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Using an Educational Training Module to Increase Knowledge, Attitudes and Practices of Malaria among Medicine Vendors in Yobe, Nigeria

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Abstract

This training module focuses on providing basic guidance on the current recommended approaches regarding malaria basic information, signs/symptoms, case detection, treatment, referral, and effective prevention strategies. The module can be used for in-service training programs on malaria or to assist in improving other health educator's work as well as serve as referral handbook for practicing health professionals. It can thus be used as a stand-alone training or together with modules dealing with other aspects of malaria control, prevention and elimination. The module uses a problem-solving approach to facilitate understanding and thereby motivate trainees on improved malaria case management. In essence, the training aims to generally improve the knowledge, attitudes and practices (KAP) of the most common handlers of malaria cases in this part of the world, the training module is then expected to improve services obtained by the majority of patients on malaria. On completion of training using this module, trainees will have acquired appreciable knowledge and skills on malaria basic-information, signs/symptoms, case detection/differentials, recommended drug treatment/appropriate dosing, indication for referral of complicated cases, effective prevention methods and the need to sensitise communities to stand up against malaria.

Keywords: malaria KAP training, case detection, management and prevention, medicine vendors

1. Introduction

Malaria remains a major global public health and development challenge over the years and in its World Malaria Report 2019, the World Health Organisation's (WHO's) global tally of malaria in 2018 alone was estimated at 228 million cases and 405,000 deaths [1]. Malaria is holo-endemic in many parts of sub-Saharan Africa thereby infecting citizens all year round and hence impacting the most devastation in this region. Worldwide, about 88 countries still remain at risk of malaria, with the types of species, severity and disease trends depending on the geographical location.

One of the greatest challenges facing malaria endemic countries with regards to malaria containment efforts is the lack of proper basic information, poor diagnosis and hence lacking early treatment of uncomplicated cases which progresses to the deadly severe stages, poor treatment and referral practices and poor preventive strategies [2].

Problems of malaria endemicity cannot be unconnected to the widely claimed inadequately trained health manpower and hence poor practices of the health personnel, these health personnel comprise mostly of Patent Medicine Vendors (PMVs) in most rural areas of sub-Saharan Africa. It has been reported that up to 60% of all malaria cases in this sub-region are preferentially first treated by the PMVs and these services leaves much to be desired [3], a situation which informed the development of this training in an attempt to give a more pragmatic approach to PMV the training program. Patent Medicine Vendors are individuals that usually engage in the stocking and sale of Over-the-Counter (OTC) drugs as well as provision of other basic healthcare services and as such, they assume the most common sources of antimalarial treatment throughout Sub-Saharan Africa as they also play a potentially critical role in the struggle against malaria [4].

To facilitate learning by all participants, the training strategies will encourage participants to learn from each other as well as from the researcher / facilitators, particularly in the form of lecture sessions, group discussions, demonstration exercises, role plays, brainstorming exercises and collectively tackling case studies. Each participant will therefore be expected to take part actively throughout the course. In working through the modules, there will be opportunities to put into practice, individually or collectively, what has been learnt. Various strategies were then implored to achieve this objective.

Presentations: Formal presentations such as lectures from the facilitators will be limited to a minimum and this will be presented in the form of explanation to the principles, basic knowledge, and then practical experiences with the class in session. All information provided in sessions are contained in the modules and participants need not to take much notes. Lectures will be combined with a demonstration (physically or on slides). The participants will be asked frequently to present their work in plenary session. This will provide experience on how to tackle arising issues, both by presenting and by learning from the observations and suggestions made during discussion. Posters and slides will be used to enhance learning.

Demonstrations / Practical Sessions: Demonstrations will be used to illustrate some procedures for the diagnosis, treatment and prevention of malaria that will be carried out. The program will include demonstration sessions so as to provide as much practical experience in all aspects of malaria to be studied. In some sessions, the facilitator will work with smaller sub-groups of not more than ten participants; by limiting the size of the groups, the participants will receive extensive individual attention and increased opportunities for learning and practice.

Group discussions / Small group discussions: Discussions will be based on topics and cases taken from the modules which will take place during small group exercises and in general plenary sessions. In these exercises, the facilitator will lead the discussions on the selected subjects with emphasis on participation of group members. These sessions provide opportunities for the participants to give their individual opinions and experiences, to develop ideas, learn from one another, to discuss issues with respective colleagues, to share ideas, opinions and useful experiences, and to finally make efforts towards drawing their own conclusions from intensive discussions. Small group discussions are usually considered to form a valuable component of the courses taken. Participants are also encouraged to take full advantage of these useful sessions and to partake freely and actively in all the discussions. At each session in the group work, there will be changes in the

moderator and also the reporter so as to ensure that every participant gains experience in such roles and this will also ensure that tasks are shared equitably. Solving case studies, role plays and quiz sessions will also encourage sharing ideas.

This program is designed to employ the use of various motivational enhancement techniques. Motivational Enhancements can be thought of as processes encouraging 'the probability that a person will enter into, continue to, and adhere to specific change strategies'. It is the responsibility of a facilitator to increase the probabilities that participants will follow a recommended course of action towards changes. Thus, motivation is a key part of a facilitators tasks.

For facilitators, five general principles guides behaviour during sessions. They include:

1. Express Empathy: use skillful reflective listening to understand and accept the participant's contributions without judging, criticising, or blaming.
2. Develop Discrepancy: Raise / draw the participant's consciousness and awareness of the consequences of unhealthy, unethical practices. Remember that participants should lead group discussions and present the need for changes in their attitudes and practices.
3. Avoid Arguments: Arguments are counter-productive and increases participant's resistance to change, as such facilitators should be diplomatic.
4. Support Self-Efficacy: Facilitators must always convey to participants a feeling of 'You can do it, and you will succeed' message. In essence, imparting a belief in the ability for change is an important motivator. Hope is usually found in the range of different approaches available. If one does not work, the facilitator can try others.
5. Elicit self-motivational statements: this strategy helps participant's move beyond ambivalence.

It is important to understand the community culture and traditions. These are the basis of community members' values, which shape community members' attitudes on topics like malaria control. Often, these local beliefs influence community members' actions (or non-actions) more than any other source of information. Community members are likely to trust what they hear from family, friends and community leaders. Often they hear a mix of information, including local beliefs and messages that are passed down from health workers. Some myths / local beliefs about malaria will be reviewed in sections 4 and 6. These mix of messages can be very confusing, so informed participants could use the opportunity to impact on their community's health.

The use of drugs for malaria treatment and prevention involves only drugs recommended by the World Health Organisation (WHO) and employed by the Nigerian government for malaria treatment within the region, this is so because recommended drugs vary depending on region of the world due to the particular specie of malaria infesting the region and the pattern of resistance there.

2. Malaria basic information

Table 1 below describes the training module on malaria basic information, which comprises the session objectives, learning objectives, time duration for the

Session Objectives	To understand the basic information on malaria	
	To understand the cause and how malaria can be transmitted	
	To understand the malaria cycle in man and in vector	
	To understand who is most vulnerable to malaria	
Duration	25 mins	
Learning objectives At the end of the session, participants should be able to:	Know what uncomplicated malaria is	
	Know what complicated malaria is	
	Be able to differentiate what causes and what does not cause malaria	
	Be able to differentiate what transmits and what does not transmit malaria	
	Be able to differentiate between suspected and confirmed malaria	
	Be able to differentiate between uncomplicated and severe malaria	
Training Materials	Participant's manual	Pens & Notebook
	Slides	Laptop computer
	LCD projector	Flip chart and markers
Methods used	Lecture	
	Demonstration classes	
	Question & Answer sessions (Brainstorming exercise)	
	Group discussions	
	Reflection on the module	
Instructions for the facilitator	1. Begin the session by explaining the objectives of the session	
	2. Get the participants to discuss what they understand by malaria and their experiences	
	3. Give a lecture on the general information about malaria using Lecture 2.1 below. (Notes below each slide explain what points need to be made)	
	4. Think about sections which the participants might find difficult and common questions they may ask	
	5. Ask the series of questions (at end of this module) and discuss the answers	
	6. Ask the group questions to be discussed	

- 7. Try to find out if the participants did understood the lecture by making the class participatory since everyone knows at-least something on malaria

Table 1.
Summary of session on malaria basic information.

module, training materials needed, methods used and other relevant instructions that will assist the facilitators.

2.1 General facts about malaria

You may be wondering why the emphasis on improving knowledge, treatment and prevention. The main reason is because malaria, being a life-threatening parasitic disease affects parts of the world we live in and remains the major public health problem in Nigeria. It is an avoidable cause of death and illness in children and adults. In Nigeria, malaria continues to be endemic and is the first major cause of morbidity and mortality among the most vulnerable groups- children under 5 years, pregnant women and people living with HIV/Aids. Malaria is characterised by a stable, perennial, transmission in all parts of the country. Transmission is higher in the wet season than in the dry season. This seasonal difference is more striking in the northern part of the country.

According to the World Malaria Report (2013), there was a worldwide estimate of 207 million cases of malaria and an estimated 627 000 deaths in 2012 alone. 81% of these cases and 91% of the deaths were from sub-Saharan Africa [5], and Nigeria alone bears up to 25% of the burden [6]. Again, about 63% of hospital attendance in the Nigerian health care facilities are caused by malaria which is also the cause of absence in workplace / schools, in addition to a huge health expenditure to households leading to a total estimated economic loss to the country of up to 132 billion Naira per year [6].

Note that, in the absence of an effective vaccine, malaria treatment and prevention still remains the vital strategies of malaria control, especially to you PMVs, who are usually the first place of call to the bulk of community residents.

- What is Malaria?
 - ☐ Malaria is a serious and sometimes fatal disease caused by a parasite called plasmodium which infects human blood cells. (A parasite is an organism that can only exist in the body of another organism for all or part of their life)
 - ☐ There are 4 main kinds of plasmodium parasites that cause malaria in humans. These are:

- *Plasmodium falciparum* (Pf).
- *Plasmodium vivax* (Pv).
- *Plasmodium malariae* (Pm).
- *Plasmodium ovale* (Po).

In Nigeria 98% of malaria infections are due to *P. falciparum*. This parasite causes the most deadly form of malaria, known as severe malaria. Other forms of malaria present in Nigeria include *P. ovale* and *P. malariae* which play a minor role with the latter being quite common as a double infection in children.

Note THAT:

☐ Malaria is NOT caused by body contact, drinking contaminated water or eating any kind of food as is the assumption in some localities.

☐ Neither is malaria caused by staying under the sun, exposure to cold weather or living in a dirty environment. Though, these conditions can aggravate malaria.

2.2 Types of vector mosquitoes

There are three common types of Mosquito Vectors:

1. Anopheline mosquito

☐ wings with dark spots

☐ sits at an angle of 45 degree with the resting surface

☐ breeds in clean water

☐ bites at late night

☐ transmits malaria

2. Culex mosquito

☐ usually are referred to as nuisance mosquitoes

☐ usually found to breed in dirty waters

☐ no unique dark spots found on the wings (usually plane dark wings)

☐ appears with a hunchback when in sitting position

☐ usually transmits filariasis

3. Aedes mosquito

☐ are usually dark ornamental mosquito with unique white spots

☐ usually breeds in clean waters found in containers / overhead tanks and wells

☐ usually bites during the day time

☐ bite from this specie is usually very painful

☐ transmits Dengue/DHF/Chikungunia which are viral diseases

2.3 Life cycle of malaria parasite and the malaria transmission cycle

The vectors that carry malaria parasites (mosquito) prefer to feed on humans rather than other animals. Another unique characteristic is that the vectors prefer to feed indoors. While taking a blood meal, the female mosquito injects saliva into the person's blood vessels to stop the blood from clotting to make it easier to suck in. While injecting saliva, if she is infected with malaria parasites, she injects them as sporozoites into the person's blood as seen in **Figure 1**. On the other hand, if the person is infected, when the mosquito draws up the blood it will also take up

Figure 1.
Life cycle of plasmodium parasites illustrating stages of the cycle.

malaria parasites as gametocytes, the sexual forms of the malaria parasite. After a blood meal, the female mosquito usually finds a place to rest (usually the wall of the house) to digest her meal, and to develop her eggs. The malaria parasites which have been sucked up from the blood as gametocytes develop inside the mosquito over a period of 8 to 25 days to become sporozoites in the salivary glands. At this stage the female Anopheles mosquito becomes infective to the next person it feeds on.

Once the sporozoites get into a person with no or little immunity to malaria, they undergo various stages of development to cause disease about 7 to 12 days later as seen in **Figure 1**. Specifically, the sporozoites travel rapidly to the liver where they enter the liver cells and divide rapidly, forming merozoites. When a liver cell is full of merozoites, it bursts and discharges the merozoites into the blood where they quickly enter the red blood cells. In the red blood cells, the merozoites grow and divide again until the red blood cell bursts to release them into the blood stream to attack other red blood cells. This is what causes the person to experience symptoms such as fever, sweating and shivering. Some merozoites, however, change into the male and female forms of the parasite, called gametocytes, which are taken in by the mosquito when she sucks the blood to get her blood meal (**Figure 2**). The gametocytes enter the mosquito's stomach and mate to form eggs, which then in turn become sporozoites and move to the mosquito's salivary glands where they are ready to be injected into another person. Once the mosquito bites a person and infects him or her with sporozoites, it takes about 8 to 11 days for gametocytes to appear in the blood. In this way and under suitable conditions, one female Anopheles mosquito can transmit malaria parasites to many susceptible people during its average life span of 20 to 25 days [7]. This transmission cycle is illustrated in **Figure 2** below. In this way, this cycle of transmission continues unless interventions are used to break it.

2.3.1 The malaria transmission cycle

Key factors necessary for the process of transmission are:

Figure 2.

Malaria transmission cycle showing how malaria parasites are carried by a female *Anopheles* mosquito from an infected person to a healthy one.

☐ The malaria parasite itself
☐ The vector / transmitting agent (i.e. the mosquito)
☐ The disease reservoir which refers to the total number of the subjects in the area carrying the malaria parasites. Their blood reservoir is where the vector obtains the infection.

- Malaria is transmitted by the bite of an infected female anopheles mosquito of which there are at least 400 different species. The common species are *Anopheles gambiae*, *A. funestus*, *A. arabiensis* and *A. melas*
- Within the *Anopheles gambiae* complex *A. gambiae* s.s. is the dominant species with *A. arabiensis* found more often in the Northern part of the country and *A. melas* found only in the mangrove coastal zone.

2.4 Brainstorming exercises

Note: Facilitator will ask these questions and different opinions from participants discussed.

Why is malaria a major public health problem in Nigeria.

Answer: Because Malaria is a major cause of:

- ☐ Ill health (morbidity)
☐ Death (mortality)
☐ Impaired child development
☐ Absenteeism in school children and work places
☐ Lost productivity (estimated economic loss to Nigeria is 132 billion Naira per year)
☐ Lost opportunities for economic development, e.g. tourism and foreign investment.

How is this *Anopheles* mosquito specie different from other mosquitoes?

Answer: It is a large mosquito and when standing it is tilted with head downwards and tail upwards in the air.

Which people are most vulnerable to Malaria?

Answer:

- ☐ Pregnant women
- ☐ Children under 5 Years of age
- ☐ People living with HIV/AIDS
- ☐ People suffering from Sickle Cell disorders
- ☐ Travellers into malaria endemic areas

Note: The first two groups (Pregnant women & Children below 5 years) are most at risk within our communities because of their low immunity and the malaria endemic nature of Nigeria, as such malaria is even regarded as mainly a maternal, new-born and child health issue.

Why does only the female mosquito transmit the disease?

Answer: The female mosquito needs a blood meal for the nutrients to develop her eggs.

Do other biting insects such as flies transmit malaria?

Answer: No. Only the female mosquito transmit malaria.

List 3 factors or reasons why people who have malaria die.

Answer:

- ☐ Delay in starting treatment
- ☐ Inappropriate treatment (wrong drug, incorrect dosages, non-compliance)
- ☐ Failure to recognise and manage complications

What is the difference between Suspected Malaria and Confirmed Malaria?

Answer:

Suspected Malaria: A patient with a fever or history of fever in the last 24 hours who lives in, or has come from anywhere in Nigeria or any other endemic country. Previously, all patients with this definition of malaria were given treatment with an antimalarial. Now, however, the best practice is to test all patients with suspected malaria with a confirmatory test before giving treatment.

While Confirmed Malaria: A patient with suspected malaria who has been shown to have malaria parasites through a parasitological test such as microscopy (using a blood smear) or rapid diagnostic test (RDT).

What is the difference between uncomplicated malaria and severe malaria?

First: Ask participants to differentiate between the two.

Answer:

Uncomplicated Malaria is a situation where a patient presents with a history of fever, or a fever in the last 48 hours, with no signs of severity or evidence of vital organ dysfunction but with a positive confirmatory parasitological test;

While in severe malaria, a patient presents with a positive confirmatory parasitological test and presentation of one or even more symptoms of the severe disease state (see 3.1 below).

2.5 Reflections on this module

Think about the topics you have just been discussing. How will you use the new knowledge you have gained when you go back to your premises? Use the questions below to help you reflect on this. Record your thoughts on paper for discussions.

1. What is simple malaria?
2. What have I learned about malaria today that I did not know before I came to this training program?
3. How will this new information be useful when I go back to work?

- 4. What other questions do I now need to ask the trainer and get answers for?
- 5. What questions do I have about how I will use this information when I go back to my community?

3. Signs & symptom / diagnosis of malaria

Table 2 below describes the training module on signs and symptoms and the diagnosis of malaria. This comprises the session objectives, learning objectives, time duration for the module, training materials needed, methods used and other relevant instructions that will assist the facilitators to impact the training.

What is meant by Signs & Symptoms of a malaria?

First: Ask participants to assess their understanding.

Session Objectives	To understand the signs and symptoms of malaria (uncomplicated and severe)	
	To identify cases of suspected malaria	
	To understand that malaria can be diagnosed based on signs and symptoms, but this method has limitations	
	To understand the use of Rapid Diagnostic Tests (RDTs)	
Duration	25 mins	
Learning objectives At the end of the session, participants should be able to:	Know the signs and symptoms of uncomplicated & severe malaria	
	Know that not all fevers are caused by malaria; and know some diseases presenting with fevers	
	Appreciate the use the RDTs in malaria confirmation	
	Be able to conduct appropriate investigations of suspected malaria using RDTs	
Training Materials	Participant’s manual	Pens & Notebook
	Slides	Laptop computer
	LCD projector	Flip chart and markers
	Rapid Diagnostic Test kits, pair of hand gloves, lancets, alcoholic pads	
Methods used	Lecture	
	Demonstration classes	
	Question & Answer sessions	
	Case Studies	
	Reflection exercise	

Instructions for the facilitator	1. Begin the session by explaining the objectives of the session
	2. Get the participants to mention the symptoms of uncomplicated malaria they know.
	3. Then give a lecture on the signs and symptoms of both uncomplicated and severe malaria using “Lecture 3.1”below.
	Note THAT each slide explain what points need to be made.
	4. Think about sections which the participants might find difficult and common questions they may ask.
	5. Ask a series of questions to find out if the participants did understood the lecture
	6. Try to simulate situations at the participants’ place of work during discussions and while answering questions.

Table 2.
Summary of session on signs & symptoms/diagnosis.

Answer: There are varying approaches to defining the medical meanings of signs and symptoms. A symptom is generally subjective while a sign is objective. Any objective evidence of a disease, such as a convulsing patient or a skin rash is considered a sign. This can be recognised by the physician, nurse, PMV, family members and even the patient themselves. However, headache, pain and weakness, fatigue, and some others can only be detected by the patients themselves.

What is symptomatic diagnosis?

First: Ask participants to assess their understanding.

Answer: Symptomatic diagnosis of malaria as the name implies, is a diagnosis that is based on the patient’s signs and symptoms which is also known as clinical diagnosis. Malaria can then be classified into two types depending on extent of the infection and the severity of the symptoms, they are: uncomplicated or simple malaria and severe or complicated malaria.

3.1 Signs and symptoms of malaria

Signs and symptoms of uncomplicated malaria

Fever is usually the main symptom of malaria. It can be reported by the patients themselves or parents of children (could be even when the temperature returns to normal when being examined) or ascertained by taking the temperature (equal to or higher than 37.5° under the armpit or up to 38° rectally).

The signs and symptoms that may occur in uncomplicated malaria include:

- ☐ Headache
- ☐ Fever
- ☐ Sweating
- ☐ fatigue and dizziness
- ☐ loss of appetite
- ☐ muscle and/or joint aches

- ☐ chills / Rigours
- ☐ perspiration
- ☐ digestive disorder: such as diarrhoea, abdominal discomfort
- ☐ nausea, vomiting
- ☐ worsening malaise

These signs and symptoms can be identified by asking the patient or their caregiver what they have noticed since the patient started the episodes of illness. The PMV and other healthcare providers can also take the patient's vital signs, including their temperature. **Figure 3** shows presentations of a patient with malaria as it transits from shivering to profuse sweating.

Signs and symptoms of severe malaria

Malaria is said to be severe or complicated when a patient presents with one or several of the under listed signs and symptoms:

- ☐ very high temperature (could be $>40^{\circ}\text{C}$)
- ☐ Prostration (i.e. generalised weakness that patient is unable to sit or walk)
- ☐ severe anaemia (normocytic type: a very common complication)
- ☐ consciousness disorders (confusion, agitation, drowsiness and coma)
- ☐ multiple convulsion (>2 in last 24 hrs)
- ☐ repeated vomiting (hindering oral treatment),
- ☐ dehydration (thirst, dry lips, sunken eyes and deep set fontanel),
- ☐ icterus (jaundice),
- ☐ dark (coca-cola) coloured urine
- ☐ Renal failure
- ☐ hypoglycaemia
- ☐ breathing difficulties
- ☐ spontaneous bleeding

Other clinical signs could also appear such as anaemia, acute renal injury, acute pulmonary oedema /Adult Respiratory Distress Syndrome (ARDS), circulatory collapse or shock, abnormal bleeding (e.g. bruising, bleeding gums, haemoglobinuria).

Cerebral Malaria is a common presentation of severe malaria and may cause residual problems. A patient with malaria and altered level of consciousness, confusion, delirium, hallucinations or frank coma with or without convulsion is said to have cerebral malaria.

Note that:

- ☐ Malaria always causes fever and therefore any fever should be suspected to be due to malaria in endemic areas.

o Pictorial presentation of malaria signs & Symptoms

Patient has chills or shivering followed by high fever daily or on alternate days. Patient may also have vomiting

Fever comes down with profuse sweating. Patient may also complain of headache and body ache

Figure 3.
Signs and symptoms of malaria.

- ☐ All cases of pregnant women and children below 5 years of age presenting with malaria are considered as severe malaria.
- ☐ All patients presenting with conditions listed above for complicated malaria or that which you do not fully understand, please REFER PATIENT IMMEDIATELY!

3.2 Diagnosis of malaria

3.2.1 Symptomatic malaria diagnosis

Symptomatic diagnosis of malaria is a diagnosis based on patient’s signs and symptoms. This is also known as clinical diagnosis (suspected diagnosis). Remember that sign and symptoms of uncomplicated malaria are usually not only specific to malaria alone, with fever being a symptom to many illnesses. So if we take all fevers to be caused by malaria then this will certainly lead to over-diagnosis and hence an over-use of antimalarials.

The table below (**Table 3**) lists other possible reasons for fever including additional signs and symptoms. Noting that fever can be caused by other illnesses, it becomes of utmost importance to test and confirm if the fever is caused by malaria. Should any of the additional signs and symptoms be present, the patient should then be treated according to that disease.

3.2.2 Confirmatory malaria diagnosis

Diagnosing malaria on the basis of clinical features alone can be highly inaccurate and is likely to result in significant over-treatment. It is therefore important to establish capacity for confirmatory diagnostic testing. Effective confirmatory diagnostic testing can help to:

- identify patients who need antimalarial treatment;
- reduce unnecessary use of antimalarial drugs for patients without malaria;

Suspected disease	Additional signs and symptoms
Common cold	Running nostril, Cough
Gastroenteritis	Colicky pains, Diarrhoea (bloody or not), Vomiting
Hepatitis	Icterus, Enlarged spleen, Right hypochondriac pain
Meningitis	Stiff neck Bulging fontanel (young infants)
Mumps	Bilateral or unilateral swelling on the jaw
Pneumonia	Pneumonia Cough, Fast breathing Chest in-drawing
Tonsillitis sore throat	Pains in the throat Red inflamed throat with or without spots Painful cervical lymph nodes
Typhoid fever	Prolonged treatment not responding to appropriate antimalarial treatment. Dissociation between pulse rate and temperature.
Viral diseases Which include measles and varicella	Many cases in the neighbourhood with characteristic skin rash

Table 3.
Other diseases that fever presents as symptoms.

Note:

□ Parasitological confirmation of suspected malaria before treatment is now recommended for all patients because not all fevers are due to malaria [8].

There are currently two widely available options for confirmatory diagnostic testing of malaria:

3.2.2.1 Light microscopy

Microscopy has been regarded as “gold standard” for a long time due to its effectiveness in malaria diagnosis. Microscopy is far more sensitive than RDTs for the detection of even low levels of *P. falciparum* parasitaemia (<100 parasites/ μ l) and the test can differentiate into the various malaria species. To achieve an effective microscopy for malaria parasites, we require: (i) good-quality reagents and equipment; (ii) skilled technicians with experience on how to prepare, stain films, in addition to identifying parasites and differentiate between the different Plasmodium species; and (iii) effective technical supervision and quality control of tests. However, these may not always be available in emergency situations, it is then easier and more beneficial for PMVs to establish a capacity for RDT.

3.2.2.2 Rapid diagnostic tests (RDTs)

In acute emergency phase of infections, limited time and resources make RDTs preferable to microscopy for confirmation of clinical diagnosis in low-transmission areas, and for confirming malaria in severely ill patients in moderate to high-transmission areas. RDTs found in Nigeria are usually only sensitive to *P. falciparum*. This is because *P. falciparum* is the most predominant species, accounting for about 98% of malaria cases in the country, and again, the majority of non-falciparum species within the country cause mixed infection with *P. falciparum*. The RDT differ from microscopic diagnosis of malaria through a number of ways. **Table 4** below is a comprehensive comparison between microscopy and RDTs.

3.3 Case studies

Activity 3.3.1

Instructions for the facilitator:

1. Divide the class into four groups, ask participants of each group to study the case studies below on the description of patient's signs & symptoms, diagnosis, misdiagnosis and appropriate suggestions from a trained PMV (allow 10 minutes to discuss & 5 minutes for each group to present).
2. Ask what the patient is suffering from.
3. Note the various points raised by participants and use them to discuss the various cases.
4. If the participants suspect that the patient has malaria, how do they arrive at such conclusions?

NB. It is important to find out how they confirm this. Encourage them to emphasise the need to test.

5. Conclude the session by discussing each group's presentation

Microscopy		RDTs
Requirements		
Equipment	Microscope	None
Electricity	Preferred, not necessary	None
Transport / storage conditions	Reagents stored out of direct sunlight	Avoid exposure to high temperature (4–30°C recommended)
Quality assurance	Periodic re-reading of percentage of slides by expert microscopist and supervision	Lot testing of kits, monitoring of storage temperature, supervision of workers
Performance		
Test duration	Usual minimum 60 minutes	15–20 minutes
Labour-intensiveness	High	Low
Dependence on individual competence	High	Low
Direct costs		
Cost per test	US\$0.12–0.40	US\$0.60–1.00
Technical specifications		
Detection of all 4 species	Yes	Some RDTs

Table 4.
Comparison between microscopy and RDTs.

Note that:

- RDTs are fast, convenient and can be handled by an incompetent hand. RDTs are fairly cheap and do not require electricity.
- They are thus convenient for use by PMVs where it will improve their services with resultant avoidance of unnecessary treatment and over-treatment with antimalarials.

Activity 3.3.2 Read and discuss the case studies below.

Case study 1: An unknown patient comes to your PMV shop and complains that he has fever, headache, and joint pains. He continued that the fever has been coming on and off for about three days but he usually feels fine during the day and in the evening he has fever.

What is he/she is suffering from and what is your line of action?

Case study 2: A mother comes to your premises with a 3 year old child that looks very weak. The child had vomited severally and on checking, you found the child had 40° C. discuss your actions.

3.4 Demonstration exercise

Demonstration of the use of RDT to show purple/red line in test and control windows on strip showing antigen–antibody reaction if positive. Discuss advantages of RDTs mentioned earlier.

3.5 Reflection on the module

Participants are asked to make think about the topics they have just discussed. How will they use the new knowledge gained when back to their premises? Also use the questions below to help reflect. Record the thoughts on paper for discussions.

1. What is RDT and how do you compare it to microscopy?
2. What have I learned about malaria today that I did not know before I came to this training program?
3. How will this new information be useful when I go back to work?
4. What other questions do I now need to ask the trainer and get answers for?
5. What questions do I have about how I will use this information when I go back to my community?

4. Treatment of malaria

Table 5 below describes the training module on malaria treatment. This module comprises the session objectives, learning objectives, time duration for the module, training materials needed, methods used and other relevant instructions that will assist facilitators to adequately explain malaria treatment approaches.

4.1 National treatment protocol

What is the National Malaria Treatment Protocol about?

Answer: The national treatment protocol contains recommendations on the most effective treatment that should be given for malaria. The current protocol recommends Artemisinin-based Combination Therapy (ACT) as the most effective treatment for uncomplicated malaria instead of Chloroquine and SP.

4.1.1 Treatment of uncomplicated malaria

- First line treatment:

To be given to a patients with malaria when ACT are not contra-indicated.

☐ **Artemether /lumefantrine (AL):** as a fixed dose combination, given twice a day for (3) three consecutive days with the second dose being given 8 hours after the first [7–9].

OR

☐ Tabs **Artesunate + Amodiaquine (AA):** Given once daily for three (3) consecutive days [7–9].

- Second line treatment:

To be given in the event of true treatment failure (defined as failure to clear parasites after the three days of a full treatment course). It can also be used in situations when ACT is not appropriate.

☐ **Oral Quinine:** 8 hourly for seven (7) days [8, 9].

Note: Details of treatment regimens are seen in Section 4.3 below.

Session Objectives	To understand the essence of the National Malaria Treatment Protocols	
	To understand the treatment of uncomplicated malaria	
	To understand the treatment of complicated malaria	
Duration	30 minutes	
Learning objectives At the end of the session, participants should be able to:	To appreciate why government changed its policy on malaria treatment (thereby appreciating the shortfalls associated with the use of Chloroquine which is still in use)	
	Know the treatment of uncomplicated malaria in children, adults & pregnant women	
	Know the treatment of complicated malaria for all categories of patients	
	To provide appropriate anti-malarial drugs to patients of all categories	
Training Materials	Participant's manual	Pens & Notebook
	Slides	Laptop computer
	LCD projector	Flip chart and markers
Methods used	Lecture	
	Quiz session	
	Group discussions	
	Demonstration Exercise	
	Role plays	
	Reflections on the module	
Instructions for the facilitator	1. Begin the session by explaining the learning objectives of this module	
	2. Give a lecture on the treatment of uncomplicated and severe malaria in various situations using "Lecture 4.1–4.6" below.	
	3. Think about and emphasise sections which the participants might find difficult and common questions they may ask.	
	4. Ask series of questions to find out if participants did understood the lecture	
	5. Divide the class into four groups for group discussions / Quiz	
	6. Try to simulate situations at the participants' place of work during discussions and while answering questions	

Table 5.
Summary of session on the treatment of malaria.

4.1.2 Management of uncomplicated Malaria in pregnancy

- First Trimester
Oral Quinine is used, or a combination of oral quinine and Clindamycin.
- Second and Third Trimesters

Oral Quinine is used or the combination of **AL or AA** is used [8].

Note THAT for pregnant women with co-morbidities of HIV and sickle cell anaemia, the above treatment shall be used.

4.1.3 Home management of uncomplicated malaria

AL is the combination drug of choice for treatment of uncomplicated malaria for children below five (5) years of age. Essential skills in behaviour change communication are thus necessary for community based agents such as the PMVs to effectively home manage uncomplicated malaria.

4.1.4 Treatment failure in uncomplicated malaria

Quinine shall remain the drug of choice for the management of malaria in the event of treatment failure.

When treatment fails in pregnancy, though ACTs are not recommended in the first trimester of pregnancy, their use shall however not be stopped in cases where they are considered to be life-saving and other antimalarials are not suitable.

For second and third trimesters in pregnancy, **Quinine or AL or AA** combination therapies shall be used depending on which drug was first given. Usually, a treatment option other than what was first given to the patient will be used where treatment failure is established.

4.1.5 Treatment of severe malaria

Management of severe/complicated malaria requires parenteral treatment to provide adequate blood-serum concentrations as quickly as possible initially; subsequently it is reverted to oral treatment as soon as the patient's condition permits.

IM/IV Quinine or I.M. Artemether shall be the drugs of choice for treating complicated malaria. The necessary support therapy shall be provided as and when appropriate.

The treatment of pregnant women with severe malaria shall be with Parenteral **Quinine (I.V. or I.M. in all trimesters)** until the patient can take oral preparations. I. M Artemether can be used for the second and third trimesters. Pregnant women with co-morbidities of HIV and sickle cell anaemia shall be treated as above.

Note that:

☐ Severe malaria is a Medical Emergency. So it should always be referred to secondary Healthcare facilities immediately!

☐ Severe malaria needs special attention because:

- It is associated with dangerous complications (See Section 2.1)
- It is a common cause of avoidable deaths from malaria

☐ The correct use of ACTs is essential for the success of treatment.

4.2 Why government changed 1st line malaria treatment from CQ to ACTs?

CQ and SP are no longer effective in treating malaria in Nigeria due to high treatment failures resulting from widespread resistance. Efficacy studies that test the ability of antimalarial medicines to kill and clear malaria parasites have shown that ACTs are better than chloroquine. **Table 6** below describes the two older drugs that are no longer indicated for malaria treatment.

S / No	Drug	Comments
1.	Sulphadoxine-Pyrimethamine (SP)	Not recommended for treatment of malaria. Reserved for intermittent preventive treatment (IPT) in pregnancy
2.	Chloroquine (CQ)	Inadequate efficacy and therefore no longer recommended for treatment of malaria in Nigeria

Table 6.
Older drugs for treatment of uncomplicated malaria.

Artemisinin derivatives are the most effective drugs against malaria in the world at the moment and yet if misused the parasites can potentially develop resistance to them. Already there are some signs from Far East Asia that improper use and use of poor quality ACTs is making the malaria parasites have some ability to withstand treatment with ACTs causing cure to take longer to achieve.

A technique to prevent resistance developing to Artemisinin derivatives is to combine them with other antimalarials so that as a combination there is less possibility of the parasites developing mechanisms to avoid both medicines.

Note that: The objective of prompt and effective malaria treatment is to:

- Cure the disease and eliminate the parasites from the body
- Prevent progression to severe disease or death
- Prevent transmission to others
- Prevent the parasites developing resistance to the malaria treatment
- Minimise adverse drug reactions

4.3 The first line treatment of malaria

Below are details of the treatments for malaria as recommended by the Government of Nigeria:

4.3.1 Artemether/Lumefantrine (AL)

This is a fixed dose combination of Artemether 20 mg and Lumefantrine 120 mg. It exists as several brands which have been registered by NAFDAC for use in the country. The combination is abbreviated sometimes as AM/LM. **Table 7** below describes the dosing for AL with respect to age and body weights.

NOTE: The tablets of Artemether/Lumefantrine can be in the form of plain tablets or dispersible tablets. The only difference is that the dispersible tablets dissolve when immersed in a liquid whereas the plain tablets have to be crushed to make a mixture for children that cannot swallow tablets. Only ACT 1 and 2 have dispersible tablets.

4.3.2 Artesunate + Amodiaquine (AA)

Artesunate + Amodiaquine is sometimes abbreviated as ASAQ. A fixed dose combination pre-pack and a co-packaged pre-pack exist as is seen in **Tables 8 and 9** below. There are three presentations of this combination, namely Infant, Child and Adult. These age and weight specific blister packs are colour coded.

Number of tablets and dosing times							
Weight / Age	ACT pack	Day 1		Day 2		Day 3	
		0 h0urs	8 hrs	24 hrs	36 hrs	48 hrs	60 hrs
5 to <15 kg / 6mths – 3 yrs	ACT1	1	1	1	1	1	1
15 to <25 kg /4 – 8 yrs	ACT2	2	2	2	2	2	2
25 to <35 kg /9 – 14 yrs	ACT3	3	3	3	3	3	3
≥ 35 kg /> 14 yrs	ACT4	4	4	4	4	4	4

Table 7.
Dosage schedule for AL (AM 20 mg/LM 120 mg) showing the four weight and age categories.

Weight (kg)	Age	AS tablets (50 mg)			AQ tablets (153 mg)		
		Day 1	Day 2	Day 3	Day 1	Day 2	Day 3
6.5 to <10	4 to 11 months	½	½	½	½	½	½
10 to <22	1 year to <7 years	1	1	1	1	1	1
22 to <36	7 years to <14 years	2	2	2	2	2	2
36 and above	14 years and above	4	4	4	4	4	4

Table 8.
Dosage schedule for co-packaged pre-pack tables AS+AQ (AS 50 mg + AQ 153 mg) showing the four weight and age categories.

Weight/Age	Tablet strength	Dosage regimen
4.5 kg to <9 kg 2 months - 11 months	25 mg/67.5 mg	1 tablet once daily for three days
9 kg to <18 kg 1 year to 5 years	50 mg/135 mg	1 tablet once daily for three days (or 2 tabs of 25/67.5 mg)
18 kg to <36 kg 6 years to 13 years	100 mg/270 mg	1 tablet once daily for three days (or 2 tabs of 50/135 mg)
36 kg and above 14 years and above	100 mg/270 mg	2 tablets once daily for three days

Table 9.
Dosage schedule for tables AS/AQ fixed dose combination pre-pack (AS 50 mg + AQ 135 mg) showing the four weight and age categories.

When using the co-packaged tablets of AS+AQ, the client should be instructed that the.

Artesunate and Amodiaquine tablets must be taken together, at the same time. ASAQ fixed dose combination (FDC) should be used whenever possible.

Side effects of ACT:

- ☐ Artemisinins are generally well tolerated at the doses used to treat malaria.
- ☐ The side effects from the Artemisinin class of medicines are similar to the symptoms of malaria: nausea, vomiting, anorexia, and dizziness.

4.4 Second line treatment

The second line treatment for malaria in Nigeria is **Quinine** in tablet formulation. The indication for using Quinine is where a patient has confirmed malaria and

has already taken a full course of the first line antimalarial treatment, i.e. AM / LM or AS+AQ, and has not recovered. Parasitological confirmation of the diagnosis should be done with microscopy before prescribing oral Quinine.

Dosage: Quinine tablets (300 mg salt) are given as a dose of 10 mg/kg body weight up to a maximum dose of 60 kg body weight, e.g., 600 mg every 8 hours for 7 days.

4.5 Good prescribing practices

NOTE THAT:

☐ Malaria can be 100% cured by ACTs, but ONLY when used appropriately
☐ The only ACTs recommended in the National Protocol are AM/LM and AS+AM.

☐ It is not advisable to use other non-recommended ACTs.
☐ Artemisinin monotherapies are not recommended as treatment for uncomplicated malaria.

☐ Use of antimalarials by patients that do not have malaria means patients are taking medicines that they do not need, which could be dangerous.

☐ Overuse of antimalarials also has economic consequences to patient & the nation

It is good practice to strongly encourage the client to take a full course of treatment and complete the dose, otherwise the patient will not get well. This means that you, as the health provider, need to counsel the client by providing health information and advice.

Clients need to know about:

- ☐ the type of treatment they are receiving
- ☐ how to take/give the medicine
- ☐ the dosage required
- ☐ importance of completing treatment
- ☐ details of how to watch out for adverse drug reactions

Dosing advice to healthcare providers regarding treatment of their clients:

- ☐ Always dispense the full 3-day course of medicines
- ☐ Show the client how to split the tablet (if necessary) to get the correct dose.

This can be done by pressing a knife along the seam on the top of the tablet

☐ If possible, have client take the first dose in front of you, so you can supervise as needed

- ☐ Refer the client to health facility if they have any indications for referral.

Dosing advice to healthcare providers regarding treatment of their clients:

☐ They should always take the medicine with or right after meals with a full glass of water

☐ When using a co-packaged (two different drugs together) product, both medicines must be taken together in correct doses.

☐ To completely cure the illness, the full course of treatment (the correct number of tablets taken at the correct number of times each day for the correct number of days) must be taken.

☐ Symptoms may not disappear immediately after taking the first dose. Improvement may take up to two days.

- ☐ If the client vomits within half an hour, then the dose should be repeated.

☐ The client should take plenty of fluids to avoid dehydration and food to maintain strength. Fluids that contain sugar or glucose are an advantage.

☐ For small children, it helps to crush the tablets and mix it with fruit juices, or sugar and clean water to make a solution that is easier to swallow.

4.6 Demonstration exercise

Observe the commonly available ACTs and discuss dosage presentations, so also how to crush and split tablets for children (where necessary).

4.7 Group quiz

The facilitator will divide the class into four groups and each group will present their answers to the quiz question below:

1. What is the drug of choice used in the treatment of uncomplicated malaria in Nigeria excluding pregnant women?

Answer:

The anti-malarial drug of choice is: Artemeter - Lumefantrine (AL).

Alternatively: Artesunate + Amodiaquine (AA).

2. What drugs are used for severe malaria treatment?

Answer:

☐ Parenteral drugs (IM or IV route) are required

☐ IM or IV Quinine is the drug of choice.

☐ Injectable Artemether is an alternative choice

☐ Dosages are given in the treatment guidelines.

3. Which drug is used for treatment failure?

Answer:

☐ Oral Quinine (after laboratory confirmation and ruling out other causes of fever)

☐ In pregnancy depending on the alternatives available and the trimester of pregnancy (refer to Guidelines).

4. What drugs are used for treating uncomplicated malaria in pregnancy & What is the dose?

Answer: Artesunate-Amodiaquine or Artemether-Lumefantrine in the 2nd and 3rd trimesters; Quinine tablets or Quinine-Clindamycin in the first trimester of pregnancy. Refer to guidelines for dosage.

5. What drug is used for Intermittent Preventive treatment (IPT) of malaria in pregnancy?

Answer: Sulphadoxine - Pyrimethamine (SP) (Discuss whyRefer to treatment guidelines).

4.8 Role play

A volunteer from the class will be the health provider in a premises. Another volunteer pretended to be a client presenting with malaria symptoms. On provision of a complete ACT regimen, the client decides to take and pay for an incomplete treatment.

What will be your response in the situation and how will you convince the client?

4.9 Reflection on module

Think about the topics you have just been discussing. How will you use the new knowledge you have gained when you go back to your premises? Use the questions below to help you reflect on this. Record your thoughts on paper for discussions.

1. Outline the treatment of both uncomplicated and severe malaria?
2. What other treatments have you learnt today?
3. How will this new information be useful when you go back to work?
4. What other questions do you now need to ask the trainer and get answers for?

5. Indications for referral

Table 10 below describes the training module on referrals of malaria patients. This module comprises the session objectives, learning objectives, time duration for the module, training materials needed, methods used and other relevant instructions that will assist facilitators to adequately explain referrals and its approaches.

Emphasise that certain conditions require a patient to be referred from a primary health center to a higher level facility for treatment. These conditions are referred to in this module as indications for referral.

5.1 Conditions requiring referral

The indications for referral from a primary to a secondary or tertiary health facility are when:

- ☐ One or more danger signs are present
- ☐ The patient has features of severe malaria
- ☐ The patient is on recommended malaria treatment, but there is no improvement after 48 hours
- ☐ The client is not complying with treatment, because of vomiting or are otherwise unable to take drugs by mouth
- ☐ The client has adverse drug reactions to the ACT medicine that prevents him / her from taking / completing treatment
- ☐ You are unsure of the client's illness or condition
- ☐ The patient is having fever every day for seven or more days

Those patients who are not severely ill but have one or more indications for referral should be referred with a referral form / letter. Patients who are severely ill as shown by the presence of danger signs or features of severe malaria should be given pre-referral treatment.

5.2 Treatment failure

The recurrence of *P. falciparum* malaria usually results due to either a re-infection or recrudescence / failure. Failure in treatment is defined as the failure to effectively clear malaria parasites from the blood or can also be described as the

Session Objectives	To identify cases requiring referral from the signs and symptoms presented
	To identify cases of treatment failure
	To understand the causes of treatment failure
	To understand and identify danger signs
Duration	40 minutes
Learning objectives At the end of the session, participants should be able to:	Know the conditions requiring referral
	Applying the knowledge of conditions requiring referral to practice
	Appreciate and identify when a treatment has failed
	Be able to refer patients to the appropriate health facility
	Be able to identify danger signs
Training Materials	Participant’s manual Pens & Notebook
	Slides Laptop computer
	LCD projector Flip chart and markers
Methods used	Lecture
	Case studies
	Group discussions
	Demonstration Exercise
Instructions for the facilitator	1. Begin the session by explaining the learning objective of the session
	2. Emphasise that reduction of death and disability from severe malaria is a public health priority for Nigeria. This can be achieved by prompt referrals of severe cases.
	3. Give the lecture on Indications for referral, Treatment failure, Danger signs & Pre-referral treatment.
	4. Think about sections which the participants might find difficult and common questions they may ask.
	5. Ask a series of questions to find out if the participants did understood the lecture
	6. Split the class into four groups to discuss and answer the case studies
	7. Try to simulate situations at the participants’ place of work during discussions and while answering questions

Table 10.
Summary of session on indications for referral.

inability to resolve clinical symptoms despite administration of antimalarials. Treatment failure can result from so many causes.

- Vomiting or poor absorption of drug – the patient or the caregiver usually gets confused on what to do should the drug get vomited.

- Poor practices in prescribing – prescribing of incomplete course of treatment increases the risk of treatment failure in malaria. This is a common practice with PMVs. So always insist patients take home full / complete treatment regimen, with proper advice on need to complete dose.
- Poor adherence: which may be due to several factors, including:
 - information on correct regimen could be unclear to the patient or caregiver ab-initio;
 - some patients choose to stop taking treatment once the pressing symptoms have resolved (a common problem with drugs having a very rapid symptoms clearance), and some patients share the remaining treatment with their family / friends;
 - in cost-recovery systems, some patients cannot even afford a complete course of their treatment, this presents a big challenge;
 - Except for co-formulated products, patients may discard one of the components of the combination that is associated with side effects or taste hence its ineffectiveness.
- Drug quality – the use of substandard antimalarials with inadequate recommended amount of active ingredient is a particular risk for drug. So ACT quality must always be ensured by:
 - sourcing from reputable pharmaceutical outlets or their representatives;
 - proper storage all through the distribution system to avoid exposure to high temperatures; and
 - Avoiding administering expired drugs.
- Drug resistance in this case is the ability of a given parasite to survive or multiply despite drug administration and absorption in doses equal to or higher than the usually recommended, but within the tolerance of the subject.

Though treatment failure within 14 days of treatment with an ACT is very unusual, a good history and proper examination is necessary to confirm any non-malaria related causes of symptoms (refer to module 2). For instance, was a complete course of ACT really taken, accompanied by food or not where appropriate, and without vomiting in the first hour following any dose? So also, all treatment failures must be confirmed parasitologically, and preferably by taking blood slides for examination.

Note THAT, it is very important to keep good records of all confirmed treatment failures and this information forwarded to appropriate health authorities, as these failures need to be imputed into drug efficacy studies and these studies usually lead to the observed changes in first-line antimalarial treatment.

- Whenever the treatment failure is after 14 days of initial treatment, it should be considered to be a re-infections and another dose of ACT can be given.
- Treatment failures within 14 days of initial treatment should be treated with a second-line antimalarial such as Quinine (for a total of 7 days).

5.3 Danger signs

Generally, all danger signs are dangerous as the name indicates and emphasis is on the need for an immediate referral. The most common danger signs include:

- Convulsions or fits within the last two days or at present
- Not able to eat / drink or breastfeed (in children)
- Vomiting everything taken (severe vomiting) or severe diarrhoea
- Prostration indicated by extreme weakness, unable to sit or stand
- Altered mental state such as lethargy, drowsiness, confusion or unconsciousness
- Breathing difficulties
- Severe dehydration shown by sunken eyes or if skin is pinched
- Severe anaemia or lack of blood shown by pale lips or palms

Note that:

All patients who have danger signs need urgent treatment at a secondary or tertiary healthcare facility that has the equipment and expertise to handle emergency conditions. To save this patient, you need to refer immediately.

5.4 Pre-referral treatment

All patients especially children who do not respond to treatment (with AL within 24 hours) and the very ill (i.e., having any danger signs or features of severe malaria) shall be referred immediately to the nearest hospital. Time is important at this point and every hour of delay reduces the patient's chance of survival. Pre-referral treatment is used to increase the chance of the patient surviving long enough to get to the health facility for further treatment.

5.4.1 Rectal Artesunate (or Artemether)

10 mg/kg body weight rectal artesunate is the recommended minimum dose. Give a single dose as pre-referral treatment. The choices you have are artesunate or artemether suppositories. This is repeated after 8 hours if transfer is delayed.

5.4.2 IM quinine

IM quinine 10 mg/kg. This is an alternative to Rectal artesunate. OR.

5.4.3 IM Artesunate or Artemether

IM artesunate 2.4 mg/kg single dose, OR IM artemether 3.2 mg/kg single dose.

5.5 Demonstration exercises

- A sample of Artesunate Suppository is torn to show participants its presentation and the insertion process is described.
- Filling of Referral forms; done as a group work

Note that: Pre-referral treatment is not a replacement treatment for severe malaria.

6. Malaria prevention

Table 11 below describes the training module on malaria prevention. This module comprises the session objectives, learning objectives, time duration, training materials needed, methods used and other relevant instructions that will assist facilitators to adequately describe malaria prevention approaches.

6.1 Reasons for prevention

- Malaria can kill if it infects an individual, so we try to prevent it.
- Malaria will make you sick, and therefore make you unable to work, so people may lose jobs /miss school etc.
- Malaria leads to poverty because Malaria and poverty are connected, you cannot work and earn money or go to school for your future if you are ill with Malaria, and you will need to spend a lot of money for treatment.

Note that:

- The first step towards malaria control is prevention.
- It costs far less to prevent malaria than it costs to treat it.

What must you do as a healthcare provider to help your clients prevent malaria?

- Provide health education to your community. As a health care worker you can provide community members with information on prevention methods that are available so that they can take steps to prevent malaria.
- Be a good example to the community by using the preventive methods you are advocating, especially the ITNs.

What about the long awaited Vaccine for malaria?

An effective vaccine is not yet available for malaria, this is because of the different phases which the parasite does exist within the human body giving it different / contrasting properties. Although several vaccines are under development. So far, a prospective vaccine candidate known as RTS-S/AS01 has shown potentially promising results in clinical trials in Africa. Evidence-based policy recommendations on the issue are expected to be made this year (2015) depending on data that will become available. While this wait goes on, prevention will then depend on how to avoid parasites getting into the body.

Session Objectives	To understand reasons for emphasis on prevention
	To understand the various prevention strategies
	To identify reasons why many communities do not embrace malaria prevention and how best to encourage them
Duration	60 minutes
Learning objectives At the end of the session, participants should be able to:	Know the various prevention methods
	Be able to appropriately treat and hang an ITN
	Be able to appropriately advice clients on malaria prevention measures
	Know the various locally circulated myths about malaria and how to address them
	Understand the various excuses given by clients for not taking prevention and how to persuade them against such negative acts
Training Materials	Participant’s manual Pens & Notebook
	Slides Laptop computer
	LCD projector Flip chart and markers
Methods used	Lecture
	Case studies
	Group discussions
	Brainstorming exercise
	Demonstration Exercise
Notes to facilitators	1. Begin the session by explaining the objective of the session
	2. Emphasise that reduction in death / disability from malaria and reduction in cost / stress of disease its treatment could be achieved by effective prevention strategies.
	3. Think about sections which the participants might find difficult and common questions they may ask.
	4. Give participants opportunities to air their various contributions / experiences and myths.
	5. Ask a series of questions to find out if the participants are following.
	6. Try to simulate situations at the participants’ place of work during discussions and while answering questions.

Table 11.
Summary of session on malaria prevention.

How do we stop parasites getting into our body?
The mosquitoes that spread malaria tend to bite at night between the hours of 10 p.m. and 4 a.m. They prefer to feed on human blood. After feeding, the

mosquitoes rest inside the house, usually on the walls. Common ways of preventing malaria take advantage of these characteristics of the mosquito vector.

Key elements for transmission of malaria (as discussed in module 1.3) are:

- The malaria parasite itself,
- The transmitting agent (i.e. the vector mosquito), and
- The reservoir of the disease (i.e. people carrying the parasites in their blood).

The general objective of preventive efforts are:

1. Reducing vector-host contact: Since the mosquito must feed once on an infected host to acquire the malaria parasite and once on an uninfected person to transmit it, reducing host-vector-host contact is an effective way of reducing transmission.
2. Reducing the longevity and abundance of adult mosquito population: The more the mosquito population in an area the greater is the probability of transmission. So, reducing the longevity and abundance of adult mosquito population in an area reduces probability of transmission.
3. Reducing suitable breeding sites (source reduction) wherever this is feasible and sustainable.

How effective these strategies are will greatly depend upon how assiduously they are applied. The Federal Ministry of Health in Nigeria has adopted and prioritised these prevention strategies: Insecticide Treated Nets (ITNs), the Intermittent Preventive Treatment (IPT) for pregnant women, Complementary and increasing Indoor Residual Spraying (IRS), Environmental Management and larval Source Management (to reduce breeding where significant proportions of breeding sites can be identified and targeted). They are the key prevention strategies to be discussed.

Finally, there are on-going research initiatives looking to find new ways to tackle malaria. For example, many scientists are involved in the search for new drugs and vaccines (as stated earlier), which will be safe, effective, and with affordable price tags, that could change our thinking on conquering malaria. Similarly, due to drug-resistance, particularly with *Plasmodium falciparum*, new medications are constantly being tested. A combination of all efforts towards fighting malaria put together had reduced the mortality of malaria greatly over the years; the major aim now for governments and all other partner organisations such as the WHO, Roll Back Malaria (RBM), Society for Family Health (SFH), Malaria No More (MNM), etc. is to get to a point where deaths from malaria are eliminated through effective treatment and prevention strategies.

6.2 Insecticide treated nets (ITNs)

An ITN provides effective barrier between the person who is sleeping under it and the mosquito vector. It reduces the opportunity for mosquito to bite and infect. The impregnated insecticide also acts to kill and repel any susceptible vector that rests on the net. An Integrated Vector Management System (IVMS) for malaria prevention is also in place in the country and is a combined approach involving the distribution of Insecticide Treated Nets (ITNs) as the major approach this involves

all form of deliveries such as free public sector donation campaigns either jointly integrated with other health activities (such as vaccination campaigns, National immunizations) or as stand-alone campaigns, to the free public sector routine distributions such as ANC and EPI services, and the subsidised and at cost sales through hospitals, clinics and at PMV outlets.

Insecticide treated bed nets can be either conventional ITNs or Long Lasting Impregnated Nets (LLINs). Conventional ITNs, as the name implies must be treated once or twice a year (usually dependent on the duration of the transmission). LLINs are nets, whose fabrics have been impregnated with insecticides by a special technique from the source, so that the insecticidal effect is maintained for as long as the net can withstand daily usage, i.e. usually 3–5 years or about 20 washes. **Figure 4** below shows an example of an impregnated bed net hung outside to protect people from vector transmission within a garden. Total access to LLIN is the ultimate aim in public health and public sector distributions focuses on children under 5 years of age and pregnant women.

6.3 Intermittent preventive treatment (IPT) during pregnancy / special care patients

Currently, the most preferred intervention to prevent malaria in pregnancy is the use Intermittent Preventive Treatment (IPT) apart from ITNs. And this is based on the use of anti-malaria drugs that are usually given in treatment doses at some defined intervals after quickening (16 gestational weeks). This serves to reduce malaria parasitaemia which usually leads to poor pregnancy outcomes. IPT with other products like haematinics and anthelmintics are preferably provided as part of a comprehensive antenatal package. Every pregnant woman should also have access to insecticide treated nets (ITNs) in addition to the IPT, which should be used throughout the pregnancy as an additional method of malaria prevention.

Drug of Choice for Intermittent Preventive Treatment (IPT) Sulphadoxine - Pyrimethamine (SP) is a combination drug (Sulphadoxine 500 mg + Pyrimethamine 25 mg) and shall be reserved only for Intermittent Preventive Treatment (IPT).

6.4 Indoor residual spraying (IRS)

Indoor residual spraying with an insecticide is sprayed on the wall every four or six months to kill mosquitoes that rest on the wall to digest its blood meal. Before and after feeding on a person, the mosquito rests on the wall where it picks up some of the insecticide which eventually kills it. IRS is a very effective way of preventing malaria.

Figure 4.
An impregnated bed net (LLIN) being hanged in a garden.

Although this method is complementary to ITN distributions, it will form an important and increasing part of the preventive strategy. Scenarios that are potential focus for IRS include:

- Areas where IRS has advantages to ITNs or has a synergistic effect (e.g. in and around densely populated cities).
- Areas having a short and usually a malaria transmission season which is limited and where the addition of the sprays can make local elimination possible (e.g. the Sahel savannah in the North-East of this country).
- Areas where using treated nets shows to be difficult to implement (e.g. consistent low use rates found with some communities).
- Institutions with marked populations such as boarding schools, army and police barracks etc. the use of ITN seems more challenging in such places.

6.5 Other vector control interventions (environmental & Larval source management)

These include Environmental Management (EM) and Larval control strategies by using larvicides, predators or growth inhibitors.

6.5.1 Environmental management

Management of the environment to reduce breeding sites of the Anopheles vector usually revolves round source reduction, and this is by targeting mosquito breeding sites with the objective of reducing the availability of suitable breeding sites. This will focus on man-made breeding sites in urban and peri-urban settings, construction sites, agriculture projects etc. It should be **note THAT** Anopheles does not breed in garbage or polluted gutters. So removal of garbage / filth is good for public health in general, and reduces the number of nuisance mosquitoes. But however, it has little impact on malaria control directly. The life span of an Anopheles mosquito is between 2 and 3 weeks, if breeding is curtailed, the population of mosquitoes will drastically drop due to this short life span.

To prevent breeding of mosquitoes, every householder must ensure that there is no water collection around their houses.

6.5.2 Larvivorous fish (biological control)

Different predator fish species have been widely used to protect public health, since early 1903. One of the most widely used and successful control agent against mosquito larvae is the mosquito fish *Gambusia affinis* also called top water minnow. Another fish which has received the most attention as a mosquito control agent is *Poecilia reticulata*, the common guppy [7].

6.5.3 Chemical larviciding

Chemicals are used in breeding sites that cannot be drained, filled or where other larval control methods are impossible to implement or too expensive. This method is good only for vectors which tend to breed in semi-permanent or permanent water bodies that can be identified, and where the population of the human to be protected is sufficiently high to justify such treatment. Thus, larvicides are

restricted to urban areas, barracks, labour or refugee camps and development project sites.

The residual effect of larviciding conducted varies considerably depending on the type of the breeding places and quality of the water, but is relatively short for most larvicides. Such larvicide treatment must be repeated at fairly short cycles which may vary from two to ten weeks. Temephos and Fenthion are some of the most commonly used larvicides [10].

6.5.4 Use of screens in homes

House protection with screening of windows, eaves and doors is an effective method of reducing human-vector contact, if properly implemented and maintained. Screens are popular, cheap and accessible to most members of the community.

6.5.5 Mosquito coils, repellents, protective clothing, and others

The use of protective cloths and repellents are indicated for people who are mostly outdoors during peak vector biting periods. Repellents have a very short duration of effect in most cases and are costly. Aerosols and mosquito coils are mostly popular in urban areas. Protective cloths usually covers most of the body, i.e. long sleeve shirts and jackets, protective stockings with covering trousers can provide a certain level of personal protection from mosquito.

6.6 Demonstration session

- Demonstration on the appropriate spread of the ITN to suite both indoor or outdoor use
- Demonstration on the proper method of treatment of the ITN using Deltamethrin.

6.7 Brainstorming session

- What advice would you as a PMV give a patient about prevention of malaria?

Answer:

- Use of insecticide treated materials should be encouraged.
- Mosquito screening devices in house designs and protective dressing.
- Use of insecticides and mosquito repellents.
- Environmental management especially destroying mosquito breeding sites.
- Which role can you play in the prevention and management of malaria in the community?

Answer:

Discussions should be along these lines:

- Case management aspect
- Vector control, Behaviour Change Communication
- Health education and Community participation

7. Discussion

A systematic review was conducted in 2017 on the effectiveness of different malaria intervention programmes among Patent Medicine Vendors (PMVs) by the authors of this book chapter [11]. The researchers tried to identify and review the different studies addressing poor KAP on all relevant topics that had characterised services rendered by the PMVs. The review showed that all studies analysed were effective in improving KAP despite adopting different intervention approaches for their different interventions with relatively wide range of topics all relating to malaria.

An intervention conducted in 2014 to strengthen PMV Associations for an improved malaria management [12], was also conducted in Nigeria just like the present study, but was specifically concerned with the use of RDTs for effective confirmatory test before commencement of treatment, this intervention training was embarked upon to check indiscriminate use of antimalarials without a confirmatory test. The use of RDTs was however treated in Section 3 of this training in addition to other aspects of malaria. Other studies conducted in Nigeria had a wide range of intervention focus such as PMVs knowledge and perception regarding the ACT treatment [13], improving knowledge on Pharmacovigilance [14], Influence of training on community malaria treatment and practices [15], training of rural PMVs towards improving childhood malaria treatment / referral practices [16], and primary care training for medicine vendors in rural communities of Nigeria [17].

Many other intervention trainings regarding malaria were conducted in several different malaria prone countries such as Pakistan, Kenya and Tanzania [18–24], and each had a focus on improving the services of medicine vendors, but they all had different approaches, aspects of malaria being treated and modes of delivery of intervention.

In the course of developing this training manual, inputs were considered from many malaria intervention trainings and studies, almost all the studies considered tried to improve on the knowledge and practice of respondent [13–25], while only three studies improved and assessed attitudes of respondents [12, 15, 20]. This training module however tried to improve on all aspects of knowledge, attitudes and practices of the respondents using its problem-solving approach to facilitate understanding and thereby motivating trainees by using a combination of the techniques / strategies used by all these studies and hence consolidating on their successes.

The gains of a combination of strategies cannot be overemphasised, and this had led to great successes in the fight against malaria in many parts of the malaria endemic world leading to a WHO report claiming 1.5 billion malaria cases and 7.6 million deaths have been averted since the year 2000 [26]. The African countries which shouldered more than 90% of the overall disease burden in recent years had reduced its malaria death toll by 44%, from an estimated 680,000 to 384,000 annually [26]. However, for progress to be sustained, efforts have to be intensified, particularly in those countries with the highest burden of the disease despite the environmental, economic, political and other challenges discussed.

8. Conclusion

This paper puts forward a concise training module for everyday handlers of malaria cases in sub-Saharan Africa. The training module comprising the basics in the management of malaria such as basic information, its signs, symptoms/

diagnosis, its treatment, referral and prevention as was conceptually meant for the training of Patent Medicine Vendors but its relevance extends to all other categories of health providers tasked with managing malaria. The topics and contents treated had been carefully put together to cover the relevant aspects necessary to impact a required improvement in knowledge, attitudes and practices (KAP) of the trainees and other practicing healthcare providers alike. The emphasis placed on medicine vendors is rooted to the fact that they had long been identified as the most patronised and most commonly available group of healthcare providers within the sub-Saharan African region on malaria issues, hence any intervention on their KAP will hugely influence malaria epidemiology within the sub-region.

The peculiar mode of delivery of training used across the sections of the training module included presentation of lectures, demonstration exercises, differential diagnosis to distinguish malaria from other diseases with similar presentations, quizzes / brainstorming exercises such as question and answer sessions, empathy exercises, group discussions, handling of case studies, participation in role plays, and reflections on each module with the facilitators was conceptualised due to the realisation that the medicine vendors are deficient in their knowledge, attitudes and practices with respect to malaria handling, that the various methods employed have been proved to be effective in various stand-alone trainings and that collectively employing all the various methods used will strategically improve on the KAP generally.

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Conflict of interest

No conflict of interest declared.

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