

# MODULE

## *Malaria*

For the Ethiopian Health Center Team



**Ethiopia Public Health  
Training Initiative**

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In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center,  
the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

2005



Funded under USAID Cooperative Agreement No. 663-A-00-00-0358-00.

Produced in collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education.

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## Acknowledgement

The development of the module has gone through series of meetings, discussions, revisions, writings, individual and group works. We would like to express our deep appreciation to The Carter Center, Atlanta, Georgia for funding the activities all the way through. The contribution of Professor Dennis G. Carlson, Senior Consultant at The Carter Center is immense. Without his help the modules would not have been materialized. Many people at home and abroad have contributed their ideas and materials to the development of the module. To mention some: Dr. Shitaye Alemu, Dr. Getahun Mengistu, Dr. Addis Alemu, Dr. Liew Awoke, Dr. Charles Larson, Dr. Louis Molineaux, Ato Gebre Yesus Kidane, Prof. Nicholas Cunningham, Professor Joyce Murray, and Dr. Asfaw Desta. We thank the departments of Nursing, Environmental Health, Laboratory Technology and Internal Medicine of the Gondar College of Medicine and Health Sciences of the University of Gondar (UoG). The teams of Jimma University, Addis Ababa University, Almaya University and Debub University are acknowledged.

The following instructors from the Gondar College of Medicine and Health Sciences, (GMHS), University of Gondar, are appreciated for updating and revising this module: Dr. Nurelign Gashu, Ato Melkie Edris, Ato Getu Degu, Ato Merawi Betseha and Ato Abebaw Erdie. Two of the authors, Dr Mengesha Admassu and Ato Amsalu Feleke, had also participated in the updating and reviewing of this module.

Finally, the contributions of health officer, environmental health, nursing, and laboratory technology students during pre-testing of the materials are appreciated.

## Preface

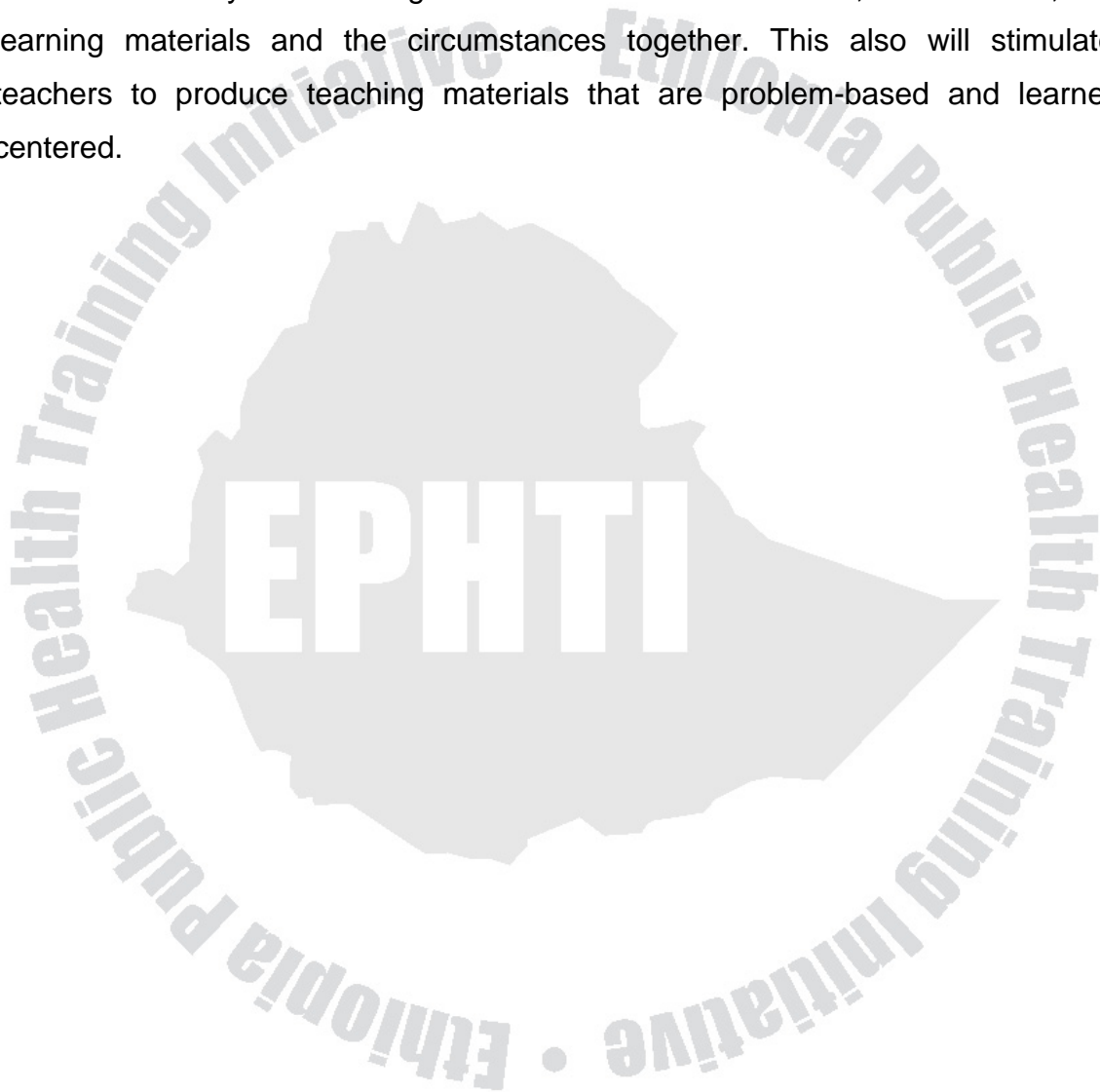
Teaching learning is a challenge under all circumstances though the problem is significant in developing countries like Ethiopia where textbooks are scarce, learning materials few, teachers overwhelmed and conditions unfavorable. Moreover, many of the learning materials such as textbooks are often bulky and at times not suitable to the conditions existing in the home country. Since the team training is somehow unique to Ethiopia and there are no learning materials specifically designed to train the health center team, the development of materials such as modules will be helpful to strengthen the training programs.

The module is specifically for the health center team, which must learn to work effectively together at the health center level. The health center team includes health officers, public health nurses, environmental health technicians, and medical laboratory technicians. The training for health officers is at a baccalaureate level while the rest three categories are diploma trainings. The health center team is basically involved in primary health care at the grass root-level. Most of the activities concentrate on health promotion, identification and treatment of common illness and disease prevention and control.

This module is prepared on malaria (uncomplicated), which has remained a major public health problem in Ethiopia. It consists of a Core Module, five Satellite modules and Take-home message for caregivers. The Core Module covers the essential minimum that should be known by all the four categories of the health center team. The satellite modules complement the core module by addressing professional areas of each category that is not well covered in the core module. The satellite modules also have included basic knowledge and skills for the Health Service Extension Workers (HSEW). Therefore, satellite modules are designed to strengthen the Core Module and try to stretch the spectrum of knowledge and skills across the professionals and the community.

This module is updated, revised and incorporated new ideas from literatures and the latest Diagnosis and Treatment Guidelines on Malaria from the Ministry of Health of Ethiopia.

Finally, this module is not supposed to replace textbooks. However, the attempt is to show clearly that it is high time to consider the teacher, the students, the learning materials and the circumstances together. This also will stimulate teachers to produce teaching materials that are problem-based and learner centered.



## Abbreviation

A. gambiae	- Anopheles gambiae
DL	- Deci Liter
EDTA	- Ethylene Diamine Tetra Acetic Acid
EHT	- Environmental Health Technician
FDRE	- Federal Democratic Republic of Ethiopia
GCMHS	- Gondar College of Medicine and Health Sciences
HCT	- Hematocrit
H.E	- Health Education
HO	- Health Officer
HSEW	- Health Service Extension Worker
IM	- Intramuscular
IV	- Intravenous
Kg	-Kilogram
Mg	- Milligram
ml	- Milliliter
Min	- Minute
MLT	- Medical Laboratory Technician
MOA	- Ministry of Agriculture
MOE	- Ministry of Education
MOH	- Ministry of Health
ORS	- Oral Rehydration Salt
P. falciparum	- Plasmodium falciparum
P. vivax	- Plasmodium vivax
PHN	- Public Health Nurse
RBC	- Red Blood Cell
RDT	- Rapid Diagnostic Test
T <sup>o</sup>	- Temperature
UoG	- University of Gondar
WBC	- White Blood Cells
WHO	- World Health Organization

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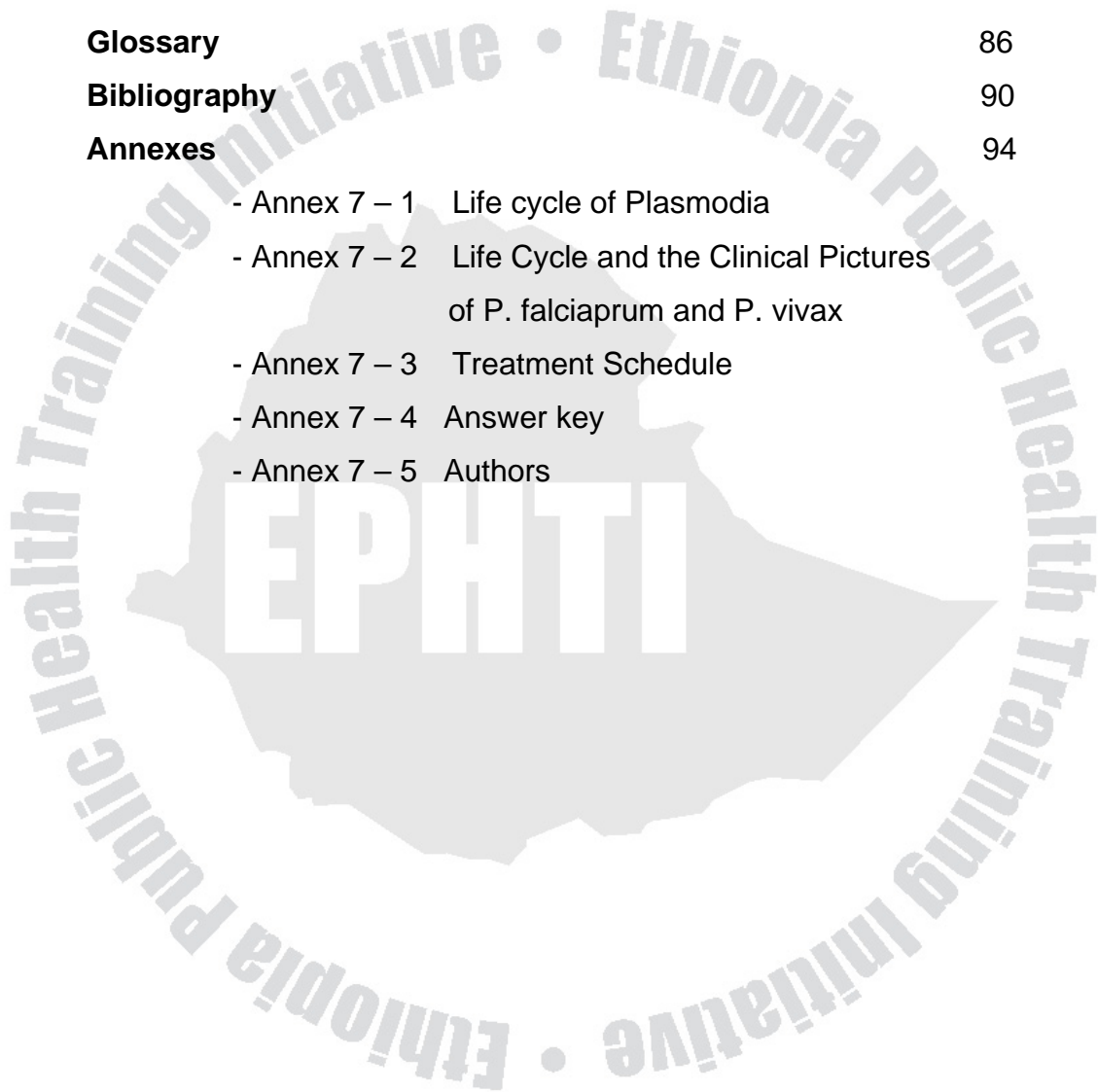
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# UNIT ONE

## INTRODUCTION

### 1.1. Purposes and Uses of the Module

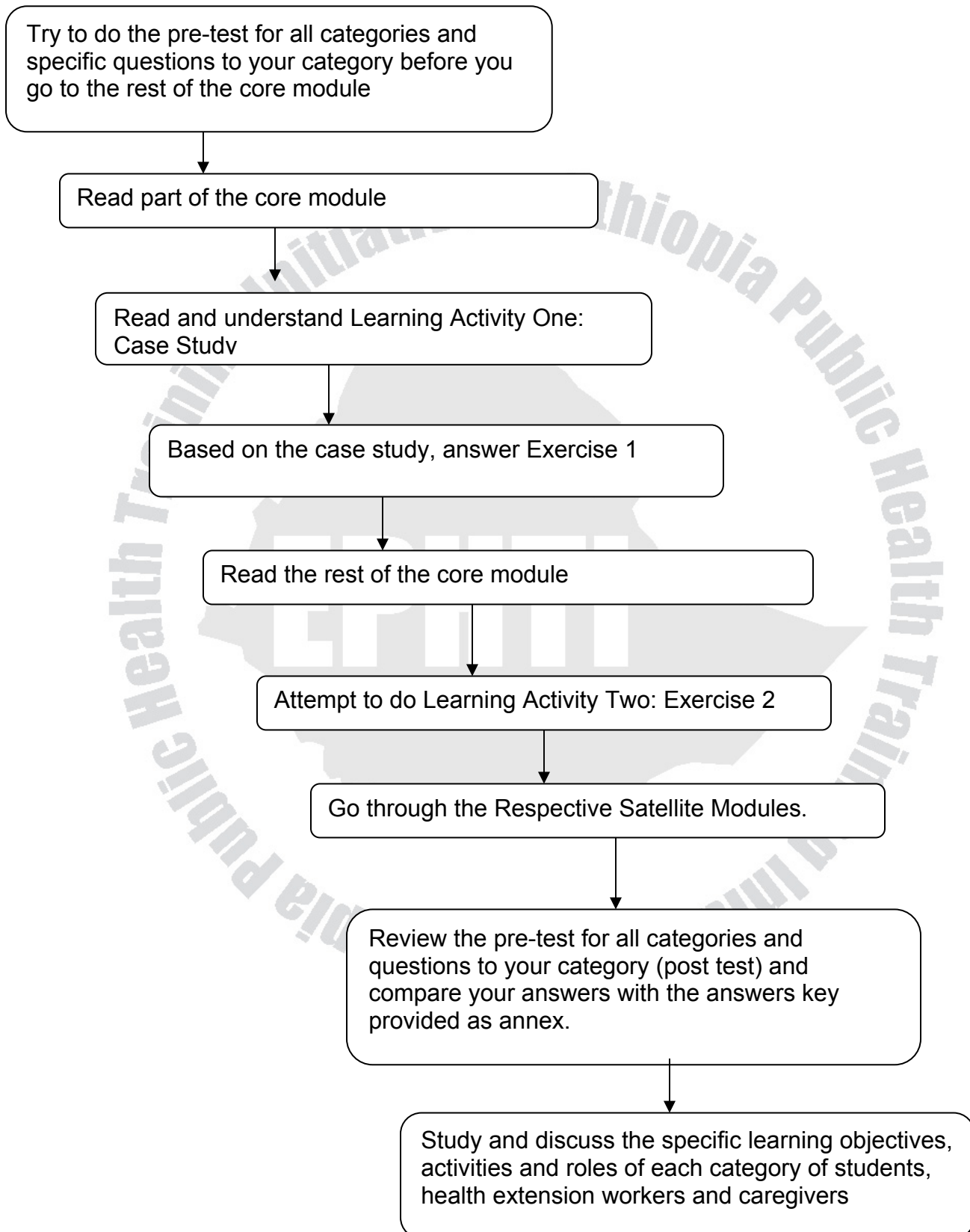
This module is prepared for Health Officer, Public Health Nurse, Environmental Health Technician and Laboratory technician students who need to work as team members. Other categories of students such as clinical nurses and health center team in the service areas could use the module too. It also shows what caregivers or health service extension workers should do.

The module will serve as a practical guide to the management of uncomplicated malaria. It enhances the theoretical knowledge acquired in the different disciplines with practical approach. However, it is not meant to substitute for other reference materials and textbooks.

The module will also help to work together as a team. The core module emphasizes the areas that need to be known by all categories of health center team members. The satellite modules however concentrate on specific tasks and skills that need to be acquired by each category of the health center team. The contents of the satellite modules include portions that are not addressed by the core module, but are essential for each professional category.

After going through the module, students will be able to appreciate the contributions that could be made by each health center team member and caregiver/self-care taker. Above all, it will enable them to identify the roles and tasks required in preventing and controlling malaria.

## 1.2. Directions for Using the Module



# UNIT TWO

## CORE MODULE

### 2.1. Pretest

#### Instruction

Before you go into the case study, attempt to answer all questions.

#### 2.1.1. All Categories of the Health Center Team

1. The important vector in the transmission of malaria is \_\_\_\_\_.
2. List the parasites that cause malaria.
3. Which one of the following diseases is the most common cause of outpatient morbidity in Ethiopia?
  - a) Typhoid fever
  - b) Pneumonia
  - c) Cancer
  - d) Malaria
  - e) Relapsing fever
4. What percentage of the Ethiopian populations is at risk of getting malaria?
  - a) 25%
  - b) 50 %
  - c) 67%
  - d) 90%
  - e) 10%
5. How much of the land in Ethiopia is malarious?
  - a) 25%
  - b) 40%
  - c) 10%
  - d) 75%
  - e) 95%
6. List the two commonest malaria parasites in Ethiopia in order of magnitude.
7. Which one of the following is the commonest route of malaria transmission?
  - a) Trans-placental
  - b) Blood transfusion
  - c) Accidental inoculation
  - d) Mosquito bite
  - e) All of the above
8. People who are at high risk of developing and dying of malaria include
  - a) Adults living in endemic areas

- b) Children
  - c) Pregnant women
  - d) Non immune travelers going to endemic areas
  - e) All are true except ' A '
9. List the effects of malaria in a pregnant mother.
10. What diagnostic method can be used to diagnose malaria at a health center level?
- a) ELISA
  - b) Blood culture
  - c) Blood film
  - d) White blood cell count
  - e) Erythrocyte sedimentation rate
11. How do you know that malaria is a critical problem at certain point of time in a population?
12. What are the reasons that malaria would be a potential problem in certain localities?
13. What diagnosis test do you use when blood film is not available at your health center?
- a) Hematocrit
  - b) White blood cell count
  - c) Rapid diagnostic test
  - d) Gram stain
  - e) Acid fast stain

### **2.1.2. Pretest for Specific Categories of the Health Center Team**

#### **2.1.2.1. Health Officer Students**

1. Which of the following is within the average incubation period of Uncomplicated malaria?
- a) Three to five days
  - b) Four to six days
  - c) One to three days
  - d) Forty to sixty days
  - e) Ten to twenty days
2. The clinical manifestation of uncomplicated malaria does not include
- a) Fever
  - b) Enlarged liver
  - c) Shivering
  - d) Acute renal failure
  - e) None of the above

3. The commonest species of anopheles mosquito in Ethiopia is \_\_\_\_\_.
4. Which of the following environmental factors does not affect the breeding of Mosquitoes?
- a) Temperature                      c) Humidity                      e) None of the above  
b) Altitude                              d) Rainfall
5. Which of the following characteristics of the vector affect the transmission of prolonged life of mosquitoes?
- a) The resting habit of mosquitoes                      c) All of the above  
b) Anthropophilic nature of mosquitoes                      d) non of the above
6. The immunity status of a community is very low in stable malaria
- a) True                                      b) False
7. The most important diagnostic tool for differentiating malaria from other common causes of fever at a health center level is
- a) Urinalysis                      c) Clinical picture                      e) All of the above  
b) BUN                                      d) Blood film examination
8. According to P.falciparum malaria treatment policy of Ethiopia the first-line drug for uncomplicated malaria is Chloroquine.
- a) True                                      b) False
9. Provision of prophylactic drugs is not indicated
- a) For all people living in malaria endemic area  
b) For pregnant women  
c) For non-immune travelers to malaria endemic area  
d) For young people going to malaria endemic area  
e) Only a and d
10. The contraindications for treatment with Artemether Lumefantrine include?
- a) Weight less than 5 kilograms  
b) Age less than fifteen years  
c) Pregnant women  
d) A person previously treated with chloroquine  
e) A and C

11. Eradication of malaria is easier in unstable malaria
  - a) True
  - b) False
12. List three factors that determine the pattern of malaria infection
13. The favourable temperature for mosquito breeding is \_\_\_\_\_.
14. Longevity is a host factor
  - a) True
  - b) False
15. Host immunity does not have a role in malaria infection
  - a) True
  - b) False

### 2.1.2.2 Public Health Nurse Students

1. The commonest and most important killer among malaria species is
  - a) P.vivax
  - b) P.falciparum
  - c) P.malariae
  - d) P. ovale
2. One of the following is wrong about the transmission of malaria
  - a) It is transmitted through the bite of female culet mosquito
  - b) There is placental vertical transmission
  - c) It is also transmitted through transfused blood
  - d) Rarely transmitted through contaminated syringes and needles
  - e) None
3. The reservoir of malaria parasite is
  - a) Female anopheles mosquito
  - b) Marshy area and stagnant water
  - c) Humans
  - d) Arthropods
  - e) Snail
4. The clinical characteristics of severe malaria include all except
  - a) Generalized convulsion
  - b) Pulmonary edema
  - c) Severe anemia
  - d) Acute renal failure
  - e) None of the above
5. Which of the following is the drug of choice for treating uncomplicated P. falciparum malaria in Ethiopia currently?
  - a) Chloroquine
  - b) Artemether Lumefantrine
  - c) Primaquine
  - d) Quinine
  - e) All of the above

6. The following are indications for urgent referral of malaria patient from health center to the next health institution except
- a) Signs of pulmonary failure
  - b) Signs of renal edema
  - c) Disseminated intravascular coagulation
  - d) Severe anemia
  - e) Fever ( $38.5^{\circ}\text{C}$ )
7. An intravenous 600 mg quinine in 600 ml 5% dextrose in saline is ordered to run for four hours. Calculate the rate of flow in drip / minute (given 1 ml =15 drops / min).
- a) 38 drop /min
  - b) 900 ml / min
  - c) 190 drop/min
  - d) 162.5 drop / min
  - e) 38 ml/ min
8. The strategies in malaria prevention and control include
- a) Inter-sectoral collaboration
  - b) Community participation
  - c) Early diagnosis and treatment of cases
  - d) All of the above
9. Nursing management includes all except
- a) Provide anti-malarial drugs
  - b) Give health education
  - c) Assess condition of the patient
  - d) Control fever
  - e) Identify type of parasite and load
10. The side effects of quinine include
- a) Cardiac arrhythmia
  - b) Hypoglycemia
  - c) Temporary hearing loss
  - d) Hypo tension
  - e) All of the above

### **2.1.2.3 Environmental Health Technician Students**

1. Malaria is a disease caused by
- a) Virus
  - b) Bacteria
  - c) Ricketessia
  - d) Protozoa

2. Which one of the following is a self-protective measure?
- a) Draining of standing water
  - b) Earth fill of open pits
  - c) Use of mosquito repellent
  - d) Addition of burning oil on standing water
3. Which of the following preventive and control measures of malaria could not be practiced through mobilization of the community?
- a) Application of screens for windows
  - b) Draining of standing water
  - c) Site clearing
  - d) Earth fill of open pits
4. Which category benefits from anti-malaria prophylaxis?
- a) Patients
  - b) Those who are immune from malaria
  - c) The susceptible host
  - d) Both patients and susceptible hosts
5. Application of larvicidal chemical is an intervention at \_\_\_\_\_ level.
- a) Patient level
  - b) Environment
  - c) Susceptible host level
  - d) both patient and susceptible host
6. Which of the following is not the most preferable among the preventive and control methods of malaria?
- a) Health education
  - b) Use of impregnated bed nets
  - c) Extensive use of insecticides
  - d) Use screens for windows
7. Which one of the following statements is not true regarding malaria?
- a) The genus anopheles mosquito is the transmitter of plasmodia
  - b) Malaria plasmodia can be transmitted vertically
  - c) Diagnosis is established on the basis of clinical, epidemiological, and laboratory findings
  - d) Areas with an average of 16<sup>0</sup> F and water are favorable places for anopheles mosquitoes to breed on
8. Which of the following is among the most likely roles of an environmental health technician concerning the prevention and control of malaria?
- a) Mobilization of the community
  - b) Providing treatment services for patients in health centers



- c) Making appropriate diagnosis
  - d) Provision of health education on self and community protection measures
  - e) Only a and d
9. All are risk factors for multiplication of the malarial parasites and multiplication of mosquitoes, except
- a) Water temperature above 15<sup>0</sup>C
  - b) Environmental temperature between 15-30<sup>0</sup>C
  - c) Marshy area
  - d) Heavy rainfall
  - e) Altitude below 2200 meters
10. When is the most likely transmission of malaria?
- a) At the end of rainy season
  - b) Following small rains
  - c) During heavy rain
  - d) During the hot season
  - e) Only a and b

#### **2.1.2.4 Laboratory Technician Students**

1. What are the specific staining techniques that help for the diagnosis of malaria?
2. What is the staining technique that you recommend for staining thick blood film?
3. List the developmental stages of plasmodia seen in blood film?
4. What are the two major criteria used for differentiating plasmodia species?

5. Thick blood smear is more advantageous than thin blood smear in
- a) Easy identification of parasites in blood film (increase yield of Parasite identification)
  - b) Easy identification of plasmodia species in blood film (increase yield of parasite species identification)
  - c) Processing of many bloods smears at a time
  - d) Taking less time for specimen processing
6. The most common parasite stage seen in blood film is \_\_\_\_\_.
- a) Trophozoite stage
  - b) Schizont stage
  - c) Gametocyte stage
  - d) All of the above
7. All are characteristics of *P. falciparum* malaria except
- a) It shows morphological changes in infected RBCs
  - b) It infects all developmental forms of RBCs in peripheral blood
  - c) Schizont stage is not seen in blood film in severe form of infection
  - d) It may have double chromatin dots
8. *P. vivax*
- a) Is the commonest plasmodia species causing malaria in Ethiopia
  - b) Is the major cause of severe and complicated malaria?
  - c) Infects only young RBCs
  - d) Shows all stages of plasmodia in blood film
9. \_\_\_\_\_ is /are the commonest causes of malaria in Ethiopia.
- a) *P. vivax*
  - b) *P. falciparum*
  - c) *P. ovale*
  - d) *P. malariae*
  - e) A and B
  - f) B and C
10. Crescent, banana shaped gametocyte is characteristics of
- a) *P. vivax*
  - b) *P. falciparum*
  - c) *P. ovale*
  - d) Both A and B

## 2. 2. Significance and Brief Description

Malaria is one of the leading causes of morbidity and mortality in Ethiopia. About 75% of the areas in Ethiopia are malarious and 67% of the population is at risk of getting malaria infection.

It has been reported that cyclic, large scale and devastating epidemics of malaria have occurred in Ethiopia. Natural and human made disasters, and developmental activities such as irrigation schemes have also contributed to this situation.

Effective preventive and control measures with early diagnosis and treatment of cases can significantly reduce the morbidity and mortality from malaria.

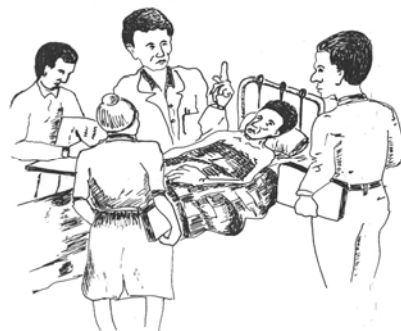
## 2. 3. Learning Objectives

Upon the completion of the activities in this module, the learner will be able to:

1. Describe the causes and clinical pictures of malaria.
2. Make appropriate diagnosis of malaria at individual and community levels.
3. Treat malaria as recommended.
4. Identify and name the different control measures for malaria.
5. Understand and identify the tasks and roles of the team members.
6. Identify the contributions that could be made by caregivers / self-care takers and health service extension workers in the prevention, control and management of malaria.



*Discussing on Malaria*



*Visiting A Patient*

## 2. 4. Learning Activity One: Case Study

Ato Abebe Fekadu is a 32-year-old high school teacher in Simada town. Simada district is one of the administrative woredas in South Gondar Administrative Zone. It is a low land area.

One morning in his way to work, Ato Abebe started to feel headache and nausea. He went to a drug shop and purchased painkiller, which he took after lunch. He went back to work as the symptoms he had felt have improved. He had a lot of work because the rainy season had already started and had to prepare final examination for his students.

In the middle of his work, the problem started again. It even became worse. He vomited what he had eaten during his lunch and the color of the vomitus looked greenish in color. He became worried when he started to have severe headache and fever. Since he was a new comer to that area he consulted his friends. They advised him to take paracetamol. That night he felt very hot. His urine color changed to brown. He couldn't eat his dinner, even a single swallow, due to nausea and fear of vomiting.

In the next morning, he even felt very weak and could not go to school. A neighbor took him to the health center, which is approximately located about 100 meters away from home. The health professional asked him about his illness, the duration, the symptoms and other related things. He examined his eyes, his blood pressure and temperature too. He also examined his abdomen. A sample was taken from his blood but showed no blood parasites. He was sent home with anti-pyretic drugs.

After going back to his home, however, he showed progressive loss of appetite. On the third day late in the afternoon, he felt very hot again and started to shiver. A friend of his who was worried about his deteriorating conditions took him to the health center for the second time. Ato Abebe did not find the one who has treated him a day before. This was because he had gone out of the town with his team to investigate the occurrence of an epidemic in the lowland areas of Simada worda.

Ato Abebe's friend rented a car for 200 Birr and took him to Debre Tabor town where there is a hospital. In Debre Tabor hospital, blood film was taken. The treating medical personnel reported the positive blood film result. He was also told that he has severe anemia and was admitted to the hospital for treatment services.

## Group Exercise One

**Based on the case history given above, try to answer the following questions by discussing with your group**

1. *What is the most likely disease that the teacher is suffering from?*
2. *What do you think are the most important methods of transmission of the disease?*
3. *The blood film done in Simada Health Center was negative for blood parasites. However, it was positive in Debre Tabor hospital. How could this happen?*
4. *What do you think will be the report of the laboratory technician in Debre Tabor Hospital?*
5. *Suppose you were the one who is treating Ato Abebe at Simada, what will you do to manage the problem?*
6. *Why was the patient admitted to the hospital?*
7. *Was there any possibility to treat Ato Abebe on ambulatory basis?*

### 2. 5. Definition

Malaria is an infection caused by the protozoa called plasmodia through the bite of an infected female anopheles mosquito and is characterized by on and off fever, chills, sweating, joint pain, backache, headache, enlargement of the spleen (splenomegally), and repeated attacks.

### 2. 6. Epidemiology

#### **Magnitude**

**Global:** About 300-500 million people suffer from malaria each year worldwide. It has remained a major health problem especially in developing countries. More than 90% of the cases are from the sub-Saharan Africa. Each year, 1.7 to 2 million people die from malaria. The majority of these deaths occur in Africa.

### ***Ethiopia:***

As mentioned earlier, majority of the population live in malarious areas. Repeated epidemics that killed many people have been documented. Reports have showed that the number of people affected by malaria has dramatically increased since 1980s. In 1989 – 1990 the number of cases per year was 21 per 1000 population. Even the situation worsened, based on health Institutions' reports (2002/03) malaria is reported to be the first cause of morbidity and mortality accounting for 15.5% of OPD visits, 20.4% of admission and 27% of inpatient deaths.

### **Transmission**

Malaria is a vector-borne disease. Malaria is mainly transmitted from the infected individual to the healthy individual by bite of female anopheles mosquito, which is the vector. The bite takes place during the dark and cool hours of the day. Although rare, malaria can also be transmitted through blood transfusion, placenta and inoculation accidents. The parasite that causes malaria is called plasmodium. These parasites are injected into the blood of humans through the bite. Human beings are the only reservoir of malaria parasites.

### **Predisposing Factors**

Young children, travelers who are non-immune, refugees, displaced people; pregnant women and laborers entering into malarious areas are groups, which are at risk of getting malaria. People in rural areas with limited access of health services are the most affected.

Epidemics of malaria occur during political upheaval, economic crisis and other environmental pressures that result from human made and natural disasters. That is like new developmental schemes that create multiple breeding sites of mosquito, such as irrigation, borrows, road and housing construction or wastes like used cans, tires, plastic cans, or natural plants like cactus (because some

leaves hold water for weeks). The developments of resistance to pesticides especially DDT and drugs such as chloroquine and sulfadoxine pyrimethamine (Fansider) by Plasmodium falciparum have contributed to the recent increase in transmission.

***The Determinants for the Transmission of Malaria Include:***

1. Population of the female anopheles mosquito (in Africa Anopheles gambiae);
2. Elevated temperature (the life cycle of the mosquito becomes complete within a short period facilitating maturation of the vectors);
3. Malaria control programs could reduce the mosquito population and the rate of the amount of infection.

**2. 7. Etiology and Pathogenesis**

***(A) Etiology***

There are four causative plasmodium species:

- 1) Plasmodium falciparum
- 2) Plasmodium vivax
- 3) Plasmodium ovale, and
- 4) Plasmodium malariae

Plasmodium falciparum accounts for the majority of the infections and is the most important killer among the species. In Ethiopia, Plasmodium falciparum accounts for 60% of all the cases and Plasmodium vivax for 40%. The other two account only for less than one percent.

***(B) Pathogenesis***

Infection follows the entry of plasmodia sporozoites from the salivary gland of female anopheles mosquitoes into the blood stream of human beings during blood meals. The parasites are carried by the blood stream into the liver where they invade the parenchymal cells of the liver and reproduce asexually. This is

known as intra-hepatic or exo-erythrocytic phase or schizogony. Each sporozoite produces many thousands of daughter merozoites. This process leads to swelling of invaded liver cells and soon after follows bursting of the cells that is accompanied by release of motile merozoites into the blood stream. This is the time where the symptomatic stage of the infection occurs. The merozoites rapidly invade red blood cells and become trophozoites. This development phase is called intra-erythrocytic phase. The trophozoites enlarge and develop specific characteristics. Pigment becomes visible and the parasites take amoeboid shape and become irregular. The parasites consume hemoglobin and occupy most of the red cell. Multiple divisions occur especially of *P.falciparum* in the erythrocytic stage. This multiplication takes place every 48 hours. That is, each attacking one RBC and then produces 8-24 merozoites, which on their turn would repeat same cycle. This justifies the importance of early treatment for malaria (Annex 7-1).

## **2. 8. Clinical features**

### ***Incubation Period:***

The incubation period is 12-14 days for *P.falciparum* and 10-20 days for *P. vivax*. The symptoms and signs of malaria are not specific to the disease. Other febrile illnesses could give the same picture. Fever is a common feature but may be absent in some cases.

### ***Symptoms and Signs:***

#### **Symptoms:**

- High grade fever
- Malaise,
- Headache,
- Shivering and sweating
- Muscle ache,
- Joint pain,
- Sometimes patients may develop: nausea, vomiting, loss of appetite (anorexia), abdominal pain, diarrhea and thirst.



**Signs :**

- Elevated temperature
- Pallor
- Enlargement of spleen and liver

A cyclic pattern of symptoms may be observed in most patients. However, in some cases this cyclic pattern may not happen. This is because the release of merozoites from RBCs may occur at different times.

**Note:** *The relationship between the life cycle of P. falciparum and P.vivax parasites and the clinical picture is shown in Annex 7-2.*

***Effects of malaria in pregnancy:***

- ◆ Abortion
- ◆ Maternal death
- ◆ Fetal death
- ◆ Premature labor
- ◆ Anemia

Severe malaria is caused by Plasmodium falciparum. The case fatality rate of severe and complicated malaria is about 10% in hospitalized adults and 33% in children under 12 years of age.

Patients with severe malaria may present with one or more of the following complications with demonstration of asexual forms of P.falciparum on blood film.

- Cerebral malaria defined as unarousable coma not attributable to any other cause in a patient with falciparum malaria.
- Generalised convulsions.
- Normocytic anaemia. (HCT 15%)
- Renal failure.
- Hypoglycaemia.
- Fluid, electrolyte and acid-base disturbances.
- Pulmonary edema.
- Circulatory collapse and shock (“algid malaria”)

- Spontaneous bleeding (disseminated intravascular coagulation).
- Hyperpyrexia. (Rectal  $T^0 \geq 39^0C$ )
- Hyper-parasitaemia. (> 5% load)
- Malaria haemoglobinuria.
- Prostration (unable to eat, sit or stand)

## 2. 9. Diagnosis

1. Suggestive Clinical history with travel to a malarious area.
2. Suggestive physical findings.
3. Laboratory findings (detection of parasites by blood film examination) or if blood film is not available, rapid diagnostic tests can be used.

Using Giemsa or Wright stain thick or thin blood film is prepared

- Thick blood film for identification of a parasite
- Thin blood film for identification of a plasmodium species

## 2. 10. Case Management

1. Provision of anti-malarial drug (early treatment is a very important principle in malaria case management).
2. Provision of anti-pyretic.
3. Supportive care -fluid replacement, diet.

The treatment of malaria depends on many factors: presence of resistance to anti-malarial drugs (chloroquine and sulfadoxine pyrimethamine resistance), type of plasmodia species, availability of the drugs, and policies of governments). The following include both general principles and current treatment policy of Ethiopia.

### (a) ***For patients able to take oral medication***

- Chloroquine is the drug of choice for chloroquine sensitive *P.falciparum* and *P.vivax*.
- In Ethiopia, for uncomplicated *P.falciparum* malaria Artemether – Lumefantrine is the drug of choice which is the first line of treatment.

**Dose:** See Annex 7-3.

- Oral quinine sulphate is also indicated for pregnant women and infant less than 5 kg.
- For chloroquine sensitive uncomplicated *P. falciparum* or *P. vivax* malaria

**Dose:** Chloroquine  $\Rightarrow$  10 mg base/kg oral route.

1 g (600 mg base) in first day (four tablets).

1 g (600 mg base) in second day (four tablets).

500 mg (300 mg base) in third day (two tablets).

Or

1 g (600 mg-base) oral route, then 500 mg(300 mg-base) 6 hours later, then 500 mg (300 mg-base) at 24 hours and 48 hours.

- The different chloroquine preparations include: 150, 250, 300, 600 mg base.
- Chloroquine is the first-line drug of choice for *P. vivax*. If the area is known to be malaria free, Primaquine 25 mg orally per day for 14 days may also be added to bring radical cure after completing treatment with chloroquine.
- If the diagnosis is made on clinical basis, combined treatment of Artemether – Lumefantrine and chloroquine is recommended (Annex 7-3).

**(b) For patients unable to take oral medication in chloroquine sensitive malaria**

- Chloroquine Intravenous Route (IV).  
10mg base/kg over 4 hours, then 5 mg base/kg every 12 hours, over 2 hours infusions (Total dose= 25 mg base/kg base). *Never give IV push.*
- Chloroquine Intramuscular (IM) route or subcutaneous route. Lower dosage than the IV route is recommended. 2.5mg base/kg IM every 4 hours or 3.5 mg base/kg every 6 hours.  
(Total dose = 25 mg base/kg)

**(c) If a patient who was diagnosed as *P. falciparum* positive comes back with no improvement after treatment with Artemether – Lumefantrine do the following:**

- Ask whether the patient has vomited the drug (1-hour after ingestion) or has diarrhea after treatment. In this case repeat half the original dose.
- Check whether the drug has not expired.
- Repeat blood film. If positive for asexual parasites (excluding other causes), give quinine orally (600 mg salt three times daily for 7 days) (Annex 7 - 3).
- Supportive care.

**(d) For patients unable to take oral medication or in severe illness**

- Intravenous quinine until oral medication is possible or tolerated. Give 20 mg /kg over 4 hrs as loading dose then 10 mg/kg over 4 hours in 5% Dextrose/Saline solution every 8 hrs until the patient is able to take oral medication.

**(e) Indications for referral**

- Not able to drink or eat
- Frequent vomiting
- Pulmonary edema
- Acute renal failure
- Bleeding tendency
- Severe anemia (if blood transfusion is required) i.e. HCT  $\leq$  15%
- Difficult breathing
- Treatment failure where facilities for malaria microscopy is not available

- Hyperparasitaemia (parasitic load > 5%)
- Altered mental state
- Hypotension (low blood pressure than normal)
- Seizure
- Hemoglobinuria
- Jaundice
- Conditions that can not be handled at the health center

**Note:** During referral send patient with first dose of quinine.

## 2. 11. Prevention and Control

### Objectives of Malaria Control

- Reduce malaria sickness (morbidity)
- Reduce the duration of illness
- Prevent and reduce malaria deaths (mortality)

### Strategies

- Health education
- Early diagnosis and early treatment
- Early recognition and referral of severe malaria
- Community participation
- Intersectoral collaboration
- Chemo prophylaxis

### Methods

#### (i) **Health Talks**

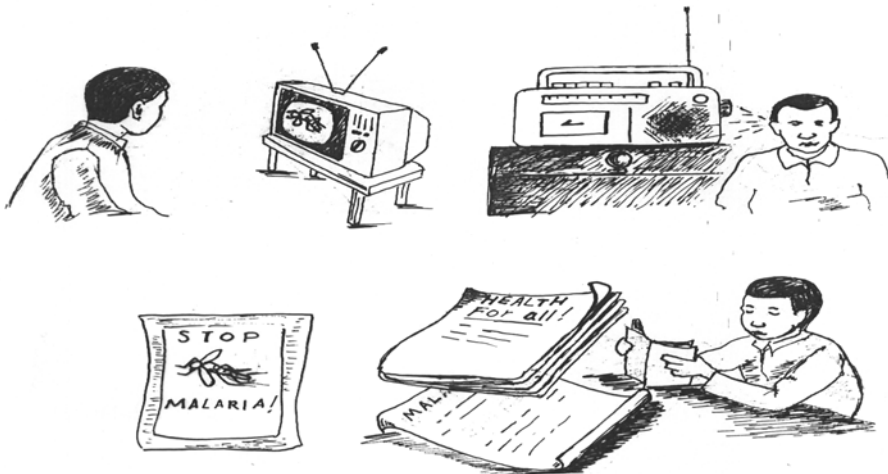
- To individuals: at home, working areas and personal meetings
- To groups: at working areas, meetings and social events
- To communities: at any gatherings such as meetings, market places, church ceremonies, during epidemics and health meetings

## **(ii) Demonstrations**

- Demonstrate breeding sites for mosquitoes and how to eliminate these sites
- How to differentiate anopheles mosquitoes and others by their resting position.
- How to identify anopheles mosquitoes larvae from other larvae by their resting position in water.
- How mosquitoes develop from larva stage by using transparent drinking glass of water covered by a piece of clothe.
- Breeding sites for mosquitoes and how to eliminate these sites.
- Drain stagnated water bodies.
- Clear residential areas.
- Apply used motor oil on stagnant water body if drainage is not possible.
- Dig pits for disposing wastes and garbage.

## **(iii) Mass Media**

- Includes newspapers, leaflets, radio, television
- Write articles
- Give health talks or expert ideas
- Prepare and present dramas or role-plays
- Presentation of actual cases of community mobilization



*Mass Media*

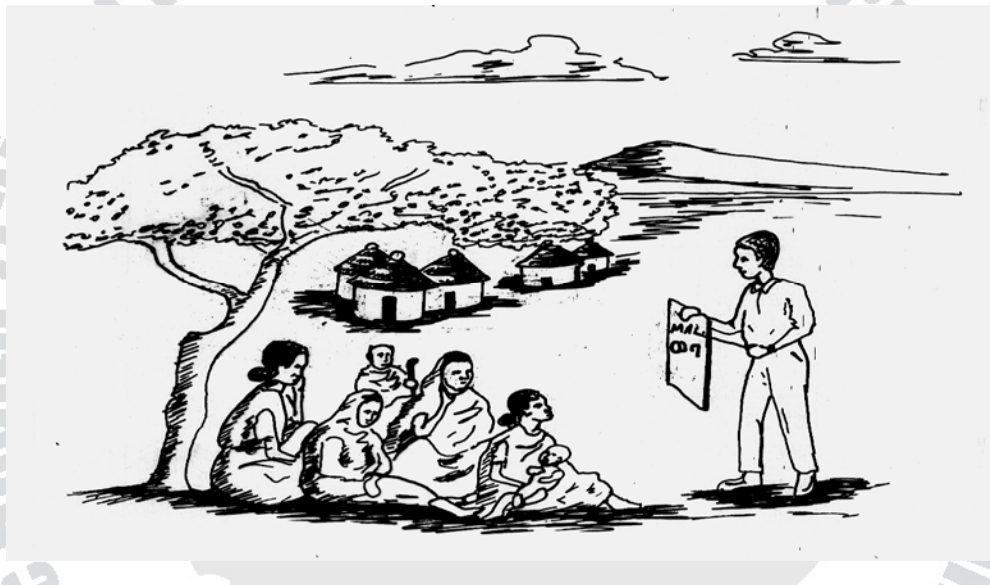
**(iv) Role-plays and Dramas**

**(v) Community Participation**

*For successful environmental management*

- Mobilize community health workers, community leaders, women, other sector personnel such as in agriculture, education, religious leaders, etc.
- Train selected community members on malaria

**Topics for Health Education**



*Teaching The Community About Malaria*

**1. Undertaking Environmental Control**

- Drainage of stagnant water
- Clean-up campaigns
- Reclaiming land by filling and drainage
- Larviciding –larval control operations
  - Proper waste disposal

**2. Reduction of Contact between People and Mosquitoes**

- Selection of settlement sites: should be more than one kilometer away from breeding sites.

- Clearing trees and vegetation around living, working areas
- Site cattle sheds away from residential areas
- Increase use of insecticide-impregnated bed nets
- Use of screen on windows
- Wearing protective clothing
- Applying mosquito repellents on the skin
- Fumigating the house

### 3. **Early Reporting to the Nearest Health Institution**

### 4. **Treatment**

- Importance of prompt and right treatment of suspected malaria especially in children and pregnant women
- Mass drug administration during outbreaks

### 5. **Prophylaxis**

- Advice to travelers and newcomers to continue taking prophylaxis when moving from malaria non endemic to endemic areas

## **Chemoprophylaxis Regimen**

### **Mefloquine**

<b>Weight (kg)</b>	<b>Age (years)</b>	<b>Number of tablets per week</b>
< 5	< 3 months	Not recommended
5 – 12	3 – 23 months	1/4
13 – 24	2 – 7	1/2
25 – 35	8 – 10	3/4
36 – 50+	11 – 14+	1

### **Side effects of Mefloquine:**

Dizziness, mild to moderate gastrointestinal disturbances, (nausea, vomiting, abdominal pain and diahorrea).



### **Contraindications of Mefloquine:**

- Persons with known hypersensitivity
- Persons with a history of severe neuropsychiatry disease
- Persons who have received treatment with Mefloquine in the previous 4 weeks.
- Persons performing activities requiring fine coordination and spatial discrimination
- The subject should not take alcohol
- Mefloquine is not recommended for pregnant women during first trimester and infants < 3 months.

### **6. Community Participation**

### **7. Intersectoral Collaboration**

### **8. Traditional Malpractice**

- Study the traditional treatment and patient care procedures of malaria in the area.
- Based on the information, discuss with people and teach about the untoward effects of the procedures.

### **Approach for the prevention and control of malaria**

- **Self-protection measures**
  1. Mosquito bed nets
  2. Window screens
  3. Clothing
  4. Insect repellent
  5. Chemoprophylaxis
- **Environmental Management (vector control) Measures**
  1. Drain stagnant water frequently
  2. Record presence of new breeding sites and locations
  3. Proper waste (solid and liquid) disposal
  4. Site clearing

## 2. 12. Learning Activity Two: Exercise

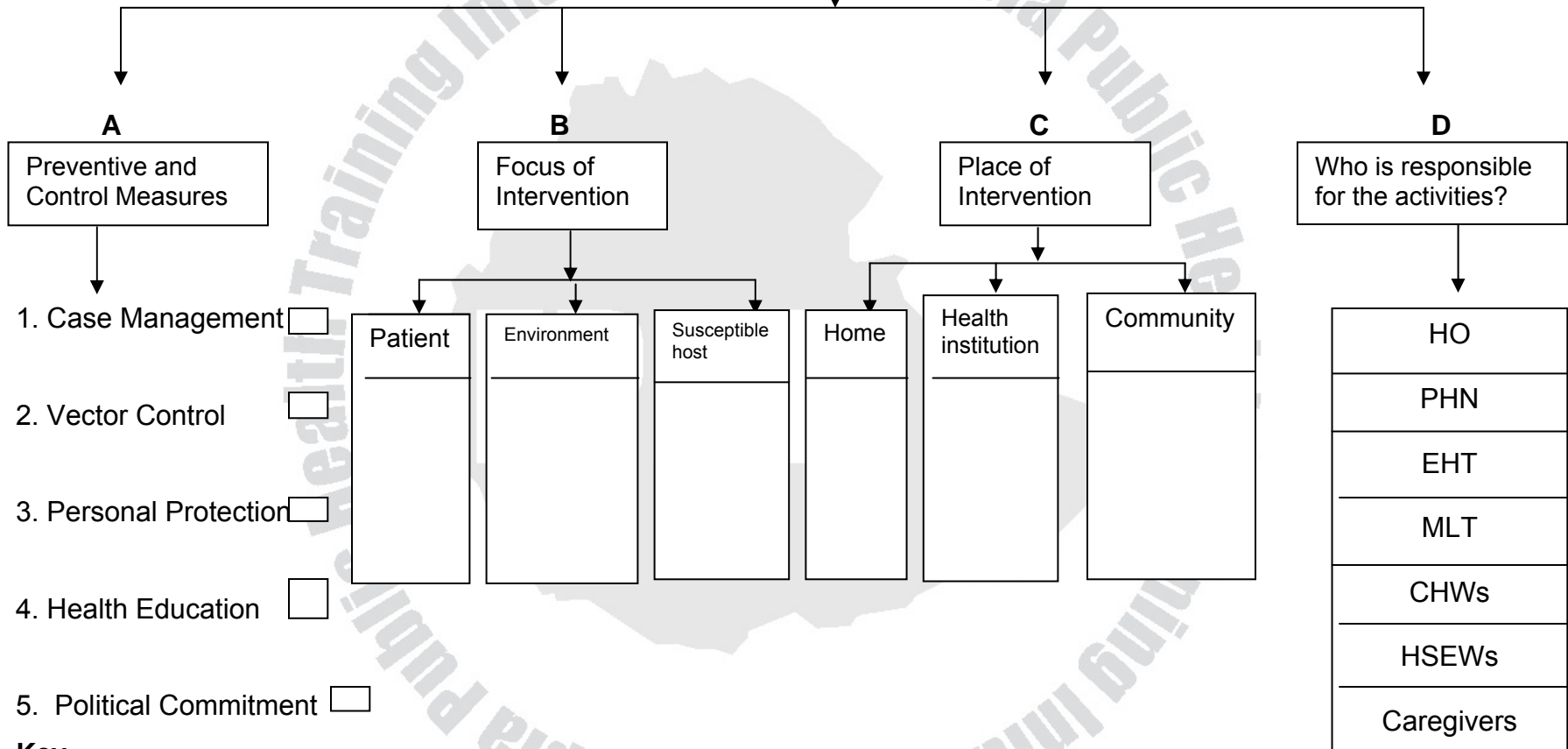
### Instructions

*The instructor or overall group leader may lead the following exercise.*

1. Divide the large group into four subgroups of six to eight students.
2. You may photocopy the exercise or write on paper using markers and post it on the wall. Transparencies could also be used.
3. Discuss within your subgroup about the exercise; study the intervention approaches presented as part I and II (10 minutes).
4. You would only do one of the four parts given on the exercise (A, B, C, and D).
5. One student from each group shall pick randomly the assignment from rolled pool of papers (A, B, C and D). This can be prepared by the instructor or overall group leader.
6. Before writing the answers, discuss with your subgroup and decide on the corresponding answers (10 minutes).
7. Subgroup "ONE", selects and writes the most relevant interventions on the space provided in part I (A) by selecting from part II (A).
8. Subgroup "TWO", writes at **least two** important points by selecting from part II B for each of the focus of interventions listed in part I B (patient, environment, susceptible host).
9. Subgroup "THREE", writes **three** important interventions for each of the place of intervention in part I C (home, institution, and community) by selecting from part II C.
10. Subgroup "FOUR", writes **two** relevant points for each of the categories that is possibly responsible for the interventions in part I D by selecting from part II D.
11. Then, one of your subgroup members shall write the answers.
12. Present your answers to the whole group;
13. Allow 20 minutes for questions, comments and discussion.

Part I

**EXERCISE  
PREVENTIVE AND CONTROL  
MEASURES**



**Key**

HSEWs = Health Service Extension workers, HO= Health Officer, PHN=Public Health Nurse, EHT=Environmental Health Technician, MLT=Medical Laboratory Technician,

## Part II    **A**

- A:1. Planning malaria control
- A:2. Mosquito repellent
- A:3. Drug prophylaxis
- A:4. Fixing of screen on windows
- A:5. Proper disposal of waste
- A:6. Early diagnosis
- A:7. Prompt treatment
- A:8. Drainage of standing water
- A:9. Impregnated mosquito net
- A:10. Filling of areas where water collects
- A:11. House spraying
- A:12. Early detection
- A:13. Clearing banks of streams and ditches

## **B**

- B:1. Early detection
- B:2. Clearing banks of streams & ditches
- B:3. Drug prophylaxis
- B:4. Early diagnosis
- B:5. Oiling of standing water
- B:6. Community mobilization
- B:7. Proper waste disposal
- B:8. Mosquito repellent
- B:9. Information about malaria mosquito net
- B:10. Impregnated bed net
- B:11. Drainage of stand water
- B:12. House spraying
- B:13. Fixing of screen on
- B:14. Filling of areas where water stands

## **C**

- C:1. Prompt treatment
- C:2. Drug prophylaxis
- C:3. Information about malaria
- C:4. Community Mobilization
- C:5. Early detection
- C:6. House spraying
- C:7. Early diagnosis
- C:8. Filling of areas where water stands
- C:9. Fixing of screen
- C:10. Insecticide impregnated mosquito net
- C:11. Drainage of standing water
- C:12. Proper water disposal
- C:13. Site clearing  
Windows

## **D**

- D:1. Community mobilization
- D:2. Fixing of screens on windows
- D:3. Proper waste disposal  
Water
- D:4. Land filling of standing
- D:5. Early diagnosis
- D:6. Supply prophylactic drugs
- D:7. Blood film examination
- D:8. Larva survey
- D:9. House spray
- D:10. Prompt treatment

# UNIT THREE

## SATELLITE MODULES

### 3.1 For Health Officer Students

#### 3.1.1. Introduction

##### 3.1.1.1. Purpose

This satellite module is prepared for health officer students. The module emphasizes only areas that were not covered by the core module.

##### 3.1.1.2. Directions

- After completion of the core module go through this satellite module
- Students are advised to refer to the core module whenever indicated.
- After completing the satellite module answer all the questions under sections 2.1.1 and 2.1.2.1
- Compare your result with that of the previous pretest taken.

##### 3.1.2. Learning Objectives

***At the end of the session, you will be able to:***

1. List factors affecting the Epidemiology of malaria
2. Describe the different epidemiological patterns of malaria
3. Describe the burden of suffering and deaths from malaria in Ethiopia
4. Identify and refer cases of malaria that can not be managed at a health center level
5. Mention the possible complications of malaria
6. Describe the laboratory procedures to diagnose malaria

##### 3.1.3 Clinical Features

**Uncomplicated malaria:** Fever, chills, shivering, malaise, sweating, tender and

enlarged spleen & liver and sometimes herpes labialis.

**Severe / Cerebral malaria:** Impaired level of consciousness, convulsions, abnormal neurologic signs, and coma.

**Hematological:** severe anemia (Hematocrit < 15%)

**Renal:** Decreased urine output (oliguria), haemoglobinuria, acute renal failure

**Gastrointestinal:** Diarrhea, occasionally very watery stool resembling cholera.

**Respiratory:** pulmonary edema

**Hepatic:** Jaundice (mainly attributed to haemolysis). Elevated serum enzyme levels, prolonged prothrombin time, and bleeding

**Fluid and electrolyte imbalance:** Increased intra-vascular volume, electrolyte imbalance

**Metabolic:** hypoglycemia

**Obstetric:** Abortion, fetal death, and premature labor.

### **Relapses and Recrudescence**

Malaria due to *P. vivax* may relapse months or years after the original infection because the exo-erythrocytic cycle has persisted. However, this does not happen with *P. falciparum*. Further febrile episodes (recrudescence) with high parasitemia may develop up to a year after *P. falciparum* infection. This is due to exacerbation of a low-grade persistence of the erythrocytic cycle (see Annex 7-1).

### **3.1.4. Epidemiology**

Infection with Plasmodia occurs throughout most of tropical Africa. The

distribution of malaria in tropical Africa is governed by two main factors:

1. A suitable vector species of anopheles mosquito. Transmission is usually limited to the period of wet seasons. They are unable to survive in prolonged dry and hot climates, such as semi-deserts.
2. A mean temperature high enough to allow the malarial life cycle to be completed within a mosquito. For instance, *P. falciparum* requires around 16-20°C, with humidity of 65%, which shortens the sexual cycle in mosquito and longevity of mosquito increases. *P. vivax* can survive in even lower temperatures, as is the case in highland plateau of Ethiopia.

The commonest vector in Ethiopia is *A. gambiae*. The breeding site of the anopheles mosquito include marshy areas, discarded tyres, plastic materials, broken bottles, construction pits, depressions left by hoof prints of animals, tractors and other vehicles in agricultural development areas, small water collections in river beds during the dry season, and irrigation canals.

**Patterns of malaria infection are determined by:**

- The duration of malaria transmission in that area
- The ability of the mosquito to infect humans
- The degree of man-mosquito contact, and
- The level of immunity of the population

**Factors affecting the epidemiology of malaria are:**

1. ***Environmental factors***

- Presence of anopheles mosquito
- Temperature above 15°C
- Humidity
- Rainfall

**Note:** That heavy rain damages the larva production.

## 2. **Factors related to vectors**

- **Life expectancy** of the mosquito- when they live longer, they become efficient transmitters. The reason is when there is favorable temperature and humidity the longevity of the mosquito increases and the life cycle of sexual reproduction period shortens.
- **Anthropophyllia** (liking to bite humans) - the vector should be susceptible to the plasmodia and the mosquito must feed frequently the human blood.
- Presence of **large numbers** of mosquitoes affects transmission.
- The **resting habits** of mosquito - after entering houses at dusk, mosquitoes feed on human blood then they rest on the walls for about 7 - 8 hours

## 3. **Parasitic factors**

- Longevity of the parasite in human host (*P. falciparum* for one year and *P. vivax* for 3 - 5 years).
- Multiplication pattern of the parasite in humans differs from species to species especially the infective forms and gametocytes. *P. falciparum* multiplies very fast.

## 4. **Host factors**

- Resistance to malaria such as frequency and occurrence of protective genetic changes
- Acquired immunity in endemic areas
- Susceptibility particularly of migrant workers, children, and pregnant women  
Some people develop immunity against a specific strain. There is no cross immunity among different malaria parasites.

## 5. **Other factors**

- Availability and accessibility of health services.
- Preventive behaviors of communities.



## **Types of Malaria**

There are different epidemiological patterns of malaria in different communities. The patterns are categorised as stable and unstable malaria.

### ***Stable Malaria***

Transmission occurs throughout the year and the intensity is fairly uniform and long living and frequently biting vectors are present. Usually the pattern repeats itself with astonishing regularity with little variation over the years. There is a high resistance in the community due to the prevailing intense transmission and as a result the main impact of the disease is in young children and pregnant women. Eradicating such type of malaria is usually very difficult.

### ***Unstable Malaria***

Uneven (in epidemics), less intense transmission (liable to flare up into dramatic epidemics), short living and less frequently biting vectors present. Due to the low level of transmission, the immunity status of the community is very low and all age groups are affected equally. Eradication is much easier than stable malaria.

### **3.1.5 Diagnosis**

- Clinical signs and symptoms
  - Read the laboratory procedures from the satellite module for Medical Laboratory Technology students

Note that in non-endemic areas history of travel to a malarious area is extremely pertinent for both adults and children.

Malaria or suspicion of malaria in a pregnant mother should be given special attention, as it can be a cause of miscarriage and fetal death.

### 3.1.6. Prevention and Control

#### Additional points in the prevention and control of malaria

1. Mefloquine at a weekly dose of 5-mg/kg-body weight
2. Vector control:
  - a. Use of larvicides.
  - b. Physical environmental modifications such as draining of stagnant waters.
  - c. Biological control using larvivorous fish.
3. Provision of treatment for those who are sick - remains the cornerstone. in reducing morbidity and mortality due to malaria.
4. Establish systems to detect epidemics early and take control measures.

#### **NOTE**

*Anti-mosquito measures must be selectively chosen to suit a particular area. Several appropriate vector control measures may be simultaneously instituted in one locality.*



## 3.2 For Public Health Nurse Students

### 3.2.1. Introduction

#### 3.2.1.1. *Purpose*

This satellite module is prepared for public health nurse students with the main purpose of enabling them to manage, control and prevent malaria effectively.

#### 3.2.1.1 *Direction*

- Study the satellite module after going through the core module.
- After completing the satellite module answer all the questions under sections 2.1.1 and 2.1.2.2.
- Compare your results with the previous performance.

### 3.2.2. Learning Objectives

*Upon completion of this satellite module you will be able to:*

1. Make effective assessment of malaria patient.
2. Diagnose uncomplicated malaria.
3. Assess patient and family readiness to learn and help them learn important behavior and attitude.
4. Make a home visit to houses of patients with malaria and their family.
5. Provide appropriate nursing care if a patient is admitted to a health center.

### 3.2.3. Learning Activity Case Study:

*W/o Martha a 30 years old female patient appears at your health center with the chief complaint of persistent vomiting of one-day duration. She is unable to take food and also claims to have fever, chills and backache since three days. Blood examination result turned out to be positive for Plasmodium vivax. You consulted the health officer in the health center and patient was admitted. She was very weak to communicate and the vital signs were: temperature (39<sup>0</sup>C), pulse rates (98 per minute) and blood pressure 90/40 millimeters of mercury).*

#### **Questions**

- (1) Mention the subjective and objective data that guide you to make appropriate nursing diagnosis.
- (2) State the nursing diagnosis of the patient (actual and potential).
- (3) List your plan to meet the needs of the patient.
- (4) Describe the important nursing interventions to solve the identified problems.

#### 3.2.4. Assessment

- Take adequate history
- Check for the clinical signs of malaria
- Check for the result of the blood tests such as blood film, Rapid Diagnostic Test (RDT) and hemoglobin level.

#### 3.2.5. Management

- Give anti-malarial drug according to the result of the blood or clinical manifestations (refer to core module)
- Control the fever
- Help them learn:

- Importance of sticking to the drug regimen
- Importance of revisiting the health center
- Relapse or based on the species of plasmodium identified
- Control and preventive measures to avoid super infection
  - If patient is admitted for any reason like due to persistent vomiting

**(a) Assess the Condition of the Patient**

**(b) Make Actual and Potential Nursing Diagnosis**

*Actual nursing diagnosis*

For example:

- Alteration in comfort related to headache and joint pain
- Alteration in thermo-regulation related to disease process
- Anxiety related to changed role

*Potential nursing diagnosis*

For example:

- Fluid volume deficit related to persistent vomiting, failure to eat and drink

**(c) Make Plan**

- Set objectives
- Prioritize the identified problems according to severity
- Identify the nursing measures to solve the problems
  - To prevent fluid volume imbalance

**(d) Nursing Interventions**

- Check vital signs and record
- Control fever, Cold compress, Give antipyretics
- Ventilate the room
- Use light clothes to cover the patient
- Encourage cold drinks
- Insert nasogastric tube.
- Assist and teach caretakers to feed the patient through nasogastric tube.
- Provide mouth care frequently.

- Open intravenous line if needed (use cannula if available).
- Provide psychological help.
- Administer the anti-malarial drug as prescribed.

**(e) Evaluation**

- Check whether vital signs are within normal limit
- Changes in signs and symptoms
- See if patient is taking fluid and food regularly and frequently

3.2.6. Discharge

When you discharge or send a patient with prescriptions from the outpatient department, take the address and appointment for home visit.

***Home Visit Activities***

- Assessment
  - The environment for pools and stagnant water, bushes around houses, empty bottles or tins, plastic Jars, old tires, cans,
  - Any similar illness in the family and neighborhood
  - Knowledge of the family about malaria
  - Any pregnant woman or under-five child
    - Identify problems in the family that contribute for the spread of malaria
    - Give health education on:
      - a) Malaria: cause, signs and symptoms, prevention and control measures
      - b) Importance of prompt medical help
      - c) Severity of the disease on pregnant and under-five children
      - d) Tell to disseminate the health information to their neighbors and colleagues
        - Demonstrate and work with them to drain stagnant water, clear bushes, etc.
        - Evaluate the actions taken by the family to control transmission of malaria.

## 3.3 For Environmental Health Technician Students

### 3.3.1. Introduction

#### 3.3.1.1 Purpose and Use of Satellite Module

This satellite module is prepared for Environmental Health Technician students. The satellite module emphasizes only areas that were not covered by the core module.

#### 3.3.1.2. Direction

- After completion of the core module go through this satellite module.
- Students are advised to refer to the core module whenever indicated.
- After completing the satellite module answer all the questions under sections 2.1.1. and 2.1.2.3.
- Compare your results.

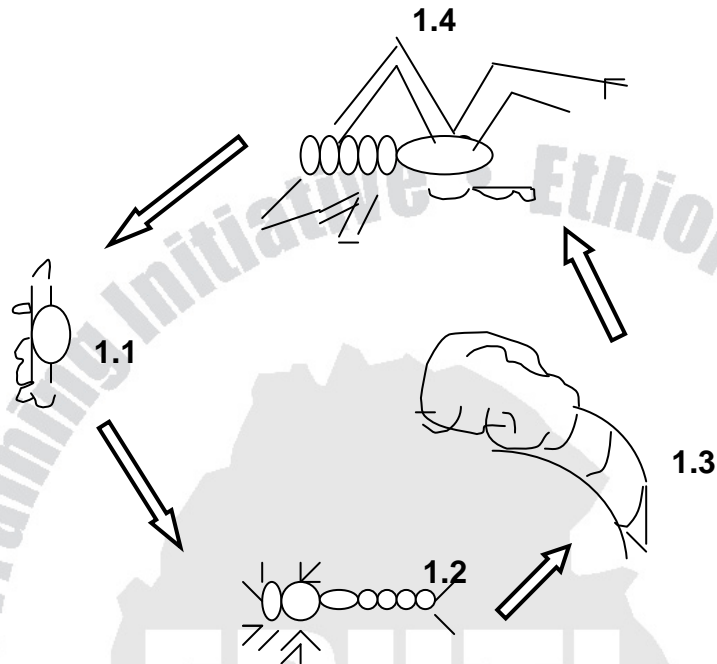
### 3.3.2 Learning Objectives

*At the end of the session you will be able to:*

- Identify potential mosquito breeding sites epidemiologically.
- Identify potential malaria areas and prioritize actions to be taken and be able to monitor it.
- Identify the preventive and control measures of malaria.
- List the intervention activities at different levels.
- Identify the developmental stages of malaria.
- State the methods of health education for action.

### 3.3.3. Learning Activity: Exercise One

Study the life cycle of mosquito



Identify the developmental stages of mosquitoes shown above (Exercise One)

- 1.1. \_\_\_\_\_
- 1.2. \_\_\_\_\_
- 1.3. \_\_\_\_\_
- 1.4. \_\_\_\_\_

### 3.3.4. Epidemiology

Malaria is a seasonal disease in many parts of Ethiopia, especially at higher elevations. Some low land areas have stable endemic malaria all the year round. Identification of the peak transmission periods is important for planning of interventions.



Larval development takes 2 to 7 days. The ambient temperature is between 15-30°C. If the temperature of water is below 10°C, the larvae do not grow.

### **3.3.5. Preventive and Control Measures**

#### **3.3.5.1. Actions and Levels**

##### ***At Patient Level (source of infection)***

- Detect cases early through screening of febrile cases.
- Plot cases by localities
- Follow up of cases for regular taking of drugs.

##### ***At the Environment Level (aiming at routes of infection transmission)***

- Elimination of breeding site of mosquitoes, e.g. Larvae.
- Drain water bodies (within three kilometers radius).
- Apply burned oil on the surface of stagnant water bodies.
- Clean and dry cattle sheds.
- Mechanical protection using: screens on windows and doors.
- Site clearing. Clear bushes and vegetation around residence.
- Proper waste disposal such as old shoes, pieces of tire, cans, garbage, etc.

##### ***Susceptible Population***

- Chemoprophylaxis for travelers going to endemic areas. (Prophylaxis begins 1-2 weeks before and 4-6 weeks after travel).
- Individual protection such as mosquito repellents, impregnated bed nets and covering the exposed parts of the body with clothing, e.g. “Gabis”, locally made clothing by weavers.

#### **3.3.5.2. Health Education**

- Increase the communities awareness /knowledge about:
  - Personal protection methods from mosquitoes/malaria.

- E.g. - Mosquito repellent
  - Chemoprophylaxis.
- Housing protection methods from mosquitoes
  - E.g.
    - Screening of windows
  - How to eliminate breeding site of mosquito.
    - E.g.
      - Proper waste disposal.
      - Draining stagnant water.
      - Clearing of vegetation.
  - Community mobilization for environmental protection.
    - E.g.
      - Proper waste disposal
      - Site clearing around living and working areas.
      - Draining of standing water and fill with earth soil.
      - Demonstration (Refer core module)

#### 3.3.5.3. Methods for Health Education

- Health talks with discussion
- Community mobilization
- Demonstration – keeping larvae in glass

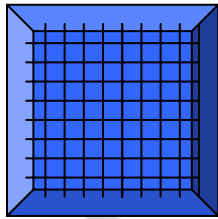
#### 3.3.6. Stages of Mosquito's Development

- **The egg stage:** the egg is laid on the surface of the water or in places where water is likely to accumulate.
- **The larval stage:** the larvae hatch and develop in water and feeds on various aquatic microorganisms.
- **The pupa stage:** when fully grown, the larva changes to a semi-dormant stage known as the pupa or “Tumbler stage”
- **The adult stage:** the skin of the pupa splits open, and an adult mosquito with wings comes out. It flies up from the water.

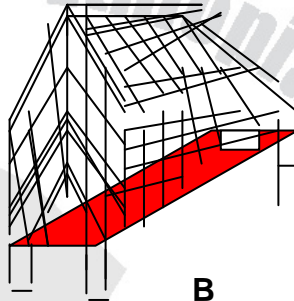
**Note:** That the life cycle of different species of mosquitoes is the same. The cycle (from the egg to the winged mosquito) takes 30.5 days at a temperature of 16-19°C and 18 days at 20-22°C and 14.5 days at temperatures of 24-27°C).

### 3.3.7. Learning Activity: Exercise Two

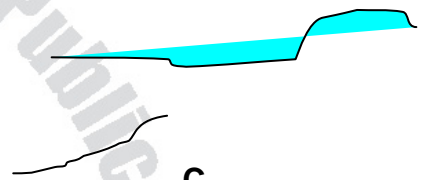
Identify the environmental protection measures shown on above (Exercise two)



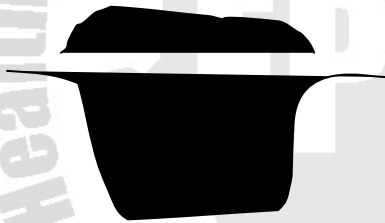
A



B



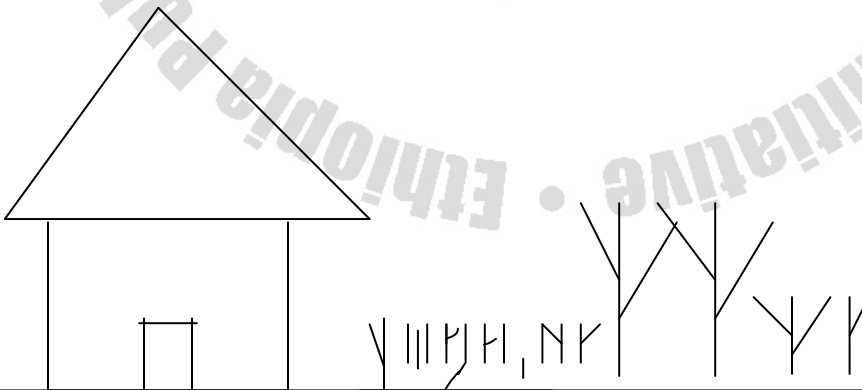
C



D



E



F

**Answers for Exercise Two**

- A. Screening windows
- B. Impregnated bed net
- C. Draining of standing water
- D. Fill open pits with earth
- E. Add burned oil on stand water
- F. Site clearing



### **3.4.1. Introduction**

#### **3.4.1.1. Use and Purpose of the Satellite Module**

This satellite module provides the specific tasks and skills that should be done by a medical laboratory technician in a health center to diagnose malaria.

#### **3.4.1.2. Direction**

- Students are advised to study the core module before going into the satellite module.
- After completing the satellite module answer all the questions under 2.1.1 and 2.1.2.4.
- Compare your results with that of the pretest.

### **3.4.2. Learning Objectives**

*Upon completion of the activities in this module, you will be able to:*

1. Name the specific laboratory techniques that help for diagnosing malaria.
2. Describe the different staining procedures used for diagnosing malaria.
3. Differentiate the different Plasmodia species with stained blood film.

### **3.4.3. Laboratory Diagnosis of Malaria**

#### **1. Complete Blood Count**

- A. Hemoglobin or hematocrit (lower values due to haemolysis of RBC)
- B. White Blood Cell count (decrease or normal)
- C. Red blood cell morphology (normochromic normocytic red blood cells); if severe hypochromic microcytic red blood cells

#### **2. Blood Film Examinations**

*There are two staining techniques:*

- A. Giemsa staining technique
- B. Wright's staining technique

### **3. Rapid Diagnostic tests (Dip stick)**

**Note:** The definitive diagnosis of malaria is identification of malaria parasite by examining patient's stained blood film under the microscope.

#### **3.4.4. Procedures for Malaria Smears**

##### **3.4.4.1. Thin Smear Method**

###### **(a) Reagents and equipment needed:**

1. Capillary or uncoagulated blood (sodium citrate, EDTA)
2. Wright stain and Buffer solution (pH: 7.6 -7.8)
3. Microscope
4. Slides
5. Sterile pricking needle

###### **(b) Preparation of thin smear**

In making a blood smear, you may use fingertip blood or fresh uncoagulated blood.

**Note:** When the blood is withdrawn, the patient should be in the “chills and fever” stage of the disease. Otherwise it will be difficult to find malaria parasites.

###### **(c) Procedure of specimen collection for blood smear**

*(i) When fingertips blood is used,*

1. Cleanse the tip of the finger (or heel in an infant) using alcohol swabs and allow the area to dry.
2. Make a finger puncture using a sterile pricking needle and wipe away the first drop of blood.
3. Put a drop of blood on a slide.

(ii) *When uncoagulated blood is used, obtain the uncoagulated blood and mix the blood with the anticoagulants slowly by inverting the test tube/ vial 10-12 times.*

1. Hold two wooden applicator sticks together and dip them into the test tube/ vial.
2. Keeping the two sticks together, remove them from the test tube and touch the two bloody sticks to a slide so a small drop adheres to the slide and place the slide on a table or flat surface
3. After you have passed a drop of blood (obtained by finger puncture or from fresh uncoagulated blood) on the slide, hold the edges of the slide with your left hand and hold another slide on your right hand, which will be used as a spreader.
4. Place the spreader on the slide making 25-degree angle with the slide and maintain this degree angle through out the remainder of the procedure.
5. Draw the spreader toward the drop of blood and make sure that the blood fans out to the edge of the spreader.
6. Keeping the spreader constantly at 25-degree angle, press the edge of the spreader firmly against the slide and push the spreader smoothly and rapidly (as fast as striking a match) over the entire length of the slide.
7. Allow the blood film to air-dry, and label the slide with the date, patient's name and number along the top of the film.

**Note:** *Do not let the blood get ahead of the spreader because it may cut or distort the cells.*

#### **Possible causes of poor blood smear**

- a. If the drop of blood is too large.
- b. Jerky movement of the spreaders hand while smearing.
- c. Failure to push blood rapidly

### **Wright's Staining Procedure**

1. Place the dried smeared slide on the rack of a staining dish.
2. Add 11 – 12 drops of Wright's stain solution using a dropper and allow to stand for 2 minutes.
3. Add equal amounts of buffered solution using another dropper.
4. Thoroughly mix the stain and buffer solution by blowing (about 4 inches above the slide).

**Note:** When the solution are well mixed, a shiny scum usually floats on top of the solution.

5. When the stain and the buffer have been well mixed, allow them to set for 3 minutes.
6. Wash with distilled water.
7. Remove the slide from the staining rack and wipe off the back of the slide with dry cotton.
8. Allow the blood smear to air-dry.
9. Place a drop of immersion oil on the thin area of the stained blood film.
10. Place the stained blood smear on the stage of the microscope and examine the Red Blood Cells for malaria parasites.

#### **3.4.4.2. Thick Smear Method**

##### *(a) Necessary reagents, equipment and specimen*

1. Either finger tip's blood or fresh uncoagulated blood
2. Giemsa's stain
3. Buffered solution (pH 7.0 - 7.2)
4. Microscope
5. Slides
6. Pricking needle

##### *(b) Preparation of thick blood smear*

1. Refer back on how to collect the specimen.
2. Place a large drop of blood on a glass slide.



3. Using the corner of another slide or applicator-stick spread the drop of blood over, so that it covers an area about the size of a one coin.
4. Allow some time for the smear to air-dry.
5. Label the slide with date, patient's name and number on top of the smeared slide.

(c) Giemsa staining procedure

Immediately before use, dilute the Giemsa stain as required:

- 3% solution for 30 minute staining

- Measure 50 ml of buffered water (or stain).
- Add 1.5 ml of Giemsa stain and mix gently.
- The stain can be measured using a graduated plastic bulb pipette or a small volume (2 ml) plastic syringe.

- 10% solution for 10 min staining

- Measure 45 ml of buffered water, in a 50 ml cylinder. Add 5 ml of Giemsa stain (to 50 ml mark) and mix gently.
  1. Hold the dried thick smear
  2. Dip the slide to the fresh diluted of Giemsa stain
  3. Allow the stain to stand for 30 min or 10 min according to your Giemsa stain concentration.
  4. Wash the stain from the staining container using clean water (need not be distilled or buffered)

**Important:** Flushing of the stain from the slides and staining container is necessary to avoid the films being covered with a fine deposit of stain

5. Clean the smear
6. Plan ---- malaria parasites and report the stage and density of the parasite.

**Note:** Do not forget labeling of the slides

### 3.4.5. Recognition of Malaria Parasite

#### ***Thin Blood Smear Technique***

##### *Advantage*

- Easy identification of malaria parasite species

##### *Disadvantage*

- Decreased yield of malaria parasite in blood film

#### ***Thick Blood Smear Technique***

##### *Advantage*

- Increases yield of malaria parasite
- Many blood film smears could be processed at a time

##### *Disadvantage*

- Difficult to identify species of malaria parasite

Malaria parasites pass through a number of developmental stages. In all stages, the same parts of the parasite stain the same color.

- Chromatin (parts of the parasite nucleus) is usually round in shape and stains deep red.
- Cytoplasm (ring form, irregular shape) always stains blue.

### 3.4.6. Stages of the Malaria Parasite

Stages of the malaria parasite that you see in a blood film described below

The Trophozoite stage (a growing stage) - most commonly seen in blood film and is also named as ring stage.

The Schizont stage - here you see parasites with two chromatin dots with a number of chromatin dots and definite cytoplasm.

The Gametocyte stage - seen as round or banana shaped depending on the species.

### 3.4.7. Main Identification Features of Malaria Parasites in Stained- blood Film

#### a) *Plasmodium falciparum*

- Many parasites may be present
- Usually only trophozoites and gametocytes are seen

#### *Host red cells*

- Not enlarged
- Maurer's dots (clefts) may be seen in the late stage of trophozoites
- May contain several parasites
- Parasites may lie on red cell membrane

#### *Trophozoites*

- Mainly small and delicate rings (thin film) or small pieces of cytoplasm with chromatin dot (thick film)
- May have double chromatin dot
- In heavy infections, a few larger rings may be seen

#### *Schizonts*

- Very rarely seen
- Their presence in blood film (usually with many rings) indicates severe infection

#### *Gametocytes*

- Crescent (banana) shaped with rounded or pointed but oval forms may be seen
- Pigment granules present, mainly around the nucleus

#### b) *Plasmodium vivax*

- Rarely 2% of red cells become infected
- Trophozoites, schizonts and gametocytes can be seen

*Host red cells*

- Become enlarged and irregular in shape
- Schuffner's dots are present

*Trophozoites*

- Most are large and irregular in form (amoeboid)
- In thick films, the cytoplasm appears fragmented

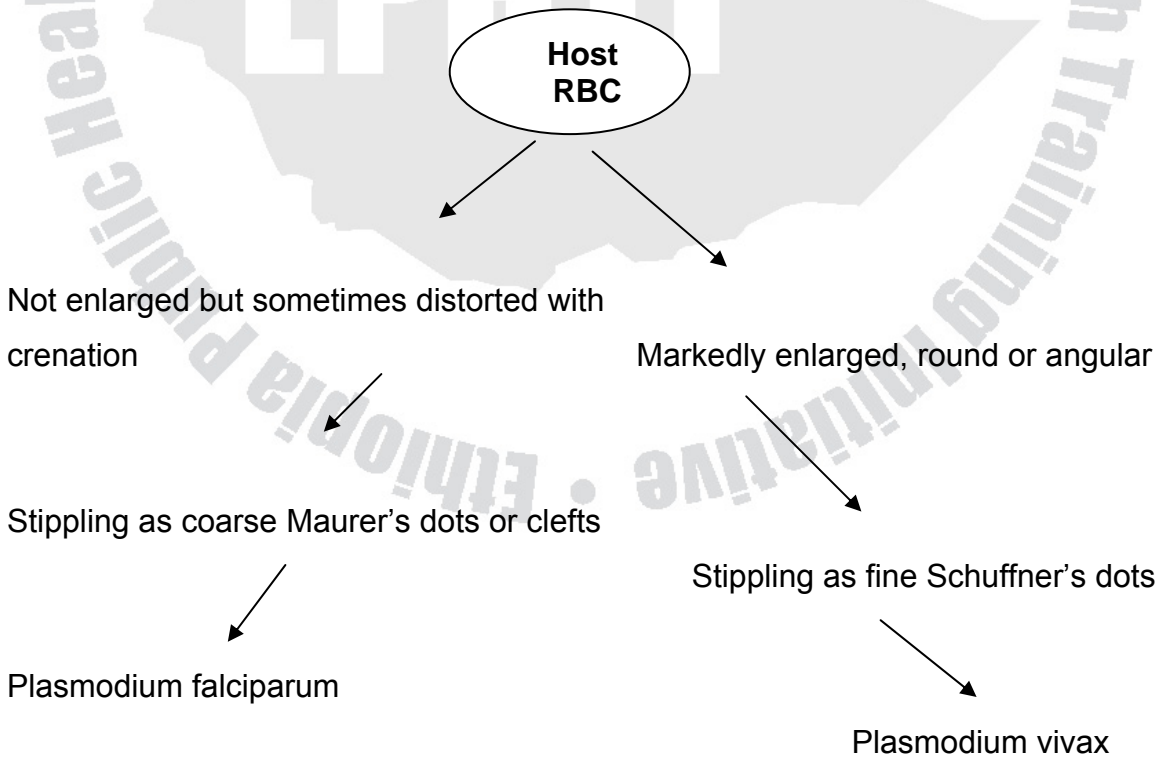
*Schizonts*

- Large, round or irregular in form
- Mature schizont contains greater or equal to 24 merozoites

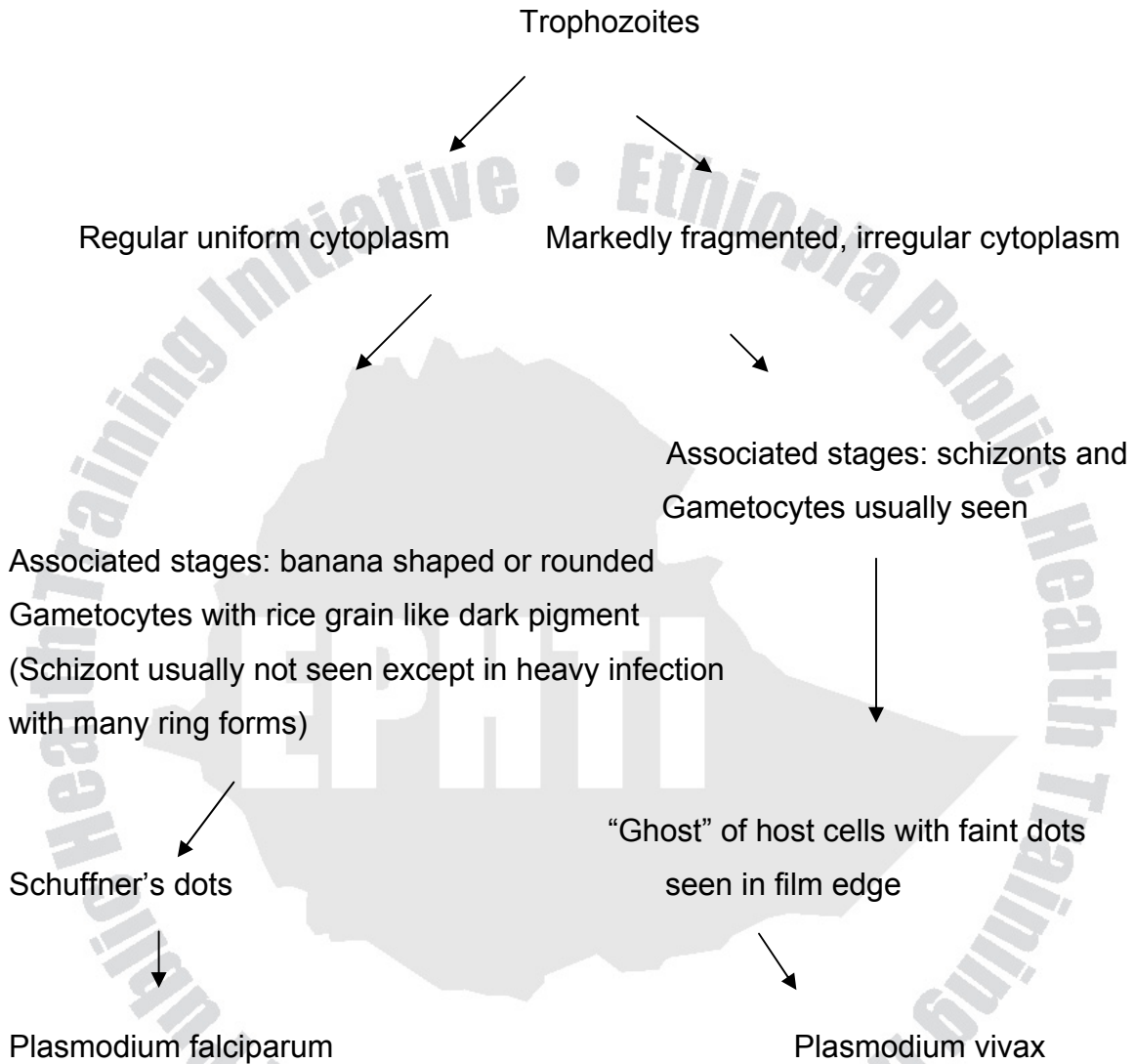
*Gametocytes*

- Large and round irregular in form
- Contain scattered pigment granules

**3.4.7.1. Species differentiation of malaria parasites by host cell change in thin blood film**



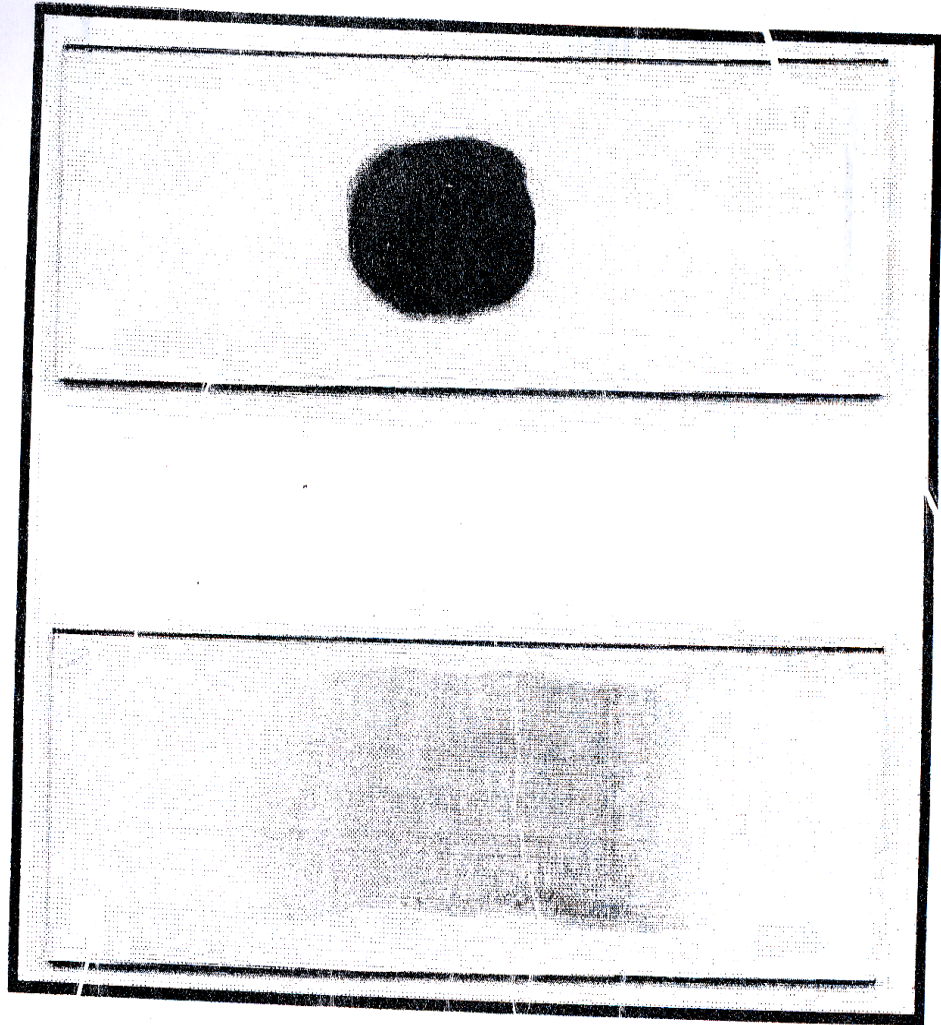
### 3.4.7.2. Species differentiation of malaria parasites by cytoplasmic pattern of trophozoites in thick blood films



3.4.7.3 a) Thick and

b) Thin Blood Films

a)

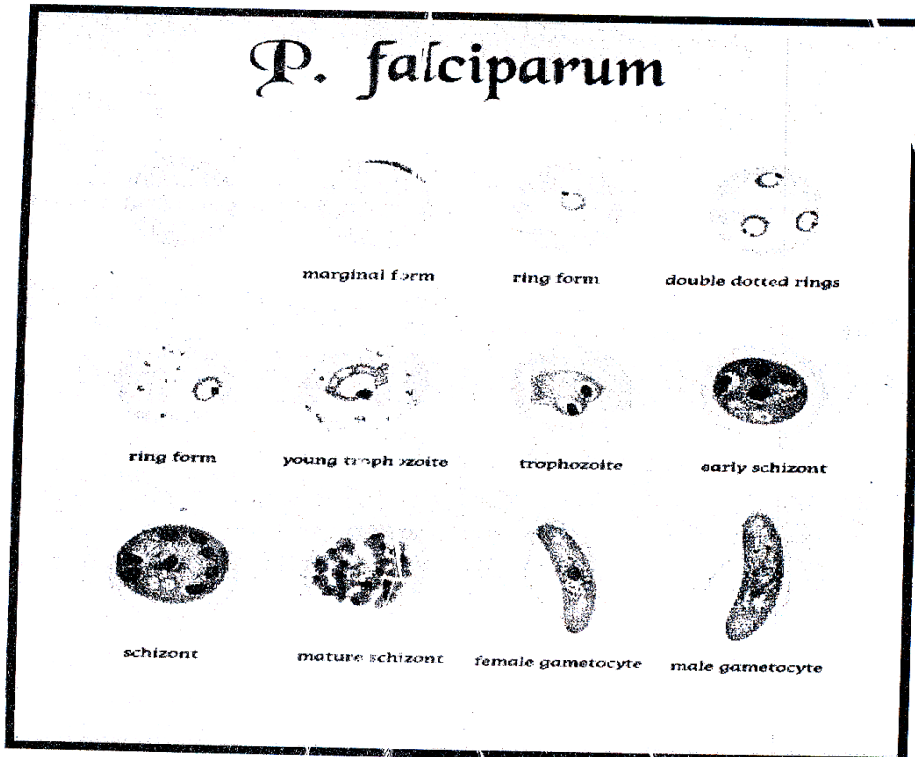


b)

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### 3.4.7.4. The characteristics of *P.falciparum* and *P.vivax*

#### a) *Thick blood smear*

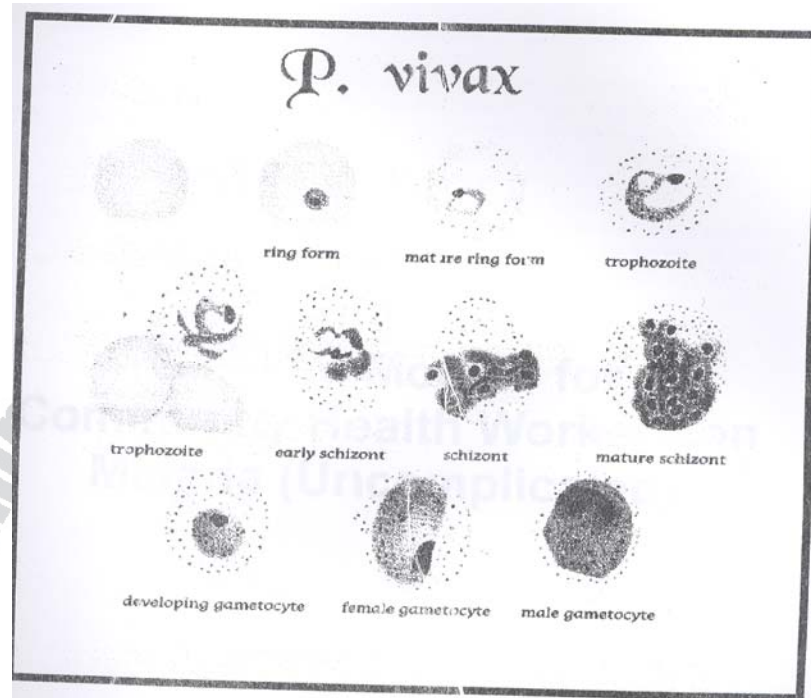


#### Diagnostic points:-

1. Red cells are not enlarged.
2. Rings appear fine and delicate and there may be several in one cell.
3. Some rings may have two chromatin dots.
4. Presence of marginal or appliqué forms.
5. It is unusual to see developing forms in peripheral blood films.
6. Gametocytes have a characteristic crescent shape appearance. However, they do not usually appear in the blood for the first four weeks of infection.
7. Maurer's dots may be present.

b) Thin blood smear

**P. Vivax**



**Diagnostic points:-**

1. Red cells containing parasites are usually enlarged
2. Schuffner's dots are frequently present in the red cells as shown above.
3. The mature ring forms tend to be large and coarse.
4. Developing forms are frequently present.

**3.4.7.5. Rapid diagnostic tests (dipsticks) (RDT)**

Dipstick tests have the potential of enhancing the speed and also the accuracy of diagnosing particularly in no specialized laboratories where inexperienced or junior staff may be involved, since very little training is required for these tests.

**NOTE**

Always stick yourself the manufactures instruction for the procedure.



## 3.5 For Health Service Extension Workers

### 3.5.1. Introduction

#### 3.5.1.1. *Purpose and Uses of the Module*

This satellite module, which is an extension of the core module on uncomplicated malaria, is intended to consider the important issues that can help the health service extension workers (HSEWs), especially in the prevention and control of malaria. Malaria is a known communicable disease that affects most of our people. Prevention and controlling mechanisms have to be strengthened at the community level to decrease illnesses and deaths.

As a health service extension worker of the community, your knowledge on malaria will help to save many lives. That is why this short and precise satellite module is prepared for you to teach and to work with community in the control and prevention of malaria.

#### 3.5.1.2. *Direction for Using the Satellite Module*

- Try to study and answer all the questions in the pre-test.
- Read and understand the learning activity (case study).
- Based on the case study, answer questions listed down.
- Read and understand the satellite module.
- Compare your results using the keys after finishing your part of the module.

### 3.5.2. Pre-test

1. Malaria is caused by 'evil eye.'  
A) True                      B) False
2. Drinking the local alcohol ("Arakie") can prevent malaria.  
A) True                      B) False
3. The only measure to control malaria is by using bed nets.  
A) True                      B) False

4. Malaria cannot be controlled and prevented.  
A) True                      B) False
5. What preventive measures can you take in a community where you live, to protect the people from getting malaria?
6. What control measures will you take in case people in your community are suffering and dying from malaria?

### 3.5.3. Learning Objectives

***After completing this satellite module, the HSEW is able to***

- Identify the causes of the disease.
- Describe the contributions of HSEWs in the prevention and control of malaria at community level.
- Identify individuals with fever, (during malaria outbreaks) treat and refer to the nearby health center.
- Identify roles in provision of chemotherapy during epidemics and provision of chemoprophylaxis for high-risk groups (pregnant mothers and children).

### 3.5.4. Learning Activity: Case Study

Hussen is a 12 year old, second son of a family and lives in the low land of Tach Armacheho, about 200 kilometers northwest from Gondar town.

In October at about midnight, Hussen developed unexpected fever followed by chills, headache and pain at the joints.

Three days before, Hussen had been taking bath in a small river around his area. His father, Ato Nuru was angry because of the bath. So when Hussein became sick, the father thought of the “evil eye”, and the “bad water”. Thinking about it, the father woke up and brought a small smelling local herbs ragged in small piece of cloth (locally known as “Altit”) and let him smell it. But that didn’t give him any improvement.

In the next morning after coffee-ceremony, they took him to a local healer living nearby, known as ‘Shah Kemal’ (Muslim healer). The Shah is a known traditional healer for treating such evil caused illnesses in Tach Armachiho. The Shah started his healing process by chewing ‘Chat’ and by making pray. Then, touched and massaged the sick boy and immediately took out the chewed chat from his mouth and rubbed on Hussein’s skin. He was repeatedly doing the same procedure while the poor Hussein was convulsing, sweating profusely, and getting weak.

The treatment given by the healer did not satisfy the father, who was worried by the sickness of his beloved son. So he decided to take him to another healer in the nearby who is known for treating such cases. On the fourth day, Hussein was taken to this person. The moment the healer saw the sick boy, without hesitation, he said that the boy is suffering from ‘Mogn bagegn’ (“let me find the full”), which has to be treated by blood letting through cutting a blood vessel from the forearm. After consulting the father, the healer cut a blood vessel across the left forearm and then a dark blood gushed out. The healer was satisfied with the drainage of the dark blood and said, “look, this is the disease that makes our red blood turn dark; when this dark blood

comes out from the body, the illness disappears and people get relieved.” In the mean time, the blood continued to flow for quite a considerable time. Hussein became very weak and failed to communicate even when his father was calling him by name.

The father was crying out loud and a few people passing by came and observed what was happening. They saw Hussein lying flat and very weak. They advised the father to take him to Armachiho health center. After some hesitation, Ato Nuru took him to the health center.

### **Questions**

1. What do you think the disease was?
2. Do you think “evil-eye” and bathing in “bad water” can cause malaria?
3. Does cutting the vein and spilling out of blood save life?
4. Is there any other disease to have the same features?
5. What would you advise to the father if you were there?
6. What measures would you take to save Hussein?

### **3.5.5. Short Notes**

#### **3.5.5.1. Burden**

- ◆ Malaria is one of the leading causes of sickness and death in Ethiopia.

#### **3.5.5.2. Most Affected Population Group**

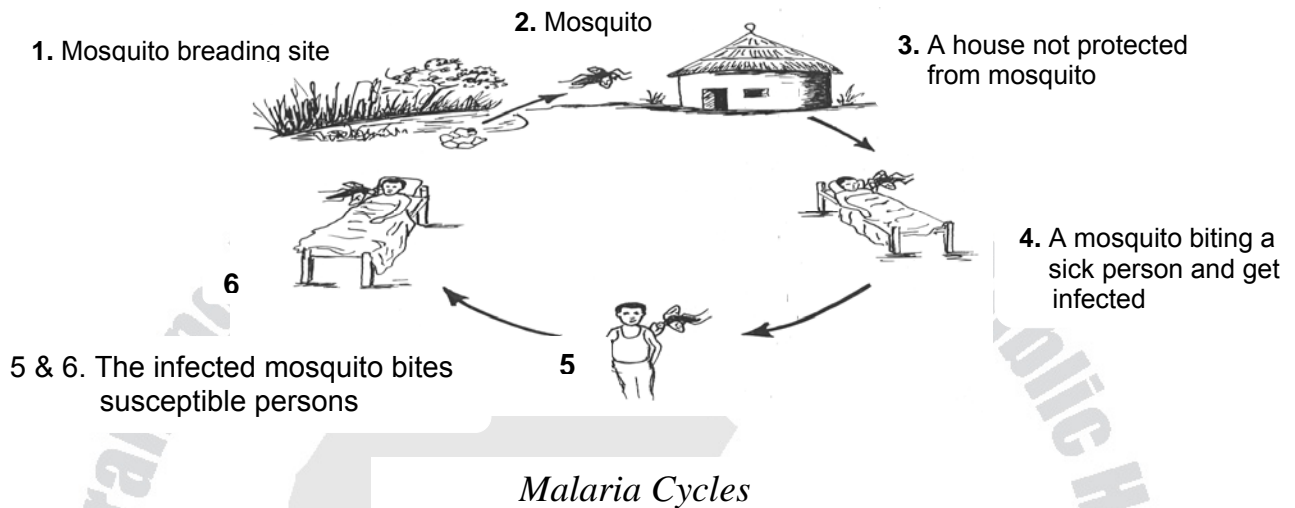
- ◆ Malaria affects all age groups and both sexes. However, **children and pregnant mothers are the frequent victims.**

#### **3.5.5.3. Areas**

- ◆ Malaria is common in lowlands (*Kola*). However, these days, some temperate (*Woyina Dega*) areas are also affected.

#### 3.5.5.4. Causes

- ◆ Malaria is caused by **parasites** and commonly transmitted from person to person by the **bite of infected insect (mosquitoes)**.



#### 3.5.5.5. Symptoms and Signs

- ◆ Malaria is an acute disease, which presents with fever, chills, shivering, profuse sweating, headache, joint pains and generalized ache. However, sometimes patients may develop nausea, vomiting, abdominal pain, diarrhea, poor appetite and thirst. The symptoms and signs may be confused with other diseases that cause fever such as measles “Kufig”), pneumonia “Samba Mich” and upper respiratory infections. In children, failure to feed and fever should be considered seriously.

#### 3.5.5.6. Diagnosis

- ◆ Knowing the symptoms of malaria is very important. At community level, the diagnosis of malaria is based on signs and symptoms of malaria. In an area where malaria is common, presence of fever or history of fever at least within the past two days is adequate to make a diagnosis of malaria. Asking patients for recent travel (within the last two weeks) to a place where malaria is common is helpful when malaria is not a problem in the area.

### **3.5.5.7. Traditional Malpractices**

- ◆ Most of the traditional mal-practices in communities do not cure malaria. For example, cutting the vein and losing the blood can lead to death. Blood - letting is a dangerous procedure and can kill the patients. Blood is important for sustaining life of human beings.

### **3.5. 5.8. Treatment**

#### **There Are Two Main Objectives for Treating Malaria.**

- ◆ To shorten the course of the illness, decrease sufferings, and decrease spread of disease.
- ◆ To prevent the severe forms of malaria that leads to death

#### **Drug of choice**

- a) Artemether Lumefantrine is the first drug of choice for treating uncomplicated malaria.
- b) The drug is given according to age and weight (see the table).
- c) Give the drug under supervision and patient should remain nearby for about an hour.
- d) If vomiting occurs within one hour after the dose, give an additional dose that is half of the first dose.
- e) If vomiting persists refer the patient to the nearest health center or health station.
- f) Advise the patient that
  1. The patient is suffering from malaria.
  2. Malaria is transmitted by bites of infected mosquitoes.
  3. Malaria is treatable and coming to the health post for early diagnosis and treatment is very important. Otherwise, malaria may lead to severe forms and death.
  4. Prevention of malaria can be done by eliminating mosquitoes' breeding sites such as draining stagnant water, clearing vegetation

around residence, disposing garbage in a disposal pit and cleaning the area. Mosquito bed nets can be used to prevent the bite.

5. Return to the health Service extension worker if fever persists for 48 hours and the sickness continues or becomes worse.

#### **3.5.5.9. Supportive Treatment**

1. Treat the high fever (39<sup>0</sup>C or more, rectal in children) using paracetamol or give advice on tapped sponging and fanning.
2. If patients are dehydrated (loss of fluid by sweating due to the high fever), provide ORS sachets and advise patients to take increased amount of fluids and food. In infants advice on extra breast feeding and home based oral rehydration therapy.

#### **3.5.5.10. Follow Up**

1. If fever persists for more than 2 days (48 hours) following treatment, give full dose of chloroquine.
2. Advise the patient to come back if symptoms persist for more than two days (48 hours). Refer the patient to the nearest health center.

### 3.5.5.11. Indications for Referral

**Refer immediately if one or more of the following symptoms do exist**

1. Altered consciousness (confusion, sleepy, drowsy, loss of consciousness)
2. Patient is unable to drink or feed
3. Frequent vomiting
4. Bleeding
5. Yellowish discoloration of the eyes
6. Difficult breathing
7. Convulsions
8. Patient is unable to sit or stand up (for older children and adults)
9. Patient did not pass urine for the last one day (24 hours)
10. Other conditions that can not be managed by the health service extension worker

### Dosages of Drugs for the Treatment of Malaria

**Table 1:** Artemether – Lumefantrine: Treatment schedules

Tablet containing 20 mg Artemether plus 120mg Lumefantrine in a fixed dose combination.

Weight (kg)	Age (Years)	Number of tablets per dose					
		Twice daily for 3 days					
		Day - 1		Day - 2		Day - 3	
		Morning	Evening	Morning	Evening	Morning	Evening
5 –14	3 month – 2 years	1	1	1	1	1	1
15-24	3 – 7 years	2	2	2	2	2	2
25-34	8 – 10 years	3	3	3	3	3	3
35+	> 10 years	4	4	4	4	4	4



**Side effects:**

The following adverse effects have been reported; dizziness and fatigue, anorexia, nausea, vomiting, abdominal pain, palpitations, myalgia, sleep disorders,

**Contraindications:**

- Malaria prophylaxis either alone or in combination.
- Persons with a previous history of reaction after using the drug
- Pregnant women, mothers with infants less than three months of age and infants less than five kg
- Persons with severe malaria.

**Table 2: Dosage of Chloroquine and Schedules**

<i>Age group</i>	<i>Day one</i>	<i>Day two</i>	<i>Day three</i>
<4 months Tablets	½	¼	¼
Syrup	5 ml	5 ml	2.5 ml
4-11months Tablets	½	½	½
Syrup	7.5 ml	7.5 ml	5 ml
1-2 years Tablets	1	1	½
Syrup	12.5 ml	12.5 ml	7.5 ml
3-4 years Tablets	1	1	1
Syrup	15 ml	15 ml	15 ml
5-7 years Tablets	1 ½	1 ½	1
Syrup	20 ml	20 ml	15 ml
8-10years Tablets	2 ½	2 ½	1
11-13years Tablets	3	3	2
14+ years Tablets	4	4	2

- ⇒ 5ml (of one tea - spoonful) is equivalent to ½ tablet.
- ⇒ Remember that there are different chloroquine preparations.
- ⇒ Febrile children under-five years of age living in malarious areas should always anti- malarial treatment.

### **Contraindications**

Do not give chloroquine for persons with epilepsy ‘yemitil Beshita’ or for persons with history of previous skin rash following chloroquine intake.

### **Reasons for not responding to treatment**

Patients may fail to respond to treatment with chloroquine or other anti-malarial drug for various reasons such as:

- Inadequate treatment, when the full dose is not taken
- The cause of the fever may be other than malaria
- The quality of the drug may be poor e.g. expired drug
- The parasite may be resistant to the drug
- The patient may have vomited the drug

Therefore, where there is no alternative anti-malaria drug, the patient should be referred to a higher health institution.

### **Possible Side Effects of *Chloroquine***

The possible side effects include: dizziness, skeletal muscle weakness, nausea, vomiting, abdominal discomfort, diarrhea, and allergic skin eruption.

### **Do Not Give *Chloroquine* To**

- Persons with known allergy to the drug
- Persons with history of epilepsy
- Persons who are suffering from psoriasis

## Preventive and Control Measures



*Draining Standing Water*



*Clearing Site*



*Solid Waste Disposal*



*Keeping The Surrounding Clean From Mosquitoes*



*Use window screens to prevent mosquitoes from entering the house*

### **Actions Against Mosquitoes' Breeding Sites**

- Drain water collection sites (standing water) frequently.
- Clean up the residential area: remove garbage and dispose in a properly prepared pits (including plastic materials, broken glasses and broken clay pots).
- Clear vegetation around residential area.
- Participate in insecticide spraying,
- Help community members learn about the causes, transmission and prevention of malaria.
- In large water collection bodies, burned oil can be applied.

### **Actions for Self-Protection**

- Cover the body parts with clothes, e.g. “Gabié” locally made cloth by weavers.
- If possible teach people to buy impregnated mosquito bed-nets if they can afford
- Cover windows and openings with screens, clothes, etc. to prevent the entry of mosquitoes
- Protect children and pregnant women, e.g. by applying repellants.

### **Persons Sick with Malaria**

- Give treatment for patients
- Refer patients who are severely ill or who are not responding to the treatment given
- Report to the health center
- Call for support if the conditions are beyond the capacity of the health post
- In a malarious area, suspect malaria in a patient with high fever.

### 3.6 Take-Home Messages for Caregivers/ Self-Care

#### 1. About Malaria

- Many people suffer from malaria and many die from it.
- Children and pregnant women are severely attacked
- People who are traveling to malarious areas could easily be infected if not protected.

#### 2. Cause of Malaria

- Malaria is caused by parasites through the bite of mosquitoes.
- Mosquitoes carry the parasites within their body.
- Transmission occurs when a mosquito bites a sick person and transmits the parasites by biting a healthy person

#### 3. Treatment of Malaria

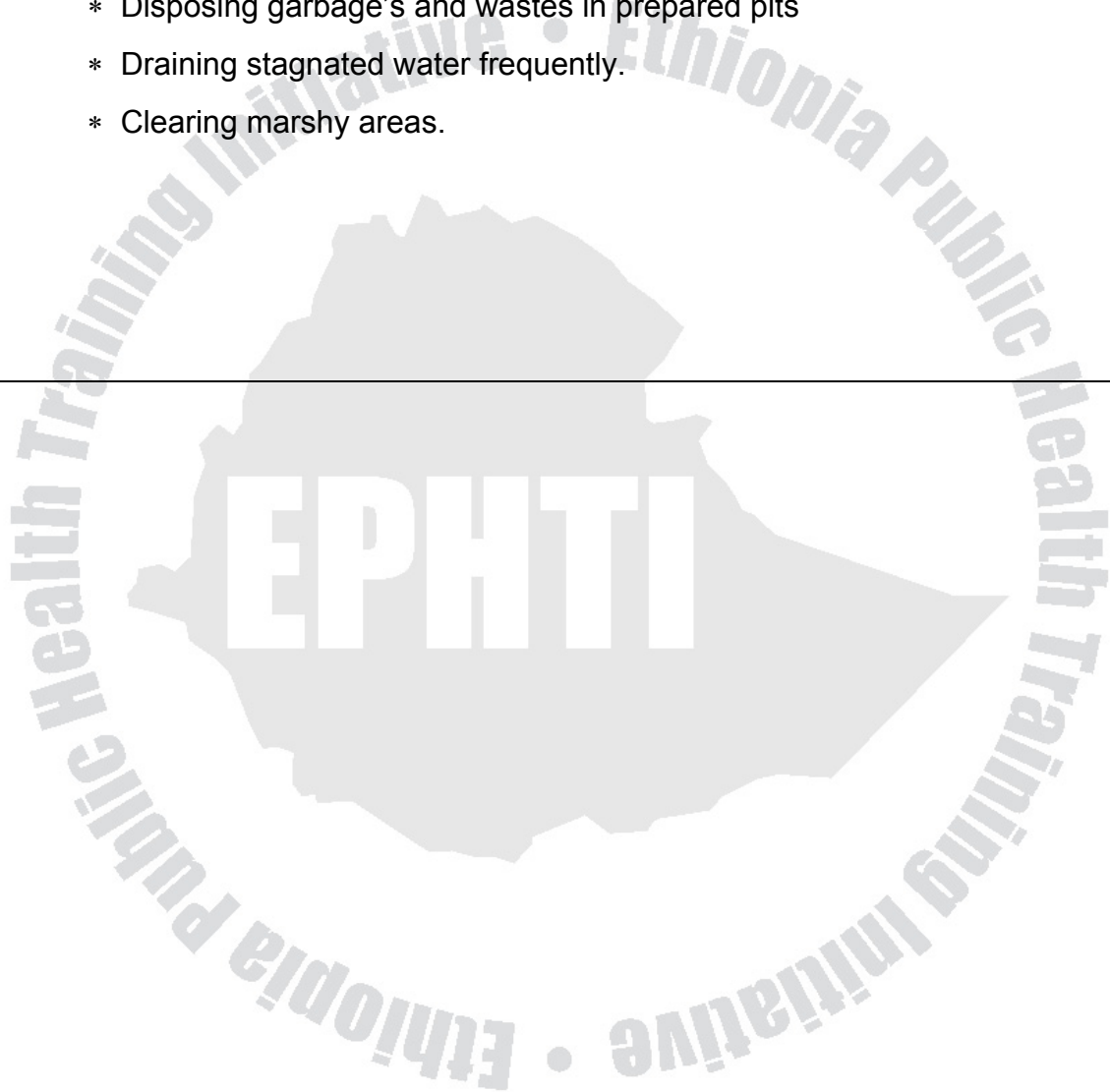
- *Malaria is treatable*; visit your nearby health institution if you become febrile at any time.
- Getting treatment immediately reduces suffering and the chance of death.
- Take or provide the prescribed medications.
- If there is no improvement, visit a health institution/consult a health worker.

#### 4. Prevention of Malaria

##### ***Malaria Can Be Prevented***

- The prevention could be by protecting the body from the bite of mosquitoes.
  - \* Wearing clothes.
  - \* Fixing screen on windows and doors
  - \* Use of impregnated mosquito bed net.
  - \* Taking prophylaxis.

- \* Application of mosquito repellants.
  
- Eliminating mosquito breeding sites
  - \* Cutting vegetation around residence
  - \* Cleaning the environment
  - \* Disposing garbage's and wastes in prepared pits
  - \* Draining stagnated water frequently.
  - \* Clearing marshy areas.



# UNIT FOUR

## ROLES AND TASKS ANALYSIS

For Students of Health Officer, Public Health Nurse, Environmental Health Technician, Medical Laboratory Technician, Health Service Extension Workers and Care givers

**Table 1: Knowledge-Objectives and Activities by Category of Students**

Learning Objective	Activities of each category			
	HO	PHN	EHT	MLT
<i>Describe the causes of malaria</i>	Study the causes of malaria	Study the causes of malaria	Study the causes of malaria	Study the causes of malaria
<i>Describe the modes of transmission of malaria</i>	Study the modes of transmission	Study the modes of transmission	Study the modes of transmission	Study the modes of transmission
<i>Describe the life cycle of malaria</i>	Study both sexual & asexual phases	Study both sexual and asexual phases	Study both sexual and asexual phases	Study both sexual and asexual Phases
<i>State the diagnostic approach</i>	Study the epidemiological pattern, the clinical features & laboratory methods of investigations	Study the epidemiological pattern, the clinical features & laboratory method of investigations	Study the epidemiological pattern and environmental factors	Study the laboratory procedures and interpretation of results
<i>Describe the recommended treatment protocol</i>	<ul style="list-style-type: none"> <li>-Study the type, dose and routes of administration of drugs used for treatment of malaria</li> <li>-Study the supportive measures for admitted patients</li> <li>- Study about drug resistance</li> <li>- Study about side-effects of drugs</li> </ul>	<ul style="list-style-type: none"> <li>- Study the type, dose and routes of administration of drugs used for treatment of malaria</li> <li>-Study side effects of drugs</li> <li>-Study about drug resistance</li> <li>-Study about supportive measures</li> </ul>	Study the types & side effects of anti-malarial drugs	
<i>Describe preventive &amp; control measures</i>	Study the preventive and control measures including the indications for prophylaxis	Study the preventive and control measures including indications for prophylaxis	Study the preventive and control measures	Study the preventive and control Measures
<i>Identify epidemiological factors related with malaria</i>	Study epidemiological factors related with malaria	Study epidemiological factors related with malaria	Study epidemiological factors related with malaria	Study epidemiological factors Related with malaria
<i>Describe the current national guide lines for treatment &amp; control of malaria</i>	Study the <i>current</i> national guide lines for treatment and control of malaria	Study the <i>current</i> national guide lines for treatment and control of malaria	Study the <i>current</i> national guide lines for treatment and control of malaria	Study the <i>current</i> national guide lines for treatment and control of malaria

**Table 2: Attitude-Objectives and Activities by Category of Students**

<b>Learning Objectives</b>	<b>Activities of each category</b>			
	<b>H.O</b>	<b>PHN</b>	<b>EHT</b>	<b>MLT</b>
<i>Help believe that malaria is preventable</i>	<ul style="list-style-type: none"> <li>- Encourage preventive measure of malaria.</li> <li>- Use different health education methods such as health talks, demonstration (campaign), mass media, community mobilizations</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage preventive measure of malaria.</li> <li>- Use different health education methods such as health talks, demonstration (campaign), mass media, community mobilizations</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage preventive Measures of malaria</li> <li>- Use different health Education methods such as health talks, Demonstration (campaign), media, - Community mobilizations</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage preventive measure of malaria.</li> <li>- Use different health education methods such as health talks demonstration (campaign), mass media, - community mobilizations</li> </ul>
<i>Help believe that malaria is treatable</i>	<ul style="list-style-type: none"> <li>- Provide information that malaria is curable if medication is taken at the right time, dose &amp; duration</li> </ul>	<ul style="list-style-type: none"> <li>Provide information that malaria is curable if medication is taken at the right time, dose &amp; duration</li> </ul>	<ul style="list-style-type: none"> <li>Provide information that malaria is Curable if medication is taken at the right time, dose &amp; duration</li> </ul>	<ul style="list-style-type: none"> <li>Provide information that malaria is curable if medication is at the right time, the dose &amp; duration</li> </ul>
<i>Convince treating cases decrease</i>	<ul style="list-style-type: none"> <li>- Encourage people to come early for diagnosis &amp; treatment</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage people to come early for diagnosis &amp; treatment</li> <li>- In a malarious area</li> </ul>	<ul style="list-style-type: none"> <li>Help in organizing community distribution of anti-malaria drugs</li> </ul>	<ul style="list-style-type: none"> <li>Help in organizing community distribution of</li> </ul>



<i>transmission of malaria</i>	<ul style="list-style-type: none"> <li>- In a malarious area any person with fever should visit the near by health institution</li> <li>-Facilitate/ Organize community distribution of malaria drugs, whenever needed.</li> </ul>	<ul style="list-style-type: none"> <li>any person with fever should visit the near by health institution</li> <li>- Facilitate/ organize community distribution of malaria drugs whenever needed</li> </ul>	whenever there is a need	<ul style="list-style-type: none"> <li>anti-malaria drugs</li> <li>whenever there is a need</li> </ul>
<i>Believe in mothers and caregivers role in the treatment of malaria</i>	<ul style="list-style-type: none"> <li>- Understand &amp; advice that care givers are as equally important as health professionals in the treatment of malaria</li> <li>- Respect care-givers &amp; communicate clearly</li> <li>- Make caregivers understand their roles</li> </ul>	<ul style="list-style-type: none"> <li>-Understand advice that caregivers are as equally important as health professionals in the treatment of malaria</li> <li>- Respect caregivers &amp; communicate clearly</li> <li>- Make care-givers understand their roles</li> </ul>	<ul style="list-style-type: none"> <li>- Understand and advice that care givers are as equally important as health professionals in the treatment of malaria</li> <li>- Respect caregivers &amp; communicate clearly</li> <li>- Make caregiver s understand their roles</li> </ul>	<ul style="list-style-type: none"> <li>-Understand and advice that care givers are as equally important as health professionals in the treatment of malaria</li> <li>- Respect caregivers &amp; communicate clearly</li> <li>- Make caregivers understand their roles</li> </ul>
<i>Help believe self protective</i>	Give health education on self protection such as	Give health education on self protection such as use of mosquito	Give health education on self protection such	Give health education on self protection

<i>measures reduce the risk of malaria</i>	use of mosquito nets, window screens, insect repellent, clothing, and prophylaxis	nets, window screens, insect repellent, and clothing, prophylaxis	as use of mosquito nets, window screens, insect repellent, clothing, and prophylaxis	such as use of mosquito nets, window screens, insect repellent, clothing, and prophylaxis
<i>Help believe that early detection of cases helps in the management of malaria</i>	-Understand and promote home visit for active case detection - Understand and promote the importance of establishing surveillance system and provision of treatment services	-Understand and promote home visit for active case detection - Understand and promote the importance of establishing surveillance system and provision of treatment	-understand and promote home visit for active case detection - understand and promote the importance of establishing surveillance system and provision of treatment	- promote the importance of taking and examining blood samples
<i>Make believe that transmission differs in intensity in different seasons</i>	- Identify the peak malaria transmission season - Prepare for preventive & control measures - Increase awareness of the community - Promote	- Identify the peak-time for malaria transmission - Prepare for preventive & control measures - Increase awareness by the community	- Identify the peak-time for malaria transmission - Prepare for preventive & control measures - Increase awareness by the community	- Identify the peak-time for malaria transmission - Prepare for preventive & control measures - Increase awareness by the community

	intersectoral collaboration (MOA/MOH/National meteorological Agency, MOE)			
<i>Help believe environmental management reduces the risk of malaria</i>	<ul style="list-style-type: none"> <li>- Encourage environmental management to prevent the attraction and breeding of mosquitoes</li> <li>• Proper waste disposal</li> <li>• Drain stagnant/stand water, site clearing of nearby residence</li> <li>• Application of larvicide</li> <li>• Inter-sectoral collaboration</li> <li>• Community mobilization</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage environmental management to prevent the attraction and breeding of mosquitoes</li> <li>• Proper waste disposal</li> <li>• Drain stagnant/stand water site clearing of nearby residence</li> <li>• Application of larvicide</li> <li>• Intersectoral collaboration</li> <li>• Community mobilization</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage environmental management to prevent the attraction and breeding of mosquitoes</li> <li>• Proper waste disposal</li> <li>• Drain stagnant/stand water site clearing of nearby residence</li> <li>• Application of larvicide</li> <li>• Intesectoral collaboration</li> <li>Community mobilization</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage environmental management to prevent the attraction and breeding of mosquitoes</li> <li>• Proper waste disposal</li> <li>• Drain stagnant/stand water site clearing of nearby residence</li> <li>• Application of larvicide</li> <li>• Intesectoral collaboration</li> <li>• Community mobilization</li> </ul>

**Table 3: Practice Objectives and Activities by Category of Students**

<b>Learning object</b>	<b>Activities of each category</b>			
	<b>H.O</b>	<b>PHN</b>	<b>EHT</b>	<b>MLT</b>
<i>Detect early &amp; treat malaria case</i>	<ul style="list-style-type: none"> <li>•Conduct home visit</li> <li>•Treat the case as recommended</li> <li>•Establish and utilize the surveillance system               <ul style="list-style-type: none"> <li>• Predict, manage and evaluate an epidemic</li> </ul> </li> <li>•Early referral, if required</li> <li>• Provide H.E on the importance of early medical seeking and treatment</li> </ul>	<ul style="list-style-type: none"> <li>•Conduct home visit</li> <li>•Treat the case as recommended</li> <li>• Give treatment as prescribed</li> <li>• Provide H.E. on the importance of early medical seeking and treatment</li> </ul> <p>Give supportive care for admitted patients</p> <ul style="list-style-type: none"> <li>• Predict, manage and evaluate an epidemic</li> </ul>	<ul style="list-style-type: none"> <li>•Conduct home visit</li> <li>•Establish and utilize the surveillance system</li> <li>• Provide H.E. on the importance of early medical seeking and treatment</li> <li>• Predict, manage and evaluate an epidemic</li> </ul>	<ul style="list-style-type: none"> <li>•Conduct home visit</li> <li>•Take blood sample (seasonal, febrile cases)</li> <li>•Report the result as quickly as possible</li> </ul>
<i>Involve mothers, caregivers and patients in the management of malaria</i>	<ul style="list-style-type: none"> <li>- Communicate properly with mothers and caregivers or patients about the importance of taking medication as early as prescribed</li> <li>- Follow up to assess patient response to medication</li> <li>- Identify specific</li> </ul>	<ul style="list-style-type: none"> <li>- Communicate properly with the caregivers and mothers or patients about the importance of taking medication as early as prescribed</li> <li>- Follow up to assess patient response to medication</li> <li>- Identify specific</li> </ul>	<ul style="list-style-type: none"> <li>Communicate properly with the mothers and caregivers or patients on self and environmental protections</li> </ul>	<ul style="list-style-type: none"> <li>- Communicate properly with the mothers and caregivers or patients</li> <li>- Encourage and advice patients or caregivers</li> </ul>

	caregivers' and mothers' roles	mothers and caregivers' roles		to cooperate in giving blood samples
<i>Promote practice of self protection</i>	<ul style="list-style-type: none"> <li>- Initiate the use of mosquito nets, window screens, local repellents e.g. plants, smoke</li> <li>- Encourage protection of the body with clothes</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate the use of mosquito nets, window screens, local repellents e.g. plants, smoke</li> <li>- Encourage protection of the body with clothes</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate the use of mosquito nets, window screens, local repellents e.g. plants, smoke</li> <li>- Encourage protection of the body with clothes</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate the use of mosquito nets, window screens, local repellents e.g. plants, smoke</li> <li>- Encourage protection of the body with clothes</li> </ul>
<i>Provide anti-malaria prophylaxis</i>	Give anti-malarial prophylaxis for pregnant women, children, immigrants, and travelers to endemic area	Give anti-malarial prophylaxis for pregnant ladies, children, immigrants, and travelers to endemic area		
<i>Promote environmental management</i>	<ul style="list-style-type: none"> <li>- Encourage &amp; conduct:               <ul style="list-style-type: none"> <li>.environmental control to prevent the attraction and breeding of mosquitoes such as waste disposal,</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Encourage &amp; conduct:               <ul style="list-style-type: none"> <li>.environmental control to prevent the attraction and breeding of mosquitoes such as waste disposal, drainage of stagnant</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Encourage &amp; conduct:               <ul style="list-style-type: none"> <li>.environmental management to prevent the attraction and breeding of mosquitoes</li> </ul> </li> </ul>	

	<p>drainage of stagnant water, site clearing, application of larvicide &amp; use of insecticide, regularly</p> <ul style="list-style-type: none"> <li>. Community participation</li> <li>. Inter-sectoral collaboration</li> </ul>	<p>water, site clearing application of larvicide &amp; use of insecticide, regularly</p> <ul style="list-style-type: none"> <li>. Community participation</li> <li>. Inter-sectoral collaboration</li> </ul>	<p>such as waste disposal, drainage of stagnant water, site clearing application of larvicide &amp; use of insecticide, regularly</p> <ul style="list-style-type: none"> <li>.Community participation</li> <li>.Inter- sectoral collaboration</li> </ul>	
<p><i>Identify the peak transmission seasons</i></p>	<ul style="list-style-type: none"> <li>• Collect &amp; analyze data</li> <li>• Communicate with relevant sectors</li> <li>• Prepare for preventive and control measures</li> </ul>	<ul style="list-style-type: none"> <li>• Design studies, collect and analyze and interpret data</li> <li>• Increase the awareness of the community</li> <li>• Prepare for preventive &amp; control measures</li> </ul>	<ul style="list-style-type: none"> <li>• Collect data</li> <li>• Increase the awareness of the community</li> <li>• Prepare for preventive &amp; control measures</li> </ul>	<ul style="list-style-type: none"> <li>• Collect data</li> <li>• Increase the awareness of the community</li> <li>• Prepare for preventive &amp; control measures</li> </ul>

**Table 4: Knowledge-Objectives and Activities for Caregiver /Self- Care/HSEWs**

<b>Learning Objectives</b>	<b>Activities of Caregivers and HSEWs</b>	
	<b>Caregiver /Self-care</b>	<b>HSEWs</b>
<i>Describe the causes of malaria</i>	Know malaria is caused by blood parasites but not by evil-eye or dirty water	Describe malaria is caused by Plasmodium parasites
<i>Describe the modes of transmission</i>	Know that malaria is transmitted from the sick to the healthy person by the bite of mosquito	Describe that malaria is transmitted from the sick to the healthy person by the bite of anopheles mosquito
<i>List the major symptoms and signs of malaria</i>	Know fever, chills, rigors, headache are some of the major symptoms of malaria	Study fever, chills, rigors, headache are some of the major symptoms of malaria
<i>Identify the recommended treatments of malaria</i>	Know that malaria is treatable and curable	Describe the drugs used for treatment of malaria
<i>Describe the preventive and control measures of malaria</i>	<ul style="list-style-type: none"> <li>- Know self-protective measures such as mosquito net, window screen, insect repellent etc.</li> <li>- Know environmental control measures such as proper waste disposal, site clearing, drainage of stagnant water, application of larvicide &amp; insecticide</li> <li>- Know the roles of community in</li> </ul>	<ul style="list-style-type: none"> <li>- Describe self-protective measures such as mosquito net, windows' screen and insect repellent.</li> <li>- Describe environmental control measures such as proper waste disposal, site clearing, drainage of stagnant water, application of larvicide &amp; insecticide</li> </ul>

	preventing and controlling of malaria	- Describe the roles of community in preventing and controlling of malaria
<i>State the main risk factors related to malaria</i>	Know that pregnant women & children are at risk of getting malaria	Know that pregnancy, malnutrition, younger age increase the risk of getting malaria





**Table 5: Attitude-Objectives and Activities for Caregivers/ Self- care/HSEWs**

<b>Learning Objectives</b>	<b>Activities of Care givers and HSEWs</b>	
	<b>Caregivers /Self care</b>	<b>HSEWs</b>
Believe that malaria is preventable	Accept that malaria is preventable	<ul style="list-style-type: none"> <li>- Help mother and self-caregiver or community to accept that malaria is preventable</li> <li>- Encourage preventive measures</li> <li>- Use different health education methods health talks, demonstrations, social mobilization, etc</li> </ul>
Believe that malaria is curable	Accept that malaria is treatable and curable	Provide information that malaria is curable if medication is taken as prescribed
Convince treating cases decreases the transmission of malaria	<ul style="list-style-type: none"> <li>• Accept that early and completing treatment decreases transmission</li> <li>• Accept that any person with fever should visit nearby health institutions</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage people to come early for diagnosis and treatment</li> <li>• In a malarious area, consider malaria for any patient with fever</li> </ul>
Believe self- protective measures reduce the risk of malaria	Accept self protective measures such as mosquito nets, windows screen, local insect repellents, and clothing prevent from contracting malaria	Accept and convince the importance of self protective measures such as use of mosquito nets, window screen, local insect repellent, clothing and prophylaxis
Believe caregivers are	Accept that mothers and	Accept that mothers and care-

important in the treatment of malaria	care-givers/self-care are equally important as health professionals in the treatment of malaria	givers/self-care are equally important as health professionals in the treatment of malaria
Believe that early detection of cases help in the management of malaria	Accept that any person with fever should visit the nearby health institution or community health service extension worker	<ul style="list-style-type: none"> <li>- Encourage early reporting of any person with fever</li> <li>- Home visit is important for detecting cases early</li> <li>- Involve community and caregivers in identifying and reporting of cases</li> </ul>
Believe transmission differs in intensity in different seasons	Accept that the peak time for malaria transmission is the beginning and end of the rainy season	<ul style="list-style-type: none"> <li>- Convince that the peak time for malaria transmission is at the beginning and the end of the rainy season</li> <li>- Accept the importance of working with people working in the different sectors to prevent seasonal transmission of malaria</li> <li>- Convince through demonstration the development of larvae to adult mosquito</li> </ul>
Believe environmental management reduces the occurrence of the disease	Accept environmental management such as proper waste disposal, drainage of stagnant water, site clearing decrease the breeding of mosquitoes	<ul style="list-style-type: none"> <li>- Encourage and involve environmental management to prevent the attraction and breeding of mosquitoes by proper waste disposal, drainage of stagnant water, site clearing, application of larvicide</li> <li>- Accept social mobilization</li> </ul>

		helps to manage the environmental control measures
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**Table 6: Practice-Objectives and Activities for Caregivers/Self-Care/HSEWs**

<b>Learning Objectives</b>	<b>Activities of Care givers and HSEWs</b>	
	<b>Care givers/Self-care</b>	<b>HSEWs</b>
Detect early & treat malaria cases	Detect early symptoms of malaria and treat. Visit nearby health institution or HSEW	Detect Symptoms and signs of malaria and treat the cases Refer to the nearby health institution if no improvement within 48 hours
Involve caregivers/self care in the management of malaria	<ul style="list-style-type: none"> <li>- Visit the nearby health institution or HSEWs as early as possible when sick</li> <li>- Give the medication as prescribed by the health worker or HSEWs</li> <li>- Follow instructions provided by health workers</li> </ul>	<ul style="list-style-type: none"> <li>- Identify specific-roles of care givers</li> <li>- Communicate properly with the caregivers: concerning the importance of early health seeking, early taking of medication as prescribed and subsequent follow-ups</li> </ul>
Promote practice of self protection	<ul style="list-style-type: none"> <li>- Use mosquito bed nets, window screen, local mosquito repellents,</li> <li>- protect the body with clothing</li> </ul>	<ul style="list-style-type: none"> <li>- Initiate the use of mosquito nets, window screen, local repellents (plants)</li> <li>- Encourage protection of the body with clothes</li> </ul>
Provide anti-malarial prophylaxis	<ul style="list-style-type: none"> <li>- Consult the health worker, HSEWs about the chemo-prophylaxis when planning to go to malaria epidemic area</li> <li>- Take the chemo-prophylaxis as prescribed</li> </ul>	<ul style="list-style-type: none"> <li>- Give anti-malaria chemo-prophylaxis for pregnant women, under age 5 children, for immigrants, travelers to a new area, and pregnant women</li> <li>- Provide health education on the importance of chemo-prophylaxis</li> </ul>

<p>Promote environmental management</p>	<ul style="list-style-type: none"> <li>- Manage the environment to prevent attraction of breeding of mosquitoes such as: proper waste disposal, drainage of stagnant water, site clearing (vegetation, waste), applying larvicide (burned oil), use insecticides</li> <li>- Participate in campaigns &amp; community activities</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage environmental management to prevent the attractions of breeding of mosquito such as: proper waste disposal, drainage of stagnant water, site clearing (e.g. vegetation, waste), application of larvicide (burned oil), use of insecticides</li> <li>- Mobilize the community</li> <li>- Collaborate with other sector workers at the community level</li> </ul>
<p>Identify the peak transmission of seasons</p>	<p>Report to health service extension workers about patients with major symptoms of malaria such as fever</p>	<ul style="list-style-type: none"> <li>- Gather information from the people</li> <li>- Conduct home visits</li> <li>- Screen febrile cases and report to the near by health institution.</li> <li>- Request &amp; prepare relevant drugs &amp; materials for treating cases</li> <li>- Prepare preventive &amp; control measures</li> </ul>

## GLOSSARY

- Acidosis:** Condition where there are more acid waste products than normally in the blood
- Acute renal failure:** A sudden failure to pass urine or significant reduction in the amount of urine passed in 24 hours (<400ml/24hours in a catheterized patient)
- Anemia:** Condition where the level of red blood cells is less than normal or where the hemoglobin is less, making it more difficult for the blood to carry oxygen
- Anopheles:** The type of mosquito that carries the malaria parasite
- Anti-pyretics:** Drugs that help to reduce fever
- Asexual:** Not involving sex
- Gamete:** Mature sexual form, male or female, which in the case of malaria develops in the red blood cells
- Gametocyte:** Cell, which is developing into a gamete
- Granulocytopenia:** Lowering of the number of granulocytes (type of white blood cells) in the blood due to defects in bone marrow
- Haemolysis:** Destruction of RBC
- Hemoglobinuria:** The presence of free hemoglobin in the urine.
- Hyperparasitemia:** Parasites load above 5%.
- Hypochromic:** The presence of cell having a larger than normal area of central pallor, causing the cell to stain weakly and appear to have less than normal pigmentation.

<b>Hypoglycemia:</b>	Low concentration of sugar in the blood (<40mg/dL of blood)
<b>Hypotension</b>	Lower blood pressure than normal
<b>Insecticide:</b>	A chemical used for killing isects.
<b>Jaundice:</b>	Excess of the bile pigment in the blood leading to yellowish discoloration of the white part of the eyes and the skin
<b>Larvacide :</b>	A chemical used for killing larva
<b>Malaise:</b>	Feeling of discomfort
<b>Malarious:</b>	Areas where malaria is endemic
<b>Malpractice:</b>	Inappropriate (unprofessional) or harmful traditional medical practice
<b>Maurer's Dots:</b>	Reddish dots present in the cell parasitized by P. falciparum
<b>Merozoite:</b>	Product of segmentation of tissue schizont in the liver or of an erythrocytic schizont before entering a new host
<b>Microcytic:</b>	an abnormally small red blood cell.
<b>Normochromic:</b>	Normal color of RBC (Hemoglobin concentration)
<b>Normocytic:</b>	Normal size of RBC
<b>Oocyst:</b>	Fertilized cell after encystment, developing in malaria parasite from the Ookinette in the mosquito
<b>Oogonium:</b>	Cell produced at the beginning of the development of an ovum in the mosquito

- Ookinette:** Motile stage of the malaria parasite following fertilization of the gamete and before the oocyst formation in the mosquito.
- Pesticide:** Substance which kills insects
- Plasmodium:** Type of parasite, which infests red blood cells and causes malaria
- Pre-erythrocytic:** Existing before the infection of the red blood cells
- Protozoa:** Tiny simple organisms with a single cell (singular = protozoon)
- Psoriasis:** A skin disease that causes a rough red areas where the skin comes off in small pieces.
- Pulmonary edema:** Collection of fluid in the lung
- Schizont:** The multinucleate stage in the development of some members of the Sarcodina and some sporozoans during schizogony.
- Schuffner's dots:** Pinkish dot present outside the parasite and inside the cell parasitized by *P.vivax*
- Schizogony:** The asexual reproduction of a sporozoan parasite (sporozoite) by multiple fission of the nucleus of the parasite followed by segmentation of the cytoplasm, giving rise to merozoites intracellular (in the RBC).
- Seizure:** Sudden contraction of the muscles of the whole or part of the body
- Self-care:** Looking after yourself properly so that you remain healthy



**Sporozoite:** Final stage of development of the malaria parasite in the mosquito (Infective form in the salivary gland of the mosquito)

**Trophozoite:** Intracellular forms of the malaria parasite in a red blood cell in their early stages of development before the nucleus begins to divide.



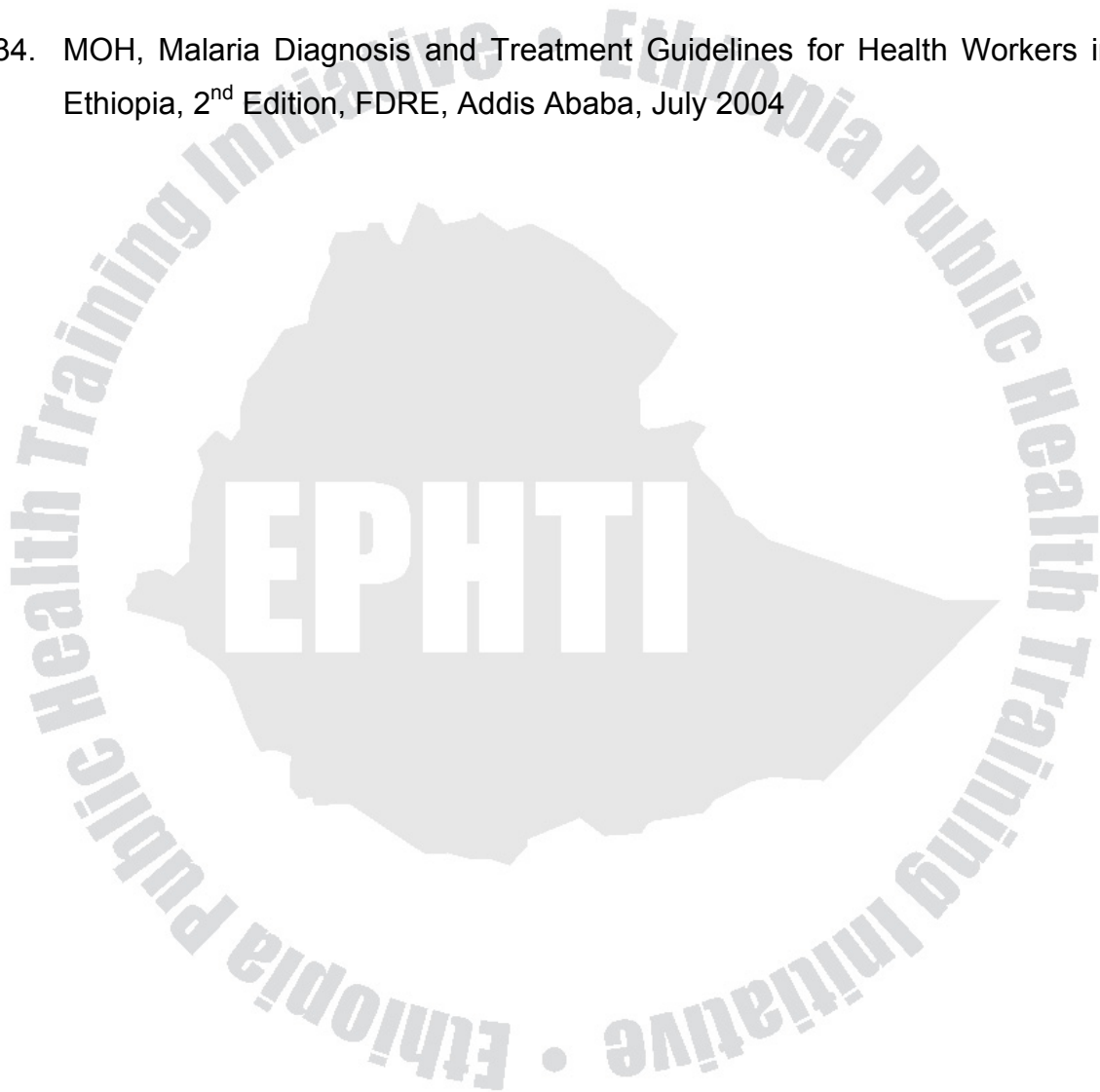
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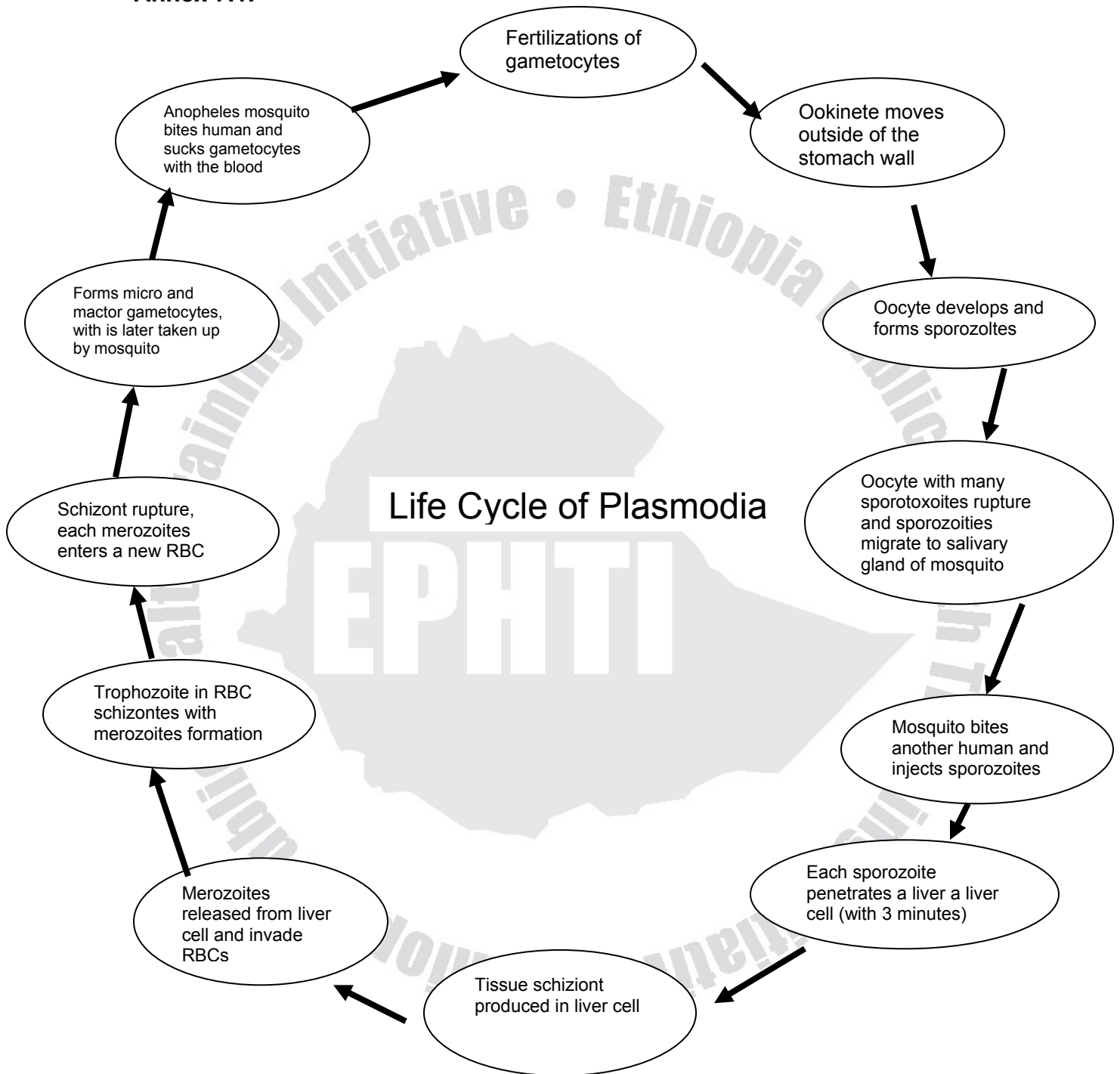
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# ANNEXES

## Annex 7.1.



## Annex 7.2.

### Relationships between the life cycle and the clinical pictures of *P. falciparum* and *P. vivax* parasites

<i>Cycle/feature</i>	<i>P.falciparum</i>	<i>P. vivax</i>
Pre-patent period	9 - 10 days	11 -13
days		
Asexual period	48 hours	48 hours
Periodicity of fever	aperiodic	tertian
Exo-erythrocytic cycle	pre-erythrocytic only	
persistent hypnozoites		
Delayed onset	rare	
common		
Relapses	recrudescence (upto 2 years)	
common(many years)		
Preerythrocytic stage	5½ - 7 days	6-8
days		
Number of merozoites	30,000	10,000
In pre-erythrocytic		
schizont		

### Annex 7.3. Treatment schedules

Artemether – Lumefantrine: (coarthem)

Tablet containing 20 mg Artemether plus 120 mg Lumefantrine in a fixed dose combination.

Weight (kg)	Age (Years)	Number of tablets per dose					
		Twice daily for 3 days					
		Day - 1		Day - 2		Day - 3	
		Morning	Evening	Morning	Evening	Morning	Evening
5 –14	3 month – 2 years	1	1	1	1	1	1
15-24	3 – 7 years	2	2	2	2	2	2
25-34	8 – 10 years	3	3	3	3	3	3
35+	> 10 years	4	4	4	4	4	4

#### **Possible side effects**

- Gastrointestinal disturbances with nausea, vomiting and anorexia.
- Dizziness, mylgia, palpitation, headache, sleep disorders.

#### **Contraindications**

- Malaria prophylaxis either alone or in combination.
- Persons with previous history of skin rash after using Artemether Lumefantrine
- Infants less than 5 kg.
- Pregnant women and mothers with infant less than 3 months.



**Dosage of Chloroquine for tablets of 150 mg base and syrup 50 mg base/ 5 ml**

<b>Weight in Kg</b>	<b>Age group</b>	<b>Day One</b>	<b>Day Two</b>	<b>Day Three</b>
5-6	<4 months Tablets Syrup	½ 5 ml	¼ 5 ml	¼ 2.5 ml
7-10	4-11 months Tablets Syrup	½ 7.5 ml	½ 7.5 ml	½ 5 ml
11-14	1-2 years Tablets Syrup	1 12.5 ml	1 12.5 ml	½ 7.5 ml
15-18	3-4 years Tablets Syrup	1 15 ml	1 15 ml	1 15 ml
19-24	5-7 years Tablets Syrup	1 ½ 20 ml	1 ½ 20 ml	1 15 ml
25-35	8-10 years Tablets	2 ½	2 ½	1
36-50	11-13 years Tablets	3	3	2
50+	14+ years Tablets	4	4	2

**Total dose:** 25 mg base/kg of body weight over three days (10 mg base on day 1 and 2, and 5 mg base per kg on day 3). **Note that** 5 ml (of one tea - spoonful) is equivalent to ½ tablet.

**Side effects of chloroquine**

The side effects include: dizziness, skeletal muscle weakness, nausea, vomiting, abdominal discomfort, diarrhea and allergic skin eruption.

### **Contraindications**

1. Persons with known allergy to the drug
2. Persons with history of seizure
3. Persons with psoriasis

### **Dosage of Quinine**

Weight (kg)	Age	Oral (tablets, dosage to be given daily for 7 days)	
		200 mg salt	300 mg salt
4 –6	2-4 months	$\frac{1}{4}$	None
6-10	4-12 months	$\frac{1}{3}$	$\frac{1}{4}$
10-12	1-2 years	$\frac{1}{2}$	$\frac{1}{3}$
12-14	2-3 years	$\frac{3}{4}$	$\frac{1}{2}$
14-19	3-5 years	$\frac{3}{4}$	$\frac{1}{2}$
20-24	5-7 years	1	$\frac{3}{4}$
25-35	8-10 years	1 $\frac{1}{2}$	1
36-50	11-13 years	2	1 $\frac{1}{2}$
50+	14+ years	3	2

### **Side effects**

- Dizziness
- Ringing in the ears
- Blurred vision
- Tremors
- Hypoglycemia

**Note:** with the above dosages these side effects are not severe enough to stop treatment and subside spontaneously when the administration of the drugs ends.

### **Contraindications**

- None to the oral administration of the drug within the above dosage

### **Dosage of primaquine based on weight and age**

Weight in Kilogram	Age in Years	Number of tablets	
		7.5 milligram	15 milligram
19-24	5-7	2 ¼	None
25-35	8-10	3	1½
35-60	11-13	4 ½	2 ¼
50 and above	14+	6	3

0.75 mg base per kg, single dose

### **Side effects of the drug**

Anorexia, vomiting, abdominal pain and cramps and other vague symptoms such as weakness and uneasiness in the chest

### **Contraindications**

- 1) Pregnant women
- 2) Children under four years
- 3) Conditions that predispose to granulocytopenia, rheumatoid arthritis, systemic lupus erythematosus.

**Note:** Patients may fail to respond to treatment with chloroquine or other anti-malarial drug for various reasons such as:

- Inadequate treatment, when the full dose is not taken
- The cause of the fever may be other than malaria
- The quality of the drug may be poor e.g. expired drug
- The parasite may be resistant to the drug
- The patient may have vomited the drug

Febrile children under-five years of age living in malarious areas should receive anti-malarial treatment.

## Anne 7.4. Answer Keys

### 7. 4.1. For All Categories

1. Female anopheles mosquito
2. 2.1.1.3. 1. Plasmodium falciparum, 2. Plasmodium vivax,  
3. Plasmodium ovale and Plasmodium malariae
3. D
4. C
5. D
6. P. falciparum and P.vivax
7. D
8. E
9. 1=abortion, 2=maternal death, 3=fetal death, 4=premature labor  
5= anemia.
10. C
11. Epidemic, new cases, deaths, school absentees and etc.
12. Road and housing construction, irrigation, population  
mobilization, flood and etc.
13. C

### 7.4.2. For Specific Categories

#### 7.4.2.1. Health Officers Students

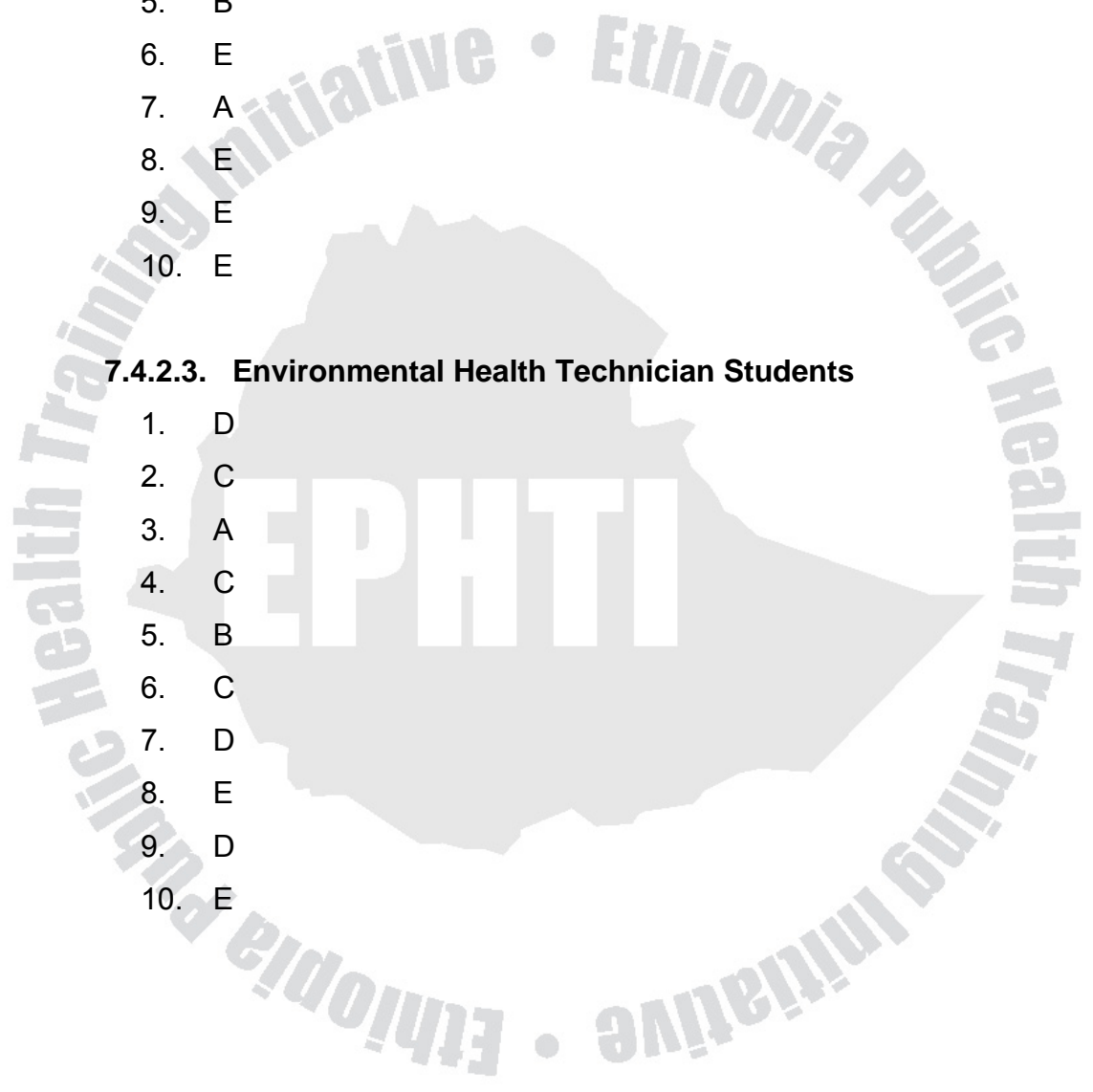
1. E
2. D
3. Anopheles gambiae
4. E
5. D
6. B
7. D
8. B
9. A
10. C
11. True (a)
12. Ability of mosquito, contact, immunity
13.  $\geq 15^{\circ}\text{C}$
14. False (b)
15. False (b)

**7.4.2.2 Public Health Nurse Students**

1. B
2. A
3. A
4. E
5. B
6. E
7. A
8. E
9. E
10. E

**7.4.2.3. Environmental Health Technician Students**

1. D
2. C
3. A
4. C
5. B
6. C
7. D
8. E
9. D
10. E



#### 7.4.2.4. Medical Laboratory Technician Students

1. 1=Wright staining technique 2=Giemsa staining techniques
2. Giemsa stain
3. Trophozoite, schizont, and gametocyte
4. Host RBC morphological change and parasitic trophozoite cytoplasmic pattern
5. A
6. A
7. C
8. C
9. E
10. B

#### 7.4.2.5. Health Service Extension Workers

1. B
2. B
3. B
4. B
5.
  - a. Detect cases by home visiting, treat, and report to the nearby health institution.
  - b. Mobilize the community to:
    - drain water collection sites,
    - clean up the surrounding of the houses; remove garbage and dispose in a properly prepared pits, clear vegetation around the houses, etc.
  - c. Give health education to the community wherever possible market places, churches, mosques, meetings, etc.
  - d. Advise the community to cover their body with clothes during the night, to use impregnated mosquito nets, to cover windows with screens, etc.
  - e. Participate in insecticide spraying,

- f. Apply burned motor oil on standing waters, if available.
- 
- 6.
    - a. Give prophylaxis, if available
    - b. Give treatments to detected patients
    - c. Refer patients if they do not show any improvement within three days
    - d. Report to the nearest health institution immediately
    - e. Call support if the conditions are beyond your capacity
    - f. Give health education
    - g. Participate and mobilize the community on environmental sanitation, etc.

**Case Study Answers for Health Service Extension Workers**

- 1) Malaria
- 2) No, they do not cause malaria
- 3) No
- 4) Yes, E.g relapsing fever "Girsha Tesibo"
- 5) To take his son to the nearest health institutions (Armachiho health center) without any delay.
- 6) Refer the patient.

## **Annex 7.5. The Authors**

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