4.6 Prevention and alleviation of disability due to lymphatic filariasis

Patients with lymphoedema and thickened skin folds (for example, as in Figure 37.21) can be empowered to manage their symptoms and reduce their discomfort and pain through simple, but rigorous, hygiene techniques. You should educate them to wash the affected parts carefully every day, especially between the folds of thickened skin, and gently dry the area with a clean cloth. They should elevate (raise) swollen legs as much as possible whatever they are doing during the day and raise the foot of the bed or sleeping mat at night (Figure 37.22). Advise the patient to exercise the limbs any time and anywhere, as often as possible, to help the fluid to exit from their swollen limbs.

The methods described here are also used to reduce the swelling due to podoconiosis (non-infectious elephantiasis, Study Session 39).

Figure 37.22 Washing the affected limbs and elevating them while working or sleeping helps to alleviate the pain and swelling due to lymphatic filariasis. (Diagrams: WHO, 2003, *Community Home-Based Prevention of Disability due to Lymphatic Filariasis*)

In the next study session, you will learn about two more diseases of public health importance in Ethiopia – rabies and taeniasis (tapeworm disease) – which are spread to humans by warm-blooded animals (dogs and cattle).

Summary of Study Session 37

In Study Session 37, you have learned that:

1 Schistosomiasis is caused by parasitic flatworms transmitted from freshwater snails to humans. It is common in communities living near rivers, lakes and streams, where infected people shed *Schistosoma* eggs when they urinate or defaecate into the water.

2 *Schistosoma mansoni* affects blood vessels in the intestines and causes abdominal pain, bloody diarrhoea and anaemia. *Schistosoma haematobium* affects blood vessels in the bladder and causes pain during urination and bloody urine.

3 Leishmaniasis is caused by protozoan parasites transmitted to humans through the bite of sandflies, which breed in warm humid, places such as rubbish collections and rodent burrows.

4 *Leishmania donovani* causes the life-threatening condition called visceral leishmaniasis (or *kala azar*), manifested by fever, weight loss and swelling of the liver and spleen. Three other *Leishmania* species cause cutaneous leishmaniasis, which manifests as ulcers in exposed areas of skin.

5 Onchocerciasis is caused by a nematode worm (*Onchocerca volvulus*) transmitted in the bite of blackflies, which breed near fast-flowing rivers with good vegetation. The microscopic microfilaria cause skin nodules and can migrate to the eye, causing blindness.

6 Lymphatic filariasis (or elephantiasis) is caused by a nematode worm (*Wuchereria bancrofti*) transmitted to humans in the bite of female mosquitoes. The worms block the lymphatic system, causing swelling of the limbs and sometimes the genitals, resulting in severe pain, disability and bacterial infection of thickened skin folds.

7 Integrated vector control measures such as indoor residual spraying, use of insecticide treated bed nets (ITNs), chemical treatment of water, use of personal protective clothing and environmental management to destroy vector breeding sites are key interventions to prevent these vector-borne diseases.

8 Mass drug administration of the entire at-risk population at regular intervals for several years is the recommended strategy to prevent onchocerciasis and lymphatic filariasis in endemic communities.

9 Educating the community on the modes of transmission of vector-borne diseases, effective prevention strategies, and early diagnosis and referral of patients are important activities for Health Extension Practitioners and Workers in affected areas.

Self-Assessment Questions (SAQs) for Study Session 37

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 37.1 (tests Learning Outcomes 37.1, 37.2 and 37.5)

How many communicable diseases can you name that can be prevented by integrated vector control methods? (Think about all the vector-borne diseases you have learned about in this Module – not just in this study session!)

SAQ 37.2 (tests Learning Outcomes 37.1 and 37.2)

Complete Table 37.1 by writing the common name of the vector in the second column beside the disease that it transmits.

Table 37.1 Four common vector-borne diseases and their vectors.

Vector-borne disease	Vector
Schistosomiasis	
Leishmaniasis	
Onchocerciasis	
Lymphatic filariasis	

SAQ 37.3 (tests Learning Outcomes 37.1, 37.2, 37.3, 37.4 and 37.5)

Imagine that you have been assigned to Humera and you see a 25-year-old man who has signs of severe weight loss, fever and a hugely enlarged abdomen.

(a) What is your diagnosis?
(b) What should you do for this patient?
(c) What should you educate his family about the mode of transmission and how to protect themselves from this disease?

SAQ 37.4 (tests Learning Outcomes 37.1, 37.3 and 37.4)

(a) How could you tell the difference between the skin lesions of onchocerciasis and cutaneous leishmaniasis?
(b) In addition to the physical consequences of the skin lesions, what impact can both these diseases have on the lives of affected people?

SAQ 37.5 (tests Learning Outcomes 37.1, 37.3 and 37.5)

(a) Which regions of Ethiopia are most affected by schistosomiasis?
(b) Why are children in affected communities particularly at risk of schistosomiasis, and what impact does the disease have on their lives, in addition to the pain and discomfort it causes?

Study Session 38 Common Zoonotic Diseases in Ethiopia: Rabies and Taeniasis

Introduction

In the last two study sessions in this Module, you learned about vector-borne diseases in which the infectious agent is transmitted to new human hosts by body lice, flying insects or snails. In this study session, we turn to two communicable diseases found in Ethiopia in which a non-human warm-blooded animal transmits the infectious agent to humans. These diseases are rabies transmitted to humans by dogs, and taeniasis (or tapeworm disease) transmitted by cows. Diseases in which a warm-blooded animal transmits the infectious agents to humans are known as **zoonotic diseases** (or zoonoses).

Taeniasis is pronounced 'teen-eye-assis'. Zoonotic is pronounced 'zoo-nott-ik'.

Zoonotic diseases are difficult to control because the non-human animal acts as a reservoir of infection that can be passed on to humans. Dogs and cows are domestic species, living in large numbers in human settlements (Figure 38.1), where it is very easy for the infection to be transmitted to people. In this study session, you will learn about the causes, modes of transmission, clinical manifestations, and the prevention and control measures against these two zoonotic diseases – rabies and taeniasis.

Figure 38.1 Cows are a reservoir of infection by intestinal tapeworms, which can be passed on to humans. (Photo: Basiro Davey)

Learning Outcomes for Study Session 38

When you have studied this session, you should be able to:

38.1 Define and use correctly all of the key words printed in **bold**. (SAQs 38.1, 38.2 and 38.3)

38.2 Describe the mode of transmission of rabies and taeniasis to humans by their animal hosts. (SAQs 38.1, 38.2 and 38.3)

38.3 Describe the symptoms and diagnosis of rabies and taeniasis and state how you would treat or refer cases to a higher level health facility. (SAQs 38.1, 38.2 and 38.3)

38.4 Describe how you would apply prevention and control measures against rabies and taeniasis. (SAQs 38.2 and 38.3)

38.1 Rabies

Rabies is a severe life-threatening viral disease, transmitted to humans in saliva in the bite of infected animals, particularly those in the dog family (canines). Foxes, wolves, hyenas, bats, raccoons and skunks are also a reservoir of rabies virus, but in most countries they rarely transmit the disease. Bats are the main cause of rabies transmission in the USA and Canada.

Figure 38.2 A bite from a dog infected with rabies virus is the source of 99% of human deaths from rabies. (Photo: CDC Image Library, image 8319)

The infectious agent of rabies is a virus in the *rhabdovirus* family, which attacks the nervous system. If an infected person is not treated very quickly, death is almost inevitable (i.e. rabies has a very high **case-fatality rate**). The WHO estimates that around 55,000 people die from rabies every year, and 24,000 of them are in Africa; 99% of these deaths are the result of a bite from a dog (Figure 38.2).

38.1.1 The transmission of rabies in Ethiopia

Rabies is one of the most severe communicable diseases in Ethiopia, with many cases of the disease diagnosed in many parts of the country. For example, a study in Addis Ababa showed that about 73% of street dogs are infected with rabies virus and more than 2,000 people annually received treatment for rabies after a dog bite. Children are particularly vulnerable to being bitten by dogs, and about 40% of all cases are children under 15 years.

The rabies virus exists in the saliva of the infected animal (as well as in its nervous system) and is transmitted to a person through a bite. Transmission can also be if an infected animal licks a fresh break in the person's skin or mucus membranes, e.g. in the mouth (see Table 38.1 later, for different exposure categories). The virus travels in the nerves to the brain, where it causes inflammation. Person-to-person transmission is theoretically possible if someone with advanced rabies bites another human, but this is not known to have occurred.

38.1.2 Clinical manifestations and diagnosis of rabies

Figure 38.3 A rabid dog biting a man; the rabies virus from the dog's saliva travels along the nerves to the person's brain.

From the site of the bite, the virus goes to the central nervous system (Figure 38.3) and causes the clinical manifestations which, if untreated, eventually lead to death. Rabies has the highest case-fatality rate of any communicable disease. After an incubation period usually lasting one to three months, but sometimes even up to one year after the bite, the patient develops symptoms that are similar to many other illnesses – fever, headache and general weakness. The speed of progression is faster if the original site of infection was in an area of the body that is close to the spinal cord or brain, e.g. a bite on the face or hands. As the disease gets worse, the patient experiences anxiety, confusion, difficulty sleeping, hallucination (seeing things that aren't there), spreading paralysis (inability to move the muscles), difficulty swallowing and convulsions (uncontrollable shaking). A characteristic sign of late-stage rabies in some patients is hydrophobia (fear of water), which manifests in the patient reacting in terror if a bowl of water is brought near. This form of the disease (known as 'furious' rabies) prevents the patient from drinking and speeds the arrival of death within a few days. Other patients become increasingly paralysed and lose consciousness before death.

Diagnosis is made on the basis of these clinical signs. There are no tests to confirm rabies with absolute certainty while the patient is still alive. Viruses can be detected by laboratory investigation of the patient's brain after death, but this test is not usually carried out in countries with few resources.

38.1.3 First aid and post-exposure prophylaxis for rabies

Wound care and anti-rabies treatment after a dog bite can reduce the occurrence of rabies in a bitten person by up to 90%. This is what you should do if someone is bitten by a dog in your *kebele*.

First aid

Immediately after a dog bite, you should thoroughly clean and flush the wound with soap and water, detergent, or a substance that kills viruses such as 70% alcohol, tincture of aqueous solution of iodine, or povidone iodine. Continue flushing the wound for at least 15 minutes. The wound should not be sutured (stitched) unless this is essential to stop heavy bleeding. If stitches are required, the wound should not be sutured until after post-exposure prophylaxis has occurred.

Post-exposure prophylaxis for rabies

If a person is bitten by a dog in countries where rabies is endemic, there is no way of being certain that the animal is free from rabies. The bitten person should be given post-exposure prophylaxis (details of the regimen are described below) as soon as possible after the bite. Every year, around 15 million people receive this treatment worldwide, preventing an estimated 327,000 human deaths from rabies.

■ What do you understand by the term 'post-exposure prophylaxis' and where have you met this term in an earlier part of this Module?

□ **Post-exposure prophylaxis** (or PEP) means giving preventive therapy very soon after a *possible* exposure to a life-threatening infectious agent; it is given without waiting for a test to see if the exposure has actually transmitted the infection, because delay could mean that the infection spreads through the person's body. PEP is given after possible exposure to HIV, for example when a healthcare worker is splashed with blood or is pricked with a needle after injecting a patient with HIV/AIDS.

Post-exposure prophylaxis for HIV is described in Study Session 26 in Part 3 of this Module.

The WHO has published the guidelines in Table 38.1 for PEP following different levels of contact with a suspected rabid animal. Details of the vaccines and rabies immunoglobulin mentioned in the table will be described below.

Table 38.1 Guidelines for post-exposure prophylaxis against rabies based on the level of contact.

Contact category	Action
Category I: touching or feeding the animal, licks on intact skin (i.e. no exposure)	None
Category II: nibbling of uncovered skin, minor scratches or abrasions without bleeding	Immediate vaccination and local treatment of the wound
Category III: single or multiple bites or scratches that break the skin; contamination of mucus membranes with saliva from licks	Immediate vaccination and administration of rabies immunoglobulin; local treatment of the wound

After flushing the wound as directed, immediately refer people with Category II or Category III exposure to the nearest health facility for urgent post-exposure prophylaxis.

Rabies vaccines

Two types of vaccines exist to protect people from rabies after a Category II or III exposure. The older type is made from nerve tissue infected with rabies virus and is given intramuscularly (IM). The newer type of vaccine is made from virus-infected cells grown (cultured) in the laboratory and is safer and more effective. The WHO recommends that the rabies cell-culture vaccine (rabies CCV) should be used in preference to the nerve tissue vaccine wherever possible. Rabies CCV can be given either by intramuscular injection, or intradermally (ID) into the upper arm (Figure 38.4). The intradermal route has been shown to be as safe and effective as the traditional intramuscular route, and is cheaper because it requires less vaccine.

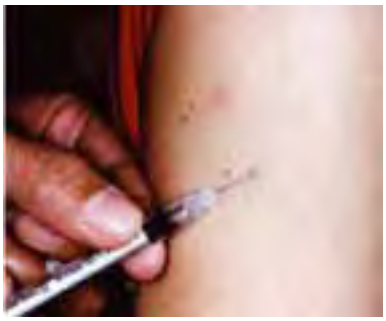

Figure 38.4 Intradermal injection of rabies cell-culture vaccine into the upper arm. (Photo: WHO, 1996, *Recommendations on Rabies Post-Exposure Treatment and the Correct Technique of Intradermal Immunization against Rabies*)

Modern cell-culture vaccines should be given in four or five doses: the dosage for each injection depends on the vaccine type and the route of administration (intramuscular dosages are 0.5 ml or 1.0 ml, whereas the intradermal dosage is only 0.1 ml). If you are referring someone to a health centre for rabies post-exposure prophylaxis, you should tell the patient and their family that it is *essential* to return at fixed intervals for repeat vaccinations in order to prevent rabies if they have been infected by the bite.

The intramuscular regimen is given at days 0, 3, 7, 14 and 28 after the exposure. The intradermal regimen is given at days 0, 3, 7, 28 and 90 after exposure. There is also a rabies vaccine which is administered at days 0, 7 and 28 days (IM), and rabies duck embryo vaccine, which is administered at day 0, 7 and 21 days (IM or ID). For both these vaccines, a booster dose is given after two to three years.

Rabies immunoglobulin

Specific protection in humans with Category III exposure (see Table 38.1) is provided by injecting a human or equine (horse) immunoglobulin at the site of the bite, as soon as possible after exposure to neutralise the virus. The term 'immunoglobulin' refers to a preparation of antibodies made either in humans or in horses who have been vaccinated against rabies. Antibodies from their blood which attack the rabies viruses are harvested and stabilised in an injectable liquid. As much as possible of the dose of rabies immunoglobulin is given into, or as near as possible to, the site of the bite. If there is any remaining in the syringe, it is injected at a different site to elicit active immunity. Human rabies immunoglobulin is given in a single dose of 20 international units (IU) per kilogram (kg) of the person's body weight. Horse rabies immunoglobulin is cheaper, but less effective and more likely to produce adverse allergic reactions; it is given in a single dose of 40 IU/kg.

38.1.4 Prevention of rabies

Since very few people survive after they develop symptoms of rabies, prevention is the best alternative. The main prevention measures against rabies are aimed at controlling the animals that transmit the virus, educating the community on how to protect themselves from dog bites, and what action to take if they are bitten. Your roles as a Health Extension Practitioner are to contribute to a comprehensive rabies control programme by carrying out the following activities:

- Educate the owners of dogs and the public on the importance of restricting the activity of their dogs.
- People should be educated that they must be careful handling or approaching strange-acting dogs and other canines. Warn parents that their children are particularly at risk.
- If a registration and immunization programme is available in your locality, register and immunize with anti-rabies vaccine any dog that owners want to keep.
- All unwanted dogs should be killed to reduce the population of animals living wild; maintain active searching for rabid dogs and take measures to ensure that they are killed.
- Detain and clinically observe for 10 days any healthy-appearing dog known to have bitten a person, if the owner wants to keep the animal. Unwanted dogs and dogs developing suspicious signs of rabies should be destroyed immediately.
- Give first aid for any dog bite and immediately refer the patient to the nearby health centre for post-exposure prophylaxis.

38.2 Taeniasis (tapeworm infestation)

In this section, you will learn about the definition, mode of transmission, clinical manifestations, and methods of prevention of taeniasis (tapeworm infestation). **Taeniasis** is a parasitic zoonotic disease caused by the adult stage of large tapeworms that live in the intestines of human hosts. The most common causative agent in Ethiopia is the beef tapeworm, *Taenia saginata*, which has the cow as its intermediate host. The other tapeworm that can cause taeniasis (*Taenia solium)* has pigs as its intermediate host, but they are not so common in Ethiopia. Taeniasis due to beef tapeworm is highly prevalent in Ethiopia due to the widespread habit of eating raw beef (*kitfo* in Amharic, Figure 38.5) and poor sanitary conditions. Defaecation in open fields in grazing lands, disposal of raw human sewage in rivers and its use as a fertiliser, facilitate the spread of taeniasis. The highest cases of taeniasis are found in the towns of Northern and Eastern Ethiopia.

Figure 38.5 The tradition of eating raw beef in Ethiopia exposes people to the risk of taeniasis through eating tapeworm eggs embedded in the meat. (Photo: Basiro Davey)

Other tapeworm diseases also exist in certain communities, e.g. people in fishing communities may be exposed to fish tapeworms (*Diphyllobothrium* species). Hydatid disease is also found in some parts of Ethiopia, caused by *Ecchinococcus* tapeworms transmitted mainly by dogs, which also infect people, cattle, sheep and horses. However, in this study session, we are focusing exclusively on the most prevalent form of tapeworm infestation in Ethiopia – taeniasis transmitted to humans by cows.

38.2.1 Mode of transmission of taeniasis

Adult beef tapeworms of the species *Taenia saginata* can grow very large – they can reach a length of five metres within a few months of infecting a person, but some have been recorded at up to 25 metres! The tapeworm attaches to the inside of the intestine by four strong suckers in its tiny head (Figure 38.6a). The long flat body of the tapeworm is formed from between 1,000 to 2,000 sections called *proglottids* (Figure 38.6b). The proglottids near the end of the tapeworm mature and become capable of surviving for a time after detaching from the main body of the worm. When a mature proglottid breaks away from the adult worm, it can contain up to 100,000 eggs. Approximately six mature proglottids are passed in the person's stool every day – shedding up to 600,000 eggs into the environment daily!

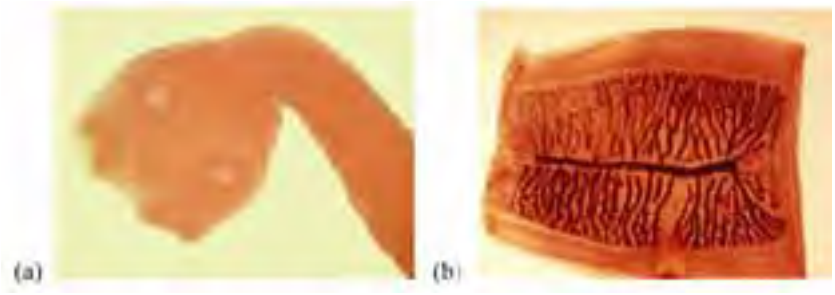

Figure 38.6 The beef tapeworm, *Taenia saginata* (a) The magnified scolex (head) of the tapeworm, showing the four suckers where it attaches to the wall of the intestine; it is only 1–2 mm in diameter. (b) A proglottid shed in the faeces. (Photos: CDC Parasite Image Library, at http://www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/Taeniasis_il.htm)

Proglottids of *Taenia saginata* passed in the faeces of an infected person onto grazing land, or used as fertiliser, are eaten by cows grazing on the same fields. The eggs hatch into larvae inside the cow's intestine, and burrow out through the intestinal wall into the muscles, where they become trapped inside a wall of tissue that forms around them. This stage of the tapeworm's lifecycle is called a *cysticercus*. Transmission to new human hosts occurs when the person eats raw or undercooked beef containing a cysticercus. The digestive enzymes in the person's stomach and intestines digest the wall around the tiny immature tapeworm in the cysticercus, releasing it into the intestine, where it attaches to the intestinal wall by the four suckers shown in Figure 38.6(a). The tapeworm matures in the person's intestine and begins to release proglottids, continuing the lifecycle.

Cysticercus (singular) is pronounced 'siss-tee-surr-cuss'. The plural is cysticerci ('siss-tee-surr-kye').

38.2.2 Clinical manifestations, diagnosis and treatment of taeniasis

Generally, people live with relatively few symptoms even with a large tapeworm inside them. They may experience discomfort around the anus when proglottids are discharged, and diagnosis is made on the basis of seeing the flat white proglottids wriggling in the stools. Mild abdominal pain or

discomfort, nausea, change in appetite, weakness, and weight loss can also occur with *Taenia saginata* infection.

Traditionally, people with tapeworm in Ethiopia self-treat with extracts of *kosso* – the Amharic name for a slender flowering tree (species name *Hagenia abissinica*, Figure 38.7), or *enkoko* – the scarlet fruits of the climbing shrub (*Embelia schimperi*), both of which have proven taenicidal properties. Medical treatment is to give a single dose of praziquantel (one 10 mg tablet for every kilogram of the patient's body weight), which is highly effective at killing tapeworms. You are not expected to prescribe praziquantel, which is given at a health centre.

Taenicidal refers to any treatment that kills tapeworms; it is pronounced 'teen-ih-side-ull'.

Figure 38.7 The flowers of *Hagenia abissinica* (or *kosso*) are a traditional treatment for tapeworms in Ethiopia. (Photo: Pam Furniss)

■ Which other communicable disease have you learned about in this Module, which is treated with praziquantel?

□ Schistosomiasis is also treated with praziquantel, but at a much higher dosage (40 to 60 mg/kg, given in two or three doses during a single day – see Study Session 37, Section 37.1.4).

38.2.3 Prevention and control of taeniasis

The most important role for you as a Health Extension Practitioner in the prevention of taeniasis in your community is to educate community members about the mode of transmission of tapeworms from humans to cows and back to humans.

■ What health education messages should you give to people in your community to help prevent taeniasis?

□ You should educate them to:

- avoid open defaecation in the fields, and instead they should use a latrine
- avoid fertilisation of grazing lands by untreated human faeces
- wash hands thoroughly with soap and water after defaecation
- cook meat thoroughly and do not eat raw beef.

You also have a role in food hygiene inspection and community sanitation. Refrigeration or salting for long periods, or freezing at –10°C for at least nine days, also kills cysticerci in beef. You should also oversee the proper disposal of human faeces in your *kebele*.

Your role in education and inspection to improve food hygiene, sanitation and waste disposal are covered in the Module on *Hygiene and Environmental Health*.

Summary of Study Session 38

In Study Session 38, you have learned that:

1 Rabies is the most fatal of all communicable diseases; it is almost never cured once the patient shows symptoms.

2 The virus that causes rabies is transmitted in the bite of infected canines; 99% of cases in Africa are due to dog bites.

3 Immediate first aid for the wound and urgent referral for post-exposure prophylaxis with rabies vaccine and rabies immunoglobulin reduces the transmission of rabies after a dog bite and saves thousands of lives.

4 Prevention of rabies is mainly through elimination of unwanted dogs, vaccination where this can be afforded, and education of the population about avoiding dog bites and seeking immediate treatment if they are bitten.

5 Taeniasis due to beef tapeworm is a common disease in Ethiopia due to the culture of eating raw beef. Infected cows have tapeworms embedded in cysts in their muscles, which can be killed by thorough cooking.

6 Infected humans pass up to 600,000 eggs in their faeces every day. Open defaecation in fields and using raw human sewage as fertiliser contaminates grazing land, where cows eat the eggs attached to the grass. This perpetuates the lifecycle.

7 Environmental and food hygiene, proper sanitation, and cooking of beef thoroughly are the major prevention measures against taeniasis.

Self-Assessment Questions (SAQs) for Study Session 38

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 38.1 (tests Learning Outcomes 38.1, 38.2 and 38.3)

Mr. Kebede is bitten on the face by a dog which has shown abnormal behaviour in the last three days. The skin is clearly broken and the wound is bleeding a little bit.

(a) What category of exposure is this event?

(b) If Mr. Kebede comes quickly to your Health Post, which of the following actions should you do for him? In each case, explain why the action is correct or incorrect.

A Give him an antibiotic and send him home

B Suture his wound

C Thoroughly clean his wound with soap and water and send him to the nearby health centre for post-exposure prophylaxis

D Admit him to the Health Post and give him intravenous fluids.

SAQ 38.2 (tests Learning Outcomes 38.1, 38.2, 38.3 and 38.4)

Kemal is a three-year-old boy who has had close contact with his pet dog. In the last two days, the dog has showed abnormal behaviour and now it has run away. You examine Kemal carefully all over his body. You find that he has not been bitten and he does not have any scratches or breaks in his skin.

(a) What is Kemal's category of exposure?
(b) What do you advise Kemal's family?

SAQ 38.3 (testing Learning Outcomes 38.1, 38.2, 38.3 and 38.4)

Which of the following statements is *false*? In each case, explain what is incorrect.

A Most people who show symptoms of rabies will be cured if they are referred for medical treatment.

B Taeniasis causes discomfort in people who have a tapeworm in their intestines, but the disease is almost never fatal.

C Eating well-cooked beef may not protect people from taeniasis.

D Abdominal pain and the appearance of flat white worms in faeces are signs of taeniasis.

E Open defaecation in grazing lands is a risk factor for taeniasis.

Study Session 39 Diseases of Poor Hygiene and Environmental Health: Trachoma, Scabies and Podoconiosis

Introduction

This study session focuses on three significant health problems in Ethiopia, which are common in communities where there is poor hygiene and sanitation, and where people find it difficult to keep their environment clean. You have already learned a lot in this Module about diarrhoeal diseases and other infections in which poor hygiene is a major contributory cause. In this study session, we contrast three other conditions where the local environment makes an important contribution:

- *Trachoma,* a potentially blinding eye disease caused by bacteria, but flies are a strong environmental factor in its transmission
- *Scabies*, a persistent irritating rash caused by tiny crawling mites that burrow into the skin
- *Podoconiosis,* a form of elephantiasis (swollen limbs with thickened skin) that is not caused by an infection at all – but by irritating particles of red clay soil causing a damaging reaction in the skin.

A common feature of these diseases is the lack of clean water for washing, and lack of education about their causes and how to prevent them. As you will see, washing the body and clothes regularly and disposing of rubbish safely is the key to prevention and control. In this study session, you will learn about the causes, modes of transmission, treatment and prevention of trachoma, scabies and podoconiosis. A better understanding of these diseases will help you to diagnose, treat or refer patients, and educate your community on prevention measures.

Learning Outcomes for Study Session 39

When you have studied this session, you should be able to:

39.1 Define and use correctly all of the key words printed in **bold**. (SAQs 39.1 and 39.2)

39.2 Describe the causes of scabies, trachoma and podoconiosis and the environmental factors that contribute to their prevalence. (SAQs 39.1, 39.2 and 39.3)

39.3 Describe the symptoms, diagnosis, treatment and referral criteria for scabies, trachoma and podoconiosis. (SAQs 39.1 and 39.2)

39.4 Describe the prevention and control measures at community level against scabies, trachoma and podoconiosis. (SAQs 39.1, 39.2, 39.3 and 39.4)

39.1 Trachoma – the ‘quiet blindness’

Trachoma is an infectious eye disease that can eventually cause blindness if left untreated. Infection of the eyes with the bacteria *Chlamydia trachomatis* usually occurs in childhood, but infected people generally do not develop severe sight problems until adulthood.

It is therefore essential that you are able to identify the early signs of the disease and treat patients appropriately in order to avoid severe complications developing later in life.

First, we will describe the infectious agents that cause trachoma, their modes of transmission and the clinical manifestations of the disease. This knowledge will enable you to identify people with symptoms, grade the signs according to a classification of severity, and decide whether you should treat patients yourself or refer them to a health centre or hospital. Then you will learn how to give health education about trachoma and its prevention in your community.

39.1.1 What causes trachoma?

Look closely at the diagram of the eye in Figure 39.1. Identify the areas labelled as the conjunctiva and the cornea. In the initial stages of trachoma, the bacteria *Chlamydia trachomatis* primarily infect the **conjunctiva** (pronounced 'kon-junk-tie-vah'). This is a thin clear membrane that covers the inner surface of the eyelid and the white part of the eyeball. First it becomes itchy and inflamed (red, swollen and painful); later it becomes scarred and the eyelashes turn inwards.

The **cornea** is the thick transparent tissue over the front part of the eye, covering the white, black and coloured areas. The damage to the cornea is not due to the bacteria, but by persistent scratching from the eyelashes, which have turned inwards due to scarring in the conjunctiva.

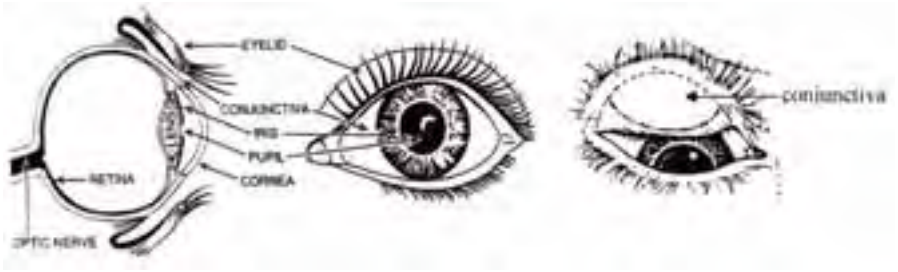

Figure 39.1 Anatomical structure of the eye. The conjunctiva lining the inside of the eyelids is the area most visibly affected by trachoma in the early stages. (Source: WHO, 1993, *Primary Healthcare Level Management of Trachoma*)

39.1.2 Modes of transmission of trachoma

Routine newborn care is described in the Modules on *Postnatal Care* and *Integrated Management of Newborn and Childhood Illness* (IMNCI).

The bacteria that cause trachoma are transmitted mainly by contact with the discharge (pus) coming from an infected person's eyes. Note that direct transmission from one person's eyes to the eyes of another person is unusual, but direct mother-to-newborn transmission can occur during birth if the mother has *Chlamydia* bacteria in her birth canal. These bacteria can live in the genitals of males and females, causing a sexually transmitted infection, which can get into the eyes of the baby as it is born. This is why tetracycline eye ointment (1%) is applied to the eyes of all babies as part of routine newborn care.

However, the most common routes by which *Chlamydia* bacteria get into the eyes and cause trachoma are through:

- Flies landing on the face of an infected person and then carrying the infected discharge to another person's face (Figure 39.2a).
- An infected person touching his/her eyes and then touching another person on the face or directly on their eyes (Figure 39.2b).

- Clothing used to wipe infected eyes (Figure 39.2c), and then contaminating the eyes of another person, for example if it is used as a towel.

Figure 39.2 Transmission of trachoma by (a) flies, (b) eye contact with contaminated hands, (c) eye contact with contaminated clothing. (Source: WHO, 1993, *Primary Healthcare Level Management of Trachoma*)

■ Based on your study of earlier parts of this Module, the infectious agents of which other diseases may be transmitted by house flies?

□ The infectious agents causing diarrhoeal diseases, such as dysentery and acute watery diarrhoea, can be transmitted by flies (Study Sessions 32 and 33).

39.1.3 How common is trachoma in Ethiopia?

Trachoma is a very common disease in developing countries, including Ethiopia – particularly in dry rural areas. About 80 million people in the world suffer from trachoma, of whom about eight million have become visually impaired. There are currently more than 238,000 people with blindness due to trachoma in Ethiopia. Trachoma is very common among children in certain parts of the country; for example, more than 50% of Ethiopian schoolchildren have had trachoma infections at some time. Without proper treatment, many of them will suffer severe eye problems in later life.

39.1.4 Clinical manifestations of trachoma and disease progression

As a Health Extension Practitioner you should examine affected children and adults to identify the severity of the trachoma. Use your clean hands and a pen to turn the eyelids upwards, so you can see the conjunctiva, as illustrated in Figure 39.3.

Figure 39.3 Examination of the conjunctiva inside the upper eyelid for signs of trachoma. (Source: WHO, 1993, *Primary Healthcare Level Management of Trachoma*)

Wash your hands thoroughly with soap and water before and after each eye examination!

The clinical manifestations of trachoma have been classified by the World Health Organization (WHO) into five *grades* indicating how far the disease has progressed. The first grade is the earliest manifestation of the infection, and the fifth grade is permanent eye damage causing sight loss and leading eventually to blindness. It is important for you to know the signs that indicate these grades, because the actions you take when you see a person with suspected trachoma depends on correct grading. The names and code letters of the five grades are given in Box 39.1; they are each described in detail below the box.

Box 39.1 The five grades of trachoma progression

First grade = Trachomatous follicles (TF)

Second grade = Trachomatous inflammation (TI) or (TF+TI)

Third grade = Trachomatous scarring (TS)

Fourth grade = Trachomatous trichiasis (TT)

Fifth grade = Corneal opacity (CO)

Trachomatous follicles (TF)

The first and earliest trachoma grade is characterised by the presence of five or more **trachomatous follicles** in the conjunctiva inside the upper eyelid. They are round, slightly raised, whitish areas of at least 0.5 mm in size (Figure 39.4). Trachomatous follicles should not be confused with trachoma scars, which are flat (see Figure 39.5 below), or the normal eyelash follicles on the edge of the eyelids. Other signs that you may notice are redness and swelling of the conjunctiva as a result of inflammation caused by the bacterial infection.

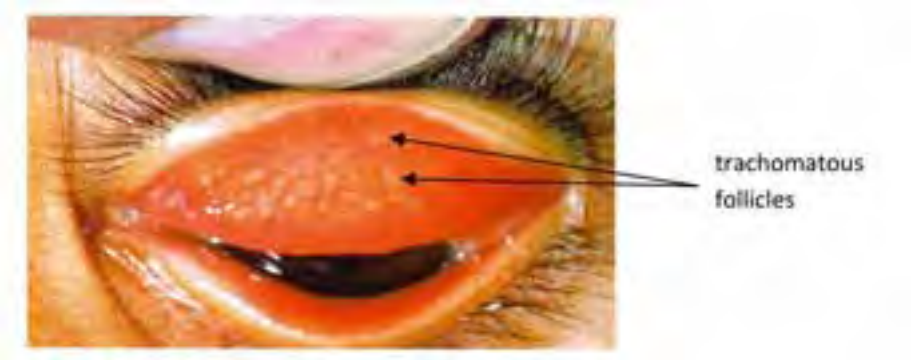

Figure 39.4 Trachomatous follicles in the upper conjunctiva of a child with early signs of trachoma. (Photo: WHO at http://www.who.int/blindness/causes/priority/en/index2.html)

Trachomatous inflammation (TF+TI)

The second grade is when profound inflammation occurs in more than half of the upper conjuctiva, which is red, thick and swollen, and has many trachomatous follicles (Figure 39.5). In severe cases, the blood vessels of the eyelids may not be visible due to the swelling of the conjunctiva.

Figure 39.5 Trachomatous inflammation with trachomatous follicles. (Photo: WHO, sources as in Figure 39.4)

Trachomatous scarring (TS)

In time, the inflammation resolves and the follicles are replaced by *scars* on the conjunctiva, which appear as small glistening lines or stars, and later may become flat, thick, white bands (Figure 39.6). This is the characteristic third grade of trachoma progression.

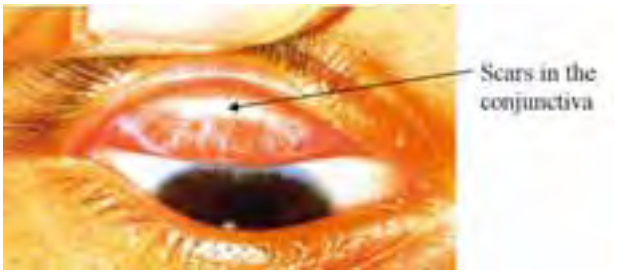

Figure 39.6 The white bands and lines are scars in the conjunctiva of the inner eyelid. (Photo: WHO, source as in Figure 39.4)

Trachomatous trichiasis (TT)

The scars gradually cause the eyelashes to turn inwards, and at least one eyelash rubs on the cornea. This sign is called *trichiasis* (pronounced 'trik-eye-assis') and is the fourth grade of trachoma severity. You can see in Figure 39.7 that many of the eyelashes are turned inwards and rub the cornea when the person blinks. This is painful and distressing for the person and it gradually damages the cornea.

Figure 39.7 Eyelashes rubbing the cornea. (Photo: WHO, source as in Figure 39.4)

Corneal opacity (CO)

A healthy cornea appears black where it covers the lens at the front of the eye. In the fifth and most severe grade of trachoma, the cornea becomes white and opaque (not transparent) as in Figure 39.8. This is known as **corneal opacity**.

Figure 39.8 Corneal opacity due to chronic trachoma. (Photo: WHO, source as in Figure 39.4)

- What effect will corneal opacity have on the person's sight?

  - Light cannot pass easily through the opaque cornea, so the person's sight will be severely impaired and total blindness may result.

- How can you tell the difference between trachomatous follicles and trachomatous scars in the conjunctiva?

  - Follicles are raised and round and at least 0.5 mm in diameter. Scars are lines or bands and are flat.

39.1.5 Prevention and control of trachoma

There are four major components for the prevention and control of trachoma at community level, which are represented by the letters **SAFE** (see Box 39.2 and the details below the box).

Box 39.2 SAFE strategy for the prevention and control of trachoma

S = Surgical treatment for trichiasis to stop eyelashes rubbing the cornea

A = Antibiotic treatment of active cases of trachoma by tetracycline ointment 1% applied to the eyes

F = Faces and hands washed regularly to prevent infection spreading

E = Environmental sanitation and safe water supply.

Surgical treatment

A simple surgical procedure can save a patient from becoming blind. Surgery can be carried out at the health centre by trained nurses and may simply involve turning out the eyelashes that are scarring the cornea. Your role is to reassure and refer patients with Grades 3 to 5 (i.e. trachomatous scarring, trachomatous trichiasis, or corneal opacity) for immediate surgery. Explain that the operation is very simple, quick and safe, and it will greatly reduce the discomfort in their eyes and prevent further damage from occurring.

Antibiotic treatment

You are expected to treat grade 1 and grade 2 **active trachoma** (i.e. people with trachomatous follicles and trachomatous inflammation in at least one eye) in the community. You should show parents how to administer tetracycline 1% ointment onto the conjunctiva inside the eyelids twice every day for six weeks (Figure 39.9a and b). If you identify two or more family members with trachoma, treat the whole family.

Figure 39.9 (a) Positioning a child to apply tetracycline eye ointment. (b) Placing the ointment inside the lower eyelid. (Diagrams: Dr Radmila Mileusnic)

If you are informed by the District Health Office that trachoma is a major concern, you may be advised to treat all the children in your community as a preventive measure. If this is the case, treat all children with tetracycline eye ointment for five consecutive days in a month, and repeat the same procedure for six consecutive months. Alternatively, a doctor may prescribe the oral antibiotic azithromycine (20 mg/kg bodyweight) as a single dose in place of tetracycline to treat the whole community.

Face washing

Educate all families, particularly mothers of children (Figure 39.10), by going house to house to teach them the importance of regular washing of face and hands, ideally using soap. Go to schools to teach children there in a large group that washing regularly prevents the transmission of trachoma from person to person. Everyone should learn the habit of washing their hands with soap and water in the early morning before they touch their eyes, before and after eating or preparing food, and after using the latrine.

Figure 39.10 Women teaching children how to wash their hands and faces in Wonji, Ethiopia. (Photo: WHO TDR Image Library, image 9400962/Martel)

Environmental sanitation

Detailed procedures of personal hygiene and sanitation are given in the Module on *Hygiene and Environmental Health*.

Educate every family to dispose of their household rubbish in a pit dug away from their home (Figure 39.11). Garbage and other dirty materials can be buried using spades or other locally made tools. The waste materials should be covered with soil or burnt inside the pit. Educate adults and children to keep their surrounding environment clean and free from rubbish and animal dung, to avoid encouraging the breeding of flies. Animals should be penned away from the house at night. Encourage everyone to use latrines and a safe water supply to prevent disease transmission by flies and dirty hands. Latrines should be properly covered after use.

Figure 39.11 Waste disposal in a pit away from the house. (Source: WHO, 1993, *Primary Healthcare Level Management of Trachoma*)

Now read Case Study 39.1 and then answer the question that follows it.

Case Study 39.1 Mrs Halima asks about her child's eye problems

Mrs Halima lives in a remote rural village in Wollo. Her ten-year-old son has had eye discharges for the last three years, which seem to be getting worse. During the last year, his eyes frequently weep tears and look swollen and red, and the boy complains that his eyes are sore. Mrs Halima has taken him to several traditional healers, but his eye problems have not been cured. She tells you she believes that her child's eye problems are related to supernatural powers and no treatment can help him.

- ■ What do you advise Mrs Halima and what action do you take for the child?
- □ Explain to the mother that her son's eye problems are a disease called trachoma, caused by bacteria. Tell her it can be cured using medicine in the eyes or a very simple operation to stop the child's eyelashes turning inwards and rubbing his eyes. Examine the boy's eyes and decide what grade of trachoma the disease has reached. If the grade is TF or TF+TI, treat him with tetracycline eye ointment 1%, and show the mother how to do it twice a day for the next six weeks. Follow up his progress regularly every week. If the boy needs surgery, inform the mother and refer him to the health centre immediately.

39.2 Scabies

Scabies is not a serious condition, but it is very common in poor communities and it may severely impair the quality of life of affected children.

39.2.1 What causes scabies and how is it transmitted?

Scabies (*ekek* in Amharic) is a parasite infestation of the skin caused by microscopic mites, *Sarcoptes scabiei* (Figure 39.11). These tiny animals are spread principally by direct skin-to-skin contact (e.g. during close physical contact between children and parents, or during sexual intercourse), and to a lesser extent through contact with infested clothes and bedding.

Male and female mites mate on the surface of the person's skin. The female burrows into the skin, depositing eggs in the tunnel behind her. After the eggs are hatched, larvae migrate to the skin surface and eventually change into the adult form. An adult mite can live up to about a month on a person, but they survive only two to three days once away from the human body. Individuals who become infested with scabies mites for the first time usually develop symptoms after four to six weeks, but they can still spread the mites during this time. If someone is cured of scabies, but acquires the mites again later, the symptoms appear much more quickly, within days.

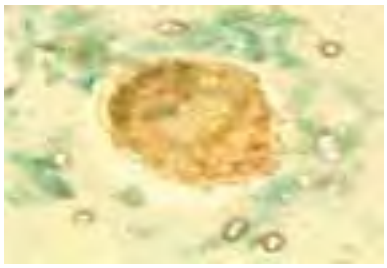

Figure 39.12 *Sarcoptes scabiei*, stained and viewed through a microscope. (Photo: CDC at http://www.cdc.gov/parasites/scabies/)

39.2.2 How common is scabies in Ethiopia?

Scabies mites are found worldwide, in all communities and climates. There are thought to be about 300 million cases of scabies in the world each year. In Ethiopia, as elsewhere, scabies is common where there is poverty, poor water supply, poor sanitation and overcrowding.

39.2.3 Clinical manifestations of scabies

The first clinical manifestation of scabies is severe itching of the skin, particularly at night. The characteristic raised red pimples on the skin that develop later are due to an allergic response to the mites. You may also be able to see the threadlike burrows in the skin made by egg-laying female mites. In infants, the palms, soles, face and scalp are most often affected (Figure 39.13a). In older children and adults the rash is most often found in the spaces between fingers and toes, wrist (Figure 39.13b), armpits, ankles, navel, 'belt line', groin, buttocks, genitals in men and breasts in women.

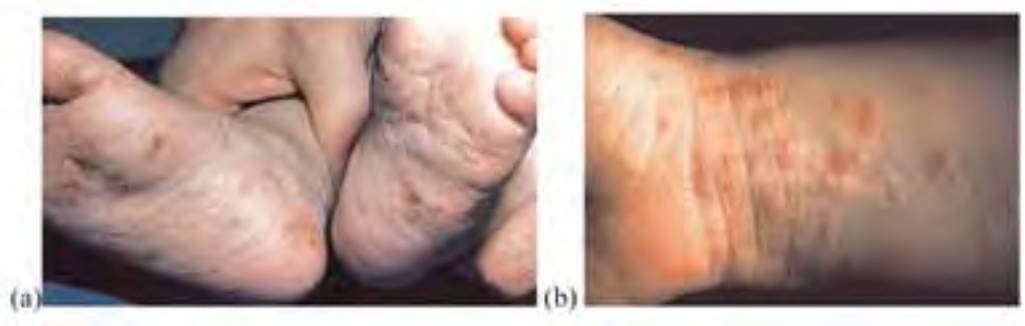

Figure 39.13 Scabies sores on (a) the soles of a baby's feet, (b) an adult's wrist. (Photos: DermNet, Dartmouth Medical School, USA, at http://hardinmd.lib.uiowa.edu/dermnet/scabies.html)

39.2.4 Treatment and prevention of scabies

A chemical called benzyl benzoate lotion (BBL, 25% solution) is used for the treatment of scabies. In adults, the lotion should be applied to the whole body, including the neck, face and ears – but taking care not to get it into the eyes, nose or mouth. Use a cotton swab to squeeze the lotion under the ends of the fingernails and toenails, where mites can hide. Tell the person not to wash! Repeat the treatment the following day and advise the patient not to wash for another 24 hours.

Children should also be treated with BBL, but the advice is to apply the lotion every day for three days; on each day leave the lotion on the child's body for 13 hours, then wash it off.

Other people who have been in close contact with a child or adult with scabies should also be treated with BBL to avoid re-infection, and all clothes and bedding should be thoroughly washed with hot water and dried in sunlight (Figure 39.14).

Figure 39.14 Sunlight helps to kill infectious agents in washed clothes and bedding dried in fresh air. (Photo: Basiro Davey)

Education on prevention of scabies should focus on explaining the transmission of the itchy mites and good personal hygiene, such as bathing and washing clothes frequently. The main control measures are early diagnosis and treatment of patients and contacts.

- How do you tell the difference between the skin manifestations of scabies and onchocerciasis? (Think back to Study Session 37.)

- Severe itching of the skin is the common characteristic of both scabies and onchocerciasis. However, onchocerciasis has additional symptoms such as loss of skin colour and nodule formation, whereas scabies rashes are raised red pimples and flaky skin. Scabies occurs mainly in conditions of poverty and overcrowding where the mites can easily breed; whereas onchocerciasis is common in south-west Ethiopia in communities living near the fast-flowing water required by the insect vector (blackflies).

39.3 Podoconiosis

Podoconiosis is pronounced 'poh-doh-koh-nee-oh-sis'.

Podoconiosis is a type of **elephantiasis** (swelling of the limbs) that is common in highland Ethiopia (*woina dega* or *dega*) in areas of red clay soil, usually at high altitudes. There is a great deal of misunderstanding about the disease in affected communities. Some people think it is caused by treading on a snake or frog, others that it is a curse or form of punishment. In reality, **podoconiosis** (Figure 39.15) is a reaction in the body to very small soil particles that have passed through the skin of the feet. The swelling begins in the feet and progresses up the legs, and both feet are usually affected.

Figure 39.15 Podoconiosis is swelling and deformity of the feet and ankles caused by reactions in the body to particles of red clay soil getting into the skin. (Photos: Gail Davey)

Unlike other types of elephantiasis, podoconiosis is *not* caused by any bacteria, viruses or parasites. It cannot be transmitted between people, so close contact with someone who has podoconiosis is totally safe. You may wonder why you are learning about it in a Module on *Communicable Diseases;* there are two reasons. First, severe podoconiosis looks a lot like lymphatic filariasis, which you learned about in Study Session 37. It is important to know the difference between these diseases because there are differences in their treatment. Second, how you teach patients to reduce the disability due to podoconiosis is exactly the same as the methods you have already learned about for lymphatic filariasis.

39.3.1 Distinguishing podoconiosis from lymphatic filariasis

The outward appearance of legs and feet affected by podoconiosis and lymphatic filariasis is very similar – you can't tell the difference just by looking. But there are some questions you can ask the patient that can help you to decide which diagnosis is most likely to be correct.

Where does the patient live?

If the patient lives more than about 1,200 metres above sea level, then the leg swelling is likely to be due to podoconiosis. This is because the mosquitoes that transmit lymphatic filariasis cannot survive above this altitude – it is too cold at night. If the patient has always lived in *dega* or *woina dega* areas, or does not live in zones where lymphatic filariasis is known to be prevalent, then you should diagnose the leg swelling as podoconiosis.

Where did the disease start and what body parts are affected?

If it started in the feet and both feet/legs are affected, then the diagnosis is likely to be podoconiosis. If the swelling began in the groin and spread downwards, if only one leg is affected (look back at Figure 37.21a), and/or the lymph nodes in the groin are enlarged – then the disease is likely to be lymphatic filariasis.

■ Can you suggest why it is important to distinguish between podoconiosis and lymphatic filariasis? (Think back to Study Session 37.)

Malaria can be transmitted by mosquitoes in communities up to 2,000 metres above sea level. See Study Session 5 in Part 1 of this Module.

□ Podoconiosis is not infectious (it is caused by soil particles), so patients don't need drug treatment because there is no infectious agent to kill; there is no vector so their houses don't need to be sprayed to kill mosquitoes (unless, of course, malaria is endemic in the area). Treating podoconiosis with the drugs used to treat lymphatic filariasis would be a waste of precious resources and would not cure the disease.

39.3.2 How does podoconiosis affect people?

There is a major similarity in the experiences of people with podoconiosis and lymphatic filariasis, as we already mentioned in Study Session 37. They often face severe stigma and rejection by their communities. They may be forced out of school, or even rejected by their church, mosque or *idir*. Other people may be reluctant to eat with them or associate with them in other ways. Marriage for people in affected families may be restricted to people from other affected families. Many of these social problems arise because people mistakenly fear that podoconiosis is infectious, and that they may catch it from patients.

People with swollen legs due to lymphatic filariasis face the same problems as people with podoconiosis.

In addition to this social stigma, people with podoconiosis often find it difficult to do physical work because their legs are heavy and uncomfortable. They often become very poor as a consequence of being unable to farm or take produce to market. Whole communities are also poorer because people with podoconiosis cannot work on their farms. As a country, the WHO estimates that Ethiopia loses US$200 million each year because of the work that people with podoconiosis are unable to do.

39.3.3 Treatment of podoconiosis.

Most people do not know that leg swelling from podoconiosis can be treated – but it can! Using simple foot hygiene, ointment, elastic bandages, socks and shoes, brings improvement to more than nine out of ten patients. They can manage their own foot care if you show them what to do. The basic steps of treatment will be familiar from Study Session 37, but are summarised again briefly here:

1 Foot hygiene. First soak the feet for 20 minutes in a basin of cold water into which half a capful (about 10 drops) of *berekina* (bleach) have been added.

2 Then wash the feet carefully using soap and clean cold water (Figure 39.16a). Dry between the toes with a clean cotton cloth.

3 Rub a small amount of ointment or oil into the skin after drying.

4 For patients with softer swelling of the legs, elastic bandages are useful. Show the patient how to apply the bandage from the toe to the knee, with the leg raised (Figure 39.16b).

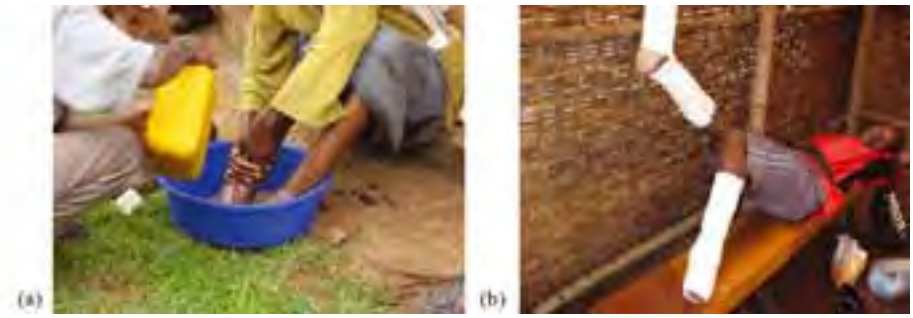

Figure 39.16 (a) Foot hygiene and (b) elastic bandages and raising the legs can greatly improve the symptoms of podoconiosis. (Photos: Gail Davey)

5 Encourage the patient to perform exercises to improve their circulation, such as toe points, ankle circles and calf raises, two or three times per day.

6 Raise the affected legs whenever possible by raising the foot end of the bed, or resting the foot on a stool when sitting.

7 Clean socks and closed shoes are vital in preventing further exposure to the soil. If local houses have floors made of earth (Figure 39.17), the floor should be covered with mats.

■ What do you now know about podoconiosis that may also help to break down the stigma that many patients face?

□ It is not infectious. Podoconiosis can be treated using simple hygiene measures. It can be prevented through regular use of shoes.

Experience in Southern Ethiopia has shown that more than 90% of patients with podoconiosis can be successfully treated without need of referral for care within the government health system. Communities can handle most of the problems that podoconiosis patients have without need for formal healthcare. Seeing young men and women fully treated (Figure 39.18) has a positive impact on the communities that knew them previously as patients.

Figure 39.18 These young women have been successfully treated for podoconiosis. Now they have found work as hairdressers. (Photo: Gail Davey)

Figure 39.17 Houses with earth floors should be covered with mats to prevent soil particles penetrating bare feet. (Photo: Janet Haresnape)

39.3.4 Podoconiosis-plus: problems that need urgent referral

Some podoconiosis patients will develop symptoms that need urgent referral for further care at a health centre or hospital. Here are some of the warning signs:

- *Red hot leg.* Sometimes, people with podoconiosis develop bacterial *superinfection* ('added infection' by bacteria that usually live on the skin) in the swollen leg. They report aching pain and increased heat and swelling in the leg, fevers or chills, and sometimes headaches. They need antibiotics to control the infection, and painkillers.
- *Open wounds.* After an injury, a person with podoconiosis is more likely to develop an open wound that may not heal easily. Careful wound care using clean techniques and local dressing materials will be needed, most likely at a health centre.
- *Deep fungal infection* (a fungus has taken root deep in the swollen tissues). The patient may notice black dots on the surface of the skin. They need hospital treatment.
- *Skin cancer.* Looking carefully, you will see an ulcer with a rolled edge (like rolled *injera*). This needs hospital treatment.

39.3.5 Prevention of podoconiosis

Here is the good news – because the disease is a reaction to soil particles, wearing shoes every day to protect the feet from the soil will prevent it completely! So if children wear shoes all the time, the next generation will not suffer from podoconiosis.

Summary of Study Session 39

In Study Session 39, you have learned that:

1 Trachoma is one of the leading causes of blindness in Ethiopia; it is due to infection with *Chlamydia trachomatis* bacteria, transmitted from person to person by flies, on hands and clothing, and sometimes also from mother to newborn if the bacteria are in the birth canal.

2 Patients with active trachoma (grade TF or TF+TI) should be treated at community level with tetracycline eye ointment. More severe grades of trachoma should be referred for specialist treatment, often involving simple surgery to stop the eyelashes from rubbing the cornea.

3 Scabies is a severe skin inflammation caused by reactions to a microscopic parasitic mite that burrows into the skin. The irritation can seriously impair the quality of life of affected children.

4 Good personal hygiene, particularly washing the face, body and clothes with soap and clean water, and environmental hygiene, including disposal of rubbish and other waste, and using latrines, are important ways to prevent trachoma and scabies.

5 Podoconiosis is a non-infectious type of elephantiasis (swollen leg) caused by reactions to particles of red clay soil entering the skin. It can be prevented if children grow up wearing shoes all the time.

6 People with podoconiosis can be successfully treated in the community using simple foot hygiene, ointment, elastic bandages, socks and shoes. Sometimes, patients with podoconiosis need urgent referral for treatment of 'superinfection' with bacteria or fungi, open wounds, or skin cancer.

7 If you educate people that podoconiosis is not infectious and can be treated and prevented, the stigma and rejection that patients often experience can be resolved.

Self-Assessment Questions (SAQs) for Study Session 39

Now you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering the following questions. Some of the questions test your knowledge of earlier study sessions in this Module. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 39.1 (testing Learning Outcomes 39.1, 39.2, 39.3 and 39.4)

Which of the following statements is *false*? In each case, explain what is incorrect.

A Zinash is a 16-year-old girl who has had eye problems for the last four years. There are white bands inside her swollen red eyelids. You should immediately refer her to hospital.

B A newborn with red and swelling conjunctiva should be treated by putting tetracycline ointment into the eyes.

C Corneal opacity is reversible through treatment with tetracycline ointment.

D Scabies can be treated successfully with tetracycline ointment.

E The SAFE strategy for preventing trachoma stands for surgical treatment, antibiotics, face washing and environmental sanitation.

F Disability resulting from podoconiosis and lymphatic filariasis can be reduced by foot and leg hygiene, exercising the affected part and raising the legs when sitting or sleeping.

G Trachoma, scabies and podoconiosis are all communicable diseases found in conditions of poverty, overcrowding and poor access to clean water and sanitation.

SAQ 39.2 (testing Learning Outcomes 39.3 and 39.4)

If you see a girl with discharge coming from her eyes and flies landing on her face (Figure 39.19), what should you advise her family**?**

Figure 39.19 A girl with eye discharges and flies on her face.

SAQ 39.3 (testing Learning Outcomes 39.1, 39.2 and 39.3)

Name at least three communicable diseases that can result in blindness.

In each case, briefly state the cause of the eye problems.

SAQ 39.4 (testing Learning Outcomes 39.1, 39.2, 39.3 and 39.4)

How many diseases can you remember learning about in this Module where the symptoms are at least partly caused by allergic reactions by the patient's immune system to foreign material getting into the body?

In each case, briefly describe the foreign material.

Study Session 40 General Principles of Public Health Surveillance

Introduction

In Study Sessions 3–39, you have studied the major communicable diseases in Ethiopia. Communicable diseases spread easily from person to person in the community and can cause many illnesses and deaths. In this study session you will learn in detail about **public health surveillance**, which consists of close observation, recording and reporting of cases of important communicable diseases or conditions in your community. A good understanding of public health surveillance will enable you to detect the occurrence of *excess cases* of communicable diseases in your locality (that is, more than expected), and report them to the higher authorities.

Using public health surveillance data, you can also assess the magnitude (or burden) of major communicable diseases in your locality by counting the number of cases occurring over a period of time. Collecting and analysing public health data will help you to plan appropriate measures to control communicable diseases, for example, distributing appropriate medicines and educating the community about disease prevention. This study session will describe in detail the basic concepts of public health surveillance, the types of surveillance and the activities you will undertake in recording and reporting disease.

Learning Outcomes for Study Session 40

When you have studied this session, you should be able to:

40.1 Define and use correctly all of the key words printed in **bold**. (SAQs 40.1, 40.2 and 40.3)

40.2 Explain the purposes of public health surveillance in Ethiopia and illustrate the features of a high-quality surveillance system. (SAQs 40.1, 40.2 and 40.3)

40.3 Describe the difference between passive, active and mixed public health surveillance systems. (SAQs 40.2 and 40.3)

40.4 Describe the activities you should conduct in your public health surveillance role as a rural Health Extension Practitioner. (SAQs 40.1, 40.2 and 40.3)

40.1 Public health surveillance

Public health surveillance of communicable diseases involves continuous data collection, examination of the data (data analysis), interpretation of the data, and dissemination of the information to concerned bodies such as the District Health Office and the nearby Health Centre. Based on the information, health workers like you, supported by the higher authorities, can take appropriate disease control measures. Surveillance activities are information loops that start with data collection and end with appropriate disease control measures, as shown in Figure 40.1 (on the next page).

Figure 40.1 Information loop involved in surveillance of diseases.

As part of a healthcare team with reponsibility for around 500 families in your community, you will routinely need to collect, analyse and interpret health-related data, and send reports of your findings to the nearby Health Centre. In addition, during an outbreak or epidemic of infectious disease (i.e. an increase in the expected number of cases), you will need to work with other health team members to actively find new cases in your catchment area. In the following sections, we will present detailed descriptions of the activities needed for surveillance as set out in the boxes in Figure 40.1.

40.2 Data collection and recording

Gathering and recording data about diseases in your community is a very important activity. As part of your routine practice, you are expected to collect health data from patients when they come to your Health Post. You are also expected to collect data during home visits about illnesses and deaths due to major communicable diseases, as well as about other health-related factors such as nutrition, immunization coverage and use of family planning methods. During data collection, you should record basic information about patients, such as their age, sex, address, symptoms of the illness and suspected disease or disorder (for example, injuries, spontaneous abortions, etc.)

Never collect data that you cannot or will not use, because it is a waste of your time, energy and resources.

Table 40.1 shows an example of data on cases of disease/disorders recorded at Zemen Health Post. Remember, you should only collect data that you can use to improve health programmes in your area.

Table 40.1 Diseases and other health problems recorded at Zemen Health Post during three days in 1996 (Ethiopian calendar).

Serial no.	Date seen	Name	*Kebele*	Sex	Age (months/ years)	Signs and symptoms	Suspected disease/ disorder
01	6/5/96	A.M.	C	M	6 mths	Cough, fever, difficulty in breathing	Pneumonia
02	6/5/96	T.F.	A	M	2 yrs	Fever, cough, rashes	Measles
03	6/5/96	N.N.	C	M	22 yrs	Laceration (cuts) on right arm	Injury
04	6/5/96	Y.E.	C	F	28 yrs	Pregnancy, fever, anaemia	Malaria
05	7/5/96	I.L.	B	F	7 mths	Fever, bulging fontanel	Meningitis
06	7/5/96	R.E.	B	F	8 mths	Fever, cough, difficulty in breathing	Pneumonia
07	7/5/96	K.L.	D	F	4 yrs	Fever, vomiting, diarrhoea	Malaria
08	7/5/96	T.I.	A	M	13 yrs	Fever, headache, bodily pains	Malaria
09	7/5/96	A.F.	D	F	10 yrs	Fever, severe muscle pains with paralysis of the lower limbs	Poliomyelitis
10	7/5/96	D.O.	D	F	24 yrs	Fever, headache, neck stiffness	Meningitis

Serial No.	Date seen	Name	*Kebele*	Sex	Age (months/ years)	Signs and symptoms	Suspected disease/ disorder
11	8/5/96	K.M.	A	M	22 yrs	Watery diarrhoea	Diarrhoea
12	8/5/96	U.G	A	F	20 mths	Fracture, left upper arm	Injury
13	8/5/96	P.F.	C	M	23 mths	Cough, fever, rashes	Measles
14	8/5/96	H.I.	C	F	24 yrs	Vaginal bleeding at four weeks pregnant	Spontaneous abortion
15	8/5/96	G.T.	C	F	21 yrs	Fever, shock	Malaria
16	8/5/96	W.T.	A	F	16 yrs	Five weeks of cough, fever, weight loss	Tuberculosis
17	8/5/96	R.Y.	B	M	26 mths	Diarrhoea, vomiting, dehydration	Diarrhoea
18	8/5/96	A.C.	C	M	1 yr	Fever, cough, difficulty in breathing	Pneumonia

40.3 Analysis and interpretation of public health data

Data analysis is the organisation and systematic examination of the data you have collected. **Data interpretation** is the process of understanding and communicating the meaning of your data. These are the next steps in surveillance after data collection and recording. Before you can explain what your data means (interpretation), you need to organise the data in a meaningful way, and then analyse the data. A particularly useful analysis to carry out is to calculate the number and types of new cases (the *incidence rate*) of every disease or disorder, and see how the occurrence is changing over time. This section shows you how to do this.

Techniques of data analysis and interpretation are given in the Module on *Health Management, Ethics and Research.*

40.3.1 Counting the number, percentage and types of cases

In order to count the number of cases of a particular disease or disorder, you need to be able to decide if a person really has that condition or not. You make your diagnosis based on criteria given in a **case definition**, i.e. a set of standard descriptions of the disease. You will learn about case definitions in detail in Study Session 41.

To calculate the percentage of cases that are due to a particular disease or disorder, you *divide* the number of cases of that condition (e.g. malaria) by the total number of cases of all diseases and disorders combined, and *multiply* the result by 100.

For example, there were four cases of malaria in the three days covered by the data in Table 40.1, and 18 cases in total of all diseases or disorders. The percentage of malaria cases is therefore:

$4 \div 18 \times 100 = 22.2\%$.

So 22.2% of all cases seen in those three days in Zemen Health Post were due to malaria.

Now complete Activity 40.1 on the next page.

Activity 40.1 Ranking causes of disease/disorder in order of magnitude

Take a pen or pencil and a sheet of paper, and draw a table ranking the causes of disease/disorder shown in Table 40.1 according to their magnitude (i.e. the largest number at the top and the smallest number at the bottom). For each disease/disorder listed in your table, give the number of cases seen, and calculate the percentage of the total cases that were due to this cause.

Comment

Your table should look like Table 40.2 below.

- Use your version of Table 40.2 to answer the following question. What is the highest ranking (i.e. most common) disease/disorder among people attending the Zemen Health Post during the three days of data collection, and what is the second most common diagnosis?
- Malaria is the most common disease/disorder and pneumonia is the second most common diagnosis, as Table 40.2 shows.

Table 40.2 List of causes of disease/disorder seen at Zemen Health Centre during three days, ranked in order of magnitude (based on data in Table 40.1).

Disease/disorder	Number of cases	Percent of total cases
Malaria	4	22.2% (4/18)
Pneumonia	3	13.6% (3/18)
Measles	2	11.1% (2/18)
Injury (laceration, fracture)	2	11.1% (2/18)
Meningitis	2	11.1% (2/18)
Diarrhoea	2	11.1% (2/18)
Tuberculosis	1	5.5% (1/18)
Polio	1	5.5% (1/18)
Abortion	1	5.5% (1/18)

40.3.2 Incidence rate

The **incidence rate** is a very useful measure of the frequency of *new* cases of a disease or disorder occurring in your community over a given period of time (usually a year, month, or a week during new outbreaks). Calculating the incidence rate at intervals enables you to assess whether a particular health condition is improving or getting worse in your community over time.

The incidence rate is calculated using a simple formula, which has a *numerator* (the number above the line in a fraction) and a *denominator* (the number below the line in a fraction). To calculate the incidence rate for a particular disease/disorder, you need to know:

- The total number of new cases of that condition seen in a particular population (country, region, town, village) during the period you are interested in (this is the numerator)

- The total number of people in the population you are interested in, during the same period (this is the denominator).

You divide the numerator by the demoninator and multiply the result by 1,000. This is the traditional way of expressing an incidence rate, as the number of new cases of the disease/disorder per 1,000 people in the population. The formula is given in Box 40.1.

Box 40.1 Formula for calculating the incidence rate of a disease/disorder

Incidence rate per 1,000 population =

$$\frac{\text{Number of new cases occuring in the population in a given period of time}}{\text{Total number of people in the same population during the same period of time}} \times 1{,}000 \text{ population}$$

■ Imagine that there were 50 new cases of typhoid fever in your community during June 2010. The total population of your community was 5,000 people. Calculate the incidence rate of typhoid in your community in that month.

□ The number of new cases of typhoid = 50
and the total population = 5,000.

Divide 50 by 5,000 and multiply the result by 1,000 to calculate the incidence rate per 1,000 people in this population:

$$\text{Incidence rate per 1,000 population} = \frac{50}{5{,}000} \times 1{,}000 = 10$$

Therefore, the incidence rate of typhoid in June 2010 in this community was 10 new cases in every 1,000 people in the population.

40.3.3 Analysing public health data by person, place and time

The distribution of a disease can be described by recording which person was affected (who), the place where the case occurred (where) and the time when it occured (when). Information about the person affected should include their age, sex, ethnic group, religion, occupation and marital status (Figure 40.2, on the next page). Place of illness may be household, *kebele* or *woreda*. Time of illness can be recorded as a day, week, month or year.

Figure 40.2 Public health data about a population should record the age, sex, ethnic group, religion, occupation and marital status of each individual. (Photo: Basiro Davey)

- Can you describe the distribution of malaria and pneumonia in Table 40.1 by the *age* of the patients (compare those aged five years old or younger, with those aged over five years), and the *sex* of the patients? Express your answer in words and construct a table showing the distribution of cases based on their age and sex.

- Three out of the four malaria cases occurred in patients above the age of five years; all three pneumonia cases occured among children under five years. Three out of four cases of malaria occured in females, while two out of three cases of pneumonia occured in males. Table 40.3 shows this distribution.

Table 40.3 Distribution of malaria and pneumonia cases at Zemen Health Centre during three days, by the age and sex of the patients.

Age/sex of patients	Malaria cases (4)	Pnuemonia cases (3)
Age		
< = 5 years	1	3
> 5 years	3	0
Sex		
male	1	2
female	3	1

The symbol < = means 'less than or equal to'. The symbol > means 'greater than'.

40.3.4 Comparing data in different time periods

In order to assess your progress in preventing communicable diseases and other disorders in your community, it is essential to compare the incidence rate (explained above) of each condition at different times (e.g. in the present year compared to the previous year).

- Suppose that the incidence rate of typhoid in a community was 10 per 1,000 population in 2009, whereas in 2010 it was 50 per 1,000 population. How has the incidence of typhoid in this community changed?

- The incidence of typhoid has increased sharply – it was five times higher in 2010 than it was in 2009, having increased to 50 per 1,000 population from 10 per 1,000.

When the incidence of a disease has increased compared to the previous figure, it may indicate an epidemic, so you should immediately report it to the Health Centre and/or District Health Office. It is also important to describe the distribution of cases by age, sex and place of residence. You will learn more about epidemic surveillance and reporting in Study Sessions 41 and 42.

40.4 Reporting public health surveillance data and getting feedback

After you have analysed and interpreted your public health surveillance data, you should prepare a report and send it to your supervisor at the nearby Health Centre. For monthly reports, you can summarise the data as in Tables 40.1 to 40.3. For **immediately reportable diseases** (diseases that should be reported within 30 minutes), such as polio and cholera, you should use other reporting forms which are described in Study Session 41. The Health Centre or District Health Office will use your report for planning and allocation of resources, such as drugs and other Health Post supplies (Figure 40.3). They may also use the data to improve health services, assess the progress of activities of the health institutions and control an epidemic.

Figure 40.3 Your reports help in the effective planning and allocation of resources for your Health Post. (Photo: Basiro Davey)

Always try to get oral or written feedback on your report from your supervisor at the Health Centre and/or officials at the District Health Office, because they can help you to improve your work.

40.5 Linking surveillance information to practice

A national surveillance system collects information about communicable diseases from all health facilities in the country. Surveillance is important at all levels of the health system, including your Health Post. Each institution is responsible for sending reports about disease to health offices at a higher level, at the time specified by the health authorities. Reports contain information about the types of diseases seen, the numbers of people affected by the disease, and their age, sex, place of residence and so on.

The Ethiopian Federal Ministry of Health (FMOH) analyses the data from health facilities (Hospitals, Health Centres and Health Posts) all over the country. Based on these data, the top ten causes of illness and death in adults and in children under five years are determined.

Note that an important purpose of public health surveillance is to give you and other health professionals an 'early warning' so you can take rapid and effective action against epidemics of communicable diseases. You are part of the national surveillance system and you can obtain useful information about communicable diseases in your catchment area, which will help you to prevent and control infection more effectively.

In summary, the information collected from health facilities is useful to:

- Describe the magnitude and distribution of diseases by place, time and personal characteristics such as age and sex
- Allocate resources such as drugs to the District Health Offices based on the magnitude of diseases
- Identify epidemics in time before they spread
- Evaluate progress towards their control.

Remember that there is no reason to carry out surveillance if the data collected are not used to improve health programmes, or to deliver better services or to control diseases in the community. Your collection and interpretation of data should help you to take action, for example to control outbreaks related to food or waterborne diseases, measles, malaria and other types of infectious diseases common in your area. These actions will be covered in Study Session 42 when we talk about epidemics and outbreaks of diseases.

40.6 Types of public health surveillance

There are three basic types of surveillance systems – passive, active and mixed surveillance – and you need to know about and do them all.

40.6.1 Passive surveillance

Passive surveillance refers to the collection of data by health facilities as part of their routine work of diagnosis and treatment (Figure 40.4). It is called 'passive' because the data is obtained only from the people who seek help from the health services – the health workers make no additional effort to contact other individuals. In Ethiopia, there is a passive surveillance system based on *monthly activity reports* and weekly reporting of **notifiable diseases**, i.e. diseases that must be reported to the health authorities. Most communicable disease outbreaks should be reported by telephone or radio to your Health Centre (as you will learn in Study Session 41).

Figure 40.4 A health worker collecting health data as part of her routine practice; here she is asking mothers about the immunization status of their infants. (Photo: UNICEF Ethiopia/Indrias Getachew)

Figure 40.5 shows the flow of passive surveillance information in Ethiopia. Under this system, your Health Post and other facilities are required by the Federal Ministry of Health (FMOH) to report all collected data about diseases in your community on a regular basis. The reports are made routinely at agreed intervals (e.g. every month) without being requested. As the solid arrows in Figure 40.5 indicate, Health Posts report surveillance data to Health Centres, the Health Centres report data to the *woreda* District Health Offices, and so on until the information reaches the FMOH, the highest level. The broken arrows show that exchange of information also occurs in the opposite direction.

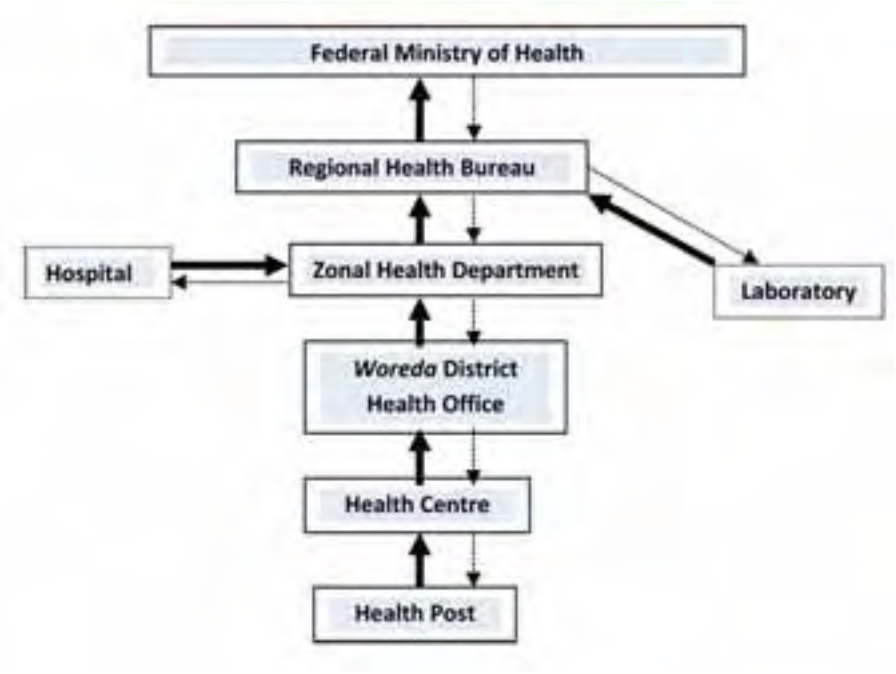

Figure 40.5 Passive surveillance information flow in Ethiopia. The solid arrows show the initial route of information flow. The broken arrows show that contact and information can also flow in the opposite direction.

■ What do you think is the importance of the solid arrow from the Laboratory to the Regional Health Bureau (RHB) in Figure 40.5?

□ Laboratory confirmation of a clinical diagnosis is important in providing accurate data on confirmed cases of communicable diseases in the community.

Passive surveillance is cheap to operate, because it takes place as part of routine health-service work, and it helps you and the higher authorities to monitor the occurrence of many diseases and other health problems. However, it has some disadvantages. The surveillance reports may take a long time to reach the highest level, and some key information may be lacking (e.g. if the health worker forgets to collect data on a statistic such as the sex or age of some patients).

■ What gaps could there be in the data on diseases/disorders in a community if the data are only collected through passive surveillance?

□ Passive surveillance misses all the cases out in the community in people who haven't sought help from the health services. This gap is a particular concern in remote areas, where people may not be able to access health services easily.

40.6.2 Active surveillance

The second type of surveillance is called **active surveillance**, in which the health professionals actively seek to collect data from all possible cases in their area, under instruction to do so from a higher level in the health system. Active surveillance is usually conducted in relation to a specific disease or disorder, or it seeks to assess the takeup of a particular health service (e.g. family planning or immunization). Active surveillance data are collected because the higher health authorities request a specific surveillance report, instead of waiting for Health Posts or other health facilities to send them routine reports. In this sense, it is the opposite of passive surveillance.

Figure 40.6 shows the information flow under active surveillance in Ethiopia. The solid black arrows indicate that the FMOH, at the highest level of the health system, takes the first step and requests surveillance data from all lower levels of the health system. Intermediate levels contact those below, all the way down to the level of your Health Post. As the broken arrows show, your Health Post prepares the requested data and sends it back to the Health Centre, the Health Centre sends the data to the *woreda* District Health Office, and so on to the highest level. Note, that without a request from a higher level, the active surveillance report would not have been prepared and submitted.

Figure 40.6 Active surveillance information flow in Ethiopia. The solid arrows show the initial requests for information. The broken arrows show how the requested information flows back up the system.

Active surveillance can also be a type of *event-based surveillance*, which refers to unstructured data gathered from sources such as media reports, community concerns and rumours. For example, if there is a rumour about a measles outbreak in your community, the Health Centre will ask you to report if there are any new cases of measles during a defined period of time.

You will then have to actively collect data about new cases of measles by making house-to-house visits in your catchment area and reporting back to the Health Centre (Figure 40.7).

Figure 40.7 A Health Extension Practitioner collecting health information from a woman in a rural household. (Photo: Federal Ministry of Health, Ethiopia: *Health Extension Program Profile in Ethiopia*, 2007)

40.6.3 Mixed surveillance

Mixed surveillance means combining passive and active surveillance systems. This can work well, leading to better monitoring of communicable diseases and other health problems. Disease control programmes for HIV/AIDS, polio and malaria use a combination of passive and active surveillance systems.

So far, we have described to you the background needed to understand surveillance systems in Ethiopia. Box 40.3 summarises the features of a high-quality public health surveillance system in *any* country.

Box 40.3 Features of good public health surveillance

A high-quality public health surveillance system:

- Involves and encourages the community to report all cases of diseases and other health problems
- Uses both active and passive surveillance for effective disease control and prevention
- Collects only useful data, using a simple data collection method
- Uses laboratory services to confirm clinical diagnosis of disease
- Reports data to the higher level when required and without delay
- Quickly takes the right actions to improve services or programmes after data are reported.

Summary of Study Session 40

In Study Session 40, you have learned that:

1 Public health surveillance consists of ongoing activities of data collection, analysis, interpretation and reporting to higher levels of the health system, with the ultimate aim of preventing and controlling communicable diseases and other health problems.

2 Surveillance is useful to assess the magnitude of health problems, to identify epidemics before they can spread further, to allocate appropriate resources, and to evaluate the progress of interventions and other health services provided by the health facilities.

3 Surveillance programmes can be passive, active or mixed (passive and active) in their procedures for collecting and reporting health-related data.

4 In passive surveillance, you are expected to collect, analyse and interpret data from patients and clients and send reports to the Health Centre as part of your routine work at the Health Post.

5 In active surveillance, you are asked to actively visit households to collect information related to specific diseases or health issues.

6 You should regularly report surveillance data to the nearby Health Centre or District Health Office, keeping to any deadlines; you should request feedback on your report to help you improve your work.

Self-Assessment Questions (SAQs) for Study Session 40

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 40.1 (tests Learning Outcomes 40.1, 40.2 and 40.4)

Look at Figure 40.8 below. The surveillance activities have been arranged in the *wrong order*! List the letters from the boxes in the correct order in which these activities should be carried out.

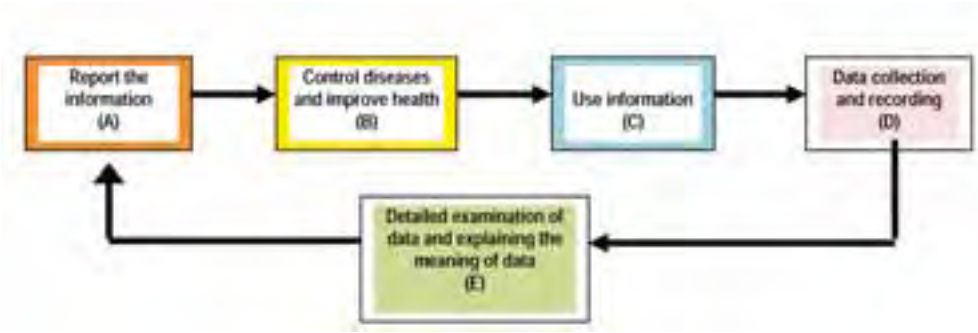

Figure 40.8 These surveillance activities are arranged in the wrong order!

SAQ 40.2 (tests Learning Outcomes 40.1, 40.2, 40.3 and 40.4)

Which of the following statements is *false*? In each case, state why it is incorrect.

A During surveillance in your community, you should always collect as much information as possible, even if you do not use it.

B One of the major purposes of public health surveillance is to detect an epidemic before it can spread very far.

C A good surveillance system uses passive and active surveillance methods to collect and report the most complete data.

D Regular recoding and reporting of public health data is not essential in a high quality surveillance system.

E Active surveillance covers many more diseases compared to passive surveillance.

SAQ 40.3 (tests Learning Outcomes 40.1, 40.2, 40.3 and 40.4)

In 2010, the District Health Office asked you to visit all households in your village to check for the presence of a cough lasting more than two weeks in adults (that is, people aged 15 years or older). The total adult population was 4,000 people in that year. Following this request, you visited all households and identified 100 people who had a cough lasting more than two weeks. Of these 100 people, 10 had a confirmed diagnosis of tuberculosis (TB) after laboratory investigation.

(a) What kind of surveillance did you conduct in the example above?
(b) Calculate the incidence rate of tuberculosis in adults in your village.

Study Session 41 Integrated Disease Surveillance and Response

Introduction

In Study Session 40 we considered what public health surveillance means and the activities it involves. In this study session, we will consider the **Integrated Disease Surveillance and Response (IDSR)** system. IDSR involves carrying out disease surveillance activities using an integrated approach. An integrated approach means that data on all important diseases will be collected, analysed, interpreted and reported in the *same* way, by the *same* people who normally submit routine report forms on health-related data. In this study session, we will also consider the *case definitions* of priority diseases in Ethiopia, and how priority diseases are reported. Proper understanding of IDSR, the case definitions and reporting methods will enable you to identify, register, analyse and report priority diseases quickly and accurately to the proper authorities. These activities are essential in order to ensure that priority diseases in your community can be prevented and controlled.

Learning Outcomes for Study Session 41

When you have studied this session, you should be able to:

41.1 Define and use correctly all of the key words printed in **bold**. (SAQs 41.1, 41.2 and 41.3)

41.2 Describe the key features and importance of the Integrated Disease Surveillance and Response (IDSR) system in Ethiopia. (SAQs 41.1 and 41.3)

41.3 Explain how you should use case definitions to identify and report cases of priority diseases and conditions in your community. (SAQs 41.1, 41.2 and 41.3)

41.1 Importance of the Integrated Disease Surveillance and Response (IDSR) system

IDSR brings many surveillance activities together to try and make sure that priority diseases can be controlled and prevented more effectively. The IDSR system requires that all important communicable diseases within a health facility are reported together, using the human and other resources already available within that facility. Collecting, analysing and reporting priority diseases in this way has several advantages:

- First, it is cheap, since the same health personnel and reporting formats are also used for routine reports of health-related data.
- Second, it creates an opportunity to computerise all the available data at the central level.
- Third, it provides training and capacity building opportunities for health personnel to develop new skills.
- Fourth, it encourages community participation to detect and respond to disease epidemics.

Thus, IDSR is a cost-effective surveillance system which addresses the major health problems of Ethiopia. Many other countries in sub-Saharan Africa have adopted a similar IDSR system.

■ From what has been mentioned above, is IDSR a passive or active surveillance system? Think back to Study Session 40 and give reasons for your answer.

□ IDSR is a passive surveillance system as the data used are collected during routine health work. Active surveillance, on the other hand, uses data collected *after* a request from higher authorities for specific information.

41.2 Priority diseases for IDSR in Ethiopia

Priority diseases are diseases that fulfil one or more of the criteria in Box 41.1.

Box 41.1 Priority disease criteria

- They have a high potential for causing epidemics
- They have been targeted for eradication or elimination
- They have significant public health importance (causing many illnesses and deaths)
- They can be effectively controlled and prevented.

Currently, there are 20 **reportable priority diseases or conditions** in Ethiopia, which are included in the IDSR system (Table 41.1). As the table shows, these 20 priority diseases are further classified into 'immediately' or 'weekly' reportable diseases. Some of the priority diseases, such as avian influenza, pandemic influenza A, cholera, measles, meningitis and relapsing fever are likely to spread quickly and to affect a large number of people. Therefore, you should always be alert for such diseases in your community, and report immediately to a health centre if you suspect, or are unsure about, a case.

Table 41.1 List of reportable priority diseases and conditions in Ethiopia in 2010 (International calendar).

I. Immediately reportable diseases (report within 30 minutes to higher authority)		**Description of the disease**
1	Acute flaccid paralysis (AFP)	Polio is the major cause of AFP (see Study Session 4 of this Module)
2	Anthrax	An acute bacterial disease, transmitted from animals to humans (zoonosis), manifested by skin lesions and (rarely) respiratory symptoms, e.g. shortness of breath
3	Avian human influenza	An acute viral disease of the respiratory tract, transmitted from birds to humans, characterised by fever, headache, muscle pain, prostration, runny nose and other symptoms of head cold, sore throat and cough
4	Cholera	Bacterial disease that causes profuse, watery diarrhoea (see Study Session 34)

5	Dracunculiasis/ Guinea worm disease	An infection of the deep part of the skin by a worm, manifested by blister formation and discharge of the worm when the affected leg of the patient is immersed into water
6	Measles	A viral disease manifested by a whole-body rash, cough and sore eyes (see Study Session 4)
7	Neonatal tetanus	A rapidly fatal bacterial disease of newborns manifested by neck stiffness, convulsions, sensitivity to bright light and inability to feed due to locked jaw (see Study Session 3)
8	Pandemic influenza A (H1N1)	An acute viral disease of the respiratory tract, transmitted from animals to humans, characterised by fever, headache, muscle pain, prostration, runny nose and other symptoms of head cold, sore throat and cough
9	Rabies	A viral disease affecting the nervous system, transmitted by the bite of a rabid dog (see Study Session 38)
10	Severe acute respiratory syndrome (SARS)	A rapidly fatal severe viral respiratory infection associated with gastro-intestinal symptoms such as diarrhoea
11	Smallpox	A viral disease manifested by a rash (but this disease has been eradicated from the world)
12	Viral haemorrhagic fever (VHF)	An acute viral disease manifested by fever, muscle pain and bleeding
13	Yellow fever	An acute viral disease of short duration, transmitted by mosquitoes, manifested by fever, muscle pain and headache
II. Weekly reportable diseases		
14	Dysentery	A bacterial or amoebic disease manifested by bloody diarrhoea (see Study Sessions 33 and 34)
15	Malaria	An acute febrile disease with chills, headaches and muscle pain, caused by plasmodium parasites transmitted by mosquitoes (see Study Sessions 5 to 12)
16	Malnutrition	A condition caused by shortage of protein, or carbohydrate or vitamins or minerals
17	Meningitis	A bacterial disease manifested by fever and stiffness of the neck (see Study Session 3)
18	Relapsing fever	A bacterial disease, transmitted by human body lice, manifested by episodes of fever, headache and muscle/joint pain (see Study Session 36)
19	Typhoid fever	A bacterial disease manifested by fever, headache, joint pain and diarrhoea (see Study Session 33)
20	Typhus	A bacterial disease, transmitted by human body lice, manifested by sustained high fever, headache and muscle/joint pain (see Study Session 36)

■ What is the difference between eradication and elimination? (Think back to Study Session 2 of this Module).

□ **Elimination** is reduction to zero (or a target very close to zero) of cases of a particular communicable disease in a particular geographic area. **Eradication** is the elimination of a communicable disease from the whole world. Polio, guineaworm disease and neonatal tetanus have been targeted for global eradication by the World Health Organization (WHO).

In addition to the reportable diseases and conditions listed in Table 41.1, you should report the health emergencies or emergency conditions listed in Box 41.2. The term **cluster** refers to a larger-than-expected number of cases with similar symptoms, but without clear evidence (at this time) that they are connected in any way. The increase in cases in a cluster could simply be a coincidence, but it could also be a sign that an **epidemic** is beginning, i.e. the rise in number is due to transmission of the infectious agents between cases. That is why you should report the conditions in Box 41.2 immediately.

Box 41.2 Health emergencies or conditions to report immediately

- Clusters of respiratory illness (including upper or lower respiratory tract infections and difficulty in breathing)
- Clusters of gastrointestinal illness (including vomiting, diarrhoea, abdominal pain, or any other gastrointestinal distress)
- Influenza-like symptoms and signs, such as fever, cough and runny nose
- Clusters of symptoms or signs indicating the possibility of meningitis (stiff neck, sensitivity to bright light, severe headache, etc.)
- Clusters of rash-like symptoms
- Non-traumatic coma (unconsciousness which is not due to an injury), or sudden death.

41.3 Role of the Health Extension Practitioner in IDSR

As a Health Extension Practitioner working and living in a community, you are likely to know the residents well (Figure 41.1). Your relationship with the community is very important and should help you in your surveillance activities. You can teach the community about priority diseases and conditions in the area so that they are aware of such diseases and report them to you. With good community participation, you can perform surveillance activities (outlined in Box 41.3) in your catchment area much more effectively.

Figure 41.1 Your relationship with the community is very important and should help you in your surveillance activities. (Photo: Basiro Davey)

Box 41.3 Role of Health Extension Practitioners in IDSR activities

Your roles are to:

- Identify cases of priority diseases and conditions in the community by using case definitions (see Section 41.4 below)
- Report any cases or possible cases to the nearest Health Centre as soon as possible
- Study suspected cases, identify everyone who is affected, and determine where and when the disease is most common
- Actively search for other cases in the community by doing home visits; inform the community about cases in the area and work with community members to find more cases
- Assist the District Health authorities to treat cases and to control the spread of the disease
- Mobilise and educate the community to prevent the disease from spreading
- Keep your community informed about the cases that have been identified and how they are being managed.

41.4 Case definitions of priority diseases

You learned in Study Session 40 that a case definition is a set of standard criteria used to help you to separate true cases (those with the disease) from suspected cases that do not have the disease. Health workers in hospitals and Health Centres should use **standard case definitions** for reporting suspected priority diseases, i.e. a definition that has been agreed and should be used by all health professionals at higher levels within the country. Standard case definitions should be applied in the same way to all the persons examined.

Standard case definitions classify cases as confirmed or suspected. A **confirmed case** shows all the typical symptoms of a disease and the infectious agent or other cause has been positively identified in a laboratory investigation. For example, in a confirmed case of malaria, the patient shows symptoms typical of malaria, such as fever, headache and joint pain, the rapid diagnostic test (RDT) is positive, and laboratory investigation of a blood smear has confirmed that the person is infected with the *Plasmodium* parasites that cause malaria (Figure 41.2). On the other hand, a **suspected case** of malaria means that the person shows symptoms of malaria, but a laboratory investigation either has not been conducted yet, or has failed to find evidence of the parasite that causes malaria.

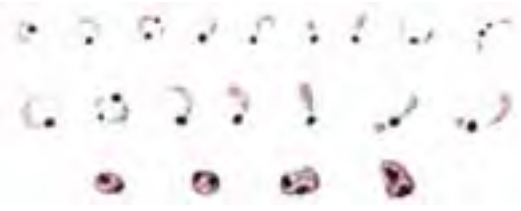

Figure 41.2 Developmental stages of the malaria parasite (*Plasmodium* species); laboratory tests demonstrating these parasites in a patient's blood confirms a case of malaria.

A **community case definition** is a simplified version of the standard case definition, adapted to suit the needs and resources of Health Extension Practitioners/Workers, community health volunteers, community members, traditional healers and birth attendants. It is useful to make a poster showing these definitions for the Health Post wall in the local language. Table 41.3 summarises community case definitions for some of the priority diseases in Ethiopia.

Table 41.3 Simplified community case definitions for use in identifying and reporting suspected priority diseases during community surveillance.

Priority disease	**Simplified community case definition**
Acute watery diarrhoea in children aged under 5 years	Any child having loose stools within the last 24 hours, or showing danger signs of loss of fluid from the body (dehydration)
Cholera	Any person aged 5 years or older with lots of acute watery diarrhoea
Diarrhoea with blood and mucus	Any person with diarrhoea and visible blood and mucus in the stools
Epidemic typhus	Any person with sudden onset of headache and fever with chills, and general muscle pains, with or without spots (rash)
Guineaworm	Any person with a history of emergence of worms from the leg
Leprosy	Any person with loss of sensation and/or weakness in the muscles of the hands, feet or face; or loss of part of the hands or feet
Malaria	Any person with fever, or fever with headache, back pain, chills, sweats, muscle pain, nausea and vomiting
Measles	Any person with fever and spots (rash)
Meningitis	Any person with fever and neck stiffness
Neonatal tetanus	Any newborn who is normal at birth, but after two days becomes unable to suck or feed
Polio	Any acute paralytic disease
Plague	Any person with painful swelling(s) under the arms or in the groin area; in an area where plague is endemic, any person with a cough, chest pain and fever
Pneumonia	Any child less than 5 years of age with a cough and fast breathing, or difficulty in breathing
Relapsing fever	Any person with a fever that returns following a previous fever
Tuberculosis	Any person with a cough lasting three or more weeks
Typhoid fever	Any person with fever, constipation or diarrhoea, confusion (delirium) and with the body in a passively prone position (prostration)
Viral haemorrhagic fever	Any person who has an unexplained illness with fever and bleeding, or who died after an unexplained severe illness with fever and bleeding
Yellow fever	Any person with fever and yellowing in the white part of the eyes, or yellowing of the skin

As a Health Extension Practitioner, you need to teach the community about these community case definitions of common diseases (Figure 41.3). The community can recognise and report common diseases to you if they understand these case definitions. The advantage of using community case definitions (instead of standard case definitions) is not only that they are simpler to understand. They are also 'broader' than standard case definitions, which means that more suspected cases will be identified using the community case definition, and fewer cases will be missed.

Figure 41.3 A health worker teaching mothers the community case definition of malnutrition in children. Malnutrition is a weekly reportable condition. Simple definitions of immediately reportable diseases can also be taught in meetings like these. (Photo: UNICEF Ethiopia/Indrias Getachew)

41.5 Reporting of priority diseases

Complete and reliable reporting of surveillance data throughout the country is vitally important, so that programme managers, surveillance officers and other healthcare staff can use the information for action. The 20 priority diseases and conditions of concern shown in Table 41.1 are classified into two categories (immediately reportable and weekly reportable), depending on their epidemic potential and whether (like polio and neonatal tetanus) they have been targeted for elimination or eradication.

41.5.1 Immediately reportable diseases

Of the 20 priority diseases in Table 41.1, 13 must be reported immediately to the next reporting level. For these **immediately reportable diseases**, a single suspected case could signal the outbreak of an epidemic, so it is important to report any cases or suspected cases to the next level of the reporting hierarchy within 30 minutes. This means you should report cases to the nearest Health Centre within 30 minutes, the Health Centre reports to the District Health Office within 30 minutes, and so on up to the highest national level (see Figure 41.4 on the next page).

Figure 41.4 Direction of reporting of immediately and weekly reportable diseases.

When you encounter a case of an immediately reportable disease, first report the information verbally or by telephone, or by sending a text using the SMS short message service. An official written report using the modified **case-based reporting format** (see Appendix 41.1) should follow immediately after the verbal report. You should remember to record the affected person's address, age, sex, vaccination status and symptoms. You should also suggest a possible diagnosis – that is, which of the 13 immediately reportable diseases you suspect. The date of referral and your signature should also be on the reporting form. After completing the form, you should immediately send the patient to the Health Centre and check by telephone to confirm the arrival of the patient at the Health Centre.

41.5.2 Weekly reportable diseases

Currently, seven diseases and conditions are identified to be reported weekly to the next reporting level (see Table 41.1). Reports should include the total number of cases and any deaths seen during the week (Monday to Sunday). Reports should be sent to the Health Centre every Monday, using the **weekly reporting format** shown in Appendix 41.2. In this format, you are expected to record the name of the disease, as well as the age and sex of the patient, and the place where the case was diagnosed (Health Post or community). For suspected cases of malaria, the laboratory result based on the rapid diagnostic test (RDT) should also be recorded.

- Before you use the weekly reporting format, what types of analysis should you do if there is more than one case of a priority disease? (Think back to Study Session 40.)

□ You should organise and report the data according to the age and sex of the cases to see if any patterns are evident. As you should remember from Study Session 40, data should be analysed in this way before reporting.

In the final study session in this Module, we describe in more detail the actions you should take to investigate and manage an epidemic of a communicable disease in your community.

Summary of Study Session 41

In Study Session 41, you have learned that:

1 In the Integrated Disease Surveillance and Response (IDSR) system, important communicable diseases within a community are integrated and reported to higher levels in the health system, using the usual human and other resources of the health facility.

2 The advantages of the IDSR system are that it is cheap and provides a training opportunity for health workers. It also makes data about all priority diseases available at a central level.

3 Priority diseases have been identified in each country to be included in the IDSR system. They are major causes of illness and death in the population, they can easily cause epidemics, they can be controlled and prevented, and they can be identified using standard or community case definitions.

4 There are 20 priority diseases of public health importance included in the IDSR in Ethiopia. They are classified as immediately or weekly reportable diseases.

5 Immediately reportable diseases should be reported to a higher level within 30 minutes, using verbal methods (radio, phone, text), followed by written reports using the official immediate reporting format. Weekly reports are sent every Monday using the official weekly reporting format.

6 As a Health Extension Practitioner, you must keep a close watch for possible cases of priority diseases in your catchment area, and quickly report any suspected or unusual cases or clusters of symptoms to the nearby Health Centre for investigation and management.

7 Standard case definitions of priority diseases are applied at Health Centres and hospitals. Simplified community case definitions have been developed for use by Health Extension Practitioners/Workers, community health volunteers, traditional healers and birth attendants, and community members. It is part of your role to educate your community on the community case definitions of priority diseases, so that they can be detected and reported as soon as possible.

Self-Assessment Questions (SAQs) for Study Session 41

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 41.1 (tests Learning Outcomes 41.1, 41.2 and 41.3)

Ayele is a 30-year-old farmer who comes to your Health Post with profuse and frequent watery diarrhoea. He has lost a lot of fluid and is very weak, so he finds it difficult to walk. His family informs you that there are several similar cases among adults in their village. What should you do?

SAQ 41.2 (tests Learning Outcomes 41.1 and 41.3)

Which one of the following health problems is *not* an immediately reportable disease?

(a) Polio
(b) Avian influenza
(c) Rabies
(d) Malnutrition
(e) Neonatal tetanus

SAQ 41.3 (tests Learning Outcomes 41.1, 41.2 and 41.3)

Which of the following statements is *false*? In each case, explain why it is incorrect.

A IDSR is a type of active surveillance where data on priority diseases is actively collected in the community.

B IDSR is cost-effective and helpful for integrating data on all reportable diseases at central level.

C To identify priority diseases in the community, community health workers and member of the community should use standard case definitions.

D Diseases targeted for eradication should be reported weekly to the higher level.

E One case of a disease cannot be an indication of an epidemic.

Appendix 41.1 Modified case-based reporting form for immediately reportable diseases

I. Address	Name of Health Post _____	Name of Kebele _____	Name of Woreda _____	Name of Zone _____
II. Patient identification	Age in years _____	Sex (M/F) _____	Occupation _____	Date of interview (d/m/y) ___ ___ ___
III. Vaccination status (if applicable)	Vaccinated for BCG (Yes/NO) _____	Number of doses of oral polio vaccine _____	Number of doses of pentavalent vaccine _____	Vaccinated for Measles (Yes/NO) _____
IV. Symptoms (write the major symptoms of the patient)				
V. Possible diagnosis (AFP, Cholera, Measles, Rabies, Anthrax, Neonatal tetanus, Avian influenza, Guineaworm, SARS, Yellow fever, Viral haemorrhagic fever or Smallpox)	_____			
VI. Treatment given	Antibiotic given (Yes/NO) _____	Treated by herbal medicine (Yes/NO) _____	Other treatment (Yes/NO) _____	
VII. Date and time of referral to the health centre	Date (d/m/y) ___ ___ ___	Time (local time) _____		
VIII. Name and Signature of the Health Extension Practitioner	Name _____	Signature _____		

Appendix 41.2 Weekly Reporting Format for Health Extension Practitioners

Name of Health Post_____ Kebele_____ Woreda_____ Date of reporting (d/m/y)_____

Name and signature of the Health Extension Practitioner _____

Serial No.	Name of suspected disease	Number of cases by sex, age, address and laboratory result (for malaria)								
		Age		Sex		Number of cases seen at the Health Post	Number of cases seen in village or community	Laboratory result (for malaria)		Remark
		<=5 years	Above 5 years	Males	Females			RDT positive	RDT negative	
1										
2										
3										
4										
5										
6										
7										

Study Session 42 Epidemic Investigation and Management

Introduction

In Study Sessions 40 and 41 you learned that one use of surveillance is to find out if there is an unusual increase in cases of any communicable diseases in your community, which could signal the start of an outbreak or epidemic. In this final study session, you will learn more about the different kinds of epidemics and how to investigate and manage them. A better understanding of epidemics will help you to detect an outbreak or epidemic of a communicable disease and report it immediately to the Health Centre and/or District Health Office. You are also expected to help the District Health Team in the control of any epidemics in your catchment area.

Learning Outcomes for Study Session 42

When you have studied this session, you should be able to:

42.1 Define and use correctly all of the key words printed in **bold**. (SAQs 42.1, 42.3 and 42.4)

42.2 Describe the different types of epidemics. (SAQs 42.1 and 42.3)

42.3 Describe the purpose of epidemic investigation. (SAQ 42.4)

42.4 Explain in outline the basic principles of epidemic management. (SAQs 42.2 and 42.4)

42.1 What is an outbreak and an epidemic?

If there is an increase in cases of a disease compared with the expected number, but it lasts for only a short time, or it occurs only in a limited area (e.g. in a few nearby households), the rise may be referred to as an **outbreak**. As you will remember from Study Session 1 of this Module, an **epidemic** is also an *excess* of cases compared with the number *expected*. However, an epidemic is more general than an outbreak the increase in the number of cases continues far longer (possibly months or even years), and the cases are distributed across a wider area.

For example, it may be that during January to March there are normally fewer than 10 cases of tuberculosis (TB) in your *kebele*. If you found 30 cases of tuberculosis in a particular January, followed by 39 cases in February and 45 cases in March, then you would strongly suspect that there was an epidemic of TB in your community. You would then need to find out why TB had suddenly increased.

- Which disease often causes epidemics during the months of June, September and October in Ethiopia? Why are these the months when these epidemics most often occur?
- Malaria is the major vector-borne disease that causes epidemics in the months of June, September and October in Ethiopia. This is when the conditions are humid and warm enough and there are plentiful water collections for the vector mosquitoes to breed in. You learned about malaria in Study Sessions 5–12 of this Module.

42.2 Types of epidemics

Epidemics are classified into different types according to the source of infection and modes of transmission.

■ From Study Session 1 of this Module, briefly describe the two main modes of transmission of communicable diseases.

□ They are: (1) direct modes of transmission, such as from mother to child, or from faecally contaminated hands into the mouth; and (2) indirect modes of transmission, such as through vectors, contaminated air, water, food or objects such as cooking bowls and utensils.

Based on criteria such as this, epidemics are classified into three types:

- common source outbreaks
- propagated or progressive epidemics
- mixed epidemics.

We will look at each of them in turn.

42.2.1 Common source outbreaks

Common source outbreaks occur when the rise in cases of an infection occurs after a group of people all came into contact with the *same* unsafe source of infection (the common source), such as contaminated food or water. For example, imagine a wedding where food was prepared in the morning to serve to wedding guests in the evening. If the prepared food was left outside on a hot day under the sun until evening, bacteria might multiply in the food. If this food was served to the guests in the evening without reheating it thoroughly, many of the guests might fall ill from eating the contaminated food (Figure 42.1). This kind of epidemic is called a common source outbreak because the affected guests all ate the same contaminated food at the wedding.

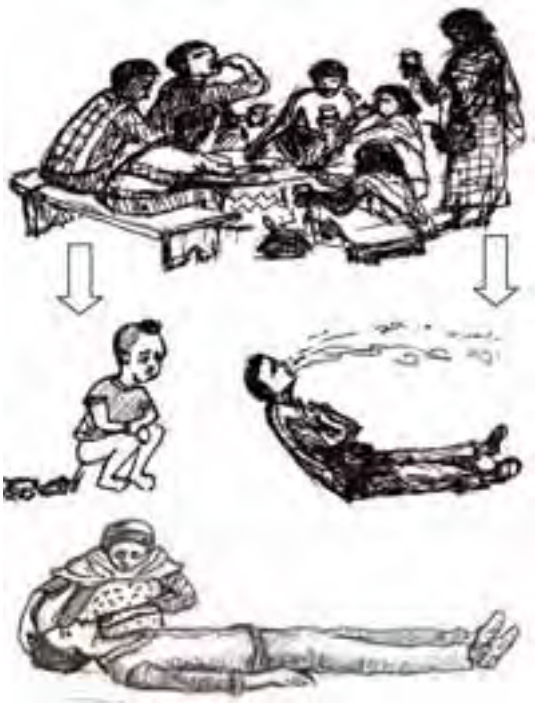

Figure 42.1 Guests eating contaminated food during the wedding become ill with diarrhoea and vomiting; the most severely affected are too ill to get up.

■ After the food had been prepared in the morning, explain what should have been done to make it safe to serve to the wedding guests in the evening.

□ Bacteria like moisture and warmth, and they multiply quickly in food left in hot sun for many hours. After the food had been prepared, it should have been kept covered in a refrigerator (Figure 42.2) or in a cool place inside the house, away from direct sun. The food should also have been reheated thoroughly before being served to the guests.

Figure 42.2 Refrigerating food reduces the risk of a common source outbreak of a foodborne infection.

A **point source outbreak** is a common source outbreak where the exposure period (e.g. the time at which the contaminated food was eaten) is short. This means that all cases who fall ill after eating the food (the common source) also have the same **incubation period**, i.e. the period between infection (eating the contaminated food) and the appearance of the first symptoms.

42.2.2 Propagated or progressive epidemics

Propagated or progressive epidemics occur when the infection spreads from person to person. The infectious agents causing the disease pass from one host to another, either *directly* from person to person (e.g. via hand shaking or kissing), or *indirectly* via vectors (e.g. mosquitoes in the case of malaria), or in water, food or another medium. The distribution of malaria cases is a good example of a propagated epidemic, because increased numbers of malaria cases occur again and again at different times. Propagated epidemics last longer than the common source outbreaks described above. This is because malaria will continue to spread in the community, as long as mosquitoes are present in the environment and there are people who carry the parasite.

■ Can you think of any epidemic-prone diseases that spread quickly in overcrowded conditions where there is poor sanitation and personal hygiene?

□ You may have thought of typhoid fever, cholera, shigellosis (bacterial dysentery), louse-borne relapsing fever and typhus. (Think back to Study Sessions 33 and 36.)

42.2.3 Mixed epidemics

Mixed epidemics show characteristics of both common source and propagated epidemics. So a mixed epidemic can start with a common source and be followed by a propagated spread. Mixed epidemics are often caused by foodborne infectious agents.

■ Typhoid fever can easily spread and become a propagated epidemic. Can you remember from Study Session 33 how the typhoid bacteria are transmitted from person to person?

□ Typhoid bacteria are transmitted from infected people to new susceptible hosts via contaminated food or water.

The organism that causes typhoid (*Salmonella typhi*) can survive in sewage for 14 days and in water for up to seven days. Water polluted by faecal matter is therefore the main source of infection for typhoid. If the whole community drinks water from the same water source (Figure 42.3), which has been contaminated with *Salmonella typhi,* there will be a common source outbreak of typhoid fever. The epidemic may continue to spread through faecal matter passing from person to person, if the people in the affected community do not improve their standards of personal hygiene, or if the water is not treated and made safe to drink. This type of spread of typhoid is called a propagated epidemic of typhoid.

Figure 42.3 Drinking water collected from the same unsafe source can expose a whole community to waterborne infection and lead to a common source outbreak, followed by a propagated spread. (Photo: Basiro Davey)

42.3 Epidemic investigation

Epidemic investigation is a set of procedures used to identify the cause, i.e. the infectious agent, responsible for the disease. It is also used to identify the people affected, the circumstances and mode of spread of the disease, and other relevant factors involved in propagating the epidemic. This is especially important if the epidemic has unusual features, if it presents a significant threat to public health, and it is not **self-limiting** (i.e. it does not end spontaneously without professional intervention).

Epidemic investigation is a challenging task for health workers. The main purpose of epidemic investigation is to control the spread of the disease before it causes more deaths and illness. As a Health Extension Practitioner, the first action you should take is to confirm the existence of an epidemic. To do this, you need to know the average number of cases of that disease during this specific month in your community in previous years, so you can compare that number with the current number of cases. Is there an excess number of cases or deaths from this disease compared to the usual occurrence? If there really are excess cases, you should report your findings to the District Health Office immediately. The reporting formats were given in Study Session 41.

The next steps (Box 42.1) will be taken by the District Epidemic Management Team, which is composed of many different health professionals such as doctors, nurses, environmental experts and others. These steps include confirming the cause (the infectious agent involved), the number of people affected (the cases) and the modes of transmission of the infection from cases to new susceptible hosts.

Box 42.1 Steps in an epidemic investigation

1 Establish the existence of an outbreak
2 Verify the diagnosis or causes
3 Define and identify cases:
   (a) Use a standard case definition (see Study Session 41)
   (b) Identify and count cases
4 Perform descriptive epidemiology, i.e. collect data on the age, sex, etc. of the cases and analyse the data to see if useful patterns emerge
5 Develop hypotheses to explain the occurrence of the epidemic:
   (a) Evaluate the hypotheses
   (b) Reconsider/refine the hypotheses
6 Carry out additional studies to confirm or reject the explanations for the epidemic:
   (a) Additional epidemiological studies
   (b) Other types of studies, e.g. laboratory tests, environmental investigations
7 Implement control and prevention measures:
8 Communicate findings to higher levels in the health system, community leaders and other local stakeholders.

42.4 Management of epidemics

Epidemic management activities include taking appropriate control measures, such as treating those who are ill to reduce the reservoir of infection, and providing health education to limit the transmission of the disease to others. Health professionals at higher levels will require your help in any measures needed to control the spread of the disease, such as giving drugs to people in the community and providing health education.

As mentioned above, you may be involved in the management of an epidemic once it is confirmed by the health authorities. The type of control measures you need to implement depend on the type of infectious agent, how the disease is transmitted, and any other factors contributing to the disease. Generally, your control measures should target the infectious agent, the source of any infection, and the treatment of those who became ill. Remember, the source of infection could be humans or animals, or non-living things in the environment.

If you do not implement the correct control measures, the epidemic may continue to spread in your area. For example, if contaminated food is the source of an outbreak in your community, you will need to control the outbreak by teaching the community about food hygiene (Figure 42.4), so they are not exposed to contaminated food. If it is caused by contaminated water, you should educate them not to drink the water until it is treated with chlorine. If mosquito breeding sites are the source of a malaria epidemic, you will need to teach the community to clear the breeding sites for mosquitoes.

Figure 42.4 Teaching community members about preparing food safely can prevent an epidemic of foodborne infection.

This short discussion of epidemic investigation and management brings the *Communicable Diseases* Module to a close. We hope that after studying the 42 study sessions and completing your practical training attachments, you will feel confident to identify, treat, refer, prevent and control communicable diseases effectively in your community, and report cases accurately and at the proper time.

Summary of Study Session 42

In Study Session 42, you have learned that:

1 An epidemic is the occurrence of more cases of a disease than would be expected in the population at that period of time. An outbreak is an increase in cases for a short time in a limited area.

2 A common source outbreak is an epidemic which arises from a single source of infection, and where most people fall ill after the same incubation period.

3 A propagated epidemic occurs when the infection spreads from one person to another, e.g. through the air, via a vector, via contaminated food or water, or during unprotected sexual intercourse.

4 A mixed epidemic can start with a common source and be followed by a propagated spread.

5 An epidemic investigation is conducted to rapidly identify the cause of an outbreak or epidemic and to take effective actions to contain and prevent the spread of the disease.

6 Epidemic investigation and management involves team work. Your role as a Health Extension Practitioner is to report the occurrence of an epidemic, to mobilise and educate the community, and to assist the District Health authorities in carrying out control and prevention measures as required.

Self-Assessment Questions (SAQs) for Study Session 42

Now that you have completed this study session, you can assess how well you have achieved its Learning Outcomes by answering these questions. Write your answers in your Study Diary and discuss them with your Tutor at the next Study Support Meeting. You can check your answers with the Notes on the Self-Assessment Questions at the end of this Module.

SAQ 42.1 (tests Learning Outcomes 42.1 and 42.2)

Explain the difference between common source and propagated epidemics, and give one example of each.

SAQ 42.2 (tests Learning Outcome 42.4)

If an outbreak is spread via a contaminated community water supply in your catchment area, what action should you take as a Health Extension Practitioner?

SAQ 42.3 (tests Learning Outcomes 42.1 and 42.2)

What differences would you expect to find if you could measure (a) the incubation period in an epidemic of HIV/AIDS in a village and (b) the incubation period in an epidemic caused by eating contaminated food at a birthday celebration?

SAQS 42.4 (tests Learning Outcomes 42.1, 42.3 and 42.4)

Suppose at your Health Post you have seen 11 cases in three days of people who have acute watery diarrhoea, and recorded them as in Table 42.1. One patient (case 7) died soon after arrival at the Health Post.

(a) Describe the distribution of the cases by the sex of the patients.
(b) What diagnosis do you suspect from reviewing these 11 cases? Explain your answer.
(c) What action should you take?

Table 42.1 Number of cases of acute watery diarrhoea recorded at a Health Post during a period of three days in 2002 (Ethiopian calendar).

Case	Age in years	Occupation	Sex	Address/*kebele*	Date illness began
1	25	Teacher	Male	01	Jan 3, 2002
2	29	Housewife	Female	01	Jan 4, 2002
3	45	Farmer	Male	01	Jan 5, 2002
4	35	Farmer	Male	01	Jan 4, 2002
5	38	Teacher	Female	01	Jan 5, 2002
6	25	Day worker	Female	01	Jan 4, 2002
7	10	Child	Male	01	Jan 4, 2002
8	29	Housewife	Female	01	Jan 4, 2002
9	22	Housewife	Female	01	Jan 3, 2002
10	39	Farmer	Male	01	Jan 3, 2002
11	21	Farmer	Male	01	Jan 5, 2002

Notes on the Self-Assessment Questions (SAQs) for *Communicable Diseases*, Part 4

Study Session 32

SAQ 32.1

A Poliomyelitis is caused by the poliovirus

B and E Shigellosis and cholera are both caused by bacteria

C and G Giardiasis and amoebiasis are caused by protozoa parasites

D and F Ascariasis and taeniasis are caused by helminths (worms).

SAQ 32.2

(a) Defaecation in the open fields increases the risk of faeco-oral diseases occurring because the soil becomes contaminated with the causal infectious agents. Infection can be transmitted to susceptible members of the community in several ways: via unwashed hands after defaecation, working or playing in the soil; unwashed or inadequately cooked fruit and vegetables grown in contaminated soil; and via flies crawling on faeces and then landing on food, utensils or hands.

(b) The prevention measures that this community could apply to reduce the risks are to build latrines for every household, dispose of faeces and other wastes safely, avoid open defaecation in fields, and adopt hygienic practices such as thorough handwashing and safe preparation of food.

SAQ 32.3

(a) This child is suffering from acute watery diarrhoea with signs of severe dehydration.

(b) You should advise the mother to take him to a health centre or hospital urgently. Give her enough ORS solution for the journey and tell her to feed sips of it to the child on the way. Go with them if you can, or send a clearly written referral note.

(c) Explain to the mother that the child's body has lost so much fluid and salts that his body systems are no longer functioning normally and his condition is potentially life-threatening. This is why he appears lethargic, his eyes are sunken, and his skin doesn't go back quickly when pinched.

SAQ 32.4

In addition to installing the protected water pump, the villagers should also use clean containers to collect and store water and clean drinking cups; wash their hands regularly and avoid their hands touching drinking water; and boil water before drinking it, or using it to wash fruit and vegetables, or mixing formula milk for babies. These measures will reduce the indirect transmission of faeco-oral diseases by contaminated water.

Study Session 33

SAQ 33.1

A is true. Typhoid fever is transmitted mainly indirectly, via contaminated food or water.

B is *false.* The characteristic manifestations of cholera are voluminous rice-water diarrhoea and vomiting – but not bloody diarrhoea.

C is true. Shigellosis is transmitted mainly by direct person-to-person contact.

D is true. Diarrhoeal diseases can lead to severe dehydration and shock.

E is true. Viruses are the commonest cause of diarrhoea in children.

F is *false.* Typhoid fever usually presents with constipation rather than diarrhoea in adults. The main symptom is continuous high fever.

SAQ 33.2

(a) In an adult patient with bloody diarrhoea, you should start immediate rehydration with ORS, and refer him/her to a higher health facility for laboratory diagnosis of the causative infectious agents and specific treatment.

(b) You should report the suspected case to the *woreda* Health Office and request assistance in preventing an epidemic. Ask the patient's family members and neighbours about the presence of other individuals with a similar illness, and advise all contacts of the patient to apply thorough hygiene measures, including handwashing with soap and water. Make sure they control the spread of the infectious agents by boiling or disinfecting clothes, bedding or utensils used by the patient; these articles must not be washed in water sources used for bathing or drinking.

SAQ 33.3

The completed version of Table 33.3 appears below.

Table 33.3 Incubation periods and most affected age-groups for common bacterial and viral faeco-oral diseases.

Disease	**Incubation period**	**Age group for most cases**
Cholera	2 hours to 5 days	All ages can be affected
Shigellosis	1 to 3 days	2 to 3 years
Rotavirus infection	2 to 3 days	Under 5 years
Typhoid fever	1 to 2 weeks	Over 5 years

SAQ 33.4

(a) Endemic means that rotaviruses and the diarrhoeal diseases they cause are 'always present' in the country at an approximately steady rate.

(b) Bacterial and viral diarrhoeal diseases are transmitted directly by hands contaminated with faeces that make contact with the mouth, and indirectly in contaminated food, water, soil and utensils (e.g. bottles used to feed milk to infants), and by flies that have crawled over faeces.

(c) The mother tells you that the infant is still breastfeeding, eating and drinking normally. As long as it is not dehydrated, there is no need to give ORS immediately. But the mother should be advised to go on breastfeeding as much as the child will drink, and feed other nourishing food and drinks with a very clean cup and spoon. She should wash her hands frequently and thoroughly with soap, particularly after changing the infant's nappy (diaper) or cleaning its bottom. Tell her she must bring the child back to see you immediately, or take it to the nearest health centre or hospital, if its diarrhoea persists or gets worse.

Study Session 34

SAQ 34.1

(a) The diseases that you should suspect as causes of bloody diarrhoea are shigellosis (bacillary dysentery) and amoebiasis (amoebic dysentery).

(b) The diseases that you should suspect as causes of watery diarrhoea include cholera or a viral diarrhoeal disease (although rotavirus infection is not common in adults).

(c) If the patient describes his condition as greasy diarrhoea, you should suspect giardiasis.

Irrespective of the type of diarrhoea, the adult patient should be started on rehydration with ORS and referred to a higher level health facility for laboratory investigation and treatment.

SAQ 34.2

(a) Your diagnosis is infection with ascaris worms (ascariasis). You should treat the five-year-old child with 1 tablet of albendazole (400 mg) or 1 tablet of mebendazole (500 mg) to be taken orally.

(b) You should also give health education to the mother and the community on measures to interrupt faeco-oral transmission via hand-to-mouth transfer of the ascaris eggs from the soil, and prevention of transmission in contaminated water and food. Using latrines, safe disposal of faeces, and avoiding open defaecation in fields prevents contamination of soils with faeces containing the worm eggs.

SAQ 34.3

(a) The common causes of anaemia to be considered include malaria, malnutrition, a recent history of bleeding, and hookworm infection.

(b) The evidence that suggests hookworm infections is the *absence* of other obvious causes (e.g. if malaria is not locally endemic, or the malaria rapid diagnostic test is negative), and the *presence* of risk factors for hookworm – walking barefooted in areas where faeces contaminate the soil.

(c) Whatever the cause, refer Abebe to a higher level health facility for laboratory diagnosis and treatment if he has hookworms, or diagnosis of another cause, and treatment for his anaemia.

SAQ 34.4

Some differences between amoebiasis and shigellosis are:

- Amoebiasis is more common in young adults, but shigellosis is more common in children below ten years
- Amoebiasis is an endemic disease that rarely causes an epidemic, whereas shigellosis (though also endemic) can rapidly spread and cause an epidemic
- The bloody diarrhoea in amoebiasis contains some formed stools, but in shigellosis only blood and mucus comes out when the patient strains to defaecate
- A patient with amoebiasis is rarely ill enough to remain in bed, whereas someone with shigellosis may be bedridden due to severe dehydration.

SAQ 34.5

(a) The route of exit for the eggs of ascaris worms and hookworms is the same – with the faeces. Prevention and control measures that are common to both diseases are use of latrines, safe disposal of faeces, and avoiding open defaecation in fields. This prevents contamination of soils with infected faeces. Another similarity is that routine deworming of children aged two to five years every six months with albendazole or mebendazole reduces the reservoir of both diseases in the community.

(b) The difference is that the route of entry for ascariasis is through the mouth, while for hookworm infection it is through the skin, usually on bare feet. Prevention and control measures for ascariasis involve prevention of hand-to-mouth transmission of the infectious agents, and avoiding contamination of food and drinking water. In addition, to the measures described in (a), prevention and control measures for hookworm include wearing shoes.

Study Session 35

SAQ 35.1

Fever, cough and fast breathing in old age can be indicators of severe pneumonia. Therefore, the man should be referred to a health centre or hospital immediately for further assessment and specialised treatment.

SAQ 35.2

A is *false*. A 40-day-old child with fast breathing should be immediately referred to a hospital or health centre for treatment. He may develop serious complications like pneumonia.

B is true. *Streptococcus pneumoniae* bacteria can cause acute otitis media and pneumonia.

C is *false*. Rheumatic heart disease is due to damage of the heart tissue by antibodies produced to attack Group A *Streptococci*. It is not caused by bacterial infection of the heart.

D is true. Bacterial pneumonia in children is usually more severe than viral pneumonia. The clinical manifestations of bacterial pneumonia include fever, cough, fast breathing, chest in-drawing and stridor. The clinical manifestations of viral pneumonia develop gradually and include fever, cough and wheezing.

E is *false.* There is not currently a vaccine available in Ethiopia to immunize against the Group A *Streptococci* that cause pharyngitis.

SAQ 35.3

Chest in-drawing, stridor, respiration rate faster than 40 breaths per minute, and the presence of general danger signs such as being unable to eat or drink, lethargy or loss of consciousness, indicate a classification of severe pneumonia in a four-year-old child.

SAQ 35.4

Co-trimoxazole (c) is the preferred drug for treating acute otitis media or non-severe pneumonia at Health Post level. If co-trimoxazole is not available, then (e) (amoxicillin) should be given.

SAQ 35.5

The completed version of Table 35.5 appears below.

Table 35.5 Prevention and control measures against ARIs.

Action	**Is it prevention?**	**Is it control?**
Early diagnosis and treatment		X
Adequate nutrition	X	
Immunization against respiratory tract infections	X	X
Reduction of indoor smoke pollution	X	
Coughing or sneezing into a cloth, or turning away from other people		X

Study Session 36

SAQ 36.1

(a) The major similarity in the way that relapsing fever (RF) and typhus are transmitted from person to person is that the infectious agents of both these vector-borne diseases are transmitted by the human body louse. Lice acquire the causative bacteria when they take a blood meal from an infected person, and they transmit the bacteria to new hosts when people come into close contact with infected lice in clothes, bedding or on bodies. The bacteria causing both diseases multiply in the gut of the louse. The infection enters the new host through breaks in the skin, caused mainly by scratching the itching louse bites.

(b) One difference is that the bacteria that cause RF are transmitted in the fluids leaking from crushed lice, whereas the bacteria that cause typhus are transmitted in infected louse faeces.

SAQ 36.2

There is poor personal hygiene in the village. Relapsing fever and typhus can quickly spread in such poor hygienic conditions if someone brings infected lice into the village on their body or clothes. You have to educate families to wash their clothes, bedding and bodies frequently to prevent diseases related to poor personal hygiene, particularly relapsing fever and typhus.

SAQ 36.3

A is *false*. Relapsing fever and typhus have similar clinical manifestations such as fever, headache, joint and muscle pains. It is very difficult to distinguish between them by clinical manifestations alone, without laboratory investigations.

B is *false*. Relapsing fever and typhus can occur at any season if poor hygienic conditions and overcrowding encourage lice infestation.

C is *false*. Treatment with drugs is not sufficient to control an epidemic of relapsing fever or typhus. Health education about personal hygiene, and delousing clothes and bedding with chemicals such as permethrin, are other necessary control measures.

D is true. The correct antibiotics can effectively treat relapsing fever and typhus if the patient is referred immediately.

E is true. Health workers are at risk from close contact with patients with RF or typhoid because they can get the infection from the body lice of the patient; therefore, close contact should be avoided.

SAQ 36.4

(a) Estifanos may have one of the febrile illnesses such as malaria, relapsing fever, typhus or typhoid fever.

(b) You should immediately refer him to the nearest health centre for further diagnosis and treatment. Visit his village to see the other sick persons and actively search for other cases, which you should immediately report to the District Health Office. There might be an epidemic of one of the febrile illnesses, which needs to be controlled by sustained preventive actions.

Study Session 37

SAQ 37.1

Malaria, relapsing fever, typhus, schistosomiasis, leishmaniasis, onchocerciasis and lymphatic filariasis are all vector-borne diseases prevented by integrated vector control methods. Did you remember all seven of these conditions?

SAQ 37.2

The completed table appears below.

Table 37.1 Four common vector-borne diseases and their vectors.

Vector-borne disease	**Vector**
Schistosomiasis	Freshwater snails
Leishmaniasis	Sandflies
Onchocerciasis	Blackflies
Lymphatic filariasis	Mosquitoes (*Culex* and *Anopheline* females)

SAQ 37.3

(a) The signs of this disease strongly suggest that the patient is suffering from visceral leishmaniasis.

(b) Inform the family that the disease is severe and life-threatening; immediately refer the patient to a higher health facility to confirm the diagnosis and begin treatment.

(c) Educate the family about the mode of transmission of the disease by sandflies biting humans to take a blood meal. Advise them to destroy all rubbish heaps and rodent burrows around the house, and fill cracks in walls where sandflies like to breed. They should agree to their house being sprayed with insecticide and they should cover exposed skin and sleep under insecticide-treated bed nets to avoid sandfly bites.

SAQ 37.4

(a) Cutaneous leishmaniasis is manifested by open skin ulcers, which may be large (see Figure 37.9). The skin lesions of onchocerciasis are characterised by changes in skin colour and the formation of large numbers of nodules (look back at Figure 37.15a).

(b) In addition to the physical disabilities and pain caused by these conditions, the disfiguring appearance of onchocerciasis nodules and cutaneous leishmaniasis ulcers often results in stigmatisation, discrimination and rejection of patients by their communities.

SAQ 37.5

(a) Highland lakes and rivers in several parts of Ethiopia (e.g. Ziway, Hawassa, Bishoftu, Wonji, Haromay, Jimma, Bahir Dar, etc.) are affected by *Schistosoma mansoni*, which affects the intestines. *Schistosoma haematobium*, which mainly affects the bladder is limited to lowland swampy land and floodplains in the Awash and Wabe Shebele valleys and along the border with the Sudan.

(b) Children are most at risk because they are more likely to go swimming in infected water, or stand in the water while fishing. They are also more likely than adults to stand in the water to urinate or defaecate. In addition to the pain caused by the disease, infected children are usually stunted in their growth and perform poorly at school.

Study Session 38

SAQ 38.1

(a) Mr Kebede has had a Category III exposure – he is bleeding after being bitten by a dog that showed abnormal behaviour.

(b) The correct and incorrect actions are listed below:

A is incorrect. Rabies is caused by a virus. Antibiotics kill bacteria – they have no activity against viruses.

B is incorrect. Suturing the wound seals the viruses inside the body and makes it more difficult to flush it with soap and water, detergent, alcohol or iodine.

C is the correct answer. Thoroughly clean the wound and send Mr Kebede to the nearest health facility for post-exposure prophylaxis.

D is incorrect. Mr Kebede's wound is only bleeding a little bit. He does not need IV fluids! Admitting him to the Health Post delays referring him for urgent vaccination and rabies immunoglobulin treatment. The delay threatens his life!

SAQ 38.2

(a) Kemal has had close contact with a dog that has shown some abnormal behaviour, but there are no signs of any bites or scratches on his body and there are no breaks in his skin. Therefore, he is in Category I – no exposure.

(b) Kemal's family should be advised to search for the dog and approach it with great care. It should be destroyed if its behaviour is abnormal; otherwise it should be kept contained for ten days to see if it develops any signs of rabies and killed if it does. They should ensure that Kemal has no further contact with this (or any other) dog, because children are at high risk of being bitten.

SAQ 38.3

A is *false*. It is almost inevitable that a person will die if they develop symptoms of rabies, no matter what medical treatment they receive.

B is true. Taeniasis causes discomfort in people who have a tapeworm in their intestines, but the disease is almost never fatal.

C is *false*. Thorough cooking kills the tapeworm larvae embedded in the meat and prevents their transmission to humans who eat the meat.

D is true. The common symptoms of taeniasis are abdominal pain and the appearance of flat white worms in the stools.

E is true. Open defaecation in grazing lands is a risk factor for taeniasis, because the eggs deposited in human faeces are eaten by cows; the lifecycle of the tapeworm is completed when the larvae become cysticerci in the cows' muscles and people eat infected raw or undercooked beef.

Study Session 39

SAQ 39.1

A is true. Zinash has scarring of the conjunctiva (white bands inside the eyelids), i.e. trachoma grade TS. Therefore, she should be referred to hospital for surgical treatment.

B is true. A newborn with red and swollen conjunctiva could have got the infection from its mother during birth and should be treated with tetracycline eye ointment (1%).

C is *false.* Corneal opacity is a permanent type of damage and cannot be improved by treating with tetracycline ointment.

D is *false.* Scabies is caused by a parasite and can't be treated by tetracycline ointment, which is used to treat grade TF and TI trachoma. A child with scabies should be treated using BBL lotion.

E is true. The SAFE strategy for preventing trachoma stands for surgical treatment, antibiotics, face washing and environmental sanitation.

F is true. Disability resulting from podoconiosis and lymphatic filariasis can be reduced by foot and leg hygiene, exercising the affected part, and raising the legs when sitting or sleeping.

G is *false.* Podoconiosis is not a communicable disease – it is caused by contact with red clay soils, not an infectious agent. However, trachoma and scabies *are* communicable diseases found in conditions of poverty, overcrowding and poor access to clean water and sanitation.

SAQ 39.2

The family of the girl should be educated about face washing with soap and clean water every day to remove the eye discharges. Tell them that the presence of eye discharge and poor personal hygiene will transmit trachoma bacteria to other people through flies landing on the face, and dirty hands and clothing touching the eyes.

SAQ 39.3

Measles, onchocerciasis and trachoma are the three major communicable diseases that can cause blindness. In Study Session 3 of this Module, you learned that measles can cause blindness, particularly among malnourished children who are lacking vitamin A. In Study Session 37 you learned that onchocerciasis can affect the eyes and cause so-called 'river blindness' because the insect vector (blackflies) needs fast-flowing water to breed. Trachoma causes blindness due to corneal damage resulting from bacterial infection of the conjunctiva.

SAQ 39.4

Several of the communicable diseases you have learned about in this Module have clinical manifestations that are due to allergic reactions by the patient's immune system to foreign material introduced into their bodies. The foreign material may be the infectious agent itself: for example, in tuberculosis, leprosy, schistosomiasis, leishmaniasis, onchocerciasis, lymphatic filariasis and trachoma – or the allergic reaction may be to scabies mites. You may also have noted that the allergic reaction to body lice bites causes itching and scratching, which enables the infectious agents of relapsing fever and typhus to enter the body through breaks in the skin. Podoconiosis is due to an allergic reaction to red clay soils penetrating the skin of bare feet.

Study Session 40

SAQ 40.1

The correct order of surveillance activities should be: D, E, A, C and B (refer to Figure 40.1).

SAQ 40.2

A is *false.* You should only collect data which is useful for the control of communicable diseases.

B is true. Detection of an epidemic is one of the major purposes of surveillance. Surveillance can also be used to assess the magnitude of health problems, to allocate resources based on disease burdens and to evaluate progress of activities by the health facilities.

C is true. A combination of active and passive surveillance is one of the indicators of a high quality surveillance system.

D is *false*. Regular recording and reporting is one of the essential elements of a surveillance system. Without proper recording and reporting, action against communicable diseases cannot be taken.

E is *false*. Active surveillance covers specific diseases (not all diseases), unlike a passive surveillance system.

SAQ 40.3

(a) Finding cases of TB through house-to-house visits based on the recommendation of the District Health Office is an example of active surveillance.

(b) In the total adult population of 4,000, there were 10 confirmed cases of TB. To calculate the incidence rate, divide 10 by 4,000 and multiply the result by 1,000, to express the incidence rate per 1,000 of the adult population.

$$\text{Incidence rate} = \frac{10}{4{,}000} \times 1{,}000 = 2.5 \text{ per } 1{,}000 \text{ of the adult population}$$

Therefore, the incidence rate of TB in 2010 in this community was 1 case per 1,000 population.

Study Session 41

SAQ 41.1

Profuse and frequent watery diarrhoea in adults may be an indication of the occurrence of a cholera epidemic. You should report the situation within 30 minutes to the Health Centre. You should verify the existence of similar cases in the community and educate the community on environmental sanitation, such as using a latrine, ensuring a safe water supply for drinking and cooking, and using personal hygiene measures such as hand washing with soap to prevent the transmission of diarrhoeal diseases. Ayele should be started on oral rehydration solution (ORS, see Study Sessions 32 and 33) and transferred to the Health Centre urgently for specialist treatment.

SAQ 41.2

(d) is the correct answer. Malnutrition is a weekly reportable health problem, not an immediately reportable priority disease. Polio, avian influenza, rabies and neonatal tetanus are all immediately reportable priority diseases.

SAQ 41.3

A is *false.* IDSR is a type of passive surveillance where data for all important diseases are gathered routinely by health institutions.

B is true. IDSR is cost-effective, since the same human resources and formats are used to report all diseases in the community. It also creates an opportunity to integrate data on all important diseases at central level.

C is *false.* To identify cases in the community, community workers and Health Extension Practitioners should use simplified community case definitions. Standard case definitions are for use in Health Centres and Hospitals.

D is *false.* Diseases targeted for eradication, such as neonatal tetanus, should be reported immediately.

E is *false.* A single case of a disease can indicate an epidemic. For example, a single case of cholera or of acute flaccid paralysis may signal an epidemic of cholera or polio.

Study Session 42

SAQ 42.1

In a common source epidemic, there is a single source of infection and most people develop the disease after the same incubation period. Good examples are foodborne diarrhoeal diseases. In propagated epidemics, the disease is transmitted from person to person via, for example, a vector, respiratory droplets coughed or sneezed into the air, sexual contact, or some other direct or indirect method. Good examples are a malaria epidemic, or louse-borne relapsing fever or typhus.

SAQ 42.2

Educate the community to boil the water or add chemicals such as chlorine before drinking the water.

SAQ 42.3

(a) HIV/AIDS occurs in propagated epidemics. Therefore, in an HIV/AIDS epidemic, the people affected will not become sick after the same incubation period, because they were infected at different times and from different sources.

(b) By contrast, in a common source outbreak of a foodborne infection, most people will become sick after the same, single incubation period because they acquired the infection from the same food at the birthday celebration.

SAQ 42.4

(a) There are 6 males and 5 females with acute watery diarrhoea.

(b) The number of cases (11) is high in three days and may indicate the occurrence of a cholera epidemic. In particular, the death of a person over 5 years old from diarrhoea is an indicator of cholera (think back to Study Session 33).

(c) Immediately report these cases and your suspected diagnosis of cholera to the District Health Office for further investigation and management. Go into the community and see if you can find other similar cases. Educate community members on how they can prevent the spread of the infection.