The MalariaCare Toolkit

Tools for maintaining high-quality malaria case management services

National malaria microscopy competency assessment and accreditation course: Facilitator’s manual for Zambia

Note: Zambia’s national program was the first under the MalariaCare project to implement a national malaria microscopy competency assessment program to assess routine malaria microscopists. The program was adapted from the World Health Organization External Competency Assessment of Malaria Microscopy course. Other countries may find such an exercise useful for building competency in malaria microscopy and strengthening quality assurance systems. In such cases, this example may be adapted for the specific context.

Download all the MalariaCare Tools from: www.malariacare.org/resources/toolkit
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1.0 **Introduction to the malaria microscopist competency assessment**

1.1 WHO external competency assessment overview

In 2005, the World Health Organization (WHO) Regional Offices for the Western Pacific and South-East Asia and partners including the Asian Collaborative Training Network for Malaria and the Research Institute for Tropical Medicine (Philippines) developed a bi-regional program to accredit malaria microscopy competency.¹ Since 2011, external competency assessments (ECAs) have been conducted in more than 14 countries, including a number of countries in the Africa region. A major objective of the ECA is to assist national malaria programs in building capacity for national or reference-level core groups whose skills can be utilized both in country and regionally.

The objectives of the ECA are:

1. Help to develop a national core group of expert microscopists in participating countries who are accredited to internationally recognized standards for malaria microscopy. This group would ideally form a multi-country or regional network that can be used for training and accreditation initiatives.

2. Provide formal certification of the competency of microscopists, to:
   a. Provide recognition of individual skill level thus providing acceptability for cross-checking and training programs.
   b. Standardize practices between countries performing malaria microscopy and standardize monitoring activities.
   c. Increase self-esteem of microscopists and confidence among providers and users of diagnostic results, and provide well-defined and attainable goals.
   d. Advocate to link results to a career structure.

Since the scope and audience of the ECA are very specific and participation is limited to 12 individuals per course (drawing from multiple countries at one time), the ECA is not an appropriate method to use to assess the competency of routine malaria microscopists. Therefore, the National Malaria Elimination Center is establishing procedures and standards to assess the competency of routine malaria microscopists through a nationally recognized accreditation program called the Zambian Competency Assessment.

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1.2 Zambian Competency Assessment overview

As mentioned above, the objectives, methods, and assessment criteria used to develop the national competency assessment (NCA) were based on the WHO ECA program. While there is significant overlap between program objectives, major differences are associated with the intended audience and the stringency of the assessment criteria.

The major objectives of the NCA are to:

1. Help to identify a core group of national experts who will lead training at both the national and provincial levels.
   - Selection should be based on their national accreditation scores, their relative ability to do well in the ECA (goal is to attain an ECA score of Level 1 or Level 2), and their capacity to function as a trainer of trainers.

2. Establish and certify a group of subnational (provincial) microscopy trainers who can perform health facility quality assurance visits.
   - This cadre of supervisors should demonstrate high-quality and consistent microscopy skills over time.

3. Assess and certify skills of lead microscopists working in any health facility where malaria microscopy services are offered.
   - This cadre of lead microscopists should demonstrate skills at a high enough level to train subordinates within their facility and practicing microscopists at lower-level health facilities.

4. Establish and certify basic minimum competencies for laboratory staff performing malaria diagnosis at the referral and peripheral levels.
   - In order to ensure microscopy quality, the course will seek to accredit microscopists based on a minimum standard necessary to perform high-quality microscopy.

5. Advocate to link results to a career structure.

This manual outlines the major components and implementation of the NCA.
2.0 Introduction to the national competency assessment facilitator’s manual

2.1 Aim of this manual

This facilitator’s manual is designed to support implementation of the NCA and to familiarize facilitators with the objectives and methods for assessment, grading, and communication of final results to participants.

2.2 Goal

The goal of this guide is to facilitate a well-planned NCA workshop.

2.3 Objectives

The objectives of this manual are to:

- Provide an overview of the NCA course, including content, learning units, and teaching/assessment methodologies applied in this course.
- Create a NCA package that includes specific documents and tools that will be used by facilitators and participants.
3.0 Role of the facilitator

3.1 Facilitator responsibilities

The NCA lead facilitator is a WHO-certified Level 1 (expert) or Level 2 microscopist with significant teaching experience in malaria diagnostic methods and quality assurance. Co-facilitation can be supported by highly experienced trainers with known competency in malaria microscopy. The facilitator is responsible for implementing high-quality education on malaria microscopy and creating an environment for participants to thrive during examination. The facilitator will be responsible for assessing both the qualitative and quantitative aspects of the NCA. In order to successfully accomplish his/her responsibilities, it is critical that the course content, course structure, and training skills are mastered prior to the workshop.

The facilitator will be responsible for troubleshooting problems (logistical and technical) that may arise during the workshop and identifying solutions in order to minimize disruption. The facilitator also will contribute to the overall cohesion of the class and be able to assess if the concepts or instructions are fully understood and when they are not. It is important that the facilitator creates an environment in which participants feel comfortable to freely ask questions and actively participate in discussions around NCA objectives.

Specific responsibilities include:

- Communicate the importance of the NCA.
- Explain and demonstrate interpersonal communication skills.
- Give clear instructions during training and assessments and verify participants’ understanding.
- Manage time during the NCA by starting and ending on time and completing all modules and assessments outlined in the course.
- Ensure that participants remain attentive, involved, and engaged.
- Provide participants with constructive feedback during training to motivate and improve their performance.
- Evaluate the skills and competency of each participant.

3.2 Using this guide

This guide should be used during both the planning and implementation phases of the course.
4.0 Preparing for the workshop

This section describes the various activities and concepts the facilitator needs to consider when planning the course.

4.1 Workshop duration

The course is conducted over five consecutive days.

4.2 Plan with national and subnational authorities

It is important to communicate training plans and intentions with planners at both the national and subnational levels, as their approval and endorsement of the activity is critical for strong attendance and implementation. These communications are especially important when identifying and selecting the most appropriate participants. In addition, it is helpful to understand the different possible logistical constraints from province to province (e.g., availability of equipment or supplies, power supply).

4.3 Participant selection and characteristics

The identified staff should be working mainly in the malaria/parasitology section of the laboratory and performing routine malaria microscopy. Health facilities such as central and provincial-level hospitals that serve a large proportion of the population may be given the highest priority.

4.4 Venue selection and length of course

An appropriate venue should be chosen based on the following specifications:

- A room that can accommodate both teaching and practical laboratory work, or separate rooms for teaching and practical laboratory work.
- One functioning microscope available per participant.
- Electricity and/or access to a reliable and well-fueled power generator.
- A facility to provide morning and afternoon tea and lunch to the participants.
- Transport to collect additional supplies and secretarial assistance.
- Access to printing and photocopying is an added advantage.
- Nearby accommodations for facilitators and participants.

4.5 Required supplies, equipment, and materials

Supplies and equipment should be organized well in advance of the training. Microscope quality should be inspected by the facilitators to ensure that all necessary components are available (e.g., 100X immersion oil
objective, etc.). Extra microscope bulbs should be kept on hand. A list of equipment, supplies, and reagents required for this training can be found in Annex 1.

4.6 Course agenda and timetable

In order to carry out a successful NCA, it is critical that facilitators become familiar with the course agenda. If there is more than one facilitator, it will be important to identify which learning units will be conducted by which facilitator based on areas of expertise. Assessment exercises should be well planned the evening before.

In order to become familiar with the course, it is important to review the sequence of all learning and assessment modules.

The following activities should be conducted in order to become familiar with the course content and structure:

- Review the curriculum and assessment requirements.
- Review the timetable and plan ahead for practical assessments.
- Decide on the number of participants (ideally not to exceed 20).
- Determine the space needed (lecture and laboratory space) to accommodate participants.
- Confirm the number of facilitators and responsibilities for each facilitator.
- Decide which modules each facilitator will teach.
- Review the list of supplies, equipment, and other materials required and initiate procurement.
- Consider the time it will take each day/ evening to grade daily malaria microscopy competency assessments.
- Plan other activities, such as opening and closing ceremonies, certification, and follow-up.

Table 1 on the following page outlines the course agenda and timetable.

4.7 Calendar of activities for preparation

A well-conceived work plan and calendar outlined with clear roles and responsibilities is essential for staying organized and prepared. Each facilitator should consult both the work plan and calendar to see which activities he/she was assigned.
<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30-9:00</td>
<td>Opening remarks</td>
<td>Review slides</td>
<td>Review slides</td>
<td>Review slides</td>
<td>Review slides</td>
</tr>
<tr>
<td>9:00-10:00</td>
<td>Introduction to NCA</td>
<td>Diagnostics overview</td>
<td>Artifacts, pseudoparasites, and mixed infections</td>
<td>Microscopy quality assurance</td>
<td>Distribution of final grades</td>
</tr>
<tr>
<td>10:00-11:00</td>
<td>Theoretical pre-assessment</td>
<td>Preparing blood films</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00-11:15</td>
<td>Tea break</td>
<td>Tea break</td>
<td>Tea break</td>
<td>Tea break</td>
<td>Tea break</td>
</tr>
<tr>
<td>11:15-12:15</td>
<td>Slide preparation pre-assessment</td>
<td>Staining with Giemsa</td>
<td>Slide preparation assessment</td>
<td>Microscopy examination review – open for questions</td>
<td>Small group discussions on training gaps, impression of the course</td>
</tr>
<tr>
<td>12:15-1:15</td>
<td>Review of slide preparation quality standards</td>
<td>Examining blood films</td>
<td></td>
<td></td>
<td>Plenary sessions (group presentations)</td>
</tr>
<tr>
<td>1:15-2:15</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
<td>Lunch</td>
</tr>
<tr>
<td>2:15-5:15</td>
<td>Malaria microscopy pre-assessment</td>
<td>Malaria microscopy assessment Day 2</td>
<td>Malaria microscopy assessment Day 3</td>
<td>Malaria microscopy assessment Day 4</td>
<td>Closing remarks and participant departure</td>
</tr>
<tr>
<td>5:15-5:45</td>
<td>Tea break and facilitator meeting</td>
<td>Tea break and facilitator meeting</td>
<td>Tea break and facilitator meeting</td>
<td>Tea break and facilitator meeting</td>
<td></td>
</tr>
</tbody>
</table>
5.0 Course monitoring and evaluation

This course utilizes a 360-degree approach to assessment, meaning the course participants are evaluated as well as the facilitators.

Overall evaluation of course participants
- Pre-assessments (theory and practical).
- Observation by facilitators.
- Daily competency assessments to measure performance in slide reading during the course.
- Post-assessments.

Course evaluation by participants
At the end of the course, the participants will be asked to fill out a standard evaluation form. The evaluation is conducted anonymously and addresses both technical and logistical issues.
6.0 National competency assessment course structure

The NCA can be opened by a representative from the central level; for example, from the National Malaria Elimination Center or the National Reference Laboratory. The opening statement should be given by a well-respected opinion leader who is recognized nationally in the field of malaria diagnostics in order to increase the motivation of the participants. Additionally, this individual should effectively express the strong interest and commitment of the Minister of Health in the NCA program.

6.1 Training methods

The facilitators will need to become familiar with the different training methods used during this course. Each method will require a specific approach in terms of logistics and preparation. It is expected that each facilitator will apply the relevant communication skills and knowledge to each training/assessment method.

The major learning tools used during this course are as follows:

- **Pre-assessments**: To measure baseline knowledge of theory and slide preparation.
- **Learning units**: Composed of a lecture using a corresponding PowerPoint presentation.
- **Competency assessments**: For preparation of malaria blood films and malaria and malaria microscopy. This activity requires advanced planning during facilitator meetings.
- **Facilitator meetings**: To review the day’s activities, troubleshoot any problems, plan for the next day’s activities, assemble slide sets, and grade the daily microscopy assessment.
- **Post-assessments**

6.2 Course structure overview

The NCA will be conducted over a period of five consecutive days and is composed of both learning and assessment modules. The learning modules will be didactic and focus on the baseline knowledge participants possess and seek to improve upon. Pre-assessment of relevant malaria theoretical knowledge, blood film preparation, and malaria microscopy will occur on Day 1. Days 2 through 4 will comprise both learning units (Annex 2) and assessment modules for preparing malaria blood films and malaria microscopy assessment of skills (detection, species identification, and parasite quantitation). Final grades will be presented on Day 5, and group discussions will be held on how to implement lessons learned once participants return to their field work. Table 2 below provides an overview of assessments that will require planning, such as preparation of slides or reagents the day before.

---

Table 2. Overview of assessments.

<table>
<thead>
<tr>
<th>Day 1 Pre-assessment</th>
<th>Day 2 Assessment modules</th>
<th>Day 3 Assessment modules</th>
<th>Day 4 Assessment modules and grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical</td>
<td>Slide preparation</td>
<td>Slide preparation</td>
<td></td>
</tr>
<tr>
<td>Slide reading</td>
<td>Slide reading</td>
<td>Slide reading</td>
<td>Slide reading</td>
</tr>
</tbody>
</table>
7.0 Pre-assessment overview

All pre-assessments will be administered on Day 1 and be used to gather baseline information on both individuals and the group.

7.1 Theory-based knowledge

Microscopists should be familiar with both the diagnostic aspects of malaria as well as the Plasmodium parasite lifecycle, how infection causes disease, and have a basic understanding of treatment for both uncomplicated and severe malaria infection. The pre-course test is in multiple choice format and is used to assess the group’s underlying knowledge base. The results will be used by the instructor to provide targeted learning during didactic lectures on Day 1 and for practical instruction during Days 2 through 4. Theoretical knowledge base, however, will not be part of the course final grade.

7.2 Blood film preparation

A pre-course assessment will be conducted to evaluate individual and group skill levels related to preparing thin and thick blood films. The instructor will make note of common errors on participants’ pre-assessments and address these identified issues during specific learning modules. Course participants will conduct a self-assessment of their blood films to become familiar with the ten quality standards that will be used by facilitators to compute their final assessment score.

Each participant will prepare two blood films on one slide, one thick film and one thin film, and submit the slide for grading. Each film will be scored against standard criteria (see Table 4 in Section 8.0) and be worth 10 points. Both film scores will be combined into a composite score by adding the results for the thick and thin films together. The maximum number of points possible for this exercise is 20 (10 points for each film). The next morning, participants will assess their own slides using the standard criteria, prior to receiving their final score from the instructor.

7.3 Malaria microscopy

Baseline scores will be obtained for malaria microscopy skills based on parasite detection, species identification, and slide preparation. Each participant will read a total of 19 unique slides and be given ten minutes per slide. Facilitators will use the table below to create the pre-assessment slide sets (one slide set per participant).
Table 3. Pre-assessment slide set composition.

<table>
<thead>
<tr>
<th>Pre-assessment slide set</th>
<th># unique slides</th>
<th># slides parasite detection</th>
<th>Species ID</th>
<th># of counting slides</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Plasmodium falciparum</em> (Pf)</td>
<td>9</td>
<td>5 slides of:</td>
<td>5 slides of:</td>
<td>4 slides of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 Pf 50-100 p/µl</td>
<td>Same as in previous column</td>
<td>1 Pf 500-1,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Pf 100-200 p/µl</td>
<td></td>
<td>1 Pf 5,000-10,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Pf (density N/A)</td>
<td></td>
<td>1 Pf 10,000-50,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Pf (density N/A)</td>
<td></td>
<td>1 Pf 50,000-100,000 p/µl</td>
</tr>
<tr>
<td><em>Plasmodium vivax</em> (Pv)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placental malaria (Pm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>7</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mixed:</td>
<td>3</td>
<td>3</td>
<td>3 slides of:</td>
<td>-</td>
</tr>
<tr>
<td><em>Plasmodium falciparum</em> (Pf)</td>
<td></td>
<td></td>
<td><em>Pf/Po</em> (density N/A)</td>
<td></td>
</tr>
<tr>
<td><em>Plasmodium ovale</em> (Po)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total # unique slides</td>
<td>19</td>
<td>15</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Results will be returned the following morning for a detailed review using the microscope. Participants also will be given one hour to review their answers against the slides.
8.0 Assessment overview

Assessments will be conducted over a period of three days (Days 2–4). The assessment component is composed of two parts:

1. Preparation of thick and thin blood films.
2. Microscopy slide reading skills and assessment of skills (parasite detection, species identification, and parasite quantitation).

A composite score based on results from the three daily assessments will be provided on the final day of the course.

8.1 Assessing participant preparation of thick and thin blood films

Each participant will be assessed on ability to prepare good-quality blood films. The thick and thin films will be prepared on the same slide. Each slide will be assessed on the ten quality standards listed in Table 4.

Each quality standard is worth 1 point, for a composite score of 10 points per film. Participants will prepare two blood films, one thick film and one thin film, and submit for grading. The maximum number of points that can be scored for this exercise is 20.

Table 4. Ten quality standards for malaria blood films.

<table>
<thead>
<tr>
<th>Quality standards for malaria blood films</th>
<th>#1</th>
<th>#2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Is the blood film labeled correctly?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Is the thick film of adequate size (~10 mm in diameter) or 90% intact?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Does the thick film have correct the thickness? (Can you read it through newsprint?)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Are the white blood cells in the thick film properly stained? (Nuclear material should be purple.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Are the red blood cells in the thick film completely lysed?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Does the thin film have a feathered edge?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Do the red blood cells appear in a single layer at the feathered edge?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Do the red blood cells show correct staining? (Color should be pink.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Is the parasite stained correctly? (The cytoplasm is stained blue and the chromatin appears as a pinkish dot.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Do both the thin and thick smears have transparent backgrounds (i.e., debris does not interfere with a normal reading of each)?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Individual film scores**

**Composite slide score**

Scoring: 17/24 points (≥85 percent correct) is required to pass this component.
8.2 Assessing participant malaria microscopy competency

Participants will be assessed on parasite detection (absence/presence of parasites), species identification, and counting (parasite density measured in parasites/microliter). Each slide will be examined for a maximum of ten minutes under strict “examination conditions.” Participants must not communicate in any way with any person other than an examiner.

8.2.1 Proposed slide sets for the microscopy competency assessment

Facilitators will need to assemble slide sets for each day for all participants (this should be done prior to the start of the course). The slide sets will be used to assess different skills, such as parasite detection, species identification, and parasite quantitation. The slide sets will comprise a different number of slides and composition, including negatives, species, and density.

8.2.2 Conducting the malaria microscopy assessment

Tables 5 and 6 below provide a breakdown of the total number of slides that will be examined each day by category (e.g., number of slides examined for parasite detection, number of slides examined for parasite identification, and number of slides examined for counting). Again, it is important to assemble slide sets before the course begins or each evening in order to avoid serious delays.

As mentioned above, malaria microscopy assessments will be conducted during Days 2 through 4. Each participant will receive one slide set.

Slide sets for Days 2 and 3 are composed of 19 unique slides each. Participants will be responsible for reading 38 slides over the two-day period. For assembling slide sets for assessment Days 2 and 3, use Table 5.

**Table 5. Day 2 and Day 3 slide set composition.**

<table>
<thead>
<tr>
<th>Days 2 and 3 assessment slide set</th>
<th># unique slides</th>
<th># slides parasite detection</th>
<th>Species ID</th>
<th># of counting slides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasmodium falciparum (Pf)</td>
<td>9</td>
<td>5 slides of:</td>
<td></td>
<td>4 slides of:</td>
</tr>
<tr>
<td>Plasmodium vivax (Pv)</td>
<td></td>
<td>2 Pf 50-100 p/µl</td>
<td>Same as in previous column</td>
<td>1 Pf 500-1,000 p/µl</td>
</tr>
<tr>
<td>Placental malaria (Pm)</td>
<td></td>
<td>1 Pf 100-200 p/µl</td>
<td></td>
<td>1 Pf 5,000-10,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Pv (density N/A)</td>
<td></td>
<td>1 Pf 10,000-50,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 Pm (density N/A)</td>
<td></td>
<td>1 Pf 50,000-100,000 p/µl</td>
</tr>
<tr>
<td>Negative</td>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed:</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasmodium falciparum (Pf)</td>
<td></td>
<td>3 slides of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasmodium ovale (Po)</td>
<td></td>
<td>Pf/Po (density N/A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total # unique slides</td>
<td>19</td>
<td>14</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

The slide sets for Day 4 are composed of 18 unique slides each. For assembling slide sets for assessment Day 4, use Table 6 below.
Table 6. Day 4 slide set composition.

<table>
<thead>
<tr>
<th>Day 4 assessment slide set</th>
<th># unique slides</th>
<th># slides parasite detection</th>
<th>Species ID</th>
<th># of counting slides</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Plasmodium falciparum (Pf)</em></td>
<td>8</td>
<td>2 slides of:</td>
<td></td>
<td>4 slides of:</td>
</tr>
<tr>
<td>Placental malaria (Pm)</td>
<td></td>
<td>1 Pm 50-100 p/µl</td>
<td>Same as in previous column</td>
<td>1 Pf 500-1,000 p/µl</td>
</tr>
<tr>
<td><em>Plasmodium ovale (Po)</em></td>
<td></td>
<td>1 Po (density N/A)</td>
<td></td>
<td>1 Pf 5,000-10,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Pf 10,000-50,000 p/µl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Pf 50,000-100,000 p/µl</td>
</tr>
<tr>
<td>Negative</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed:</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plasmodium falciparum (Pf)</em></td>
<td></td>
<td>4 slides of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plasmodium ovale (Po)</em></td>
<td></td>
<td><em>Pf/Po</em> (density N/A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total # unique slides</td>
<td>18</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

8.2.3 Scoring the malaria microscopy assessment

A composite score for the malaria microscopy assessment is tallied by summing results from Days 2, 3, and 4. For instance, a composite score will be calculated for each microscopy skill, such as parasite detection, species identification, and parasite quantification, using data from Days 2, 3, and 4. The final score is converted into a percentage by dividing the number of correct answers by the total number of slides examined and multiplying by 100. Table 7 provides detail on the scoring for this assessment, as well as roles for each level of accreditation and actions to be taken based on assessment results.

- **Parasite detection**: Slides for which there is agreement on presence or absence of parasites, divided by ALL slides inspected for parasite detection.
- **Parasite quantification**: Slides for counting parasite density within 25 percent of true count (upper or lower limit), divided by all counting slides.
- **Species identification**: Slides for which there is agreement on species, divided by ALL slides with parasites.

Table 7. Scores for malaria microscopy assessment.

<table>
<thead>
<tr>
<th>Level</th>
<th>Parasite detection</th>
<th>Species ID</th>
<th>Parasite quantitation (±25% of true count)</th>
<th>Recommended roles</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced accreditation</td>
<td>≥90%</td>
<td>≥90%</td>
<td>≥50%</td>
<td>National trainer OTSS supervisor Reference laboratory director/lead technician</td>
<td>Eligible for WHO accreditation</td>
</tr>
<tr>
<td>Basic accreditation</td>
<td>&gt;80% to &lt;90%</td>
<td>≥70% to &lt;90%</td>
<td>≥40% to &lt;50%</td>
<td>Peripheral-level microscopist</td>
<td>Attends bi-annual refresher training</td>
</tr>
<tr>
<td>Not accredited</td>
<td>&lt;80%</td>
<td>&lt;70%</td>
<td>&lt;40%</td>
<td>Peripheral-level microscopist in need of remedial training</td>
<td>Prioritized for remedial training/ work under supervision</td>
</tr>
</tbody>
</table>
9.0 Final scoring

The final assessment score combines results from the two different assessments (preparation of thick and thin films and the malaria microscopy assessment). The minimum requirement for passing the NCA is a participant score of $\geq 17$ for slide preparation and achievement of at least the “basic accreditation” level for malaria microscopy (see Table 8).

Table 8. Minimum grades for accreditation.

<table>
<thead>
<tr>
<th>Slide preparation score</th>
<th>Microscopy grade</th>
<th>Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\geq 17$ points correct quality assurance steps</td>
<td>Advanced accreditation OR Basic accreditation</td>
<td>PASS</td>
</tr>
<tr>
<td>$&lt;16$ points correct quality assurance steps</td>
<td>Advanced accreditation OR Basic accreditation OR Not accredited</td>
<td>FAIL</td>
</tr>
</tbody>
</table>
## 10.0 Annexes

### Annex 1. Equipment and reagents required for training

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Status/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Laboratory equipment and supplies</strong></td>
<td></td>
<td>✓ Items received</td>
</tr>
<tr>
<td>Electric binocular microscope</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Storage box or microscope cover</td>
<td>1 per microscope</td>
<td></td>
</tr>
<tr>
<td>Blue filters (if available)</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Lint-free tissue</td>
<td>5 boxes</td>
<td></td>
</tr>
<tr>
<td>100X immersion oil objective</td>
<td>1 per microscope</td>
<td></td>
</tr>
<tr>
<td>Extra bulbs (for microscope)</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>Power cords</td>
<td>1 per microscope</td>
<td></td>
</tr>
<tr>
<td><strong>Tally counter</strong></td>
<td>2 per participant</td>
<td></td>
</tr>
<tr>
<td>Plastic bins for washing hands (if no sink)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Slide drying racks</strong></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Balance or scale for weighing reagents</td>
<td>1 for group</td>
<td></td>
</tr>
<tr>
<td>Weighing paper</td>
<td>1 box for group</td>
<td></td>
</tr>
<tr>
<td><strong>Frosted microscope slides</strong></td>
<td>5 boxes</td>
<td></td>
</tr>
<tr>
<td>Lancets (for rapid diagnostic tests and making blood films)</td>
<td>1-2 boxes (up to 50 lancets)</td>
<td></td>
</tr>
<tr>
<td>Timing clock with alarm</td>
<td>1 for group</td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol swabs</strong></td>
<td>1 box for group</td>
<td></td>
</tr>
<tr>
<td>Cotton wool</td>
<td>1 box for group</td>
<td></td>
</tr>
<tr>
<td>Laboratory coats</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>2-5 boxes</td>
<td></td>
</tr>
<tr>
<td><strong>Rapid diagnostic tests (and required reagents)</strong></td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td><strong>Reagents for stains (solution or powder):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giemsa stain solution (best quality)</td>
<td>1L bottle</td>
<td></td>
</tr>
<tr>
<td>Giemsa stain powder (best quality)</td>
<td>5-10 g</td>
<td></td>
</tr>
<tr>
<td>Buffer tablets (pH 7.2)</td>
<td>1 box</td>
<td></td>
</tr>
<tr>
<td>Potassium dihydrogen phosphate and disodium hydrogen phosphate (to prepare 100L of buffered water, pH 7.2 if buffer tablets not available)</td>
<td>5L</td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td>5L</td>
<td></td>
</tr>
<tr>
<td>Field stain A and B</td>
<td>500ml of stain A and B</td>
<td></td>
</tr>
<tr>
<td>Glycerol</td>
<td>250-500ml bottle</td>
<td></td>
</tr>
<tr>
<td>Distilled water</td>
<td>20L</td>
<td></td>
</tr>
<tr>
<td>Filter paper (Whatman No. 1)</td>
<td>1 box</td>
<td></td>
</tr>
<tr>
<td><strong>Immersion oil (best quality)</strong></td>
<td>1 per microscope</td>
<td></td>
</tr>
<tr>
<td><strong>Glassware:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring cylinders</td>
<td>10ml, 100ml, 1L</td>
<td></td>
</tr>
<tr>
<td>Slide staining racks/jars</td>
<td>5 racks or jars</td>
<td></td>
</tr>
<tr>
<td><strong>Reagent bottles</strong></td>
<td>5 X 250-500ml bottles</td>
<td></td>
</tr>
<tr>
<td><strong>Amber bottles</strong></td>
<td>5 X 250-500ml bottles</td>
<td></td>
</tr>
<tr>
<td><strong>Glass beads</strong></td>
<td>1 bottle</td>
<td></td>
</tr>
<tr>
<td><strong>Glass rods</strong></td>
<td>1 box</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Unit</td>
<td>Status/Notes</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Course equipment and supplies:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD projector</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Laptop computer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pens/pencils</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Notebooks/writing tablets</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Name tags</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>World Health Organization malaria microscopy training CD-ROM</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Printed course curriculum/PowerPoint slides</td>
<td>1 set per participant</td>
<td></td>
</tr>
<tr>
<td>Printed timetables</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Printed pre- and post-tests</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Certificate paper</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Facilitator’s manual</td>
<td>1 per facilitator</td>
<td></td>
</tr>
<tr>
<td>Daily attendance sheet</td>
<td>1 per each day of training</td>
<td></td>
</tr>
<tr>
<td>Receipts (for tracking per diem)</td>
<td>1 book of receipts</td>
<td></td>
</tr>
<tr>
<td>Rapid diagnostic test protocols</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Malaria microscopy protocols</td>
<td>1 per participant</td>
<td></td>
</tr>
<tr>
<td>Thick and thin blood film template</td>
<td>1 per participant</td>
<td></td>
</tr>
</tbody>
</table>
Annex 2. Learning units

Lecture topics are described below and denoted by a solid circle in the agenda.

Unit ❶ Workshop introduction (1 hour)
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
- Introduction to course content
- Distribution of documents

Learning objectives
- Participants introduce themselves
- Explain the objectives of the national competency assessment
- Establish course expectations for participants
- Review the timetable for the course

Unit ❷ Quality standards for malaria blood films (1 hour)
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
- Introduction to the ten quality standards for making malaria blood films

Learning objectives
- Review the ten quality standards
- Self-assessment of slide quality

Unit ❸ Malaria diagnostics overview (1 hour)
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
- Malaria parasite lifecycle
- Importance of parasitological confirmation
- Malaria situation in Zambia

Learning objectives
- Malaria parasite lifecycle overview
- Importance of parasitological confirmation
- Rapid diagnostic tests versus microscopy – advantages and disadvantages
- Describe the distribution and occurrence of malaria in the world
- Describe the epidemiology of malaria in Zambia
- Recognize and understand the vectors of malaria in Zambia
- Articulate the progress made in malaria control in Zambia
Unit 4 Preparing blood films
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
- Handling potentially infectious blood
- Preparing thick and thin blood films on the same slide
- Correct labeling of blood films
- Blood film quality and common causes of error

Learning objectives
- Emphasize and explain why human blood should always be treated as hazardous
- Describe the importance of at least four diseases found in infected blood
- Demonstrate the necessary precautions to avoid direct contact with potentially infected blood
- Describe to learners the materials required for making thin and thick blood films
- Describe how to correctly make thick and thin blood films
- Demonstrate how to correctly label blood films
- Demonstrate how to separate thick and thin blood films of acceptable quality from unacceptable ones, giving reasons for their rejection
- Help participants to identify common faults in thick and thin blood films and their causes

Unit 5 Staining with Giemsa stain
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
- Use of equipment needed for making Giemsa
- Description of how to pH buffer and its importance
- Storing and handling Giemsa stain

Learning objectives
- Demonstrate correct operation of the balance
- Make buffer eater used to dilute Giemsa stain
- Demonstrate the correct use of pH paper or pH meter
- Make up pH balancing fluids used to adjust pH of buffered water
- Explain why pH 7.2 water is best for good Giemsa staining
- Explain when rapid and slow Giemsa staining methods are used for malaria microscopy
- Describe the correct ways to store and handle Giemsa stain
- Describe correct drying and storing of stained slides
Unit 6 Examining blood films
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
• Normal blood components
• Methods for slide examination
• Recognizing and identifying other blood parasites

Learning objectives
• List the four major components of normal blood
• Demonstrate each method used for examining a thick and thin blood film for malaria parasites
• Recognize and classify the normal components of blood
• Name the main parts of a white blood cell

Unit 7 Artifacts, pseudoparasites, and mixed infections
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
• Recognize common artifacts
• Recognize pseudoparasites
• Recognize and identify other blood parasites

Learning objectives
• Recognition of artifacts: stain deposits, dust, salts, scratches on slides
• Recognition of pseudoparasites: fungi, bacteria
• Recognition of mixed infections: thick and thin blood films
• Recognition of other blood parasites: Borrelia species, trypanosomes, microfilariae, differences from malaria parasites

Unit 8 Microscopy quality assurance
Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics
• Supportive supervision
• Quality assurance
• Quality control

Learning objectives
• Explain the importance of supervision
• Explain ways in which work can be supervised
• Describe what must be provided for supervisors to allow them to supervise their work effectively
• Describe methods of internal quality control for malaria microscopy
Unit 9 The microscope

Format – This session will be delivered as a lecture with slide presentations.

Learning unit key topics

- Using a binocular microscope
- Major components of the microscope and how to use it
- Maintenance and storage

Learning objectives

- Demonstrate the correct set-up and use of a binocular microscope
- Demonstrate correct use of the 10X paired oculars and 100X oil immersion objective
- Operate the mechanical stage correctly
- Name the ten major components of the microscope
- Describe the correct way to maintain the microscope
- Describe two ways of storing the microscope correctly
- Demonstrate the correct way to pack the microscope for long distance transport
Annex 3. Resources


