

Case management

GUIDE FOR TUTORs



Training module on malaria control : case management.

1.Malaria - diagnosis. 2.Malaria – drug therapy. 3.Antimalarials – administration and dosage. 4.Drug therapy, Combination. 5.Case management – organization and administration. 6.Health personnel – education. 7.Teaching materials. 8.Manuals. 9.Guidelines. I.World Health Organization.

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Foreword

Malaria is a major global public health problem and a leading cause of morbidity and mortality in many countries. In 2010, an estimated 3.3 billion people (about half of the world population) lived in areas where malaria is a health risk for the population. Malaria caused some 216 million cases with up to 655 000 deaths in 2010. Approximately 80% of the cases and 90% of the deaths occur in Africa while the remaining cases and deaths occur mainly in the South-East Asia and Eastern Mediterranean Regions.

The WHO global malaria control and elimination strategy aims to achieve a 50% reduction in the malaria burden by 2010 compared to the levels in 2000 levels, and at least a 75% reduction in malaria incidence and deaths by 2015. These goals are relevant for high-burden countries which implement malaria control programmes.

Elimination of malaria is defined as the complete interruption of the chain of local malaria transmission. Elimination programmes require more technical malaria expertise than standard malaria control programmes, especially in malaria epidemiology and entomology.

To achieve the objectives of malaria control and elimination programmes, appropriately planned and targeted delivery of essential malaria interventions is critical, including: early diagnostic testing of suspected malaria and prompt treatment of confirmed cases with effective artemisinin-based combination therapy (ACT); and application of appropriate vector control interventions, particularly the use of insecticide-treated nets (ITN/LLINs) and indoor residual spraying (IRS).

This training module on malaria case management has been developed to support the staff involved in malaria control and elimination programmes in the effective organization of malaria diagnosis and case management services.

Abbreviations

ACT	Artemisinin-based combination therapy
ANC	Antenatal clinic
ARDS	Adult respiratory distress syndrome
ATP	Antimalarial treatment policy
CBP	Community-based providers
DIC	Disseminated intravascular coagulation
DNA	Deoxyribonucleic acid
G6PD	Glucose-6 phosphate dehydrogenase
HMM	Home-based management of malaria
HRP-2	Histidine-rich protein 2
IMCI	Integrated management of childhood illness
IPT	Intermittent preventive treatment
PCR	Polymerase chain reaction
PCV	Packed cell volume
pLDH	Parasite lactate dehydrogenase
RBC	Red blood cell
RDT	Rapid diagnostic test
SBET	Standby emergency treatment
TET	Therapeutic efficacy testing
TNF	Tumor necrosis factor
WBC	White blood cell

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Methodology

The content of the training module is based on the 2nd edition of the *WHO guidelines for the treatment of malaria* and other evidence-based technical documents on the diagnosis and treatment of malaria (<http://www.who.int/malaria/publications>).

The training module was developed through a rigorous process involving a Technical Expert Committee representing malaria training and academic institutions, malaria researchers, country programme managers, and WHO regional offices, who guided the process of reviewing and updating the module. The process included the following steps:

- ▶ Three successive technical expert group consultations (7–9 April 2008; 14–16 October 2008 and 15–17 April 2009) were held in Geneva to review the existing WHO training materials on malaria case management and identify areas for update in view of the current status of developments in new tools, technologies and strategies for malaria control focusing mainly on the changing disease epidemiology.
- ▶ Technical experts were commissioned to incorporate the recommended updated information in the module.
- ▶ The revised module was then reviewed for content and completeness by the technical expert committee, the WHO technical staff and external experts in malaria case management.
- ▶ The module was field-tested in several national and international courses.
- ▶ Based on feedback from field tests, and in consultation with technical experts, the text was finalized for publication.

Introduction

This *Guide for Tutors* is designed primarily to assist those responsible for training courses for the health professionals involved in malaria case management. For individual study, this guide should be provided to the trainee (together with the *Guide for Participants*) so that it can be used as an “answer book”.

This module uses a problem-solving approach in which the tutor and facilitators provide guidance but do not directly assist the participants in carrying out the exercises. Tutors who are not familiar with this training system are encouraged to read this introduction carefully.

Potential users of the training module

The module is designed for health professionals who diagnose and treat patients with malaria in the course of their work. It will also be useful for those responsible for planning, executing malaria control, and monitoring activities in their respective working levels. It can be used alone for a special course on case management or as one element of a more comprehensive course on malaria control.

Design and content of the course

The principal objectives of the training are listed in the Introduction to the *Guide for Participants*, which tutors are asked to read before proceeding. This module is intended to stimulate active learning by working through a series of exercises. The exercises will be carried out on the basis of the *Guide for Participants*, preferably in small groups.

Participants are taught the salient clinical manifestations of malaria. Common errors in malaria case management are highlighted.

The participants acquire step by step all the knowledge and skills they need to recognize, diagnose and manage severe malaria. This type of training is performance-based and is highly effective.

Each Learning Unit of the *Guide for Participants* begins with a list of learning objectives which summarize the knowledge, skills and attitudes that each trainee should have acquired by the end of the Unit. Tutors and their colleagues should be satisfied that everyone has achieved the stated objectives before proceeding to the next Learning Unit. (Methods of evaluating progress are described later).

It is convenient to arrange the work of the participants in small group sessions; some discussion work can be done in plenary sessions.

Responsibility for running the course

The tutor is responsible for organizing and running the course. The two Guides of the module will be helpful, but the final results will depend largely upon the input of the tutor. It is important to use the *Guide for Participants* and the *Guide for Tutors* together in working through the Learning Units.

The tutor's role will be strengthened and the teaching more effective, if colleagues who have knowledge and experience in the subject take part in supporting the tuition, acting as course facilitators. If facilitators are available, the class can be divided into small groups of 4–8 participants, with one facilitator allocated to each group. The interaction between the participants and the facilitators results in better learning and understanding.

As the overall manager of the training programme, the tutor will be responsible for setting the timetable, explaining the learning tasks to the participants and facilitators, and providing help as needed. The role of the facilitators is to explain or demonstrate a particular activity and to watch the performance of the participants. Facilitators should be ready to admit to the trainees when there is something that they do not know (“I do not know, but I will find out for you”) and refer the question or problem to the tutor.

Many problems can be avoided by giving facilitators plenty of time to read the *Guide for Participants* and *Guide for Tutors* and to discuss any part that may need clarification. It would be useful for the tutor and the facilitators to go through the module together; the tutor could then test their knowledge by asking appropriate questions.

Why a *Guide for Participants* is provided

Providing participants with a full set of notes ensures that:

- ▶ All participants have exactly the same basic materials and guidelines on how to proceed, thus avoiding unnecessary note-taking;
- ▶ Tutors and facilitators can refer to any part of the *Guide for Participants* knowing that all participants can find the right page quickly;
- ▶ Participants can spend more time reading the *Guide for Participants*, discussing and formulating ideas. This gives a greater opportunity to understand the subject, because there is no need to take notes during the class;
- ▶ There is no risk of participants making errors in note-taking;
- ▶ After the course, each participant can take home a copy of the *Guide for Participants* and the *Guide for Tutors* as a helpful reference in his or her daily work, and perhaps also to use in teaching others.

Running the training course

This subject is covered in the introductory session in the *Guide for Participants*, which the tutor should read before proceeding.

As stated in the *Guide for Participants*, lectures should be kept to a minimum. The use of examples, group exercises and discussion groups are all much more effective ways of teaching.

Use of the *Guide for Tutors*

Participants will follow the group training activities using the *Guide for Participants* plus other materials provided by the tutor. A copy of the *Guide for Tutors* will be given to each participant at the end of the training.

The way in which the tutor and the facilitators should make use of the *Guides* and audiovisual aids will become apparent in working through the training module.

The two guides may be used together for small group training when qualified facilitators are not available. In this case the tutor must, to the extent possible, replace the facilitators. The guides may also be used in combination by individuals for study and reference.

Training facilities

A number of basic facilities and equipment must be organized before training can begin. In some countries these are readily available but in others it may be necessary to improvise or to modify existing resources. There may be long intervals between ordering supplies and getting them delivered, but training should not be delayed unnecessarily because the best equipment is not available: much can be achieved even with relatively limited facilities.

Ideally, one large room should be available for presentations and group discussions; pictures projected by the overhead and LCD slide projectors will be seen more easily if the level of lighting can be controlled. Chairs and small tables or desks will be needed for this room. Whatever the conditions, it is advisable to ensure that the participants are as comfortable as possible.

Teaching equipment

For teaching sessions and group discussions, if possible the following items should be available:

- ▶ overhead projector
- ▶ slide projector
- ▶ LCD projector
- ▶ computer (laptop)
- ▶ screen for slide projection (a white sheet is an adequate substitute but the white-board is unsuitable because it will reflect projected light)
- ▶ flip charts – one for each small group of participants; supplies of “butcher’s paper” or “newsprint” are usually cheap and readily available
- ▶ large chalk board or white board
- ▶ chalks for blackboard or marker pens for white-board, in a selection of colours
- ▶ acetate sheets for overhead projector
- ▶ coloured marker pens for acetate sheets (including some permanent markers for diagrams you may wish to keep)
- ▶ TV set and video equipment

Participants' equipment

The equipment listed below should be provided for each participant. Where supplies have to be ordered, this should be done well in advance of the course; many items are difficult to obtain at short notice:

- ▶ copy of the *Guide for Participants*
- ▶ notebook (this should be used only for occasional notes or instructions; there should normally be no need for notes to be taken during training session)
- ▶ sheets of paper for the exercises during the working groups
- ▶ ballpoint pen
- ▶ set of pencils (medium-hard graphite, plus red, blue, brown and black) for drawing during practical sessions
- ▶ pencil sharpener
- ▶ eraser
- ▶ ruler

Syllabus and timetable

The Table of Contents represents the syllabus – the list of subjects to be covered – for the training course. The tutor should go through each of the Learning Units and assess how much time will be required and decide on the most suitable type of learning activity for the topic.

The course is designed to include the following learning activities:

▶ *Group discussion*

Once participants become used to group discussions, the two-way exchange of information between them and the facilitators makes this a very effective learning activity. People share their knowledge and experience with the rest of the group and stimulate each other's thoughts on the subject in hand.

▶ *Clinical work and visits to health facilities*

Visits will be arranged for bedside teaching activities. Their purpose is to give participants the opportunity to practise diagnostic principles and the management of severe diseases. The more cases they see the more competence they will acquire.

Visits to health facilities for teaching purposes need to be well planned in advance to be sure that suitable cases are available, and the senior management and medical staff are agreeable to, and well informed about, the visits. In addition the tutor should caution the participants before each visit to conduct themselves in a professional manner and not to criticize procedures or discuss the patient's conditions while inside the facilities. All discussion and critical observations should be made back in the classroom.

▶ *Demonstrations, examples*

These are designed to reinforce the learning process. Clear examples help to clarify concepts and establish principles of malaria case management. The tutor and facilitators should have

many examples ready to use, but in addition trainees should also be invited to give examples – this is a strong reinforcement.

The timetable for the course has to be finalized on the basis of the amount of time required for each Learning Unit, the learning activities that have been selected, and the total timespan available. The duration of the programme may have been determined by circumstances other than the optimal duration; for instance, the programme may have to be limited to 3 days because of shortage of funds, although the calculated duration may have been longer. In such cases, the tutor and the facilitators will need to structure the timetable so that the learning activities can be adjusted to the time available.

In planning the timetable, time should be allowed for evaluation both during and after the course, and for the hidden activities, such as getting settled into group work, delays in transportation to the training facility etc.

A suggested timetable for a 5-day training course is shown in Table 1, provided as a guide. It is based on a 7-hour working day – 4 hours in the morning and 3 in the afternoon. A period of time is unallocated, usually in the morning sessions, to allow for further discussion, as the tutor may consider necessary. A discussion session on the afternoon of the last day can also be used in a flexible manner.

Arrangement of the meeting room

The number of working groups should be decided ahead of time. Groups of 4–8 participants are best, depending on the number of participants and number of facilitators available. The room should be arranged so that participants sit in groups, preferably in a semi-circle. Everybody should have a clear view of the blackboard and projector screen.

The group compositions can be changed occasionally if this is preferred or left the same throughout the course. For the pre- and post-test evaluations, participants must be seated apart from one another and work alone. The group activities could all take place in the same room and time is saved by not having to change places.

The tutor's first session with the participants in the meeting room should preferably be with a semicircular seating arrangement. If the chairs do not have fixed supports for notebooks, it would be helpful to have small desks or tables available.

Introduction to the course

The tutor should begin by introducing him/herself (and write the name on the board or flipchart and describe briefly his/her background and job). The facilitators should then introduce themselves in the same way.

The participants should introduce themselves next, giving brief information about their jobs, place of work, etc. The participants will have been given their copies of the *Guide for Participants*. After allowing about 10 minutes for them to read through the Introduction, a brief outline should be given of the various topics to be covered. The methods of work should also be explained, e.g. that working in small groups with facilitators should make learning easier. The importance of

exercises, which make up much of the course, should be stressed, as they provide the best way of acquiring the necessary skills.

The tutor should go through the objectives of the various Learning Units with the participants so that they understand exactly what they should have achieved by the end of the course, they should keep these objectives in mind throughout the course and always ask for help if they feel uncertain of having achieved them. It is the job of the facilitators to make the learning process as effective as possible. Participants can be reassured that the tutor and facilitators will take into account the different learning speeds of the participants throughout the course.

The tutor may wish to raise other subjects at this time. The participants should be encouraged to discuss the training programme – what they expect from it, any aspects of the content or the arrangements that may be causing concern, etc. It should be explained that the tutor and the facilitators will welcome feedback throughout the course – constructive criticism from the participants can help to improve the training programme.

Finally, the subject of evaluation should be introduced, explaining that evaluation will be a continuous process throughout the training course. Points to emphasize are that the pre- and post-tests should not cause anxiety as they are part of the learning experience and their purpose is to allow the tutor and facilitators to assess the participants' starting level and to correct mistakes and clarify misunderstandings.

Evaluation

Whether this module is used for group training or individual learning, assessment of progress made in gaining knowledge and competence in the subject matter is essential to both the participant and the tutor.

Evaluation of the participants

The participants' performance can be evaluated as they work through the Learning Units and again at the end of the training, by evaluating the level of competence and knowledge that they have acquired in the subject. The evaluation may include the use of pre-and post-tests; examples of questions that may be used are provided in Annex 1. A further evaluation of how well the participants have retained their knowledge and competence may be advisable 10–12 months later.

The pre-test can take the form of a multiple-choice questionnaire (MCQ), given before the participant reads the *Guide for Participants*. The post-test should be administered only after all the learning units have been completed. Since the answers to the questions and to the exercises are included in this *Guide for Tutors*, it is essential that participants do not have access to it until after the training activity has been completed. For both pre-and post-test evaluations, participants must be seated apart from one another and work alone.

The tutor may use the result of the pre-test to ascertain the general level of knowledge on the subject among the group, and as an indication of weak areas that need emphasis and areas of knowledge that can be de-emphasized. It could also be used to identify individuals who might assist as facilitators for particular subject areas. Another major use for the pre-test is as an

individual base-line comparator for measuring the gain in knowledge and competence at the end of the training as revealed by the post-test.

To obtain valid post-test results, the questions in the post-tests should be of the same level of difficulty as the questions in the pre-test and both tests should be taken under the same conditions and for the same length of time. The only way to ensure that the questions in the post-test are of equal difficulty to those in the pre-test is to give the same questions but in a different order, and in the case of multiple choice-questions with the answers also in a different order. It is therefore essential that the pre-test papers be collected and retained (not handed back to the participants). There is no need for participants to know the result of the pre-test until the end of the training when it is used to determine progress.

Tutors are encouraged to develop a bank of questions that can be used for pre- and post-testing in subsequent training sessions. The answers to the sample pre- and post-test questions are provided separately to enable the question papers to be reproduced easily. The answers are scored equally because all questions are considered to be of equal value.

A record of attendance and level of competence reached by each participant should be completed and retained for future reference. A certificate of successful completion should be provided to each participant at the end of the course.

Evaluation of the training by the participants

Participants can be asked to complete a questionnaire giving their opinions on the organization and content of the course and the quality of the tuition provided by the tutor and facilitators. This will give valuable information on how useful they find this type of training and on the conduct of the course, especially if they provide a short evaluation during the course and a longer one at the end. An example of a suitable questionnaire is provided in Annex 2. Frankness can be encouraged by inviting the participants to respond anonymously.

Feedback provided during the course allows the tutor to assess how well the training is being received and make any improvements that seem necessary. Feedback received at the end of the course will help to improve future programmes.

Certificate

The attendance and performance of each participant should be noted during the course and the record retained for future reference. Participants should receive a certificate of successful completion of the training course.

Note: it is important to stress to the participants that they must take time to read each Learning Unit carefully before attending the class in which it will be considered. The time allotted for the course is based on the assumption that the corresponding unit in the Guide for Participants has been studied in advance.

SUGGESTED TIMETABLE

TIME	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
08:00–10:00	Introduction Objective of training Learning Unit 1 Malaria in the workplace	Laboratory exercise (participants will go through actual processes)	Learning Unit 5 Hospital Visit	Learning Unit 7 Management at first level facility / community	Learning Unit 11 Surveillance and operational research
10:00–10:30	BREAK				
10:30–12:30	Learning Unit 2 Basic concept of malaria	Learning Unit 4 Severe falciparum malaria Pathophysiology of severe malaria	Learning Unit 5 Hospital Visit	Learning Unit 8 Home management	Learning Unit 12 Malaria Programme Management
12:30–14:00	LUNCH BREAK				
14:00–15:30	Learning Unit 3 Uncomplicated malaria	Learning Unit 4 Diagnosis and assessment of severe malaria	Learning Unit 4 Clinical exercises	Learning Unit 9 Malaria chemo-prophylaxis and standby treatment	Post Test and evaluation of training
15:30–16:00	BREAK				
16:00–17:30	Learning Unit 3 Clinical exercises	Learning Unit 4 Treatment of severe malaria	Learning Unit 6 Malaria in pregnancy	Learning Unit 10 National antimalarial treatment policy	Next steps

LEARNING UNIT 1

The malaria situation in the place where you work

Purpose of this session:

During this session you will:

- Describe the malaria situation in the country or area where you work
- Outline the main components of the national malaria control policy in your country
- Indicate the major challenges and obstacles to achieving malaria control in your place of work

Participants should be informed that the questions in the manual are to help them think about the situation of uncomplicated and severe malaria in their work place or country of practice. The purpose of the questions is to remind participants of the significance of malaria in daily clinical practice and help them think about the management of uncomplicated and severe malaria. They should be encouraged to answer the questions as clearly as possible according to what they practice.

The facilitator should assist the participants to identify key issues regarding the diagnosis, treatment and control of malaria according to their level of practice. After completion of the individual answers to the questions, the facilitator should allow a discussion of the various responses. The facilitator should note any areas where participants have problems and ensure that these are emphasised in the subsequent learning units.

Note: this is not the stage for the facilitator to discuss in detail the various issues raised but to assure the participants that they will be discussed in the subsequent learning units.

Answers

Please write only single - or few - word points under these questions. Do not write long comments or essays, as we will be discussing the questions together afterwards. Answering all these questions should take only about 15 minutes.

Question 1

a. *What is malaria?*

Malaria is a disease caused by a protozoan parasite that belongs to the genus *Plasmodium*

b. *Which species of Plasmodia are responsible for malaria in your country?*

Five different species of the *Plasmodium* parasite cause malaria in humans. These are *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi* (which is principally a monkey malaria parasite). *P. falciparum* is by far the commonest species found worldwide in tropical and subtropical areas. It is not the only species that can cause severe, potentially fatal malaria, as both *P. vivax* and *P. knowlesi* can do this, but *P. falciparum* causes the great majority of severe disease events and deaths due to malaria. *P. vivax*, which is found mostly in Asia, Latin America, and in some parts of Africa also causes significant morbidity. *P. malariae*, found worldwide, is the only human malaria parasite species that has a quartan (three-day) cycle; the other species have a tertian (two-day) cycle. *P. ovale* is found mostly in western Africa and the islands of the western Pacific, but is also found in the rest of Africa, where it contributes about 1% of malaria illnesses.

Question 2

In your area does malaria occur all year round or does it occur during particular seasons or periods of the year? (specify the seasons or period)

This could be all year round, seasonal or highly variable with occasions of epidemics. Discuss with the participants the known transmission pattern in their area of practice.

Question 3

On average, how many episodes of malaria do you think a child may have in a year, in your area?

This will depend on the intensity of malaria transmission. Discuss with the participants to reach a consensus on the average pattern for their area of practice.

Question 4

On average, how many episodes of malaria do you think an adult may have in a year, in your area?

In general, frequency of malaria tends to be lower in adults than in children due to the fact that adults are often semi-immune especially in endemic areas. In low transmission areas both adults and children are equally at risk during transmission seasons.

Question 5

a. *What methods are available for making a parasitological diagnosis of malaria in your country?*

There are two methods used for routine diagnosis of malaria: microscopy and rapid diagnostic tests (RDTs).

b. *Suggest approximately what proportion of malaria treatments are based on a parasitological diagnosis, and among these, indicate the proportion tested by each of the available methods.*

Trainees should provide information on use of malaria diagnostic testing in their respective settings, including types of diagnostic methods used and at what level of the health care service. They should have an idea of what proportion of treated cases with antimalarials receive diagnostic testing, and barriers and challenges to accessing diagnostic testing should be discussed.

Question 6

What are the principal components of the national malaria control programme in your country? [This should be just a list – not a discussion of whether or how well the programme is carried out].

The components and operational activities of a malaria control programme depend on the objectives of the programme. Participants should be able to list the core components of their respective national malaria control programmes including:

- ▶ effective case management - early diagnosis and prompt treatment
- ▶ prevention of malaria infection - insecticide treated nets, indoor residual spraying
- ▶ surveillance, monitoring and evaluation
- ▶ behavioral change communication (BCC)

Question 7

- a. *What is the national policy recommendation for first-line treatment, and what is the regimen/dose?*

Check that trainees know their own national policy for first-line treatment, including: *i)* the indications (e.g. is a parasitological diagnosis required, and/or in what circumstances should 'presumptive diagnosis' be used); *ii)* the drug/s, dosages and regimens for different age groups; *iii)* the circumstances in which first-line therapy should not be used – e.g. when there is severe disease, or an alternative obvious diagnosis.

- b. *Is this the treatment that patients actually receive? If not, explain why not, and in roughly what proportion of cases something else is used, and what are these alternative therapies?*

Trainees should be able to list reasons why patients sometimes receive treatments other than those recommended in their national policy – these reasons may include non-availability of the drug, refusal by the patient to accept the drug, self-therapy through shops etc., or preference by practitioners for giving a private prescription of their own. It is important that trainees know what other drugs are commonly used either by patients or by those who treat them – these may be other antimalarials, or additional irrelevant or traditional therapies.

- c. *Do you think the recommended treatment is effective?*

It is important for health professionals to believe that the treatment they are giving works. If they have doubts about this, it would be good to discuss their reasons for having such doubts, and to think about what should be done – should the policy be changed, or should the practitioners go their own way?

- d. *Where do people obtain their antimalarial medicines?*

This is important as it may significantly affect the likelihood of the right treatment being given. Consider whether most people use public services, private professionals or private outlets such as shops or markets, to obtain their antimalarial treatment. The answers may considerably affect statistics about the intake of antimalarial treatments and the amounts needed for the treatment of malaria in a population.

- e. *What proportion of children who need an antimalarial medicine for parasitologically confirmed malaria infection actually receive one?*

Trainees should have an idea of what proportion this is in their community, and the answers can be the basis for discussion about what the obstacles and blocks are to people having access to such treatments.

Question 8

On average how many cases of severe malaria are seen at your place of work per year?

Discuss with the participants to come to consensus on the burden of severe malaria in their area.

Question 9

How many deaths are due to severe falciparum malaria in a year?

Help the participants to make a reasonable estimate of the number of deaths attributable to severe malaria.

Question 10

Is there a specific period during the year when most cases of severe falciparum malaria occur? If so, state which period.

In most cases this will occur during the rainy seasons and during epidemics.

Question 11

Do you think that most of the patients with severe falciparum malaria in your area are brought to a health facility? If not, explain why.

This is a discussion point to highlight the challenges of the health system in each country or area of practice.

Question 12

a. *What proportion of the deaths occurring at home are among people who did not receive medical care? If you consider the proportion to be relatively high, explain why this is the case.*

Where this is high the factors are usually those of delayed and inappropriate therapies.

b. *What factors result in delay of patients with severe falciparum malaria reaching a health facility?*

This could include difficult terrain, cost of care, availability of transport, willingness to go to the referral hospital; participants can provide more options.

Question 13

What is the national policy recommendation for the treatment of severe falciparum malaria? and what is the regimen?

Check that trainees know their own national policy for the treatment of severe malaria, including the types of antimalarial medicines and regimens for different groups (children, adults and pregnant women).

Question 14

What are the major constraints in your country, or place of work, to a satisfactory treatment of severe falciparum malaria?

Emphasis should be placed on the participants seeing themselves as part of the solutions to the identified constraints. Many of the constraints are likely to reflect on malaria programme management challenges. They should brainstorm on how some of the constraints identified can be addressed.

Question 15

What do you expect from this training? List at least three expectations.

Encourage participants to note their expectations and to keep them in view in the course of the training so that they can review whether or not their expectations have been met.

Question 16

Approximately what proportion of pregnant women receive, during their pregnancy, (a) any doses of antimalarial drugs for 'intermittent presumptive therapy' (IPTp), (b) two or more doses of IPTp?

IPTp is a strategy indicated only for pregnant women living in moderate to high transmission settings. Trainees from these settings should have an idea of what proportion of pregnant women receive IPTp in their community, and the answers can be the basis for discussion about the bottleneck for high coverage of IPTp.

LEARNING UNIT 2

Basic facts about malaria

Learning Objectives:
by the end, participants should be able to...

- Name the species of parasites causing human malaria and describe their geographical distribution
- Describe the life cycle of Plasmodium and correlate the events in the life cycle with the pathogenesis and clinical features of malaria
- Define the terms: relapse, reinfection, periodicity, paroxysms, recrudescence
- Describe the relationship between the clinical features and parasitaemia
- Describe the biological characteristics of the different Plasmodium species and the clinical features associated with malaria caused by each of them
- Define uncomplicated and severe malaria

The *Guide for Participants* gives the definition, etiology and life cycle of malaria as well as the definition and salient clinical features of both uncomplicated and severe malaria. Also included is information on occurrence, distribution and endemicity of malaria. Participants MUST read the LU-2 section in the Guide for Participants – hopefully they will have done this reading the night before, but if there is any doubt about this, a period of time – eg 15 minutes – can be allotted to this during this session. After all have read, there can be a further 15-30 minutes of time for questions, when the tutor or other advisors can answer any of the participants' questions. The facilitator should have a world map showing the occurrence and endemicity of malaria relating to rainfall, altitude and the temperatures.

The tutor should explain to the participants the transmission pattern of malaria in their place of work or country of practice. It should be clear to each of the participants as to whether they are working in an area of stable or unstable malaria transmission. This will guide them during the training.

Then divide the participants into 3 small groups (of 2-5 per group), and ask them to think about the following questions – allocate one question to each group, but the groups can each go on to consider the other two questions if time allows. When 15-30 minutes of the whole LU-2 session remain, stop the group discussions and ask each group to report their thoughts, and allow others and the tutor/s to comment. (These questions are designed to make participants think about and apply the basic facts they have read about malaria):

Question 1. How long is the average [and the range of] incubation period (mosquito bite → first symptom) for falciparum malaria? What factors could affect the incubation period in different cases?

Question 2. What factors can you imagine might contribute to whether a *P. falciparum* infection causes uncomplicated malaria, or severe/life-threatening malaria, or no symptoms at all?

Question 3. How might transmission pattern or intensity affect diagnostic policy in a malaria programme?

Question 4. What problems for a malaria programme might result from the fact that a large proportion (20-80%) of asymptomatic children are parasitaemic at any one time?

It should be emphasized that the signs and symptoms of malaria may be very subtle or non-specific. When a patient shows any such signs and symptoms, malaria should always be considered or excluded. Ensure that all participants have understood the definition of severe malaria by asking each participant to identify at least one symptom.

The tutor should help the participants to define severe malaria but leave out the details until Learning Unit 4.

LEARNING UNIT 3

Management of uncomplicated malaria

Learning Objectives:
by the end, participants should be able to...

- Demonstrate competence in the clinical assessment of a suspected case of malaria
- List the advantages of parasitological diagnosis
- Recall the WHO recommendations on parasitological diagnosis
- Describe the methods for preparation of blood film, staining and microscopic examination for diagnosis of malaria
- Explain the mechanism of the malaria rapid diagnostic tests (RDT)
- State the advantages and disadvantages of malaria microscopy and RDTs
- State the recommended guidelines for the treatment of uncomplicated malaria
- Describe the supportive care for uncomplicated malaria
- Define the term “drug resistance” in malaria and list the methods for assessment of drug resistance
- Indicate the role of follow-up for case management at all levels of health services

3.1 Management of uncomplicated malaria

This is one of the most critical module. Tutors are advised to go through the module and ensure that they are very comfortable with all the information contained in it. Bear in mind the fact that the module provides an opportunity to assist the participants to understand some of the critical clinical judgements that would be required of them in the proper management of uncomplicated malaria. Often the participants may encounter conflicts between their usual practices as they are exposed to the instructions in this module. Tutors and facilitators should be on the lookout for participants with such conflicts and assist them to work through them until they appreciate the rationale for current recommendations.

The unit is divided into three main parts:

- ▶ Diagnosis of uncomplicated malaria
- ▶ Treatment of uncomplicated malaria
- ▶ Clinical exercises in relation to uncomplicated malaria

A suggested plan for this session is as follows:

- ▶ If participants have not read the Unit (LU-3), allow 30 minutes for reading now.
- ▶ Then divide the participants into 3 groups of 2-5 persons in each, to discuss the questions about diagnosis (30 minutes) and treatment (30 minutes). Each group should be allocated one question, but they should feel free to address the other questions if time allows.
- ▶ A 30-minute session of feedback from the groups' discussions about the questions (about 5 minutes for each of the six questions).
- ▶ A 30-minute discussion on the clinical exercises – 15 minutes in small groups, 15 minutes plenary afterwards to report and discuss further.
- ▶ A final 30-minute discussion on the case studies – 15 minutes in small groups, 15 minutes plenary afterwards to report and discuss further.

3.1.1 Diagnosis of uncomplicated malaria

Once the participants have completed the initial half an hour of personal readings, the tutor should divide the participants into three small groups to discuss the following questions about diagnosis of uncomplicated malaria followed by feedback sessions in plenary.

Group A

List the clinical features that may be due to uncomplicated malaria. List other common diseases with similar presenting features in your countries (in children and adults). What components of the history, examination, and readily available laboratory tests may be most helpful in distinguishing between malaria and other possible febrile illnesses?

Group B

How commonly, and in what settings, is treatment for uncomplicated malaria in countries given on the basis of a clinical ‘presumptive’ diagnosis (without a test for parasites)? List the advantages and disadvantages of a policy advocating presumptive clinical diagnosis rather than clinical plus parasitological diagnosis as the basis for treating a febrile illness with antimalarial drugs. What position will you advocate for your country or area of practice?

Group C

List the strengths and weaknesses of rapid diagnostic tests when compared with microscopy for the diagnosis of uncomplicated malaria. Discuss the advantages and disadvantages of making rapid diagnostic tests widely available for the diagnosis of uncomplicated malaria in countries.

U3

3.1.2 Treatment of uncomplicated malaria

Participants should go back to their respective groups to discuss the treatment of uncomplicated malaria and, then, followed by feedback sessions in plenary:

Group A

What are the reasons for introduction of artemisinin-based combination therapies for the treatment of uncomplicated malaria? What challenges face the national malaria programme and the health service in trying to implement ACTs as first-line therapy for uncomplicated malaria? What are the possible dangers of widespread use of ACT?

Group B

How do you define “treatment failure” following uncomplicated malaria?

What are the factors that may contribute to treatment failure? What steps could be taken to try to minimize treatment failures?

Group C

List the reasons why people with uncomplicated malaria often receive the wrong treatment.

Suggest ways to increase the percentage of cases of uncomplicated malaria that receive correct treatment.

3.2 Exercises

The exercises section of this learning unit consists of clinical exercises and case studies. Allow the participants to work individually on the clinical exercises for 15 minutes followed by plenary discussion for another 15 minutes. Then the participants should go back to their groups and discuss the case histories as indicated below:

Group A

Start with the case study for patient A and discuss thoroughly for presentation in plenary. Then move on to the other case studies as time permits but present only Case A in plenary.

Group B

Start with the case study for patient B and discuss thoroughly for presentation in plenary. Then move on to the other case studies as time permits but present only Case B in plenary.

Group C

Start with the case study for patient C and discuss thoroughly for presentation in plenary. Then move on to the other case studies as time permits but present only Case C in plenary.

3.2.1 Clinical exercises and answers

Exercise 3.1

- a. *What is the main symptom of malaria?*
Fever
- b. *List some of the clinical features of uncomplicated malaria.*
 - i. Fever
 - ii. Headache
 - iii. Chills or rigors
 - iv. Nausea or vomiting
 - v. Joint weakness or pains
 - vi. General malaise
 - vii. Enlarged spleen and liver especially in children
- c. *What are the criteria for clinical diagnosis of malaria?*
 - i. In settings where the risk of malaria is high: a history of fever in the previous 24 hours and/or the presence of pallor of the palms in young children.
 - ii. In settings where the risk of malaria is low: a history of fever in the in the previous three days, in the absence of any alternative explanation of fever (with history of recent travel to high malaria risk area).

Exercise 3.2

- a. *What are the advantages of parasitological diagnosis of malaria?*
- i. Improved patient care in parasite-positive patients owing to greater certainty that the cause of the present illness is malaria
 - ii. Identification of parasite-negative patients in whom another diagnosis must be sought (but remember that another diagnosis must also be considered even in those with parasitaemia)
 - iii. Prevention of unnecessary use of antimalarials, thereby reducing side effects and drug interactions
 - iv. Confirmation of treatment failures (although merely identifying parasitaemia cannot distinguish between treatment failure and re-infection)
 - v. Improved malaria case detection and reporting
- b. *What laboratory tests should be done?*
Microscopy or RDT

Exercise 3.3

List at least three causes of fever other than malaria that you would consider in a child.

- i. Acute respiratory infection
- ii. Measles
- iii. Acute urinary tract infection
- iv. Common cold
- v. Bacteraemia (especially due to non-typhi salmonella)
- vi. Typhoid fever
- vii. HIV/AIDS (in the early phase)

Exercise 3.4

- a. *Who should receive antimalarial treatment?*

A patient in whom there is parasitological diagnosis of malaria. Treatment solely on the basis of clinical suspicion should only be considered when a parasitological diagnosis is not accessible.

- b. *Which antimalarial medicine would you give to a patient with a confirmed diagnosis of malaria?*
- For falciparum malaria use the recommended ACT in your area. These could include: artemether-lumefantrine, artesunate + mefloquine, artesunate + amodiaquine, artesunate + sulfadoxine-pyrimethamine or dihydroartemisinin-piperaquine.
 - For non-falciparum malaria, in areas where *P. vivax* is sensitive to chloroquine, use chloroquine + primaquine or an ACT + primaquine.
 - For mixed infection, use ACT + primaquine.
- c. *What antimalarial medicine would you give a pregnant woman with uncomplicated malaria in the first trimester?*
- Quinine + clindamycin to be given for 7 days.
However ACT should be used if that is the only effective treatment available.

Exercise 3.5

- a. *Write four key messages you would give a patient about taking antimalarial medicines at home.*
- Explain to the patient or the child's mother the reason for giving the drug. Demonstrate how to measure and take or give the correct dose.
 - Watch the patient taking the drug.
 - Explain that the drugs must be used to finish the full course of treatment, even if the patient feels well sooner than that.
 - Advise them on when to return to the clinic.
 - Check that the patient or mother has understood before leaving the clinic.
- b. *What would you do for a 2-year old child who returns with persistent symptoms three or more days after initial malaria treatment?*
- Re-evaluate the patient.
 - Check on the administration of the drugs in terms of dosing and frequency of administration.
 - Check to exclude vomiting after the administration of the drugs.
 - If parasitological confirmation was not undertaken initially, this is now essential.
 - Follow the guideline on management of treatment failure if confirmed.
 - Seek other possible diagnoses.

3.2.2 Case studies and answers

PATIENT A

The place: Rural district in a falciparum malaria endemic region.

The patient: A boy aged 5 years is brought to your hospital's outpatient department. The mother says he was well until this morning when he woke up and said he was feeling tired and refused his breakfast. When the mother touched him he felt hot and she gave him a half tablet of paracetamol. When you examine, you find a well-nourished 20kg child, alert, not pale, and with axillary temperature of 38.5°C. The rest of the physical examination is normal.

U3

Question 1

What action would you take?

Request for diagnostic testing to confirm or exclude malaria infection.

Question 2

Examination of thick blood smear revealed asexual *P. falciparum* parasites.

a. *What treatment would you give the child?*

Recommended ACT

b. *At what dose?*

Dosage should be according to weight of the patient and recommended regimen.

c. *By which route?*

Oral

Question 3

What will you tell the mother?

- i. Tell the child's mother, father or guardian the reason for giving the drug. Demonstrate how to measure and take or give the correct dose.
- ii. Watch the patient taking the drug.
- iii. Explain that the drugs must be used to finish the full course of treatment even if the patient feels well before then.
- iv. Advise on when to return.

PATIENT B

The place: Rural district in malaria endemic setting.

The patient: A girl aged 36 months is brought to you with a history of fever for two days and ear pain for one day. On examination you find that she is in fair general condition, weighs 20kg, with temperature 39.2°C and discharge of pus from the left ear. Other systems are normal. RDT reveals positive test result.

Question 1

What diagnosis would you make?

- Acute ear infection
- Uncomplicated malaria

Question 2

What treatment would you prescribe?

- Oral antibiotic for ear infection
- Oral ACT for uncomplicated malaria
- Paracetamol for high fever and pain

Question 3

What have you learnt from this patient concerning malaria?

Malaria can easily occur with another disease which also causes fever in children and both illnesses must be treated.

Question 4

If the malaria slide was negative, would you give antimalarial treatment?

There will be no justification for the antimalarial treatment.

Discuss with the participants to make sure they understand the implications of other positions.

PATIENT C

The place: Rural community of falciparum malaria endemic country.

The patient: A boy aged 4½ years wakes up in the morning and takes only tea without milk. He is rather quiet with hot body. The mother gives him a half tablet of chloroquine. That day when he returned from school he was apparently well. The chloroquine was stopped. Two days later in the evening he develops a fever and vomits. The mother then gives another half tablet of chloroquine. The following morning he again refuses food, and he has a low-grade fever to touch. The mother decides to come to the clinic.

U3

Question 1

a. *Was the mother right to give the chloroquine?*

No

b. *Why or why not?*

It is no longer recommended for treatment, and she gave inadequate courses (a single dose) on both occasions.

Question 2

Why did the child get better after the first dose of chloroquine?

Chloroquine has some antipyretic effect, which will lower temperature and make the patient feel better.

Question 3

What actions would the health worker at the clinic take?

- i. Look for signs of severe malaria and any indication of an alternative cause of fever.
- ii. Request for diagnostic testing for malaria parasites.

Question 4

Diagnostic test with RDT revealed a positive test result.

How would you treat this patient?

Give a full course of recommended ACT.

PATIENT D

The place: Urban district in a country highly endemic for malaria.

The patient: A boy aged 6 years wakes up in the morning and refuses to eat. He is rather quiet but does not have fever. The mother gives two tablets of artemether-lumefantrine (AL). That day when he returned from school he was apparently well. The AL was stopped. Two days later in the evening he develops a fever and vomits. The mother then gives another 2 tablets of AL. The following morning he again refused food, and he had a low-grade fever to touch. The mother decides to take the child to the clinic.

Question 1

a. *Was the mother right to give the AL?*

No

b. *Why or why not?*

There was no fever or history of fever.

Question 2

a. *Should the mother have stopped the treatment after the initial first dose of AL?*

No

b. *Why or why not?*

It is recommended that the treatment should be completed once the treatment has been started.

Question 3

How should the health worker manage this patient?

i. Evaluate the patient carefully for other possible causes of illness.

ii. Get a blood film or RDT done if possible.

iii. Complete the full course of ACT taking into account the dose that was given the evening prior to health centre attendance.

LEARNING UNIT 4

Management of severe malaria

Learning Objectives:
by the end, participants should be able to...

- Define severe malaria
- Discuss the host-parasite interaction that contributes to the pathogenesis of severe malaria
- List the determinants of severe malaria and identify groups at high risk
- Make a diagnosis of severe falciparum malaria
- Specify the emergency and supportive measures and follow-up guidance for malaria patients with different types of complications
- Describe the recommended antimalarial chemotherapeutic regimen for severe malaria

The *Guide for Participants* gives a succinct overview on pathophysiology of severe malaria and the groups at risk for severe malaria. The tutor should make sure that all the participants carefully read the Learning Unit, and stimulate discussion.

It should be explained that, despite the amount of studies on the topic, there are still some gaps in the understanding of the pathogenesis of malaria. Owing to time constraints, discussions should be held in the plenary. For those who wish to gain further insight into the pathophysiology of malaria refer to reference.¹

¹ Severe falciparum malaria. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 94, 2000, supplement 1 (especially pages S1/20-S1/30).

The tutor should spend about 10 minutes asking questions to the whole group in order to ascertain their overall understanding of the subject and to identify any serious misconceptions or gaps. Questions that may be posed include:

- ▶ What is the purpose of taking a case history?
- ▶ What are the elements of a case history?
- ▶ What are the indications for alternative diagnosis?
- ▶ What are the indications for severity of malaria?
- ▶ What coma scales do they know and use?
- ▶ What important laboratory investigations should be carried out to confirm the diagnosis and assessment of the patient?

From the outcome of the question and answer session, the tutor will make a structured presentation of the subject using overheads or slides that have been prepared in advance. In going through the various elements carefully, plenty of time should be allowed for discussion and feedback.

With regard to assessing the coma score, it will be important to note that there are many coma scales, the three most widely used of which are proposed here: the Glasgow coma scale for adults, the Blantyre coma scale for children and the Alert-Voice-Pain-Unresponsive (AVPU) primary survey assessment of ill patients.

There is no precise age at which one scale becomes more useful than the other. As a rough guide the Glasgow coma scale can be used for people aged > 5 years and the Blantyre scale for children aged 9 months to 5 years.

With respect to laboratory investigations, the tutor must decide beforehand the most practical and cost-effective tests that can be carried out in the situation prevailing in the area where the course is being held. Of the investigations suggested in the *Guide for Participants*, some may be available and suitable for the local setting whereas others may be appropriate for more advanced settings.

4.1 Treatment

- ▶ The goals of treatment are to provide urgent treatment for life-threatening problems, specific antimalarial treatment for severe malaria, and appropriate supportive care throughout the period of illness.
- ▶ The tutor must ascertain that the participants have understood that severe *P. falciparum* malaria is an emergency and urgent treatment is required, and should discuss with the group the various steps to be followed, with explanation of the reasons why each treatment is recommended.

- ▶ The importance of the supportive treatment throughout the period of illness and related ancillary treatments should be stressed.
- ▶ An overhead transparency or slides should be shown of the treatment/progress/observation chart highlighting the importance of its correct compilation. Note that the appropriate coma scale must be chosen for the admission assessment, and that the same scale must then be used for all observations on that patient.
- ▶ A discussion in plenary must precede the presentation of the treatments that are not usually recommended or are contraindicated. For example corticosteroids may worsen the course of illness. Agents used for cerebral oedema are not necessary, fluid restriction will suffice. Screened fresh whole blood transfusion should be used instead of anticoagulants for those with bleeding disorders. This discussion session will allow the tutor to clarify misconceptions that the participants may have.
- ▶ Copies of the treatment progress/observation charts are to be provided to the participants, in order to allow working groups to discuss and familiarize themselves with the various sections.
- ▶ Finally the tutor should discuss with the participants the importance of clinical and laboratory monitoring.

4.2 Assessment of recovery

A brief structured presentation and discussion session must highlight the importance of neurological sequelae in children and adequate follow-up. Ideally, follow-up should continue until a child is completely well. Stress the importance of retesting PCV and Hb one month after discharge especially if the patient was anaemic. Discuss sequelae and their frequency.

Working in groups, the participants should develop a form to enter relevant information for review and synopsis of patients discharged from a health facility

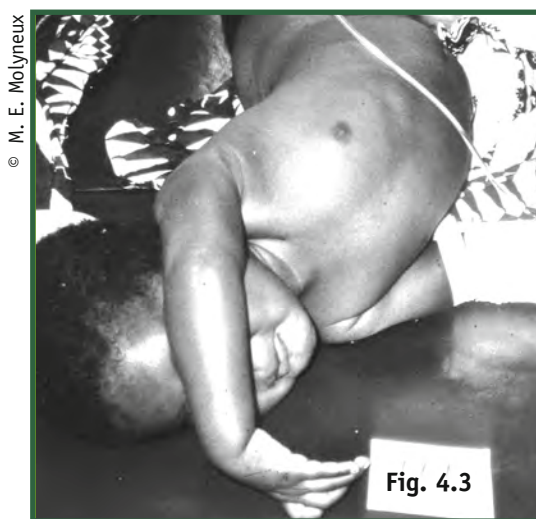
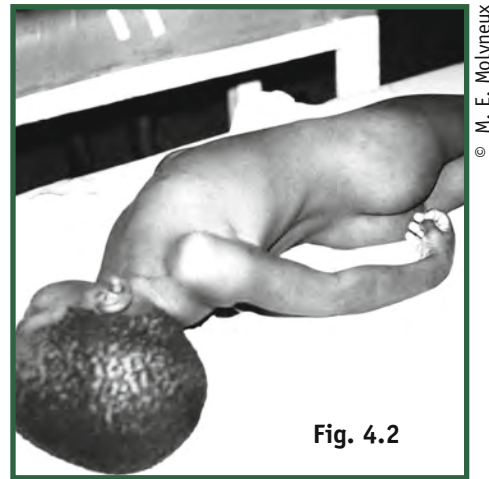
4.3 Exercises

4.3.1 Picture quiz and answers

Working in small groups, participants should answer each set of questions, then in plenary the group results can be compared; this can be done by projecting each pictures while a participant at the flip-chart notes the different answers of the groups. This should be followed by discussion and consensus regarding the correct interpretation.

In using this module over time the tutor may wish to build up a bank of pictures which could be used for a picture quiz or as part of the pre- and post-test to evaluate the participants.

A number of picture plates have been provided below. They are to help in guiding the participants on interpretation of physical signs of severe disease in children and adults, decisions on differential diagnoses, and determination of the tests that need to be carried out.



The children seen in figures 4.1, 4.2 and 4.3 were all brought to a clinic in an area where *P. falciparum* is hyperendemic. Each child is unconscious and has a heavy *P. falciparum* parasitaemia. The children are 3 to 5 years old. They are febrile (axillary temperature: 38°C–40°C). They have been immunized against measles, diphtheria, tetanus, and whooping-cough through the EPI services.

Question 1

What do pictures 4.1–4.3 show?

Opisthotonos. There is also posturing of the arms in various positions. These features indicate severe cerebral dysfunction.

Question 2

What is the differential diagnosis?

All these features may be due to cerebral malaria. The most important differential diagnosis is meningitis; it must also be remembered that any form of meningoencephalitis, including rabies, may present in a similar way; hypoglycaemia due to any cause, one of which is malaria, may also present with this clinical picture. Kernicterus may also cause cerebral dysfunction.

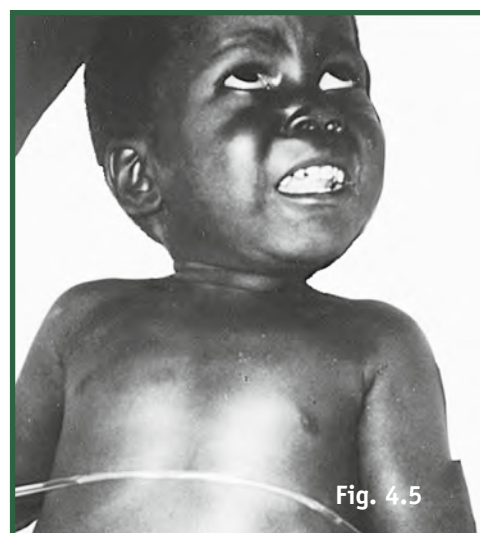
Question 3

What tests should be carried out?

Blood glucose; lumbar puncture; other tests depend on the particular circumstances and response to treatment.

The tutor should discuss with the participants the additional tests to carry out in the management of this patient that are: *i)* appropriate and *ii)* available in the facilities in which they work.

The children seen in figures 4.4 and 4.5 each have a short history of fever followed by progressive loss of consciousness. Both are in deep coma and have a heavy *P. falciparum* parasitaemia. They are 3 and 4 years old. Neither has been immunized against the common childhood diseases.



Question 4

What do the pictures seen in Figures 4.4 and 4.5 show?

Conjugate deviation of the eyes to the left (Fig. 4.4) or upwards (Fig. 4.5). The patient in figure 4.4 also has a sustained posture of the right arm, and the child in figure 4.5 appears to have contraction of lower facial muscles, causing a grimace.

Question 5

What could be the explanation for this?

These features, like those of figures 4.1 to 4.3 indicate a cerebral disorder. They may also be part of, or follow immediately after, a convulsion of any cause. All the conditions discussed under questions 2 and 3 must be considered in these patients, and the same tests should be done.

The patient seen in figure 4.6 has *P. falciparum* malaria. She was admitted in coma, treated with quinine and recovered consciousness. Two days later she had a convulsion and collapsed into coma again.



Question 6

What are the possible causes of the convulsion and subsequent coma?

- Hypoglycaemia
 - A recrudescence of malaria (not responding to quinine)
 - Meningitis
-

Question 7

What investigations would you carry out to ascertain the causes?

- i. Blood glucose test, using a “stix” method, or glucometer if available
- ii. Blood film (thick film)
- iii. Lumbar puncture
- iv. Blood culture

Question 8

How will you manage this patient?

- i. Antimalarials
- ii. The comatose patient should be given meticulous nursing care. The nurse should turn the patient every two hours or so. Allowing the patient to lie in a wet bed will promote bed sores.
- iii. If hypoglycaemia is detected by blood testing or suspected on clinical grounds, give 50ml of 50% dextrose by intravenous bolus injection (rapid injection of 50ml of fluid).
- iv. Follow with an intravenous infusion of 5% or 10% dextrose.
- v. Continue to monitor blood glucose level in order to regulate the dextrose infusion. Remember that hypoglycaemia may recur even after intravenous bolus of 50% dextrose.
- vi. The patient must be treated with broad spectrum antibiotics without waiting for culture results. If the results of blood culture and sensitivity testing become available, give the appropriate antibiotics, if not continue with the broad spectrum antibiotics.
- vii. Monitor and record the level of consciousness using the Glasgow coma scale, or for younger children the Blantyre scale, and the temperature, respiratory rate, pulse and blood pressure.

Figure 4.7 shows the supportive treatment given to a patient with severe falciparum malaria.



Question 9

What exactly does the picture seen in figure 4.7 show?

Peritoneal dialysis in progress in a hospital in a rural location. A patient with acute tubular necrosis can be kept alive by peritoneal dialysis until the kidneys recover, usually over a period of a few weeks.

Question 10

What is the most frequent complication in severe falciparum malaria that leads the physician to carry out this procedure?

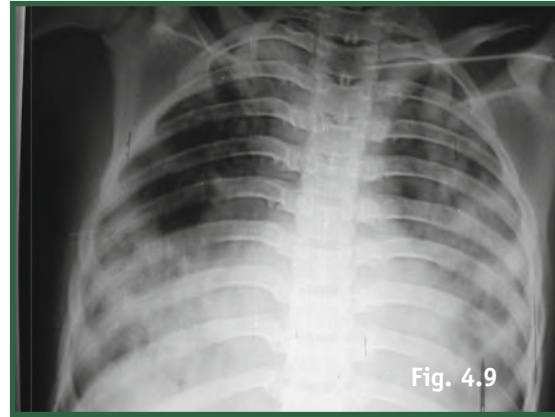
Renal failure. Dialysis is indicated if the patient remains oliguric after adequate rehydration and the blood urea and creatinine rise progressively, in the absence of facilities for standard dialysis.

Question 11

What are the complications to be feared in carrying out this procedure in rural hospitals?

Peritoneal dialysis should not be undertaken lightly in a rural hospital setting. Bleeding and secondary infections are common complications and the mortality associated with the procedure is high. Early referral to a dialysis centre is usually preferable.

Figures 4.8 and 4.9 refer to the clinical and radiological presentation of a woman soon after delivery. She has severe falciparum malaria with hyperparasitaemia and the condition shown in figures 4.8 and 4.9 was preceded by difficulty in breathing with an increased respiratory rate.



Question 12

What is the condition suggested by these pictures?

Acute pulmonary oedema that developed suddenly after delivery. The fluid balance of the woman was positive. Figure 4.9 is the radiographic appearance of acute pulmonary oedema.

Question 13

What is the differential diagnosis for this condition?

Aspiration bronchopneumonia, pneumocystis pneumonia and metabolic acidosis. Without good facilities for emergency radiography it may be difficult to differentiate acute pulmonary oedema from aspiration bronchopneumonia and metabolic acidosis although, in the latter, examination of the chest is usually normal.

4.3.2 Case studies and answers

PATIENT A

The place: A rural district hospital catering for population living in high transmission setting.

The patient: A girl aged 4 years is brought to the outpatient department of your hospital by her mother, late in the evening.

The child was well until yesterday morning (36 hours ago), when she began to have fever. Yesterday she took meals but seemed indifferent; today she has refused food, but has drunk a little. The mother says the child had a “fit” this morning; she regained consciousness immediately. For the past few hours the child has been increasingly drowsy, and for the last hour has been unconscious.

At the examination the child is well-nourished, unconscious, and not dehydrated. The axillary temperature is 40.2°C; pulse rate 120s/min, regular; blood pressure 90/70mmHg. There is no neck stiffness and no rash. The pupils are equal; a few retinal haemorrhages seen; no papilloedema. Some yellowish sticky fluid is seen filling the left external auditory meatus. Reflexes are normal.

Question 1

If facilities are limited, which laboratory tests are essential for this child as a guide for immediate action?

- Blood films for malaria parasites.
- Blood glucose.
- Lumbar puncture.
- Haematocrit and/or haemoglobin concentration.

These tests should be possible in any centre where ill patients are seen. Whether other tests are done may depend on the results of the above tests and on available facilities – blood culture, chest X-ray, biochemical studies. They are less likely to add substantially to the value of careful clinical assessment in the planning of immediate treatment.

Question 2

- Among the possible tests, blood glucose should have been included. Why does this have priority in this case?*

Hypoglycaemia may complicate any childhood fever, including malaria. Hypoglycaemia cannot be easily recognized clinically, so must be tested for; immediate correction can reverse coma and prevent cerebral damage.

- b. In this patient 2ml venous blood was taken into a fluoride oxalate sample tube and sent to the laboratory to determine the blood glucose level. The result will be available two hours later. Should you wait for the result of the blood glucose test if it will take two hours?
If you suspect that the child is hypoglycaemic then the hypoglycaemia must be corrected at once.
- c. If not, what should be done?
Do a bedside test for blood glucose (finger-prick and test “stix”)/glucometer or, if that is not possible give intravenous dextrose (see *Guide for Participants*).
Note: If it is not possible to give dextrose intravenously, either dextrose or a sugar solution should be given by nasogastric tube, or even into the buccal cavity (cheeks).

U4

Question 3

In this child the blood glucose level was 1.0mmol/l (18mg/dl); 50% dextrose was given intravenously, but the child remained unconscious.

What does this suggest?

There is another cause of coma in addition to hypoglycaemia. The dose of dextrose given may have been insufficient; or hypoglycaemia has already been sufficiently prolonged to cause brain damage. However, in this case it is likely that continuing coma is due to malaria itself.

Question 4

Figure 4.10 shows thin (a) and thick (b) blood films from this patient as seen under the high-power microscope (magnification $\times 700$).

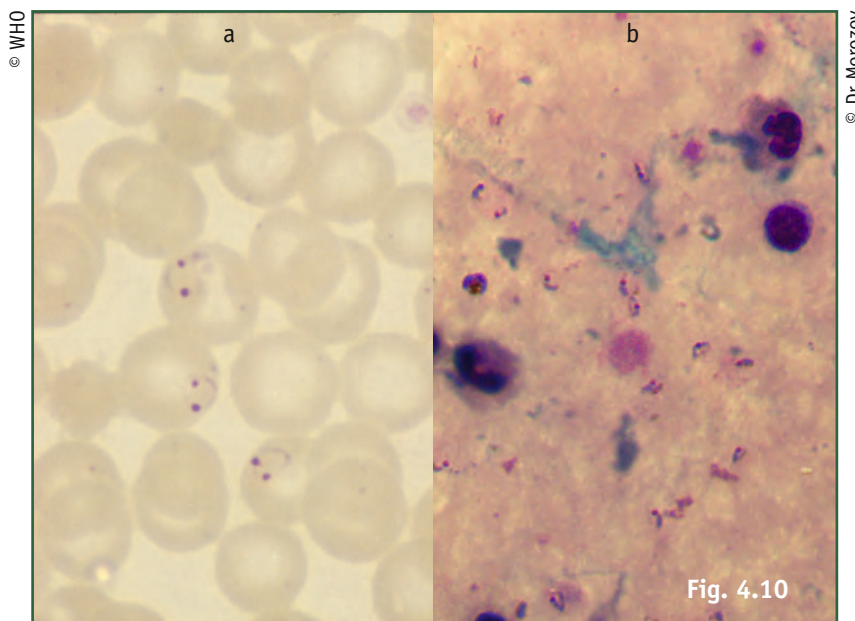


Fig. 4.10

a. *What does the film show?*

Malaria: all parasites at the “ring” stage; the infection is extremely heavy (“++++”).

b. *What species of parasite is present?*

For these reasons it is almost certainly *P. falciparum*. This patient needs urgent treatment; an accurate count of the parasitaemia can wait until treatment is started.

c. *How heavy is the infection?*

It is important to have a rough idea of how heavy the parasitaemia is because children with heavy parasitaemia are at greater risk of death. A patient with heavy parasitaemia may have a large drop in haemoglobin level over the next few hours; knowing the approximate degree of parasitaemia can help predict the need for blood transfusion in good time.

d. *How could you quantify it more accurately?*

Methods of quantifying parasitaemia are discussed in Learning Unit 2 of the *Guide for Participants*.

Question 5

If a child has *P. falciparum* parasitaemia “++++” with hypoglycaemia:

a. *Does this exclude a diagnosis of meningitis?*

In highly endemic areas the children may have heavy parasitaemia without severe illness. The fever and coma in this child may be due to something else and meningitis is a possibility.

b. *Neck stiffness was assessed in this patient. Is it still necessary to do the lumbar puncture?*

The absence of neck stiffness does not exclude meningitis, since young children with meningitis may have no neck stiffness especially if deeply unconscious, sedated or post-ictal. Therefore, lumbar puncture is still indicated.

c. *Does clear colourless cerebrospinal fluid exclude meningitis?*

Not quite, but it makes meningitis less likely. A child who is as ill as this from meningitis would be highly likely to have cloudy CSF. However, 400 cells/mm³ are needed to make cerebrospinal fluid visibly cloudy, so a fluid containing 300 cells/mm³ might appear clear. Microscopic examination of the fluid must therefore be carried out if possible.

Question 6

In this patient microscopy of the cerebrospinal fluid showed 3WBC/mm³ and 7RBC/mm³ (normal),

a. *Could the ear discharge be important in this patient?*

If the child has chronic middle ear disease, a cholesteatoma may have developed and infection could have spread to the brain or meninges. Intracerebral, subdural or extradural abscess – or meningitis – could result. The normal CSF findings exclude meningitis, but the other complications of middle ear disease remain a possibility.

b. *What should be done about it?*

The external meatus must be mopped out carefully so that the ear drum can be examined. In this child remnants of an insect were found in the external auditory meatus; after gentle mopping with cotton-wool on a stick, the drum was seen to be normal. If chronic middle ear disease had been found, antibiotics would have been indicated.

U4

Question 7

What is your decision on how to proceed with antimalarial treatment?

a. *Which medicine(s) to use?*

The decision may be guided by a national or regional policy. Otherwise consider known local parasite drug sensitivities and drug availability.

b. *By which route?*

Choice between intravenous, intramuscular, or nasogastric tube depends on available skills and staffing, drugs used, patient's condition.

c. *What is the correct dosage and schedule?*

For dosage, see *Guide for Participants*, Learning Unit 3.

Question 8

Apart from antimalarial medicine(s), is any other medicine therapy indicated for this patient? Consider specific treatment for:

- *Fever.* Paracetamol is an effective antipyretic and can be given by suppository. While waiting for this to have an effect (or if it is unavailable), apply tepid-sponging and fanning – the child's mother (or father) may help with this. Fever is only dangerous if very high; moderate fever (< 39°C) may have some beneficial effects on host response and some anti-parasitic action.

- *Convulsions.* Observe this child carefully for convulsions (including subtle convulsions) and treat accordingly. In children with convulsions due to high fever or hypoglycaemia, correcting these abnormalities may be sufficient to prevent further convulsions.
- *Complicating infection.* Septicaemia occasionally complicates severe malaria. Other potential bacterial infections include aspiration pneumonia, and urinary tract infection if the patient is catheterized. These must be looked for and only treated if they develop.

Question 9

How should fluid replacement be given?

Assess individual requirements. Pay special attention to:

- Prevention or correction of hypovolaemia, because the patient with severe malaria is at risk of developing acute renal insufficiency, even if the patient is a child < 5 years old.
- Prevention or correction of fluid overload, because pulmonary oedema may result from fluid overload, and may also be a direct complication of severe malaria.
- Prevention of hypoglycaemia. Children who are fasting are liable to develop hypoglycaemia, especially during a febrile illness; furthermore, quinine promotes pancreatic insulin secretion. The likelihood of hypoglycaemia developing can be reduced by maintaining a continuous 10% dextrose infusion (e.g. 80ml/kg/24h).

Question 10

The haematocrit is 19%. What are the implications of the levels of parasitaemia and haematocrit in this patient?

Blood transfusion may be life-saving, but because of its dangers should only be used if strongly indicated. Do not apply a 'rule of thumb' (e.g. a haematocrit level) but assess the individual. In this case, the degree of parasitaemia will help with the decision. A count on the thin film indicates that 29% of red cells are parasitized.

a. *Should a transfusion be given?*

Not now, but you should be ready to do so if the Hb falls below 5g/dl. Many of this child's red cells will soon be destroyed:

- Because of the high parasitaemia
- Because non-parasitized RBCs may also be destroyed

- Because the total body parasitaemia may be considerably higher than 29%, with many parasitized RBCs being sequestered in deep tissues
 - You can therefore predict a large fall of haematocrit values. You should monitor the Hb frequently and be ready to transfuse without delay if/when the Hb falls below 5g/dl.
- b. *If blood transfusion is or becomes necessary, how should the blood be given?*
The need in this child will be for red cells, not blood volume or plasma factors. It is therefore preferable to give packed cells in this particular case. (Where volume replacement is also needed, whole blood will be preferable).

U4

Question 11

What clinical observations should be made during the course of treatment in this patient?

Important physical signs to record include:

- Vital signs (temperature, pulse, respiratory rate, blood pressure)
- Level of consciousness (the Blantyre coma scale is suggested – see *Guide for Participants*)
- Occurrence of any convulsions or other clinical events
- Urine output
- Signs of dehydration or overhydration (skin, jugular venous pressure, heart, lung bases, liver size, blood pressure lying and sitting)

Question 12

What laboratory tests should be repeated (and when) during treatment?

- Haematocrit and/or haemoglobin level at least 12-hourly
- Parasite count 12-hourly until negative
- Blood glucose level – frequency depends on condition. Repeat immediately with any convulsion or deterioration of consciousness
- Creatinine, electrolytes if urine output impaired
- Blood culture if fever and coma fail to resolve, or if state of shock develops

Question 13

What should be followed up after the child has recovered?

Assess neurological recovery. Sequelae may occur, especially in children who have been hypoglycaemic or have had repeated convulsions. Neurological

sequelae include motor impairments and disorders of behaviour and intellect, and sometimes severe cerebral damage with loss of all functions including speech, vision and hearing. There is often considerable recovery over time.

PATIENT B

The place: A rural clinic in an area where *P. falciparum* is hyperendemic. Various antimalarial medicines are available, but intravenous infusions cannot be given.

The patient: A child aged 20 months became feverish two days ago and has vomited several times today. One hour ago the child had a convulsion, described by the mother as a repetitive twitching of limbs and mouth, followed by unresponsiveness for a few minutes. The child is now febrile (39.3°C), conscious, and able to localize and respond to a painful stimulus. Malaria rapid diagnostic test shows a positive result for *P. falciparum*. The child repeatedly vomits any antimalarial medicine given by mouth.

Question 1

a. *Does the child have cerebral malaria?*

No. The fact that the child is now fully conscious suggests that the convulsion was a “febrile convulsion” rather than a component of cerebral malaria. Convulsions occur in cerebral malaria but they are not usually followed by a rapid recovery of consciousness.

b. *What should be done about the convulsions?*

Make sure that the risk of a further convulsion is minimized by reducing the child’s temperature (paracetamol, tepid sponging and fanning).

Question 2

The district hospital is 30km away; the journey will probably take several hours by bus.

a. *Should the patient be referred to hospital?*

The decision to refer will depend on facilities at the health centre. This child needs antimalarial drugs and fluids, and should receive these at a centre able to give them and able to observe the child’s progress carefully.

b. *What treatment should be given in the meantime?*

Because the child is persistently vomiting, the first dose of antimalarial drug should be given parenterally or rectally. The options are rectal artesunate, intramuscular quinine or intramuscular artemether.

Recent studies suggest that a loading dose of quinine (20mg salt/kg) can be given safely by the intramuscular route, as long as the patient has not received quinine or quinidine in the preceding 24 hours or mefloquine in the preceding 3 days. A reasonable approach is to give quinine 10mg/kg IM immediately, then 10mg/kg (the remainder of the loading dose) IM after 4 hours). Artesunate suppositories can be given as pre-referral treatment.

Because of the history of a febrile convulsion, make sure the mother continues to give her child tepid sponging and fanning to reduce the risk of further convulsions. This child may cease to vomit soon after the injection, especially if the temperature has been successfully lowered. It may then be possible to continue treatment by mouth, without referral to a larger centre.

If the child is referred to a larger centre, make sure that the child is given dextrose by mouth or nasogastric tube during the period of travel.

U4

Question 3

On arrival at the district hospital, the child was still unable to take oral medication and was admitted. A thick blood smear showed *P. falciparum* rings “++++” and he was given quinine IV. On the third day, there had been some improvement but the child was still febrile and the parasitaemia reduced a little.

Does this suggest that the child has drug-resistant malaria?

No. Fever commonly persists, and the degree of parasitaemia may remain similar for up to 24 hours after the start of treatment, even if the parasite is fully sensitive to the drug being given. By 48 hours, however, the density of parasitaemia should be greatly reduced and the patient should be considerably better. Nevertheless other possible causes of fever should be checked.

Question 4

The child was able to feed and take oral medication on the third day.

Should the parenteral treatment with quinine be continued?

No. Parenteral antimalarials in the treatment of severe malaria should be given for a minimum of 24 hours, once started (irrespective of the patient’s ability to tolerate oral medication earlier). The patient already received parenteral quinine for two days. As the child can swallow, the treatment should be completed by giving a complete course of either the recommended first-line ACT. Other regimens recommended include artesunate plus clindamycin (or doxycycline or tetracycline) or quinine plus clindamycin, (or doxycycline or tetracycline) to complete a 7-day course of treatment.

Question 5

On completion of the treatment, a further blood test showed gametocytes “+”.

What should be done about the gametocytes present in the blood after treatment?

Gametocytes are commonly found in the blood for several days or even weeks after successful treatment of falciparum malaria; they do not indicate failure of treatment, and no action is required.

Treatment to remove gametocytes from blood circulation has been used in some settings with the aim of reducing the transmission of malaria. This is inappropriate in a hyperendemic area because most transmission occurs from the large number of people with asymptomatic malaria.

PATIENT C

The place: A country where *P. falciparum* is hyperendemic.

The patient: A male economist aged 28 years, was born and brought up locally, but attended university in northern Europe for five years. He returned home last month.

One week ago he developed fever. He decided this could not be malaria because he had grown up in a malaria-endemic area and believed he was therefore immune. Two days ago he became confused, especially at night. He stayed in bed and was attended by a servant who called the doctor today because the patient was increasingly confused. The last urine he had passed was a small volume of very dark fluid 24 hours ago.

On examination, the patient was a well-nourished adult man. He was afebrile with a rectal temperature of 36.5°C. He was restless but could give brief appropriate answers to questions, and could localize the site of a painful stimulus. He was jaundiced and his mucous membranes were pale. There was some bleeding from the gums, and there were a few retinal haemorrhages in both eyes.

Question 1

a. *What is the differential diagnosis?*

Consider all diseases that may progress to encephalopathy with jaundice: fulminant hepatitis, yellow fever, other viral fevers, relapsing fever, septicaemia, community acquired pneumonia (which is commonly accompanied by jaundice), leptospirosis, alcohol excess, sickle cell crisis, trypanosomiasis, etc.

Nevertheless, in the circumstances of this patient, in particular the failure to pass urine, severe falciparum malaria must be the most likely diagnosis.

Retinal haemorrhages are common in severe malaria, and do not on their own indicate the presence of abnormal bleeding tendency.

- b. *Was the patient right to think he was immune to malaria? Justify your answer.*
No. Immunity to malaria is partial, and may be almost completely lost after an absence of a few years from the endemic area.

Question 2

The thick blood film shows *P. falciparum* rings “++++” and the thin blood film shows that 26% of red cells are parasitized.

- a. *What else should be looked for in the thin blood film?*
Platelets. Thrombocytopenia is usual in falciparum malaria, but may be particularly severe in this patient who has signs of a bleeding tendency. Severe thrombocytopenia may be evident on a thin blood film.
- b. *What other tests are necessary to investigate the bleeding tendency?*
Platelet count and prothrombin time. In addition a bedside test that might be positive in the presence of a low platelet count is Hess’s test. If possible it would be interesting to know the levels of plasma fibrinogen and fibrin degradation products (FDPs). If the platelet count and plasma fibrinogen are very low in a patient with spontaneous bleeding, the bleeding can be attributed to disseminated intravascular coagulation (DIC). However, if only the thin blood film can be done, scantiness of platelets in the presence of bleeding in a patient with malaria suggests DIC: Hess’s test may or may not be positive. The best bedside test for the presence of abnormal bleeding due to DIC is the bleeding time (described in *Guide for Participants*). In this patient this is likely to be prolonged, since there is abnormal bleeding spontaneously from the gums. A record of bleeding time would be useful in order to monitor progress in response to treatment.
- c. *What treatment is needed for the bleeding?*
Screened fresh blood transfusion. If facilities allow, alternative treatment should be based on laboratory tests. If, in the patient with spontaneous bleeding, thrombocytopenia is the only abnormality, give platelet concentrates; if laboratory results show DIC give platelet-rich plasma or fresh frozen plasma with additional platelets. Vitamin K is not helpful because the bleeding is not due to vitamin K deficiency. Since this patient may also need blood transfusion for malarial anaemia, it would be wise to prepare urgently as many safe units of whole fresh blood as possible. It is assumed that specific treatment for malaria has already been given.

Question 3

The patient has not passed urine for 24 hours.

What kind of investigations and actions are appropriate?

Palpate the abdomen to see if the bladder is distended. Try to get the patient to pass urine. If he cannot do so, catheterize with full sterile procedure, in order to record urine volumes carefully. Test the urine (if any) by all routine methods and if possible, for sodium concentration and specific gravity. The management needed is then that of any patient with suspected acute tubular necrosis – i.e. attempt to correct any underhydration by careful saline infusion (urine specific gravity > 1.015 and sodium < 20mmol/l suggests dehydration). Some authorities use drugs such as frusemide (furosemide) and low-dose dopamine in an attempt to achieve flow of urine. High dose frusemide given with aminophylline infusion can be used. The efficacy of these treatments remains unconfirmed. Measure the plasma urea, creatinine and electrolytes if possible.

If acute tubular necrosis becomes established, intensive care is required, with peritoneal dialysis or haemodialysis if necessary.

Question 4

15ml of dark brown urine was obtained by catheter. The urine 'stix' tests showed albumin "++", blood "++++", conjugated bilirubin "++", urobilinogen "++". Microscopy of the urine showed no cells and a few casts.

How are the results of the urine test to be interpreted?

The presence of "blood" in the urine (i.e. haemoglobin) in the absence of red blood cells indicates that there is free haemoglobin in the urine, as a result of intravascular haemolysis, a complication of severe falciparum malaria. Bilirubinuria indicates that there is some increase in the conjugated bilirubin in the plasma, as a result of hepatic involvement in malaria. Urobilinogen appears in the urine when there is unconjugated hyperbilirubinaemia, as in haemolysis. Proteinuria is usual in the presence of acute tubular necrosis, which is the commonest form of renal failure to complicate falciparum malaria.

Question 5

Acute renal failure is confirmed.

a. *Is it possible that the kidneys may recover?*

Yes. In acute tubular necrosis, recovery commonly takes place within a period of a few days or weeks. It is therefore important to keep the patient alive, if

possible, by dialysis (if necessary peritoneal dialysis) because full recovery is then likely, without the need for continued long-term dialysis.

b. *What therapy should be given to this patient with acute renal failure?*

Artesunate IV/IM should be used in preference to quinine. The dosage of artesunate does not need adjustment in patients with vital organ dysfunction. If parenteral artesunate is not available, quinine therapy should be given. If acute renal failure is confirmed, the first dose of quinine should be the same as in any patient with severe malaria, but if acute renal failure becomes established, doses should be reduced by 50% from the third day onwards.

Note: peritoneal dialysis can be life-saving and is achievable without excessively expensive equipment. However, it requires experience and competence. Guidelines for indications and methods of peritoneal dialysis are available and must be taught to hospital staff who may be responsible for management of patients with severe malaria. Fortunately, acute renal failure is rare in African children with severe malaria but it is seen in adults, especially in semi-immune populations.

U4

PATIENT D

The place: A country with hyperendemic *P. falciparum* malaria in low-lying areas but no malaria transmission on the high central plateau.

The patient: A woman aged 19 years was brought to a clinic in the malaria-endemic area. The medical officer recorded that the patient gave a history of fever for the past three days with rigors and vomiting. On examination she was febrile with an axillary temperature of 39.1°C and slightly jaundiced. She was fully conscious. Because she had never been out of the country, the doctor considered it unlikely that she was suffering from *P. falciparum* malaria, but nevertheless checked a thin blood film. No malaria parasites were seen on the film so he diagnosed hepatitis and advised rest and a fat-free diet.

Question 1

a. *Do you think the medical officer was right to decide that this patient did not have malaria? Justify your answer.*

No. Because the doctor did not take into consideration the history and investigations.

b. *Could the doctor have done better with:*

i. *The history?*

Poor knowledge of the epidemiology of malaria in the country. The medical officer considered malaria unlikely because the patient had not been out of the country. He/she should have enquired about the patient's travel history: if the patient had lived all her life in the highlands, she would be highly susceptible to malaria when visiting the lowlands. The possibility of blood transfusion and contact with jaundiced persons should also be checked.

ii. *The investigations?*

Inadequate knowledge of procedures for laboratory malaria diagnosis. A diagnosis of malaria was dismissed because there were no malaria parasites on the thin film. It is much easier to identify a scanty parasitaemia on a thick film than a thin film. A thick film should have been done. Even if that was negative for malaria parasites, the doctor should have been prepared to consider a diagnosis of malaria and repeat the thick film after a few hours. If facilities allow, liver enzymes could be measured to help diagnose acute hepatitis.

Question 2

Two days later the patient was brought back to the clinic by anxious relatives. She had become drowsy and was not answering questions properly. On examination the patient was afebrile, slightly jaundiced and confused. She could not answer questions but could withdraw her hand from a painful stimulus. The possible diagnoses considered were fulminant hepatitis, sickle-cell crisis, relapsing fever and cholecystitis. Malaria was ruled out because she was not febrile. Treatment was started urgently with tetracycline intravenously and enemas to empty the large bowel. She remained unconscious and her temperature rose to 38°C; a blood film now showed scanty *P. falciparum* parasitaemia. This was considered "probably incidental" because low-grade parasitaemia was common among young adults in the area.

a. *What errors were made in clinical judgement?*

First, malaria was ruled out because she was afebrile. Malarial fever is variable and a single measurement is never sufficient to indicate the absence of malaria. Occasionally, patients with severe malaria remain afebrile for long periods despite being severely ill.

Second, the low-grade parasitaemia was considered unimportant. Patients with severe malaria usually do have heavy parasitaemia, but some patients have low-grade peripheral parasitaemia despite having severe malaria. This is because of withdrawal of trophozoites and sequestration of parasites in the capillaries of the internal organs.

b. *What errors were made in the treatment of the patient?*

First, a young woman should not be treated with tetracycline unless she is definitely known not to be pregnant. No mention is made of any attempt to discover whether the patient was pregnant. Tetracycline is also likely to be harmful in viral hepatitis, so this disease should have been excluded before the treatment.

Second, the patient was parasitaemic and ill enough to require parenteral treatment, parenteral artesunate should have been prescribed. If not available, parenteral quinine (with appropriate precautions, see *Question 3*) would have been given. Thirdly, an important mistake here was not to consider hypoglycaemia, a serious but treatable possibility in a patient with jaundice who becomes confused or drowsy – could be due to hepatic necrosis in hepatitis, or to malaria itself.

Question 3

The next day the patient was increasingly febrile and the parasitaemia had increased. The parenteral artesunate (IV or IM), the preferred antimalarial medicine for the treatment of severe malaria, was out of stock. Therefore, quinine 20mg base/kg was given intravenously to run over one hour in normal saline, to be repeated 8-hourly. Twenty-four hours later the patient became increasingly breathless. There were no signs in the chest but pneumonia was diagnosed and treated with penicillin. Twelve hours later the patient was still breathless and suddenly had a convulsion. Her level of consciousness deteriorated and she died ten hours later.

a. *What errors were made in administration of quinine?*

The dose of quinine of 20mg base/kg is too high; the correct loading dose is 20mg of quinine dihydrochloride salt (16.7mg base)/kg. One hour is too fast for an intravenous infusion of quinine (especially of a loading dose); infusion over 3–4 hours is preferable.

b. *What errors were made in diagnosis of clinical complications?*

Pulmonary oedema and hypoglycaemia were not considered. Pulmonary oedema is particularly likely in a patient with renal impairment who receives excessive fluid orally or parenterally. Acute renal failure should therefore also be looked for carefully in this patient.

PATIENT E

The place: A country endemic for *P. falciparum* and *P. vivax* malaria.

The patient: A boy aged 16 years who was brought to a clinic. His friend told the doctor that the patient had a history of fever for the past 7 days. Two days before admission, the patient went to a private clinic and was diagnosed with influenza. He was given some medication but did not improve. On examination the patient was febrile and jaundiced, with stupor. Blood smear examination showed *P. vivax* parasites.

Question 1

Could cerebral malaria be the cause of the patient's stupor?

Yes, it might be. In this case, the patient may have a mixed infection with *P. vivax* and *P. falciparum*. The reason that *P. falciparum* malaria was not found may be due to a low *P. falciparum* parasitaemia or to partial treatment with some medication from a private clinic. It is also possible, although unlikely, that the stupor is due to *P. vivax* – the possibility of severe malaria due to *P. vivax* has recently become increasingly recognized.

Question 2

What should be investigated in this patient?

In this case, the causes of altered consciousness should be investigated. Repeated blood smears must be carried out for malaria together with lumbar puncture and measurement of blood glucose in order to exclude other causes of unconsciousness such as meningitis, meningoencephalitis, or hypoglycaemia.

Question 3

*What is the case management if repeated blood smears show only *P. vivax* parasites, and blood glucose and lumbar puncture are normal?*

The cause of altered consciousness in this patient is unlikely to be due to *P. vivax* malaria, but it is possible. It is also quite possible for *P. falciparum* to cause coma in a non-immune patient while the density of parasitaemia is too low to be detected by microscopy in the peripheral blood. It is thus wise to treat the patient as a case of severe *P. falciparum* malaria. This treatment also removes *P. vivax* infection. Although the patient is only stuporous, not comatose, the treatment must be started as for severe disease.

Question 4

If the patient had a haematocrit/PCV of 18%, or Hb 5.1 g/dl, what should be done?

The rate of development and degree of anaemia in malaria depends on the severity and duration of parasitaemia. Severe anaemia may develop rapidly in association with hyperparasitaemia. In this case the parasite density is not high, therefore the cause of anaemia in this patient may not be due only to malaria. Use clinical criteria to decide whether blood transfusion will be necessary for this patient.

Question 5

*To prevent relapse of the *P. vivax* infection, when could the patient be given primaquine?*

Primaquine administration is not emergency treatment for *P. vivax* malaria. Usually primaquine can be given when the patient improves, i.e. when fever subsides. Primaquine may cause more haemolysis if the drug is given during acute illness when fever is high.

Question 6

What further antimalarial treatment will this patient require?

In patients with mixed *P. falciparum* and *P. vivax* infection, drugs which are effective against asexual forms of *P. falciparum* are also effective against asexual forms of *P. vivax*. Primaquine may be used for treatment of *P. vivax* hypnozoites after resolving the acute infection.

Question 7

What precautions should be taken with this treatment?

Where possible, test the blood for evidence of G6PD deficiency. Blood and urine must be examined periodically for evidence of haemolysis. Patients must be warned to stop treatment and report immediately to a doctor if they have abdominal pain and become weak or pale, or notice darkening of the urine to resemble coca-cola.

PATIENT F

The place: A country where *P. falciparum* malaria is transmitted in forested areas but not in the main cities.

The patient: A man aged 30 years who had a holiday in the forest one month before admission to hospital. He became ill seven days ago, with chills, sweating and headache. He went to a private clinic and was diagnosed with upper respiratory tract infection. He was prescribed an antibiotic and his condition seemed to improve, but yesterday he developed rigors and persistent vomiting. A blood film at the private clinic showed *P. falciparum* malaria with 10% parasitaemia, and oral quinine (600mg every 8 hours) was prescribed. He took 3 doses. Today he is referred to hospital because of stupor. His temperature is 39°C, pulse 100/min, and blood pressure 120/80mmHg.

Question 1

What tests are urgently required?

Blood glucose and lumbar puncture to exclude other causes of stupor. If both tests are normal, the cause of stupor in this patient may be due to cerebral malaria. If available, serological testing for yellow fever should be done if the patient has visited an area where yellow fever is endemic.

Question 2

Blood glucose was 1.7mmol/l (30mg/dl), and the patient was given an infusion of 50ml of 50% dextrose. After dextrose infusion, the patient became alert.

a. *What antimalarial treatment should be given to the patient?*

If the patient cannot take oral antimalarial medicines, give parenteral artesunate using the recommended dose regimen.

b. *If parenteral artesunate, the preferred antimalarial medicine for severe malaria, is not available, should this patient be given a loading dose of quinine?*

No. This patient took quinine in the last 24 hours. Quinine can be given in the normal dose (10mg salt/kg bw).

Question 3

If the patient had renal failure and was not given quinine before admission, should he be given a loading dose of quinine?

Yes. The aim of loading dose quinine administration is to raise the blood quinine level to the minimum inhibitory concentration (MIC). Quinine will rise to MIC level in 4 hours after loading dose administration.

Question 4

If the patient had jaundice and renal failure, how is the dose of quinine adjusted?

Quinine doses should be reduced by one third to one half on the third day of treatment if there is no improvement in the overall condition, or if acute renal failure develops. For example, 10ml/kg at 8-hourly intervals should be reduced to 7mg/kg at 8-hourly intervals after 48 hours of treatment. Quinine is biotransformed in the liver (80%) and is excreted by the kidneys (20%). If dosage is not adjusted to accommodate renal insufficiency, the level of quinine may rise to toxic levels. However, dosage adjustments are not necessary if patients are receiving haemodialysis. Note that the dosage of artemisinin derivatives does not need adjustments in vital organ dysfunction.

U4

Question 5

If the patient's consciousness does not improve after dextrose infusion and he has convulsions, what should be done?

The patient may have cerebral malaria. Treat convulsions with diazepam or paraldehyde. A slow intravenous injection of diazepam (0.15mg/kg bw, maximum 10mg for adults) or intramuscular injection of paraldehyde (0.1ml/kg bw), will usually control convulsions. Diazepam can also be given intrarectally (0.5–1.0mg/kg bw) if injection is not possible.

Note: Paraldehyde should be given from a sterile glass syringe if possible; a disposable plastic syringe may be used provided the injection is given as soon as the paraldehyde is drawn up, and that the syringe is never reused. Also note that diazepam is an irritant to the rectum.

PATIENT G

The place: A country where *P. falciparum* malaria is hyperendemic.

The patient: A woman aged 30 years who was admitted to hospital because of high fever with dyspnoea. Twenty days before admission, she had fever which did not subside after taking paracetamol. Today she developed dyspnoea and came to the hospital. On examination, her temperature was 38°C, pulse rate 120/min, respiratory rate 28/min, and blood pressure 130/88mmHg. The chest X-ray showed increased interstitial shadowing and a normal heart size compatible with non-cardiogenic pulmonary oedema. The blood smear showed *P. falciparum* parasitaemia.

Question 1

What is the possible cause of tachypnoea in this patient?

Although the patient had pulmonary oedema, the other possible causes of tachypnoea in this patient may be metabolic acidosis and hypoglycaemia. Therefore measurement of arterial blood gas and blood glucose level must be undertaken if facilities allow.

Question 2

The patient was given furosemide (30mg) and oxygen therapy via nasal cannula (with oxygen flow 5 l/min). Half an hour later, the patient had not improved and arterial blood gas showed PaO₂ 48 Torr.

What should be done?

The patient has developed respiratory failure. Mechanical ventilation must be started.

Question 3

When should the patient be started on positive-end expiratory pressure (PEEP) assisted ventilation?

PEEP must be used when the patient has low pressure of oxygen in arterial blood (PaO₂ < 70 Torr) using a ventilator with fractional inspired O₂ (FiO₂) > 50%. Failing that, the patient may develop ARDS.

Question 4

If central venous pressure (CVP) is measured to evaluate the patient's volume status, what level of CVP should be maintained?

CVP must be maintained between 0 and 5cm H₂O.

Question 5

What other severe malaria manifestations or complications are often associated with pulmonary oedema?

Hyperparasitaemia, renal failure, hypoglycaemia, and metabolic acidosis are often associated with pulmonary oedema.

LEARNING UNIT 5

Hospital visit

Learning Objectives:
by the end, participants should be able to...

- Describe the profile of malaria patients with uncomplicated and severe malaria seen in the hospital in the past year
- Take a history and conduct a clinical examination of (a) a patient with severe malaria, and (b) a patient with an uncomplicated febrile illness, who are being treated in the hospital
- Assess the basis for diagnosis and the details of the management of the patients reviewed in the second bullet above

It will be important to arrange well in advance a visit to a health facility with inpatients to allow the participants to have practice in history taking, eliciting physical signs and also evaluating the size of the malaria problem and the ways in which the hospital is practising diagnosis and management of malaria. All the necessary health authorities should be alerted well in advance, and the participants should be cautioned to act in a professional manner throughout the visit.

If several participants are visiting the same hospital, it may be necessary to divide the tasks (based on the Learning Objectives) between the students, who can then report back to each other and to the tutors in a review session at the end.

Advise the participants to obtain a complete picture of how the patients with severe falciparum malaria have used the available health facilities.

The tutor and facilitators will identify suitable cases of severe febrile illness or severe malaria to be clerked by the small groups, and will arrange for visits to the laboratory, access to ward 'Admissions books', and conversations with appropriate staff about the hospital's malaria burden.

Case records, if available, of discharged patients with severe febrile illness or severe malaria may be critically reviewed by small groups as 'paper patients'. This may be a useful approach if there are no patients currently being treated for malaria in the hospital.

Summaries of real and/or 'paper patients' should be compiled by groups for presentation during the plenary sessions.

Following the visit to the health facility, arrange a plenary session in the classroom to allow a discussion of the findings and any problems encountered. Aim to highlight the challenges to competent diagnosis and management that have been encountered, and to discuss public health implications.

LEARNING UNIT 6

Malaria in pregnancy

Learning Objectives:
by the end, participants should be able to...

- Describe the relationship between malaria and pregnancy
- List measures to prevent malaria during pregnancy
- State the justification, indications, advantages, recommended medicines and their dosage and timing, for intermittent preventive treatment (IPT)
- State the recommended therapeutic regimens for the treatment of uncomplicated and severe malaria during pregnancy

The tutor should be familiar with the various issues involved in the relationship between malaria and pregnancy. Tutors will find it helpful for preparation of the course to study the available evidence that formed the basis of current recommendations regarding the management of malaria in pregnancy (see WHO Guidelines for the treatment of malaria*).

The tutor should help the participants to identify:

- a. the effects of malaria on pregnancy, which include maternal anaemia, death, abortion, stillbirth, premature delivery, low birth weight, and neonatal death in those areas of the tropics where malaria transmission is unstable and women of childbearing age have little acquired immunity.
- b. the effects of pregnancy on malaria, which have a significant impact on the clinical course of malaria illness, especially in the non-immune populations where pregnancy is associated with a higher occurrence of hyperpyrexia, hypoglycaemia, anaemia, cerebral malaria, and pulmonary oedema.

The purpose of the discussion above is to achieve a good understanding of the need for use of malaria preventive measures in pregnancy, prompt and effective treatment of uncomplicated or severe malaria in pregnancy, and the measures to institute in monitoring the well-being of the foetus.

6.1 Treatment of malaria in pregnancy

The tutor should help the participants to understand the concerns in relation to the deployment of antimalarial drugs for treatment of uncomplicated malaria in pregnancy. The tutor should be positive about the use of the antimalarials, because the recommended drugs are safe in pregnancy, and the risk of death or severe morbidity if malaria in a pregnant woman is not treated far outweighs the low risk of any side-effects of the recommended drugs. The participants should be guided to understand the decision-making process in the treatment of both uncomplicated and severe malaria in pregnancy.

6.2 Exercises

6.2.1 Case studies and answers

PATIENT A

The place: A country where *P. falciparum* malaria is transmitted in forested areas but not in the main cities.

The patient: A woman aged 25 years is brought to the outpatient department of the central hospital in the capital. She is a local resident, the wife of a business executive, and is in the seventh month (28 weeks) of her first pregnancy.

The patient became ill five days ago, with chills, sweating and headaches. An antibiotic was prescribed and her condition seemed to improve, but yesterday she developed rigors and persistent vomiting. A blood film at the local clinic showed malaria parasites, and oral quinine (600mg every 8 hours) was prescribed. She took two doses.

Today she has been referred to your hospital because of restlessness and increasing mental confusion. Examination shows a semiconscious woman who is unable to speak. She withdraws her hand from a painful stimulus but cannot localize a stimulus applied to the sternum or forehead. There is no neck stiffness, jaundice, pallor or rash. Axillary temperature is 39°C, pulse rate 90/min, blood pressure 110/70mmHg. The uterine fundus is palpable (26–28 weeks), and the fetal heart can be heard.

* *Guidelines for the treatment of malaria. Second edition.* Geneva, WHO 2010. <http://www.who.int/malaria/publications/atoz/9789241547925/en/index.html>

Question 1

What tests are urgently required?

- i. *Blood glucose.* Pregnant women are susceptible to hypoglycaemia with any stress or infection, and they are particularly likely to develop hypoglycaemia (due to hyperinsulinaemia) during treatment with quinine. This patient is pregnant and has already received some quinine; she has altered consciousness. Hypoglycaemia is therefore a strong possibility and must be checked for urgently.
- ii. *Haematocrit/haemoglobin and parasite density.* Because the patient is pregnant she may already be anaemic due to iron or folate deficiency and increased plasma volume. Malaria may rapidly exacerbate anaemia. The risk of developing pulmonary oedema is increased in patients with severe anaemia.
- iii. *Lumbar puncture and blood culture if possible.* Meningitis may co-exist with malaria and can be impossible to identify without examination of the cerebrospinal fluid. Septicaemia may complicate severe malaria. In pregnancy there is increased susceptibility to bacterial infections – e.g. pneumococcal infections – including septicaemia and meningitis.

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Question 2

If the blood glucose is 1.2mmol/l (22mg/dl) what treatment should be given?

Intravenous dextrose. Remember, hypoglycaemia may be recurrent and severe in pregnancy; monitor the blood glucose level frequently.

Question 3

The blood film shows *P. falciparum* rings “++++”, and the cerebrospinal fluid is normal except for low glucose.

- a. *What antimalarial drug should be administered and by which route?*

Parenteral artesunate is preferred over quinine in the second and third trimesters, both because of its antimalarial efficacy and because quinine is associated with recurrent hypoglycaemia. In the first trimester, parenteral quinine should be given since the risk of hypoglycaemia is lower and data on the safety of the artemisinin derivatives are more limited. Treatment must not be delayed; so treatment with any of the drugs artesunate, artemether or quinine, whichever is available, should be started immediately. Intravenous route is preferable, but if not possible, intramuscular route should be used.

Assume that the patient is 6 months pregnant and parenteral quinine is the only available parenteral medicine

b. *Should a loading dose of quinine be given? Justify your answer.*

No, because the patient has received quinine within the last 24 hours, and a loading dose may therefore lead to dangerously high blood levels of the drug.

c. *What nursing procedures are important during this treatment?*

An important nursing responsibility is to control the rate of infusion. If quinine is allowed to run too rapidly, hypotension and hypoglycaemia may develop and the patient may become dangerously overloaded with fluid. On the other hand, if the infusion is too slow, inadequate blood levels of the drug may be achieved, and the patient may become dehydrated. Meanwhile, care of the semiconscious patient is essential. As she is restless she must be protected from falling and from pulling out drip lines. Other important nursing procedures are discussed in the following sections. Monitoring of the foetal heart rate and well-being is also very important.

d. *In a health unit without facilities for parenteral therapy, what alternative treatment could be considered?*

Make urgent efforts to refer and transfer the patient to a facility which has facilities for parenteral therapy and adequate monitoring and management of the pregnancy. But give the first dose of an antimalarial drug while referral arrangements are being made. If rectal artesunate is not available, a crushed tablet of quinine could be given through a nasogastric tube (NGT).

Question 4

After six hours the patient becomes increasingly restless. The respiratory rate increases to 40/minute. The blood glucose level is normal.

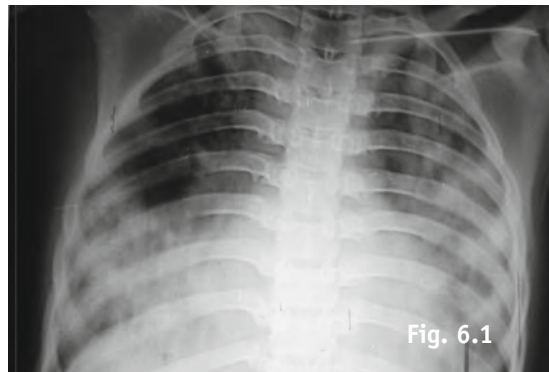
Under these conditions, what diagnostic steps should be taken?

Look for evidence of pulmonary oedema, which may complicate falciparum malaria, especially in pregnancy.

Review the urinary volumes passed, the volumes of intravenous fluid (including dextrose) given, and the fluid balance. This emphasizes the need for precise monitoring and recording of fluid intake and output – another important responsibility of those who nurse the patient. Assess the central venous pressure (clinically or, if possible, with the help of a central venous pressure line). Examine carefully for gallop rhythm, basal crepitations and hepatic enlargement.

Question 5

A chest X-ray gives the picture shown (Fig. 6.1). What is the diagnosis and treatment?



This X-ray suggests pulmonary oedema or acute respiratory distress syndrome (ARDS). The mechanisms of these two conditions are different, but the clinical and radiological pictures are similar. Both are serious complications. The most important treatment is to correct fluid overload if present, using intravenous diuretics, fluid restriction and even careful venesection. ARDS can only be diagnosed on the basis of arterial blood gas measurements. It requires assisted ventilation with careful attention to blood gases and even with these facilities the prognosis is poor.

Question 6

What other observations are particularly important in this patient?

Foetal heart rate. Foetal distress is common in malaria, especially if there is high fever. Assisted vaginal delivery or even caesarean section must be considered if foetal distress is severe.

Question 7

What other questions should this patient's relatives be asked?

Ask about travel – when has she visited parts of the country where transmission of malaria occurs? Has she received a blood transfusion recently (alternative source of malarial infection)?

6.2.2 Group work

After the initial plenary session, the tutor should divide the class into three small groups (A, B, C) for discussion of the various aspects of malaria in pregnancy.

The three groups should complete the exercise described in the *Guide for Participants* (Unit 6). The tutor and facilitators should make sure that all groups understand what they have to produce at the end. Review the main sections, stimulating discussion where possible and drawing upon the experience among the participants.

After the work of the first group has been presented, the tutor should open up the subject for discussion and clarify any misunderstandings that may have arisen before inviting the next group to present the tasks given in the outcome of their work.

Closing session

At the concluding plenary session, a representative of each group should highlight the key points from their group's discussions. The tutor should then wind up the discussion by re-emphasising the key points.

LEARNING UNIT 7

Management of fever at first level health facility

Learning Objectives:
by the end, participants should be able to...

- Manage a patient with fever at primary care level using the syndromic approach
- Describe the general danger signs in a patient with fever
- Classify a case of fever according to the recommended criteria for areas of low and high transmission
- Select appropriate treatment according to the classification
- Correctly identify cases for referral and state appropriate pre-referral treatment
- Identify the most appropriate case management where referral is not possible

In this unit, participants will be able to learn how to assess, classify and identify treatment in children and adults according to the “assess and classify” chart for fever. This should be done by health workers at the primary care level. The unit is written with the purpose of integrating recommendations on malaria diagnosis and treatment with the Integrated Management of Childhood Illness (IMCI) Guidelines and cognisant of the fact that there are areas or countries that have not yet had IMCI training. This learning unit therefore covers the management of both uncomplicated malaria and severe malaria.

This unit is modified from the IMCI Guidelines by including also children older than 5 years and adults. The tutor should explain that by using the same process as that of IMCI, participants will be able to identify signs of serious disease such as severe malaria, meningitis, septicaemia and anaemia. If trained in IMCI, they should use the IMCI ‘assess and classify’ chart for fever in children < 5 years; this chart should also be used for older children and adults.

The following plan is suggested for teaching this unit:

1. Ask the participants to read through the objectives, then introduce:

- ▶ The IMCI chart for fever management.
- ▶ Explain that the learning unit will teach how to assess, classify and identify treatment.

After the participants have read the section on general danger signs, demonstrate how to assess for the general danger signs and ask them to record on the clerk sheets “Danger signs present” e.g. convulsions, unconscious, or not able to drink.

Allow participants to read on through the section assess for fever. Demonstrate assessment for fever by going through the chart with the participants.

Point to the wall chart and show the participants where the classification tables are:

- ▶ Explain that classification tables of assess and classify have three rows
- ▶ The rows are coloured in PINK, YELLOW and GREEN
- ▶ The colour of the row helps to assess rapidly whether the patient has a severe disease requiring urgent attention
- ▶ Classification in the pink row means the patient has severe illness and needs urgent attention and referral or admission to the inpatient facility
- ▶ Classification in the yellow row means that the patient needs specific medical treatment such as oral antimalarial or other medication
- ▶ Classification in the green row means that no specific medical treatment is required

2. At this stage point out the signs in the classify column and later in the identify column.

In talking through the steps for classifying fever, point to each row as it is described.

- ▶ Look at the pink or top row. Does the patient have a general danger sign? Does the patient have a stiff neck or any other symptom and sign of severe malaria? If the patient has a general danger sign or any of the other signs in the pink or top row, select the severe classification, VERY SEVERE FEBRILE DISEASE.
- ▶ If the patient does not have the signs in the pink row, look at the next yellow. Does the patient have fever (by history or feels hot or has temperature 37.5°C or more)? If the patient has fever but no signs of severe illness, perform malaria test and if the test result is positive, select the classification in the yellow, MALARIA.

- ▶ If the patient does not come under the classification in the pink or yellow rows, look at the green row. If the patient has no signs of severe disease or malaria, select the classification in the green row, FEVER – NO MALARIA.

Participants should be reminded to start always at the top of the classification tables.

3. Explain that if the patient has signs from more than one row, the more serious classification should always be selected.

For example, if a patient has a sign in the pink and the yellow, select the more serious one, the pink.

4. Explain that if the patient has pallor, the participants should cross the lower line and assess for signs of heart failure.

Participants should be reminded that if a patient has pallor they should classify for both fever and pallor. The tutor should repeat the steps above with assessment and classification for pallor.

5. Explain to the participants that in children they should assess for the other main symptoms including cough or difficulty in breathing, ear pain, and check for malnutrition, vitamin A status and immunization, as in IMCI.

Signs of malaria can overlap with those of other diseases such as

- ▶ measles
- ▶ pneumonia
- ▶ meningitis

The patient would therefore need treatment for malaria and for these other diseases. In areas with high malaria transmission, malaria is a major cause of death especially in children <5 years old.

Due to limited facilities and staff at the primary care level, the purpose of the classification is to help the health worker recognise:

- ▶ very severe febrile disease or severe malaria
- ▶ malaria (uncomplicated malaria)
- ▶ fever, no malaria
- ▶ severe pallor or heart failure
- ▶ moderate pallor

6. After participants have learnt how to classify, they will then learn how to identify treatment.

Emphasize that identify treatment is not the same as giving (administering) treatment. They should make sure that when they are giving treatment they do not overlook any identified problem.

7. Go through treatment, including treatment where referral is not possible.

8. Organize an outpatient session to make sure that each participant sees one patient with fever.

They should do a complete assessment, check for general danger signs, assess for fever, and identify appropriate treatment for the patient.

LEARNING UNIT 8

Community case management of malaria (CCM)

Learning Objectives:
by the end, participants should be able to...

- Explain the rationale behind the strategy for CCM
- Describe the role of home caregivers in CCM
- Describe the role of community-based providers in CCM
- Describe the diagnostic and treatment procedures for CCM
- Define integrated community case management (iCCM) of childhood illnesses
- Indicate key components and actions that will facilitate delivery of iCCM

Community case management of malaria (CCM) involves educating mothers, training community-based providers and others, and supplying malaria RDTs and pre-packaged quality-assured medicines. The tutor should review the rationale for the CCM with the participants. Emphasis should be placed on the following rationale for CCM:

- ▶ There is a proven relationship between the duration of illness and fatal outcome in malaria; hence treatment must be instituted promptly (preferably within the first 8 hours of the onset of illness).
- ▶ Studies have shown that delivery of CCM is feasible.
- ▶ In many developing countries where malaria is endemic, access to health facilities is almost always difficult. CCM can significantly compensate for a lack of readily available services.

- ▶ The available antimalarial drugs are known to be safe and could be administered at community levels, with the necessary orientation for caregivers and community-based providers.
- ▶ The CCM also provides an opportunity for the delivery of an integrated health-care package at community levels.
- ▶ A marked reduction in malaria-related mortality can therefore be expected with appropriate deployment of CCM in any country or community.

The tutor should allow the participants to spend 30 minutes re-reading Learning Unit 8. The class should then, in a plenary session, discuss the following:

- a. Whether CCM takes place in any countries now. If so, what is the current level of implementation in the countries?
- b. What would be required to introduce CCM in countries where it is not presently implemented?
- c. What are the potential obstacles and challenges to achieving this?

Base the discussions on the experiences in each country or region represented in the group.

LEARNING UNIT 9

Malaria chemoprophylaxis and standby treatment

Learning Objectives:
by the end, participants should be able to...

- Specify the indications for antimalarial chemoprophylaxis
- State the medicines recommended for antimalarial chemoprophylaxis and the criteria for their selection
- Indicate the rationale for standby emergency treatment (SBET) of malaria
- State the indications for SBET
- Give appropriate guidance for travellers carrying SBET

The tutor should allow the participants to re-read Learning Unit 9 on their own for about 10 minutes.

9.1 Exercises

9.1.1 Case studies and answers

PATIENT A

The place: A city where there is no *P. falciparum* malaria transmission.

The patient: A woman aged 24 years who made a 2-month visit to a part of the country where malaria is endemic. For malaria prophylaxis she took mefloquine (250mg weekly), but discontinued this on return to the city. Twelve days later she felt tired and had a mild headache. The following evening she became febrile and began to vomit. Her general practitioner referred her to hospital. On examination, she was febrile with a temperature of 39.5°C. There were no other abnormalities. Thick and thin blood films showed *P. falciparum* trophozoites with 20% parasitized erythrocytes. Quinine was immediately started by intravenous route (loading dose of quinine 20mg salt/kg given in 4 hours, followed by 10mg salt/kg every 8 hours for a total of 10 days) to attempt a rapid reduction of the parasitaemia. During the second infusion a nurse reported that the patient could not communicate. On examination, she was conscious with open eyes but unable to speak. There was no spontaneous movement of her limbs but reflexes were normal. There was no neck stiffness or retinal haemorrhage.

Question 1

What is the neurological lesion?

The patient appeared to be awake but unable to communicate: this state is referred to either as “coma vigil” or “akinetic mutism”, and results from midbrain dysfunction due to sequestered parasitized erythrocytes.

Question 2

What important investigations should be carried out immediately?

Blood glucose must be checked because hypoglycaemia, which may cause cerebral or other neurological sequelae, may occur after quinine infusion, especially as the parasitaemia is declining; it occurs especially in severe malaria and most commonly during pregnancy. Lumbar puncture must also be performed to exclude other infectious causes of cerebral dysfunction.

Question 3

Is it possible that a person who has mefloquine prophylaxis may develop malaria?

It is possible because there is no absolute chemoprophylaxis for malaria. It must be remembered that anyone may acquire malaria when visiting a malaria-endemic area, even after taking malarial chemoprophylaxis. If a patient complains of headache, malaise, or fever, a blood smear for malaria must be carried out. Repeated checks of blood smears for malaria are necessary if the patient still has symptoms. A small number of parasites in the blood may be difficult to detect, hence the need for repeated blood smear examinations. The patient stopped prophylaxis too soon which probably allowed a hepatic form of the parasite to emerge.

Question 4

Should dexamethasone be used in this patient? Justify your answer.

No. Dexamethasone and other corticosteroids should never be used in cerebral malaria. They do not improve overall prognosis and furthermore, serious complications are significantly more frequent when they are used.

9.1.2 Group work

The participants should then be divided into three groups. Each group will discuss the same questions set out below.

- a. *Discuss whether prophylaxis is of any value in countries.*
- b. *In what circumstances would you advise prophylaxis for a person travelling within countries?*
- c. *When would you recommend standby emergency treatment? What advice would you give to the individual to accompany your recommendation to carry standby drugs? What drugs would you advise and on what basis?*

The group discussions can be completed in 20 minutes. The participants should then meet together in plenary and present key outcomes from their group discussion.

In concluding this session, the tutor should ensure that the class has a good understanding of the limited indications for chemotherapy, the current recommendations for malaria prevention in pregnancy, and the appropriate actions to take in relation to SBET.

Note: For participants working in sub-Saharan Africa, the current recommendations regarding chemoprophylaxis in sickle cell disease (SCD) patients will be of particular interest (see Guidelines for the treatment of malaria). However, among the few studies carried out on the use of chemoprophylaxis among SCD patients, a number had methodological limitations and the evidence remains unclear. New studies are needed, also to evaluate the use of intermittent preventive therapy (IPT) in SCD patients.

LEARNING UNIT 10

National antimalarial treatment policy

Learning Objectives:
by the end, participants should be able to...

- Define “antimalarial treatment policy” (ATP)
- List the purposes of the ATP
- List the components of the ATP
- Describe how an ATP is formulated, monitored and updated
- Describe how the ATP utilizes available systems for quality control and quality assurance of antimalarial medicines

Participants should be encouraged to bring their country antimalarial treatment guidelines, which should be discussed during this Learning Unit. It is also important to acquaint participants with the current edition of the WHO *Guidelines for the treatment of malaria*.

It is important to ensure that participants have understood the purpose and content of an ATP. The tutor should answer all of the questions raised by participants, especially on sensitivity of parasites and how the guidelines were developed. The recommendations that new drugs should have a cure rate of at least 95%, and that a drug should be changed if its cure rate falls below 90%, should be stressed.

If the course is being held near the country border, the tutor should be knowledgeable about the problems with the neighbouring countries in relation to cross-border cases.

Tutors and facilitators should be fully conversant with the guidelines, and know which drugs are recommended for first line and second line treatment, and for treatment of severe malaria. This should be backed by facts about the therapeutic efficacy of the drugs and the basis on which the recommendations were developed. Divide the class in three discussion groups A, B and C to discuss the following topics:

Group A

The tutor and facilitators should ensure that the group discussion includes: the justification for change; the gathering of evidence such as the degree of malaria parasite resistance to the current drugs; the building of a national and stakeholder consensus.

Group B

The tutor and facilitators should ensure that the group discussion includes: the training to be undertaken; replacements of existing stocks of medicines; the budget required to effect the changes; involvement of the public and private sector; and achievement of acceptability by all stakeholders.

Group C

The tutor and facilitators should ensure that the group discussion includes: the drugs are procured from sources complying with Good Manufacturing Practice (GMP), quality control and monitoring; the logistics to ensure that sufficient new drugs are available in required quantities where they are needed; and that they are accessible to those who need them throughout the country. Pharmacovigilance issues such as reporting of adverse drug effects, control of illegal drugs and amending of regulations governing importation and use of the drugs should be discussed.

Each group should present a summary of the discussions during the plenary session. The tutor should highlight the salient points.

Closing session

The tutor should lead a discussion on (i) the availability, distribution and quality assurance of antimalarial drugs (ii) the dosage, route of administration and proper use of antimalarial drugs for both treatment and prophylaxis. In addition, concerning the role of private practitioners, the tutor should discuss how they should be given information and emphasize the point that private medical practitioners must follow the national antimalarial treatment policy. Participants should also be invited to raise any other issues relevant to this course.

LEARNING UNIT 11

Routine surveillance and operational research in case management

Learning Objectives:
by the end, participants should be able to...

- Describe the role of evidence-based decisions in malaria case management
- Describe the systems for routine surveillance for evidence gathering
- Demonstrate an understanding of therapeutic efficacy trials of antimalarial medicines
- Describe the principles of operational research
- Identify operational research issues related to malaria case management

The tutor should ask the participants to read Annex 2 of the *Guide for Participants* before attending this Learning Unit.

In the initial plenary session, the tutor should go through the learning objectives and define the terms “surveillance”, “operational research” and other terms such as “sentinel site”. The class should then be divided into three groups to discuss the following topics.

Group A

How is malaria being treated in your country or place of work?

The tutor and facilitators should ensure that the following points are addressed:

- ▶ Adherence to national drug policy at all levels and reasons for non-compliance
- ▶ Anti-malaria treatment practices in the private sector
- ▶ Drug registration and policies and their enforcement
- ▶ Drug importation regulations and their enforcement
- ▶ Home remedies and traditional practices
- ▶ Compliance with recommended dosage of antimalarials
- ▶ Availability of recommended treatments and their packaging
- ▶ Quality control of drugs

Group B

What is the malaria disease burden in your country or place of work?

The tutor and facilitators should ensure that the following are discussed:

- ▶ Presence of an efficient and effective surveillance and epidemiological information system from the periphery to the centre with rapid reporting, analysis and action as necessary
- ▶ Treatment failure monitoring
- ▶ Evidence for antimalarial drug resistance, its distribution and level of resistance
- ▶ Routine surveillance using sentinel sites for longitudinal data gathering to measure morbidity and mortality
- ▶ Establishment of sentinel hospitals to measure trends in severe malaria cases, uncomplicated cases referred to hospital, delays in case management, case fatality rates and the management of severe disease
- ▶ Periodic epidemiological surveys such as the Demographic and Health Survey (DHS)
- ▶ Investigation around cases in low transmission areas
- ▶ Classification of cases
- ▶ The use of Geographical Information System (GIS) to demarcate the origin of cases and clustering as well as vector breeding sites

Group C

What operational research in malaria case management is done in your country or place of work?

The tutor and facilitators should ensure that examples of the following research topics are identified and discussed.

- ▶ Formal systematic review of drug efficacy
- ▶ Surveys to determine compliance, the reasons for non-compliance and suggested solutions
- ▶ Surveys to determine accessibility to the public and availability of antimalarials

- ▶ Health systems research to improve management, efficiency and effectiveness
- ▶ Trials of different antimalarial regimens in different epidemiological situations
- ▶ Trials of new drug formulations and/or combinations
- ▶ Studies to determine the practical use of diagnostic tools and ways to improve their use
- ▶ Studies to improve diagnostic capacities and introduction of new approaches
- ▶ Studies to determine community participation in malaria control
- ▶ Studies to determine the quality of drugs sold in pharmacies
- ▶ Studies to determine the participation of the private sector in malaria treatment and the drugs being used

The groups will present summaries of their discussions in the plenary session. The tutor will then highlight the important points.

LEARNING UNIT 12

Programmatic aspects of case management

Learning Objectives:
by the end, participants should be able to...

- Describe the policies and procedures for the procurement of antimalarial commodities
- Discuss medicine management in the context of a malaria control programme
- Discuss partnership coordination and role of the private sector in malaria case management
- Describe the use of health information systems and reporting in malaria case management

The tutor should ask the participants to read Annex 3 of the *Guide for Participants* before attending this unit. The details of quantification of antimalarial commodities are provided in this Annex.

Successful case management depends on correct programme implementation. This section examines issues pertaining to malaria commodity supply-chain mechanisms, building partnerships for effective programme management, and resource mobilization and strengthening the malaria-related information management systems. The malaria indicators relevant to case management are in Annex 4 of the *Guide for Participants*.

The tutor should introduce the objectives of the Learning Unit during the plenary session. The participants will then be split in three groups to discuss different aspects of programme management.

Group A

Explain the logistics, practices and cycle of procurement of malaria commodities in your country or place of work.

The tutor and facilitators should ensure that the group discusses the following:

1. Availability of data on antimalarial drug usage at all levels of the health system
2. Availability of data on disease burden in different localities and at different times of the year
3. Requisition practices based on disease burden and stock levels. (The “pull” or “push” methods of drug procurement from the centre to the peripheral health facilities are explained in the *Guide for Participants*)
4. Requisition processes – simplicity, time from requisition to delivery, condition upon arrival
5. Purchasing and quality assurance
6. Storage facilities and practices at all levels
7. Transportation methods and mode

The participants in this group should be asked to calculate the amount of a malaria commodity, such as rapid diagnostic test kits, needed in a particular area using the morbidity and consumption data from their country or workplace. The tutor should point the participants to the need for capacity building regarding quantification of antimalarial commodities, costing, and distribution logistics. The methods for undertaking these are presented in the *Guide for Participants*.

Group B

Discuss resource mobilization, partnership coordination, and the role of the private sector in malaria control programmes.

The tutor and facilitators should ensure that the following are discussed:

- ▶ Fund-raising by malaria programmes from ministries of health, international development agencies, bilateral partners, national non-governmental organizations, the business private sector, and client cost-recovery systems
- ▶ Strategic planning for programme funding
- ▶ Close communication and effective negotiation with development partners
- ▶ Sound management of resources
- ▶ Sharing of information by malaria programmes with other stakeholders, with utilisation of information coordinated (preferably) by the national malaria control programme
- ▶ Advocacy for the activities of the programme in both the public and private sectors
- ▶ Improvement of the public perception and credibility of the programme

Group C

Discuss the use of health information systems and reporting.

The tutor and facilitators should ensure that the following are discussed:

- ▶ What malaria data needs to be collected
- ▶ The sources of this data
- ▶ What advantages are derived from the data
- ▶ How does this data flow from the point of collection to the users

The groups should present their findings in the plenary session. The tutor should highlight the key points and emphasize the need for strong partnerships to offer technical and material support for programme implementation. The focus should be on the countries having a national plan, with partnerships as additional and complementary resources in the overall malaria control programme.

The time to be spent on this Learning Unit should be increased in training sessions where most of the participants are Malaria Programme Managers.

Further reading

Basic malaria microscopy. Part I: Learner's Guide, 2nd edition. Geneva, World Health Organization, 2010.

Basic malaria microscopy. Part II: Guide for Tutors. Geneva, World Health Organization, 2010.

Bench aids for the diagnosis of malaria infections. 12 colour plates. Geneva, World Health Organization, 2010.

International travel and health 2010 (updated annually). Geneva, World Health Organization. ISBN 9789241580458. www.who.int/ith

Management of severe falciparum malaria: A practical handbook. Second edition, Geneva, World Health Organization, 2000. ISBN 924154523 2

Severe falciparum malaria. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 2000, 94, supplement 1 (especially pages S1/20-S1/30).

Guidelines for the treatment of malaria. Second edition. Geneva, World Health Organization, 2010. ISBN 9789241547945

<http://www.who.int/malaria/publications/atoz/9789241547925/en/index.html>

Parasitological confirmation of malaria diagnosis. Report of the WHO technical consultation. Geneva, World Health Organization. October 2009.

World Malaria Report 2011. Geneva, World Health Organization. <http://www.who.int/malaria/publications/atoz/9789241564403/en/index.html>

Malaria case management: operational manual. Geneva, World Health Organization, 2009. ISBN 9789241598088.

http://whqlibdoc.who.int/publications/2009/9789241598088_eng.pdf

Universal Access to malaria diagnostic testing: an operational manual. Geneva, World health Organization, 2011. ISBN 9789241502092.

http://whqlibdoc.who.int/publications/2011/9789241502092_eng.pdf

ANNEX 1

Multiple-choice questionnaire for evaluation of trainees

Evaluation by the use of a multiple choice questionnaire offers the advantages of a degree of standardization of the monitoring, being less time-consuming than alternative methods for both participant and tutor, and is beneficial for those who have difficulty in expressing themselves in the language being used. It has the disadvantage of not being able to express alternative scenarios and this is a draw-back especially in medicine where variations are frequent. It is therefore suggested as a compromise that the evaluation of the trainees' progress be measured by means of a series of multiple-choice questions.

It is important to emphasize that in order to validate the questions they must be properly written, meaningful, and as far as possible problem solving rather than recall of memory. Further, to be valid the questions should not offer a set choice, i.e. if the questions ask which 2 of the following 5 replies are correct, then without knowing anything about the subject, the correct answer can be guessed in 20% of cases. To eliminate the bias and distinguish more clearly between those who know the subject and those who guess correctly, one would not indicate how many of the 5 might be correct. In this case negative marking has to be introduced otherwise by checking all 5, total marks could be obtained. It is suggested that for each wrong answer 0.5 of a mark or less be deducted and for each correct answer 1 mark be given.

Two other issues arise: (i) if equal marking is to be used then the questions must have equal difficulty and (ii) to measure progress the pre- and post-test must be of equal difficulty. This can be achieved by offering the same questions in the pre- and the post-test by rearranging the proposed answers and questions in a different sequence.

Writing multiple-choice questions is a difficult task but it can be facilitated by following certain rules, as suggested below.

- ▶ The body of each question should be a complete statement (not just a single word) and the answer should not be dependent on the answer to any other questions on the page.
- ▶ Do not overburden the question with unrelated details and avoid negative statements, but if unavoidable then highlight them to draw them to the attention of the participants.
- ▶ Use plausible or logical distractors in the possible answers – each distractor must appear to have something to do with the question otherwise it will appear nonsensical.
- ▶ Ensure that the distractors and the correct response are fairly similar in content or in the total number of words.
- ▶ Avoid clues that may suggest the correct answer and be cautious about the use of “some of the above” as a distractor or correct answer. This is especially important if the same questions are used for the pre- and post-tests, in which case rearrange the sequence of possible answers.
- ▶ If it is not possible to obtain more than three plausible responses, do not waste time trying to invent others.

- ▶ Items that have numerical answers should have them arranged in order from large to small or vice-versa;
- ▶ Review the test paper as a whole and ensure that no letter or number corresponding to the correct answer appears more frequently than some other letter.

The following are some example types of multiple-choice questions. It is good practice to mix several different types in one examination paper.

One “best” response type

Question 1

Which one of the following is the commonest species of Plasmodium causing malaria in sub-Saharan Africa?

- A. *Plasmodium falciparum*
- B. *Plasmodium malariae*
- C. *Plasmodium ovale*
- D. *Plasmodium vivax*

Multiple type response

Question 2

Which of the following may sometimes contribute to malaria treatment failure:

- A. Parasite resistance to antimalarial drugs
- B. Non-compliance with dosing regimen
- C. Substandard or counterfeit drugs
- D. Misdiagnosis

The choice could be:

- only (A) and (B) are correct
- only (C) and (D) are correct
- only (B) and (C) are correct
- all of the above are correct

The “matching” type

These are more difficult to construct but in doing so remember to:

- Limit the number of entries to 10 or less
- Do not break items at the bottom of a page
- Have a longer list of questions than of possible answers but state in the directions that they may be used more than once

Questions 3–8

Below are features of severe malaria numbered from 3 to 8 and a possible component of that feature lettered from *a* to *e*. For each of the numbered features of severe malaria, select the most appropriate lettered component and mark that letter in the answer box against the numbered items. Each lettered component may be selected once, more than once, or not at all.

Features of severe malaria:

- | | |
|----------------------------------|----------------------------|
| 3. Altered consciousness or coma | <input type="checkbox"/> c |
| 4. Convulsions | <input type="checkbox"/> d |
| 5. Severe anaemia | <input type="checkbox"/> b |
| 6. Neurological sequelae | <input type="checkbox"/> d |
| 7. Hypoglycaemia | <input type="checkbox"/> e |
| 8. Pulmonary oedema | <input type="checkbox"/> a |

Possible components:

- Difficulty in breathing with an increased respiratory rate
- Destruction of red blood cells that contain parasites
- Sequestration of parasites in the brain
- Cerebral malaria
- Can be corrected by infusing dextrose

The comparison type

The comparison type questions permit one to compare and contrast situations or events.

A list of numbered words or phrases below is followed by a set of lettered components. Mark the answer column against each numbered word or phrases:

Mark a) if the item is associated with (a) only

Mark b) if the item is associated with (b) only

Mark c) if the item is associated with both (a) and (b)

Mark d) if the item is associated with neither (a) nor (b)

Questions 9–12*Situations:*

- | | |
|--|----------------------------|
| 9. Monitoring antimalarial drug efficacy | <input type="checkbox"/> a |
| 10. Administrating rectal artesunate | <input type="checkbox"/> b |
| 11. Reducing malaria burden | <input type="checkbox"/> c |
| 12. Managing black water fever | <input type="checkbox"/> d |

Possible components:

- a) Effective antimalarial drug policy
- b) Pre-referral treatment for severe malaria
- c) Both
- d) Neither

True-false type questions should not be used and have not been included here. Where possible during the planning examination, try to pose a problem situation, perhaps based on your own experience, and then ask searching questions about what you would do and suggest the answers. The question can be of any of the types noted above.

ANNEX 2

Questionnaire for evaluation of training course

AN2

Instructions for completion of questionnaire

Use the following code to indicate the extent to which you agree or disagree with each of the statements made in the questionnaire:

1. Disagree strongly
2. Disagree
4. Agree
5. Agree strongly

These numbers are printed alongside each question. You should tick (✓) the number that corresponds most closely to your opinion.

The difference between options 1 and 2 and between options 4 and 5 is one of degree only. To oblige you to express a definite opinion, **no code 3 has been included** (except for question 12); this allows a “satisfaction index” to be calculated for each question.

Take your time over completing the questionnaire. You do not have to put your name on it if you would rather not, but please answer the questions as frankly as possible.

SECTION I. Overall assessment of the training activity

1. Overall the organization of the training programme was satisfactory. (1)(2)(4)(5)

Comments

.....

2. The training programme covered all the subject matter in adequate detail. (If you disagree with this, state which subjects should have been given greater coverage.) (1)(2)(4)(5)

Comments

.....

3. The tutors and facilitators for this training course had sufficient knowledge and teaching ability to provide you with the necessary skills and competence. (1)(2)(4)(5)

Comments

.....

4. The time allocated to each part of the training was adequate relative to the total time available. (If you disagree, state which particular topic should have been allotted more or less time.)

(1)(2)(4)(5)

Comments

.....

SECTION II. Relevance and usefulness of the different teaching methods

5. Overall, the teaching methods used in this training course were effective. (1)(2)(4)(5)

6. The use of the various teaching methods listed below was appropriate. (1)(2)(4)(5)

A) Large group presentations including plenary sessions

Comments

.....

B) Practical demonstrations (laboratory) (1)(2)(4)(5)

Comments:

.....

C) Laboratory work and facilities (including equipment) (1)(2)(4)(5)

Comments

.....

D) Field work (1)(2)(4)(5)

Comments

.....

E) Small group discussions (1)(2)(4)(5)

Comments

.....

F) Self-study (1)(2)(4)(5)

Comments

.....

G) Quizzes, tests and other evaluation exercises (1)(2)(4)(5)

Comments

.....

SECTION III. Assessment of teaching materials

7. The audiovisual materials (slides, overhead projection, etc.) used in the training were very helpful. (1) (2) (4) (5)

Suggestions for improvement

.....

8. The teaching materials provided were satisfactory in all respects. (1) (2) (4) (5)

Suggestions for improvement

.....

SECTION IV. Implementation of training; attitude of tutor and facilitators

9. The general atmosphere of the training course made this a good learning experience. (1) (2) (4) (5)

Comments

.....

10. Every effort was made to help you achieve the learning objectives. (1) (2) (4) (5)

Comments

.....

11. You were able to achieve all the learning objectives of the training programme. (1) (2) (4) (5)

Comments

.....

SECTION V. Overall evaluation of the training

12. What overall rating would you give to this training programme? (Tick your response)

(1)

(2)

(3)

(4)

(5)

Lowest

Highest

13. With regard to this training experience, state the following, giving actual examples:

a. three aspects that impressed you most favourably

b. three aspects that impressed you least favourably

14. If you have any additional comments regarding any aspect of the training programme, please note them below.

Analysing response to the questionnaire

The following method will allow the tutor to analyse the responses to the questionnaire simply and quickly. Take a fresh (uncompleted) copy of the questionnaire; against each question, mark the participants' responses. For example:

Overall, the teaching methods used in this training course were effective.

1	2	4	5

This shows that two participants considered the teaching methods were not effective while 28 agreed that they were effective.

Now multiply the number of answers by the corresponding coefficient:

$$(2 \times 2) + (10 \times 4) + (18 \times 5) = 4 + 40 + 90 = 134$$

The "satisfactory index" is calculated as a percentage. For the above example, the number 134 is multiplied by 20 (i.e. 100 divided by the maximum coefficient, 5) and divided by 30 (the number of participants):

$$(134 \times 20) / 30 = 89.3\%$$

Since the satisfaction index is calculated in such a way that 60% represents "average" satisfaction, you should make a note of any questions for which the index is below 60% (if there is none, identify the 5 questions for which the index is lowest and the 5 for which it is highest). Provide the participants with the results of this questionnaire at the final evaluation session on the last day of the training programme.

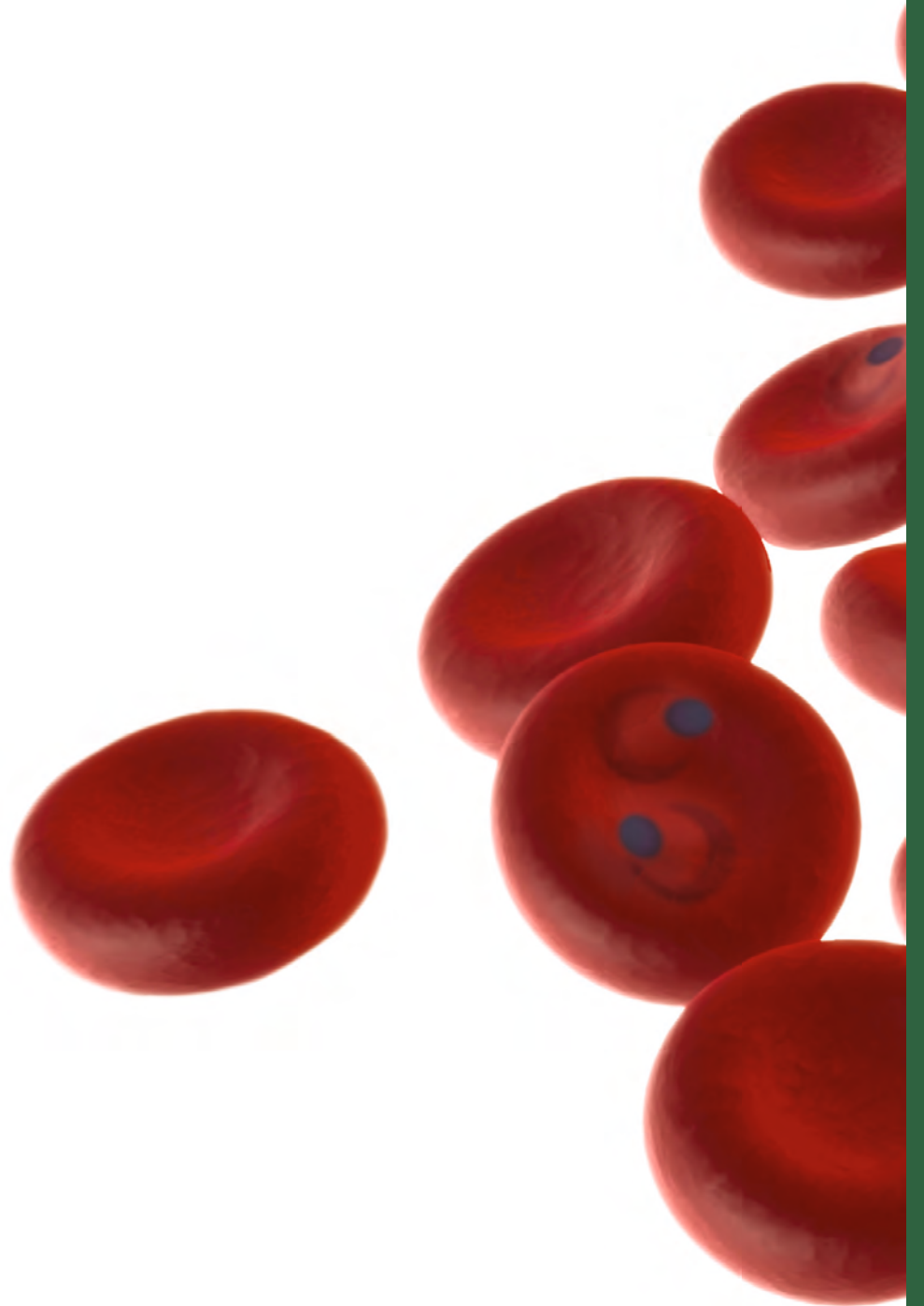
ANNEX 3

Commonly used methods of teaching and their objectives

TEACHING METHOD	PURPOSES
<p>Audio tapes</p> <p>May be used with large or small groups of participants or by the individual participant.</p>	<ul style="list-style-type: none"> • To guide practical work. • As a variation in the method of presentation of material. • For the acquisition of new knowledge.
<p>Brainstorming</p> <p>Intensive discussion focusing on a single problem. Participants are asked to develop as many solutions as possible to a problem within a limited time – generally not more than 10 minutes. No critical evaluation of solutions is offered.</p>	<ul style="list-style-type: none"> • For developing new and creative ideas. • As a prelude to detailed, in-depth problem-solving.
<p>Buzz-groups</p> <p>Groups of 2–4 participants discuss a particular topic for a short time – generally no more than 5 minutes – within the context of a large-group lecture.</p>	<ul style="list-style-type: none"> • To encourage all participants to participate. • To develop group cohesion and encourage participants to help one another. • To “rehearse” understanding and thus consolidate factual learning. • To stimulate creative thinking.
<p>Case discussion</p> <p>Real or hypothetical problems are analysed in detail. Participants are encouraged to find solutions and make decisions.</p>	<ul style="list-style-type: none"> • To help in understanding the facts underlying the problems and to eliminate misconceptions. • To show how various principles are applied to real problems.
<p>Controlled discussion</p> <p>Under the control of the tutor, participants are encouraged to ask questions, raise problems and make comments following a lecture.</p>	<ul style="list-style-type: none"> • To provide further consideration of factual learning. • To bring together and synthesize the contents of a lecture and provide feedback to tutor and participants.
<p>Demonstrations</p> <p>Certain procedures are performed by the tutor to demonstrate skills that must be acquired by participants.</p>	<ul style="list-style-type: none"> • To help develop participants’ power of observation. • To provide knowledge of principles as a prelude to participants practising the skills for themselves.
<p>Video tapes</p>	<ul style="list-style-type: none"> • For development of skills in interviewing, counselling, etc. • To allow participants to see themselves “in action”. • To provide participants with direct feedback.
<p>Free group discussion</p> <p>Discussion in which the content and direction are principally controlled by the participants. The role of the tutor is that of an observer.</p>	<ul style="list-style-type: none"> • To develop effective small-group functioning. • To help participants establish the practice of self-learning. • To allow the tutor to observe developments in the participants’ problem-solving skills.

TEACHING METHOD	PURPOSES
<p><i>Group tutorial</i></p> <p>Tutorial with 12–15 participants. The subject and direction are usually, but not invariably, under the control of the tutor.</p>	<ul style="list-style-type: none"> • To facilitate understanding of particular topics, and bring together ideas. • To develop group-functioning skills.
<p><i>Projects</i></p> <p>Varied in format and content, but generally submitted as a written exercise by a small group of participants or by individuals.</p>	<ul style="list-style-type: none"> • To develop skills in gathering organizing, applying and illustrating information in the context of a particular problem. • To provide practice in the presentation of data.
<p><i>Private reading</i></p>	<ul style="list-style-type: none"> • To assist in acquiring and understanding new information. • To assist the development of critical thinking skills. • To develop an ability to select and retrieve relevant information.
<p><i>Role-playing</i></p> <p>Participants are assigned or select certain roles (e.g. village leader, mosquito collector), then create and act out typical situations. It is essential that the content of the role-play is discussed at length by participants and observers; without this, the exercise has little value.</p>	<ul style="list-style-type: none"> • To develop “self-awareness”, i.e. to help the participant appreciate the effect that his or her attitudes have on other people. • To improve attitudes and behaviour by encouraging the participant to “get into the skin” of another person.
<p><i>Seminar</i></p> <p>Presentation of material by one participant to a group of fellow participants, followed by critical analysis and discussion. The presence of the tutor is not essential.</p>	<ul style="list-style-type: none"> • To present new information. • To help with understanding of new material.
<p><i>Individual tasks</i></p> <p>The type of task assigned to the individual participant may vary, but it will generally be a problem to be solved within or outside the classroom situation.</p>	<ul style="list-style-type: none"> • To foster active, direct learning. • To develop problem-solving skills. • To provide a context in which the tutor can help participants to remedy particular weaknesses.
<p><i>Lecture</i></p> <p>The “classical” lecture is an uninterrupted talk by the tutor to a group of participants, generally lasting about 1 hour. The form may be modified and used in conjunction with “buzz groups”, syndicate groups, etc.</p>	<ul style="list-style-type: none"> • To impart general background knowledge of a particular subject. • To synthesize a wide variety of information into a coherent whole.

TEACHING METHOD	PURPOSES
<p><i>Practical classes</i></p> <p>Participants perform experiments, write up their results, and draw appropriate conclusions.</p>	<ul style="list-style-type: none"> • To develop powers of observation. • To develop familiarity with equipment and skill in its use. • To develop problem-solving through collection, analysis and evaluation of data.
<p><i>Problem-centred groups</i></p> <p>Problem solving in the classroom situation by groups of 4–8 participants, partly under the direction of the tutor.</p>	<ul style="list-style-type: none"> • To develop skills in analysing and solving problems and in decision-making. • For practice in applying theoretical knowledge to “real” problems.
<p><i>Step-by-step lecture</i></p> <p>A lecture format linked to an organized presentation, for example, a set of 35-mm slides or a number of multiple-choice questions.</p>	<ul style="list-style-type: none"> • To impart new information and reinforce its understanding.
<p><i>Step-by-step discussion</i></p> <p>Working with a small group of 8–10 participants, the tutor directs a discussion centred on a particular issue or a set of pre-prepared questions. The intention is to draw out from the participants the required information.</p>	<ul style="list-style-type: none"> • To present new factual material. • To help participants in the process of scientific and deductive reasoning and of drawing appropriate conclusions.
<p><i>Syndicate group</i></p> <p>The class is divided into groups of 4–6 participants; all groups work on the same, or closely related, problems, with occasional teacher contact. Each group prepares a report, which is presented to the rest of the class. The syndicate group technique can be used in conjunction with tutorials.</p>	<ul style="list-style-type: none"> • To develop skills in seeking out, organizing and presenting information. • To foster cooperation between Participants in planning, writing and presenting a report.



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