Meeting Report

WHO TRAINING FOR QUALITY ASSURANCE IN MALARIA MICROSCOPY IN THE SOUTH-EAST ASIA AND WESTERN PACIFIC REGIONS

20–24 June 2016

Manila, Philippines

World Health Organization
Western Pacific Region

WHO Training for Quality Assurance in Malaria Microscopy in the South-East Asia and Western Pacific Regions
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WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR THE WESTERN PACIFIC

MEETING REPORT

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Convened by:

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR THE WESTERN PACIFIC

Manila, Philippines
20–24 June 2016

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NOTE

The views expressed in this report are those of the participants of the WHO Training for Quality Assurance in Malaria Microscopy in the South-East Asia and Western Pacific Regions and do not necessarily reflect the policies of the World Health Organization.

This report was prepared by the World Health Organization Regional Office for the Western Pacific for governments of Member States in the Region and for those who participated in the WHO Training for Quality Assurance in Malaria Microscopy in the South-East Asia and Western Pacific Regions, which was held in Muntinlupa City, the Philippines, from 20–24 June 2016.

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Keywords:

Quality assurance / Laboratory / Malaria diagnosis / Microscopy / Health personnel

ABBREVIATIONS

ECA	external competency assessment
EQA	external quality assessment
NCA	national competency assessment
OTSS	outreach training and supporting supervision
QA	quality assurance
QC	quality control
RDT	rapid diagnostic test
RITM	Research Institute for Tropical Medicine
SOP	standard operating procedure
WHO	World Health Organization

SUMMARY

The World Health Organization (WHO) organized a biregional training course on the quality assurance (QA) of malaria microscopy in the WHO South-East Asia and Western Pacific Regions between 20 and 24 June 2016 at the Research Institute for Tropical Medicine (RITM), a WHO Collaborating Centre for Malaria Diagnosis, in Muntinlupa City, Philippines. The training course was attended by 15 participants from nine countries in the WHO Western Pacific Region (Cambodia, China, the Lao People's Democratic Republic, Malaysia, Papua New Guinea, the Republic of Korea, Solomon Islands, Vanuatu and Viet Nam) and 10 participants from five countries in the WHO South-East Asia Region (India, Myanmar, Nepal, Thailand and Timor Leste). These participants are national focal persons responsible for the quality assurance of malaria microscopy who are either from the national malaria programme or national reference/public health laboratories and can disseminate the technical procedures and influence the development or revision of policies and guidelines related to malaria microscopy.

The main objective of the training course was to introduce and strengthen the essential elements of a functional quality assurance (QA) system for malaria microscopy and to standardize laboratory procedures related to malaria microscopy based on two recent WHO publications: the *WHO Malaria Microscopy Quality Assurance Manual (2016)* and *WHO Malaria Microscopy Standard Operating Procedures (2016)*. The training was spread over five days using lectures, discussions, laboratory practical exercises, field visits, group and individual works. A pre- and post-test questionnaire was also administered to assess the effectivity of the training in improving participants knowledge of the topics and subject matter presented.

As malaria-endemic countries in the Asia Pacific are moving towards malaria elimination by 2030, a functional and sustainable national QA system is essential to facilitate malaria elimination and prevent reintroduction. Discussions on the standard operating procedures (SOPs) provided a venue to determine country laboratory procedures and practices that need to be addressed while the discussion on the *Malaria Microscopy QA Manual* provided information on where countries are in terms of setting up or maintaining a QA system. This information is useful as a baseline in determining future activities and collaboration to strengthen malaria microscopy QA in countries and regions.

1. INTRODUCTION

1.1 Background

WHO recommends prompt malaria diagnosis either by microscopy or malaria rapid diagnostic test in all patients with suspected malaria before treatment is administered. The detection of malaria parasites by light microscopy remains the reference method for diagnosis of malaria as it differentiates between malaria species in various stages, determines parasite densities, is relatively low cost in control settings, and sensitive if the quality of microscopy is high. Microscopy is also the method of choice for the investigation of malaria treatment failures. However, while microscopy remains the mainstay of parasite-based diagnosis, the quality of microscopy-based diagnosis in most large health clinics and hospitals is frequently inadequate to ensure good health outcomes and optimal use of resources. Therefore, ensuring competency of microscopists and the availability of quality assured reagents and equipment must be ensured in all malaria-affected countries.

WHO, together with national malaria programmes and partners, are working on addressing factors that could help improve the quality of malaria microscopy. Continuous and regular re-training and assessment of microscopists, including supportive supervision, are some of the strategies used to improve the quality of microscopy. Training should include not only examining parasites under a microscope but also performing all aspects of microscopy correctly. In 2015, WHO developed a set of SOPs to guide malaria microscopists at all levels of health facilities. These SOPs outline the step-by-step procedures that microscopists need to follow to provide and facilitate good quality malaria diagnostic services. An updated version of the WHO Malaria *Microscopy Quality Assurance Manual (2016)* was also recently published, which considered the lessons learnt and experiences gained by malaria programmes in implementing quality assurance strategies and activities related to malaria microscopy.

Malaria, other Vectorborne and Parasitic Diseases (MVP) unit organized a Western Pacific/South-East Asia biregional training course on the quality assurance of malaria microscopy on 20–24 June 2016 to introduce and strengthen the essential elements of a functional QA system for malaria microscopy and to standardize laboratory procedures related to malaria microscopy based on the two recent WHO publications. The course was held at RITM (a WHO Collaborating Centre for Malaria Diagnosis) in Muntinlupa City, Philippines.

1.2 Objectives of the training

At the end of the course, national quality assurance officers/microscopists should be able to organize, supervise and provide good quality malaria microscopic services in their countries. Participants should be able to:

- perform and supervise malaria microscopy laboratory procedures using the *WHO Malaria Microscopy Quality Assurance Manual (2016)*;
- identify parasite species in various stages and count parasite density as per the *WHO Standard Operating Procedures on Malaria Microscopy (2016)*; and
- disseminate through teaching or national trainings technical procedures demonstrated during the course and establish/strengthen national malaria diagnostic quality assurance systems.

1.3 Participants of the training

The training course was attended 15 participants from nine countries in the Western Pacific Region (Cambodia, China, the Lao People's Democratic Republic, Malaysia, Papua New Guinea, the Republic of Korea, Solomon Islands, Vanuatu and Viet Nam) and 10 participants from five countries in the South-East Asia Region (India, Myanmar, Nepal, Thailand and Timor Leste). The participants are national focal persons responsible for the quality assurance of malaria microscopy who are either from the national malaria programme or national reference/public health laboratories and can disseminate technical procedures and influence the development or revision of policies and guidelines related to malaria microscopy.

1.4 Facilitators and lecturers

Eight microscopists from RITM and the Philippine Department of Health facilitated the training. Five (Ms Santiago, Mr Galit, Ms Modequillo, Mr Espina and Ms Perez) are WHO-certified Level 1 microscopists (therefore expert microscopists) and are members of the national core group of microscopists in charge of malaria microscopy QA system in the Philippines. All five have experience conducting microscopy trainings in the Philippines while Ms Santiago and Mr Galit also have international experience. Ms Luchavez, Ms Guballa and Ms Sornillo are in charge of the regional malaria slide bank and also conduct microscopy trainings particularly on slide-banking.

List of participants, facilitators, secretariat and observer are in Annex 1.

2. CURRICULUM AND PROCEEDINGS

2.1 Preparation of curriculum

2.1.1 Planning and preparatory workshop

Prior to the actual training, the training team convened a 4-day planning and preparatory workshop from 30 May to 02 June 2016. During the workshop, the group deliberated on the contents of each topic and drafted the training modules (in PowerPoint presentations). The group also identified and prepared all essential supplies, materials and documents (exercises, worksheets, pre/post-test, course evaluation, others) and distributed tasks, lectures and presentations among the facilitators.

The topics covered were based on two WHO publications related to malaria microscopy:

1. *WHO Malaria Microscopy Standard Operating Procedures (2016)*
2. *WHO Malaria Microscopy Quality Assurance Manual, second edition (2016)*

The WHO Malaria Microscopy Standard Operating Procedures (SOPs) were developed by WHO Regional Office for the Western Pacific with guidance from the Global Malaria Programme to guide malaria microscopists in all levels of health care on the correct procedures in performing microscopy diagnosis for malaria. These SOPs were first lifted from various WHO publications and other unpublished works of experts commissioned by WHO since 2009. A technical consultation was later conducted in November 2015 to review and finalize the WHO core set of SOPs for malaria microscopy.

The Malaria Microscopy Quality Assurance (QA) manual takes into consideration the lessons learnt and experiences of countries with malaria control programmes in implementing QA strategies and activities laid out in the initial version of the manual, published in 2009. Cross-cutting topics, largely lifted from the QA manual, were as follows: the role of microscopy and its quality assurance in malaria control and elimination; structure and function of an effective QA system for malaria; laboratory organization and management, quantification of supplies and stocks management; and approaches to training, proficiency testing and competency assessment (external and national). The use and application of other diagnostic tools, such as rapid diagnostic tests (RDT) and molecular tests, and their quality control/assurance, particularly in low transmission settings, were likewise presented.

2.1.2 Timetable and methods

The training schedule was spread over five days (see Annex 2). The objectives were achieved through lectures, supervised laboratory practical exercises (microscopy practice session and mock assessment), group (supervisory visit, fieldwork and plenary discussion) and individual (appraisal of country SOPs) work. The morning sessions were devoted to lectures (aided by PowerPoint presentations), while a significant portion of the afternoon sessions were spent on laboratory and group work. Lectures were always followed by a question and answer segment to ensure common understanding and interpretation of

the procedures. The ensuing laboratory sessions were designed to standardize application of the procedures or topics discussed.

2.2 Training proceedings

2.2.1 Day 1

The opening programme was led by RITM Director, Dr Socorro Lupisan, Dr Rabindra Abeyasinghe, Coordinator of Malaria, other Vectorborne and Parasitic Diseases, WHO Western Pacific Region, and Dr Eva Christophel, Regional Adviser for Malaria from WHO South-East Asia Region.

The training started with a short introduction by Ms Glenda Gonzales, Technical Officer, Malaria, other Vectorborne and Parasitic Diseases, on the two WHO documents used as main references for training. Then, a pre-test of 25 questions to obtain a baseline indicator of the participants' theoretical knowledge related to malaria microscopy followed. See Annex 3 for the pre-test questionnaire. The group obtained a mean score of 53%. The questions were all based on topics and presentations outlined in the training agenda. The pre-test was followed by an overview on the contents and development of the *WHO Malaria Microscopy QA Manual (2016)* and the *WHO Malaria Microscopy SOPs (2016)* which were used as main references for the training. The basic laboratory procedures (including SOPs on cleaning and maintenance of microscopes, blood collection and film preparation, staining of slides, and recording and labelling of slides) were presented in lectures, followed by discussion and practical application in laboratory session. Hard copies of all presentations and relevant publications were given to participants.

2.2.1 Day 2

The SOPs on parasite identification, counting and reporting were discussed on Day 2, followed by its application through practical microscopy sessions. Each participant examined 15 blood films – five slides for the practice session and 10 for the mock assessment (see Table 1).

Table 1. Answer Key, 10 slides for the mock assessment

Challenge No.	Malaria Species	Parasite Count (p/μL)
1	No malaria parasite seen	-
2	No malaria parasite seen	-
3	*Plasmodium vivax*	7808
4	*Plasmodium vivax*	1649
5	*Plasmodium vivax*	164
6	*Plasmodium falciparum*	5213
7	*Plasmodium falciparum*	3044
8	*Plasmodium falciparum*	1974
9	*Plasmodium falciparum*	3168
10	*Plasmodium falciparum*	439

Based on the 10 slides used for the mock assessment, some notable observations were as follows:

(a) For parasite and species identification (see Figure 1):
- The majority of the participants (range: 70.8 - 95.8%) accurately diagnosed and identified the correct *Plasmodium* species in most of the slide challenges; and
- a quarter of the participants reported “false positive” results on the two malaria-negative slide challenges (numbers 1 and 2)

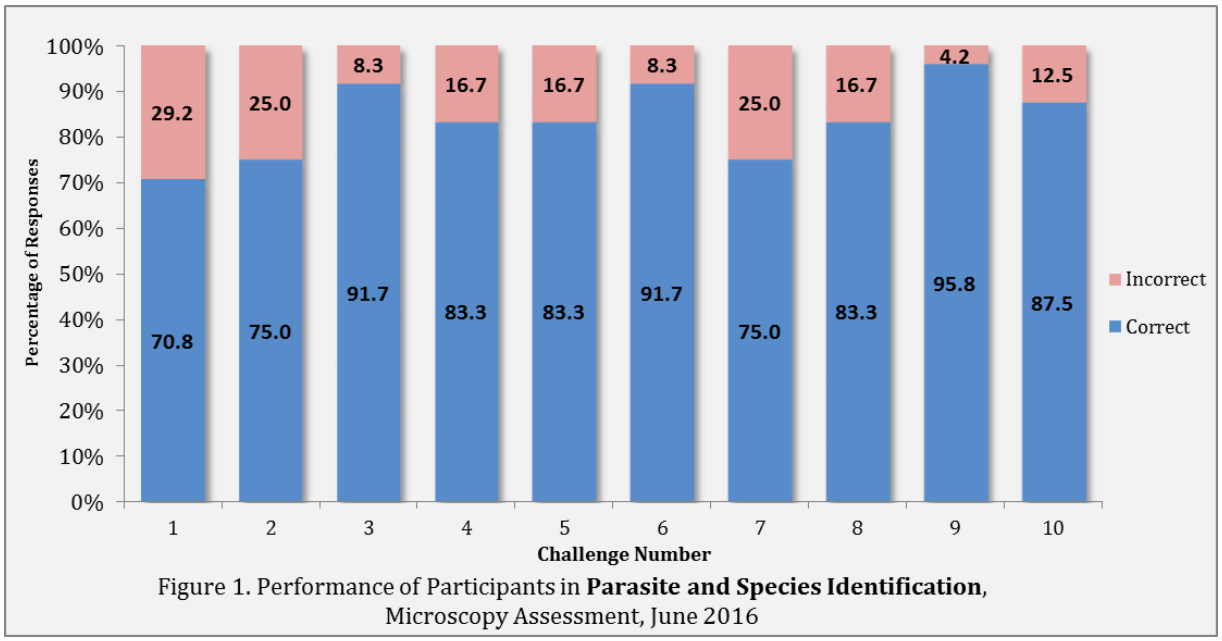

Figure 1. Performance of Participants in **Parasite and Species Identification**, Microscopy Assessment, June 2016

(b) For parasite counting (see Figure 2);

- the majority of the participants obtained an accurate count (within 50% of the reference count) following the SOP on parasite counting; and
- most participants obtained less accurate counts (outside 50% of the reference count) in challenges with counts lower than 1000 p/µL.

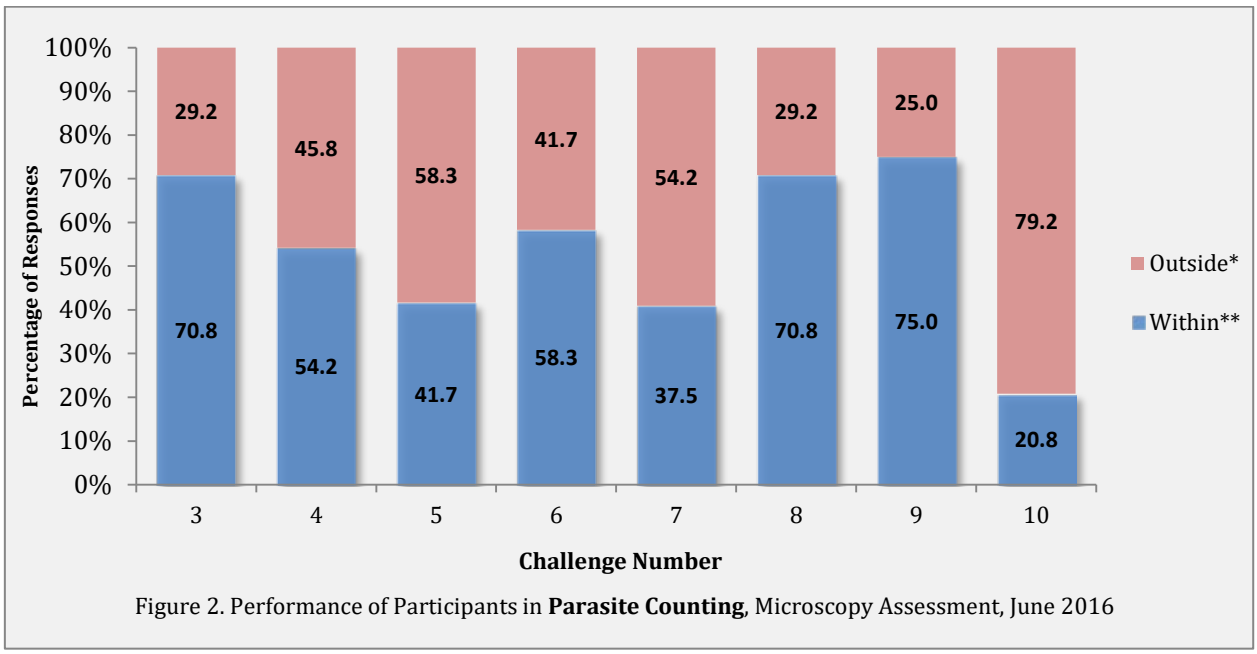

Figure 2. Performance of Participants in **Parasite Counting**, Microscopy Assessment, June 2016

** Outside 50% of the median count of the validators; ** within 50% of the median count of the validators*

** Please note that in an actual external competency assessment, an accurate count is within 25% of the reference count. In this training, participants are microscopists and malaria QA managers thus all are not familiar with parasite counting. The objective of this activity is not to assess their actual performance but give them a feel of the assessment procedures of the microscopy assessment programmes.*

Before day 2 ended, each participant was given a checklist (see Annex 4) to use for reviewing and appraising their country SOPs for any gap against the current WHO-recommended procedures. The outputs are summarized in Annex 5.

2.2.1 Day 3

Day 3 started with a discussion on the recommended elements and structure of a functional QA system for malaria microscopy. Focus was given to updated or subject matters unique to the revised version of the QA Manual, specifically the topics on outreach training and supportive supervision (OTSS) and slides cross-checking. Application was through a mock supervisory visit to a public health facility that routinely provides malaria microscopy services. The participants were divided into three groups and provided with a checklist lifted from the revised manual to aid them during the exercise.

2.2.1 Day 4

Deliberations on the groups' findings from the previous day's fieldwork started the fourth day session. Only one group presented their findings and recommendations (see Annex 6), while the rest gave their comments and inputs on the activity itself and on the report. The exercise proved to be a very useful platform for an open and active discussion wherein the trainees and trainers/facilitators freely exchanged ideas and views on the QA issues at hand. Other topics tackled on Day 4 were the methodologies for proficiency testing, competency assessments, training approaches and methodologies, and establishment of a malaria slide bank. An instructional video on slide-banking was also shown to the group as a supplement to the SOPs.

2.2.1 Day 5

The last day of the training kicked-off with the application of the SOPs on slide-banking during the laboratory session. This was followed by presentations on the quality assurance of malaria RDTs and molecular diagnostic tools recommended for low transmission areas. A short planning session followed, wherein the participants from each country prepared a list of the priority quality assurance (QA) activities that they will implement when they return to their respective countries. Country representatives presented their planned QA activities for clarifications. The lists are summarized in Annex 7.

A post-test with 25 questions similar to those in the pre-test was administered to the participants to assess the effectivity of the training in improving their knowledge on the topics and subject matters presented (see Annex 8). The group obtained a mean percentage score of 72% in the post-test, which is considerably higher than the pre-test mean percentage score of 53%, but few participants (five of the 25) obtained a lower post-test score than their pre-test score (see Figure 3). This decline can be attributed to the language barrier as some of the participants are not well versed in English thus may not understood well the lectures and discussions. The average difference in the mean percentage scores between the pre- and post-test was 18%. Less than half of the participants (44% or 11 out of 25 participants) gained a score of 80% or higher in the post-test exam. Individual results of the participants in the pre- and post-tests and microscopy mock assessment are presented in Annex 9.

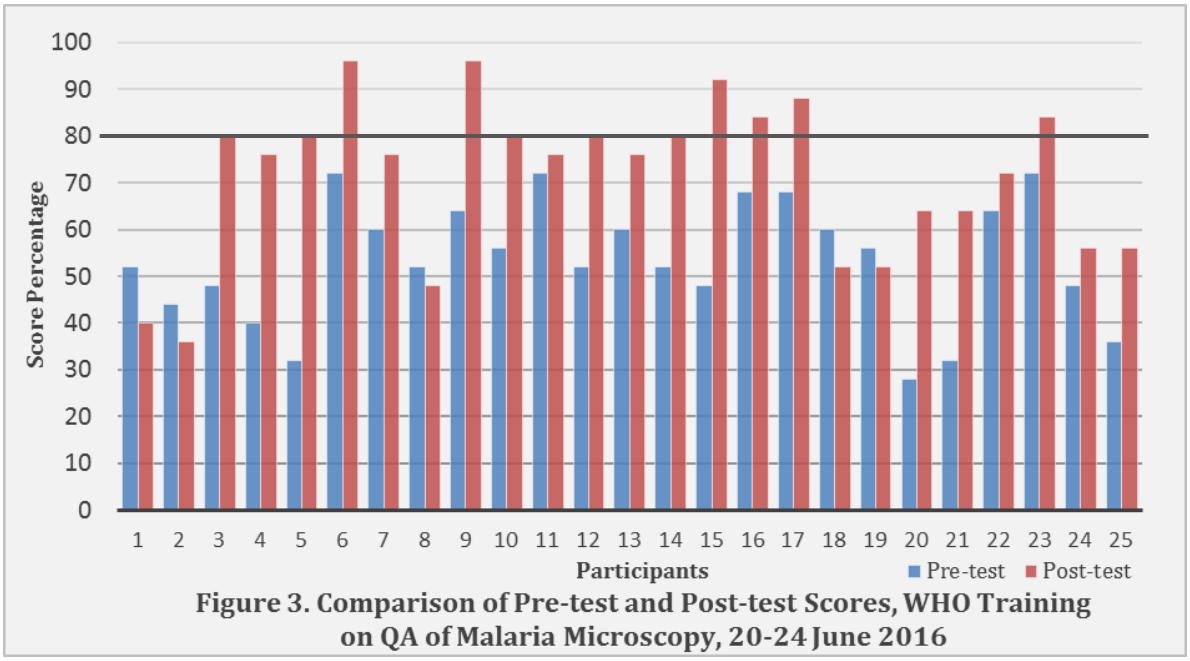

Figure 3. Comparison of Pre-test and Post-test Scores, WHO Training on QA of Malaria Microscopy, 20-24 June 2016

Closing programme

A short programme was conducted to officially close the training activity. One representative each from the WHO South-East Asia and Western Pacific Regions were asked to give feedback on the training. Dr Anup Anvikar (India/South-East Asia Region) and Mr Peter Lenis (Vanuatu/Western Pacific Region) expressed their appreciation for the training, facilitators and organizers. Representatives from WHO, Dr Christophel and Dr Andrea Bosman, Coordinator for Prevention, Diagnosis and Treatment of the Global Malaria Programme in Geneva, both expressed their appreciation for the training. Dr Bosman also mentioned that he was impressed with the strong training team from the Philippines, and the great potential and commitment of the participants to lead QA initiatives in their respective countries. On behalf of RITM, Dr Fe Esperanza Espino, head of the Department of Parasitology, thanked all the participants and reiterated the institute's commitment and support in promoting quality malaria diagnosis in the Asia Pacific region and globally.

2.3 Course evaluation

The participants rated the conduct of the training using an evaluation form (Annex 10) developed by RITM. The evaluation revealed that a great majority of the participants (91%) considered the training as either "very good" or "excellent". In general, the participants gave favourable ratings to each aspect of the training (see Figure 4).

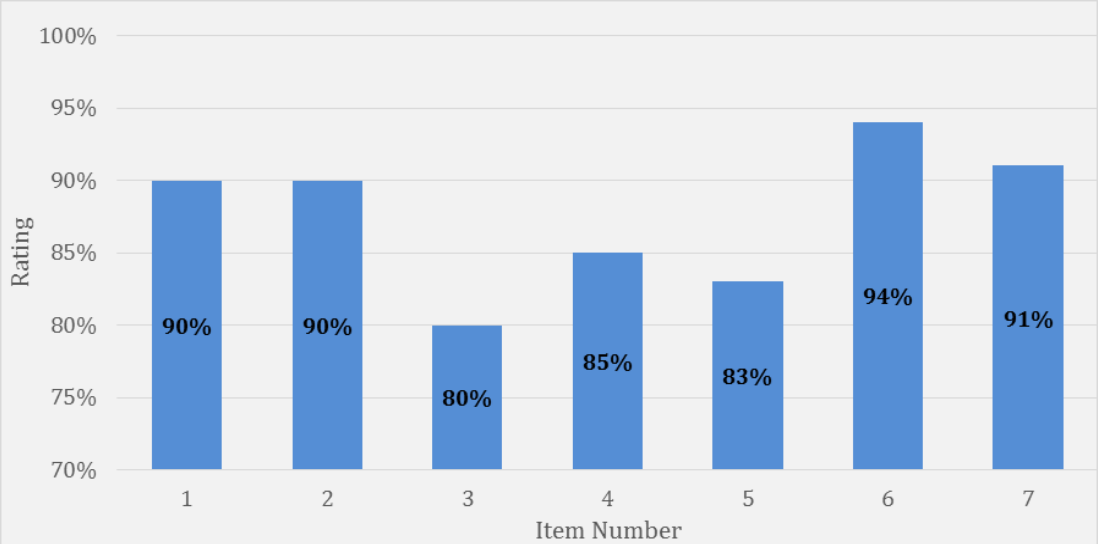

Figure 4. Evaluation of Activity, WHO Training on QA of Malaria Microscopy, 20-24 June 2016

Legend: *1 - Relevance of the topics/subject matters;* ***2*** *- Trainers' mastery of the topic;* ***3*** *- Time allotment for each topic/session;* ***4*** *- Quality of the materials (slides) used for the species identification;* ***5*** *- Quality of the materials (slides) used for parasite counting;* ***6*** *- Achievement of the objectives of the study;* ***7*** *- Overall rating*

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

- The five-day training course was well organized with a combination of lectures, discussions, group work, laboratory practical work and a field supervisory visit.
- RITM in the Philippines, a WHO Collaborating Centre for Malaria Diagnosis, provided good facilities, which include lecture rooms and laboratories necessary for the training.
- The discussions on the Malaria Microscopy Standard Operating Procedures provided a venue to determine country laboratory procedures and practices that needs to be addressed, while discussion on the *Malaria Microscopy QA Manual* provided information on where countries are in terms of setting up or maintaining a QA system.
- As malaria-endemic countries in the Asia Pacific are moving towards malaria elimination by 2030, a functional and sustainable national QA system is essential to facilitate malaria elimination and prevent reintroduction. The biregional training for quality assurance of malaria microscopy is a good step in determining baseline information from each country. Countries are urged to followed-up using this information to establish or strengthen QA activities.

3.2 Recommendations

The experiences and lessons learnt from this training course should be considered when planning succeeding courses, either regional or national, the following in particular.

- It must be emphasized that countries need to carefully identify their representative/s according to the recommended selection criteria, (the focal person for QA), specifically for malaria (if that person exists), and someone who can inform or influence policies on training and practice of malaria microscopy in their respective countries.
- Field visits, if conducted, should be planned more carefully, taking into consideration the size of the group, the time and distance it will take to reach sites, and the potential challenges that might be encountered along the way. An ideal group size should be no more than five, plus one facilitator/observer/guide, with each group member taking turns to ask questions about one particular aspect in the checklist. Orientation prior to the trip should also include pointers on how to best handle the exercise, to avoid such situations and get the most out of the activity. If health

facility/laboratory staff give consent, it would also be useful to take videos of microscopists working on diagnosis as it may capture important QA issues in the laboratory.

- The field visit exercise should be comprehensive, similar to an actual OTSS visit, which can also include cross-checking a selection of slides and bringing slides for the microscopists to examine. An entire afternoon may be devoted to this exercise, excluding travel time.
- The mock microscopy assessment was useful in standardizing participants' understanding and interpretation of the SOPs, particularly on parasite counting, as indicated in the results (the majority of the participants obtained an accurate count). A simulation of an external competency assessment (ECA) or national competency assessment (NCA) may be used for participants to have a better appreciation of the proficiency assessment strategies as recommended in the WHO QA Manual.
- For the presentations on microscopy training and national and external competency assessments, discussion on the roles, responsibilities and potential benefits of the Level 1 or 2 microscopists in countries' QA system may follow to give the participants a more practical and meaningful understanding of what is expected from them if they reach that level of expertise.
- The time allotted for each presentation should be strictly observed. With more time, each presentation may be followed by exercises (such as quantification of supplies and logistics), mock QA activities (such as internal quality control) and cross-checking of slides) and group activities (for example, reviewing and revision of the SOPs and perhaps writing a simple SOP).
- For the presentations on other diagnostic tests RDTs and molecular tools, such as PCR, a short visit is recommended to the laboratories that perform these tests, if time permits.
- The activity on QA planning can still be improved using templates to guide participants and to provide more time for participants to come up with well-thought out and realistic plans.
- This training may be duplicated in other countries, particularly those that were not able to participate in this course, considering the recommendations stated here.
- Training on QA of malaria microscopy/diagnosis may also be conducted in other WHO regions, but the training agenda and contents should be standardized or harmonized.

ANNEX 1

LIST OF PARTICIPANTS

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ANNEX 2

AGENDA

Day 1: Monday, 20 June 2016		
08:30 – 08:45	Registration	
Opening Session		
08:45 – 09:30	Welcome remarks	Dr Socorro Lupisan Director, Research Institute for Tropical Medicine Dr Rabindra Abeyasinghe Coordinator, Malaria, other Vectorborne and Parasitic Diseases, WHO Western Pacific Region Dr Eva Christophel Regional Adviser, Malaria WHO South-East Asia Region
	Workshop introduction, objectives, timetable, expectations	Ms Jennifer Luchavez Supervising Science Research Specialist, Research Institute for Tropical Medicine
	Self-introduction of participants, secretariat and observers	Ms Glenda Gonzales Technical Officer, Malaria, other Vectorborne and Parasitic Diseases, WHO Western Pacific Region
	Administrative announcements	
	Pre-test	Ms Jennifer Luchavez
09:30 – 10:00	Group photograph followed by coffee/tea break	
Session 1:	WHO Malaria Microscopy Standard Operating Procedures (SOPs)	
10:00 – 10:15	Overview: *WHO Malaria Microscopy Quality Assurance Manual (2016)* and *Malaria Microscopy Standard Operating Procedures (2016)*	Ms Glenda Gonzales
10:15 – 10:45	**SOPs** (each topic followed by 10-15 min discussion) MM-SOP-12: Use, care and maintenance of microscopes	Mr Ronald Espina Regional Malaria Validator, Inter-regional Collaborating Center for Malaria and other Vectorborne Diseases, Department of Health Philippines
10:45 – 11:30	MM-SOP-05a: Collection of finger-prick blood and preparation of thick and thin blood films MM-SOP-05b: Collection of blood by venipuncture and preparation of blood films from venous blood collected in tubes with anticoagulant	
11:30 – 12:00	MM-SOP-06a: Labelling malaria blood films	
12:00 – 12:30	MM-SOP-01: Cleaning and storing of microscope slides	
12:30 – 13:30	*Lunch break*	
13:30 – 14:00	**SOPs** (each topic followed by 10-15 min discussion) MM-SOP-07a: Giemsa staining of malaria	Ms Marie Cris Modequillo Regional Malaria Validator, Inter-regional Collaborating Center for

	blood films MM-SOP-07b: Ebola virus inactivation during staining of blood films with Giemsa stain	Malaria and other Vectorborne Diseases, Department of Health Philippines
14:00 – 14:30	MM-SOP-02: Preparation of Giemsa stock solution MM-SOP-04: Preparation of Giemsa working solution	
14:30 – 15:00	MM-SOP-03a: Preparation of water buffered to pH 7.2 MM-SOP-03b: Preparation of water buffered to pH 7.2 with buffer tablets	
15:00 – 15:30	MM-SOP-03c: Quality control of Giemsa stock solution and buffered water	
15:30 – 15:45	*Coffee / tea break*	
15:45 – 17:30	**Laboratory practical 1** Blood film preparation (MM-SOP-05a; MM-SOP-05b) and staining procedures (MM-SOP-07a; MM-SOP-07b)	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo Mr Ronald Espina Ms Shirlyn Perez
18:00 – 20:00	Reception dinner	Deckbar, Crimson Hotel

Day 2: Tuesday, 21 June 2016		
Continuation of Session 1: WHO Malaria Microscopy Standard Operating Procedures (SOPs)		
08:30 – 08:45	Role of microscopy and quality assurance in current malaria control and elimination strategies	Dr Andrea Bosman Medical Officer, WHO Global Malaria Programme
08:45 – 09:45	**SOPs** (each topic followed by 10-15 min discussion) MM-SOP-08: Microscopy examination of thick and thin blood films for identification of malaria parasites MM-SOP-09: Malaria parasite counting	Mr Sherwin Galit Senior Science Research Specialist, Research Institute for Tropical Medicine
09:45 – 10:00	MM-SOP-06b: Recording and reporting of microscopy results	
10:00 – 10:30	**Laboratory practical 2** Group teaching on parasite counting using the multi-viewer microscope	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo Mr Ronald Espina Ms Shirlyn Perez
10:30 – 10:50	Coffee/tea break	
10:50 – 12:30	**Laboratory practical 2 (continuation)** Individual practice on species identification (MM-SOP-08) and parasite counting (MM-SOP-09) five slides will be read by participating country	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo Mr Ronald Espina Ms Shirlyn Perez
12:30 – 13:30	Lunch break	
13:35 – 15:30	**Laboratory assessment** Species identification (MM-SOP-08) and parasite counting (MM-SOP-09) 10 slides will be read by each participating	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo

	country	Mr Ronald Espina Ms Shirlyn Perez
15:30 – 15:45	Coffee/tea break	
15:45 – 16:15	Discussion on laboratory practicals	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo Mr Ronald Espina Ms Shirlyn Perez
16:15 – 16:45	SOP harmonization	
16:45 – 17:00	Revision/updating of country technical SOPs to incorporate harmonized procedures	

Day 3: Wednesday, 22 June 2016		
Session 2:	*WHO Malaria Microscopy Quality Assurance Manual (2016)*	
08:30 – 09:00	Overview on quality assurance (QA)	Ms Jennifer Luchavez
09:00 – 09:20	Structure and function of an effective QA system for malaria microscopy	
09:20 – 09:40	Malaria laboratory organization and management	
09:50 – 10:10	Supplies and equipment	Ms Shirlyn Perez Regional Malaria Validator, Inter-regional Collaborating Center for Malaria and other Vectorborne Diseases, Department of Health Philippines
10:10 – 10:30	Slide cross-checking (Model reporting form for cross-checking)	
10:30 – 10:50	Coffee /tea break	
10:50 – 11:40	Proficiency testing scheme External quality assessment Internal quality control/ proficiency testing	Ms Johanna Sornillo Medical Technologist 1, Research Institute for Tropical Medicine
11:40 – 12:30	Outreach training and supporting supervision (Example checklist and reporting form for supervisory visits)	Ms Arlene Leah Santiago Supervising Health Programme Officer Research Institute for Tropical Medicine
12:20 – 13:30	Lunch break	
13:30 – 15:00	Travel to supervisory site	
16:45 – 17:00	**Practical 3:** Supervisory visit to a malaria diagnostic facility (Participants will be divided into groups)	All

Day 4: Thursday, 23 June 2016		
Continuation of Session 2: WHO Malaria Microscopy Quality Assurance Manual (2016)		
08:30 – 09:30	Group work/discussion on supervisory visit activity	Ms Jennifer Luchavez
09:30 – 10:30	Presentation of the group output on supervisory visit Group 1: Group 2: Group 3:	Ms Glenda Gonzales
10:30 – 10:50	*Coffee/tea break*	
10:50 – 12:30	Training of microscopists (Model modules for basic and refresher trainings)	Ms Arlene Leah Santiago
12:30 – 13:30	*Lunch break*	
13:30 – 14:40	External competency assessment for national core group of microscopists (ECA)	Mr Sherwin Galit
14:40 – 15:30	National competency assessment (NCA)	
15:30 – 15:45	*Coffee/tea break*	
15:45 – 16:00	Training materials and reference slide sets - Video on slide banking	Ms Felisa Guballa Technical consultant; and

	- SOPs on slide banking	Ms Angenica Regilme Science Research Specialist Research Institute for Tropical Medicine
16:00 – 16:30	WebCam microscope (Webscope) enabling in-time accurate delivery of critical diagnosis prevent unnecessary malaria deaths in remote areas	Dr Aungkana Saejeng Medical Technologist Bureau of Vector Borne Diseases, Ministry of Public Health, Thailand

Day 5: Friday, 24 June 2016		
Continuation of Session 2: *WHO Malaria Microscopy Quality Assurance Manual (2016)*		
08:30 – 09:00	**Laboratory Practical 4** **Slide banking SOPs** Batch preparation of slides	Facilitators: Mr Sherwin Galit Ms Arlene Leah Santiago Ms Marie Cris Modequillo Mr Ronald Espina Ms Shirlyn Perez
09:00 – 09:45	Batch staining	
09:45 – 10:00	Labelling and mounting	
10:00 – 10:15	Archiving	
10:15 – 10:30	Database	
10:30 – 10:50	Coffee/tea break	
10:50 – 11:20	WHO/Foundation for Innovative New Diagnostics (FIND) Malaria RDT Quality Assurance Programme	Ms Jennifer Luchavez
11:20 – 11:40	WHO Recommendations on molecular diagnostic tools for areas with low transmission	Dr Andrea Bosman
11:40 – 12:30	Post-test	Ms Jennifer Luchavez
12:30 – 13:30	Lunch break	
13:30 – 14:30	Presentation of country QA plans for the next 6–12 months	Country representatives
14:30 – 15:00	Closing programme	Feedback from participants Dr Fe Esperanza Espino Dr Andrea Bosman Dr Eva Christophel

ANNEX 3

PRE-TEST QUESTIONNAIRES

Date	
Name	
Country	

Instruction: Choose the best answer to each question. Write the corresponding letter of your answer on the space provided before each question.

Answer	Question
B	1. In malaria microscopy, one important step to ensure that the laboratory sample and data corresponds to the patient is termed as: A. Quality control B. Correct labelling C. Accurate reporting D. Proper staining
B	2. On the care and maintenance of the microscope, the following must be done on a daily basis except for one: A. After each use the objective should be wiped with lens paper to remove the oil. B. The microscope should be placed in the transport box. C. The low power objective should be lined with the stage after each use. D. The power switch should be turned off when the microscope is not in use.
C	3. Blood films for malaria diagnosis are best prepared using A. EDTA blood B. Heparinized blood C. Capillary blood D. Citrated blood
B	4. In preparing malaria blood films, the ideal angle of a spreader slide to make the thin blood film is A. 30^o B. 45^o C. 60^o D. 90^o
D	5. The following statements about cleaning and storage of microscope glass slides for malaria are true except: A. Dirty and scratched slides can result to poorly prepared blood films which can affect diagnosis. B. Slides that are slightly-scratched and considered unsuitable for malaria blood films can be used for other tests. C. Wearing of gloves can prevent accidental cuts during washing. D. Glass slides with malaria blood films should be recycled and therefore needs to be washed and cleaned.

B	6. What is the method used for rapid staining of malaria blood films? A. 3% of Giemsa working solution for 45–60 minutes B. 10% of Giemsa working solution for 10–15 minutes C. 3% of Giemsa stock solution D. 10% of Giemsa stock solution
C	7. What is the ideal pH of the buffered water? A. 6.9 B. 7.5 C. 7.2 D. 6.0
A	8. What are the components of Giemsa stock solution? A. Absolute Methanol, Glycerol and Giemsa powder B. Methanol, Glycerol and Methylene blue C. Methanol, Glycerol and Eosin D. Ethanol, Glycerol and Giemsa powder
C	9. How many millilitres (mL) of Giemsa stock solution is needed to prepare a 100 ml of Giemsa working solution in 10% staining method? A. 90 mL B. 20 mL C. 10 mL D. 100 mL
D	10. The monitoring of the performance of reagents is known as: A. Quality Assurance B. Crosschecking C. Validation D. Quality Control
B	11. In preparing malaria blood films from samples that might be infected with the Ebola virus, the following reagent is used to deactivating agent: A. 70% Methanol B. 5% Triton X-100 C. 10% Giemsa solution D. None of the above
A	12. In mixed infections or infections by more than one species, it is recommended to count all the species together (sexual and asexual stages). A. True B. False C. Both D. Cannot be determined
A	13. What is the minimum number of thick film high power (oil immersion) fields that should be examined before that film can be declared negative or no malaria parasites seen? A. 100 B. 200 C. Whole field D. Whole film
C	14. If you have counted less than 99 parasites after 503 white cells, stop the count and record the results as the number of parasites per how many WBCs? A. 500 WBCs B. 200 WBCs C. 503 WBCs D. 203 WBCs

B	15. In establishing National Competency Assessment, what level of microscopists should be involved as facilitator of the training? A. Strictly Level A only B. Level A and B C. Level C and D are acceptable D. All of the above
C	16. How many years is the validity of the External Competency Assessment (ECA) Certificate? A. 2 years B. 2–3 years C. 3 years D. 4 years
C	17. Participation in an EQA is one important element of a functioning QA system for malaria microscopy. EQA means: A. External Quality Assurance B. Extended Quality Assurance C. External Quality Assessment D. None of the above
A	18. All are key elements of a functioning quality assurance system for malaria microscopy except one: A. Parasite counting B. Cross-checking or validation of malaria blood films C. Supervision D. Training E. Equipment maintenance and calibration
E	19. All statements about Standard Operating Procedures or SOPs are correct except one. A. Must be available in the laboratory – either as hard copy of e-copy B. Must be consistent with laboratory policy C. Should be concise, but contain all required information D. Must be strictly adhered to E. Can be modified by any laboratory staff
B	20. What is the required minimum QC sample size for malaria slide cross-checking per month? A. 25 samples of blood films B. 10 samples of blood films C. 10% of samples negative for malaria D. All samples positive for malaria only
C	21. What do you call the well maintained equipment that is essential requirement for malaria microscopy? A. Binoculars B. Magic glasses C. Compound binocular microscope D. Tally counter E. All of the above
B	22. What is the meaning of OTSS? A. Outreach Training and Support System B. Outreach Training and Supportive Supervision C. Outreach Training and Systems Strengthening D. All of the above

D	23. What are the methods of trainings for malaria microscopy? A. WHO training manual and assessing competence B. Refresher and Re-training C. E- training and E- learning D. All of the above
B	24. Participating laboratories of a proficiency testing (PT) programme are given the liberty to analyse PT samples according to any manner or protocol that the laboratory personnel wishes to follow. A. True B. False C. Cannot be determined D. Undecided
Bonus	25. Write at least one expectation about this training.

ANNEX 4

CHECKLIST FOR SOP REVIEW AND APPRAISAL

Instruction. Critically review the provided WHO SOPs and determine if there is anything in your current practices (national or local SOPs) that do not conform to the details in the SOPs presented. In your group (country), develop a list of SOP deficiencies, including total SOPs missing and others that require changes. Summarize your work in the table below.

WHO Malaria Microscopy SOP	Does your country/lab have this SOP? Yes or No	If yes, list anything in your current practices (national or local SOPs) that do not conform to the details of the WHO SOP.
MM-SOP-02: Preparation of Giemsa stock solution		
MM-SOP-03a: Preparation of water buffered to pH 7.2		
MM-SOP-03b: Preparation of water buffered to pH 7.2 with buffer tablets		
MM-SOP-04: Preparation of Giemsa working solution		
MM-SOP-01: Cleaning and storing of microscope slides		
MM-SOP-05a: Collection of finger-prick blood and preparation of thick and thin blood films		
MM-SOP-05b: Collection of blood by venipuncture and preparation of blood films from venous blood collected in tubes with anticoagulant		

MM-SOP-06a: Labelling malaria blood films		
MM-SOP-06b: Recording and reporting of microscopy results		
MM-SOP-07a: Giemsa staining of malaria blood films		
MM-SOP-07b: Ebola virus inactivation during staining of blood films with Giemsa stain		
MM-SOP-08: Microscopy examination of thick and thin blood films for identification of malaria parasites		
MM-SOP-09: Malaria parasite counting		
MM-SOP-12: Use, care and maintenance of microscopes		
Other SOPs		

2. Prepare a list of SOP and other documents/requirements that can be taken on the field visit.

3. Prepare a list of SOPs that you have, but are not included in the WHO SOPs.

4. Suggest other SOPs that you think are needed.

ANNEX 5

SUMMARY – COUNTRY APPRAISAL OF SOPS

IA. Appraisal of SOPs among countries in the Western Pacific Region (checklist)

WHO Western Pacific Region Countries *"Does your country/laboratory have this SOP?" and other comments*								
	Cambodia	**China**	**Lao PDR**	**PNG**	**Republic of Korea**	**Solomon Islands**	**Vanuatu**	**Vietnam**
MM-SOP-02: Preparation of Giemsa stock solution	**X**	✓	✓	✓	✓	✓	✓	✓
	Lab not yet prepared and not enough materials; new office				SOP based on 2009 WHO malaria diagnosis guideline	Preparation is centralized means that stock solution is done at the central level	This SOP is currently followed (shortage of some reagents like glycerol)	
MM-SOP-03a: Preparation of water buffered to pH 7.2	✓	✓	✓	✓	✓	✓	✓	✓
	Made dependent of some project like NIH, in collaboration with CNM	We have SOPs of preparation of water buffered to pH 7.2 but we usually use drop water than buffered water		Some sites run out of buffer tablets due to logistics but microscopy sites continue to stain. It's very challenging. The chances of reporting false positive or negative is high	SOP based on 2009 WHO malaria diagnosis guideline	Logistically we don't have enough pH meters to check the status of the pH		

MM-SOP-03b: Preparation of water buffered to pH 7.2 with buffer tablets	✓	**X**	✓	✓	✓	✓	✓	✓
	Made dependent of some project like NIH, in collaboration with CNM			(Same as above)	SOP based on 2009 WHO malaria diagnosis guideline	It may be prepared at the central level but may not be possible at peripheral level, due to availability of test meters		
MM-SOP-04: Preparation of Giemsa working solution	✓	✓	✓	✓	✓	✓	✓	✓
	Made dependent of some project like NIH, in collaboration with CNM				SOP based on 2009 WHO malaria diagnosis guideline	Preparation of Giemsa stock has been centralized at the national level for the purpose of reliable quality control		
MM-SOP-01: Cleaning and storing of microscope slides	✓	**X**	✓	✓	✓	✓	✓	✓
	With guidelines of WHO; dependent of the project	We have but we do not clean microscope slides usually			SOP based on 2009 WHO malaria diagnosis guideline	Only done when the country experiences stock-outs		
MM-SOP-05a: Collection of finger-prick blood and preparation of thick and thin blood films	✓	✓	✓	✓	✓	✓	✓	✓
	CNM has guidelines too			We teach malaria microscopists to wipe selected finger with alcohol in a circular motion and let it air dry.	SOP based on 2009 WHO malaria diagnosis guideline	We have the SOPs in place but in our situation it's too difficult to assess the smears because they have been prepared by the nurses		

MM-SOP-05b: Collection of blood by venipuncture and preparation of blood films from venous blood collected in tubes with anticoagulant	✓	✓	✓	✓	✓	✓	✓	✓
	By another project (not CNM)			Smear slides as soon as blood received/collected in tubes with anticoagulant to reduce changes of RBCs breaking up.	SOP based on 2009 WHO malaria diagnosis guideline	Collection of samples is normally done by nurses and not the microscopists		
MM-SOP-06a: Labelling malaria blood films	✓	✓	✓	✓	✓	✓	✓	✓
				Labelling of slides is done on the frosted end; labels with lab numbers, patient initials and date	SOP based on 2009 WHO malaria diagnosis guideline	We use pencils, mini permanent markers and even stickers to do the labelling		
MM-SOP-06b: Recording and reporting of microscopy results	✓	✓	✓	✓	✓	✓	✓	✓
	Guidelines by WHO			Report as NMPS, Pf, Pfg (if gametocytes present), Pv, Pm and Po etc.; health centres do not count parasite (density count) but provincial hospitals and surveillance units report density	SOP based on 2009 WHO malaria diagnosis guideline			
MM-SOP-07a: Giemsa staining of malaria blood films	✓	✓	✓	✓	✓	✓	✓	✓
				Fast method used usually for routine microscopy, slow method sometimes	SOP based on 2009 WHO malaria diagnosis guideline			
MM-SOP-07b: Ebola virus inactivation during staining of blood films with Giemsa stain	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	Not my office			But would adapt when need arises	There is a guideline for inactivation method of Ebola virus infection	The SOP is not yet implemented in Solomon Islands		
MM-SOP-08: Microscopy	✓	✓	✓	✓	✓	✓	✓	✓

examination of thick and thin blood films for identification of malaria parasites	Used every time in school but not in CNM				SOP based on 2009 WHO malaria diagnosis guideline			
MM-SOP-09: Malaria parasite counting	✓	**X**	✓	✓	✓	✓	✓	✓
	But not at all because by some project			New method used not the plus system/method	SOP based on 2009 WHO malaria diagnosis guideline			
MM-SOP-12: Use, care and maintenance of microscopes	✓	**X**	✓	✓	✓	✓	✓	✓
			All the SOPs are developed from WHO guidelines		SOP based on 2009 WHO malaria diagnosis guideline			
Other SOPs	But not on CNM (helminthic methods)	**X**	-	-	Detection of malaria using PCR Detection of malaria using LAMP	We do not have biosafety SOPs; we do not have the SOPs for microscopy QA and refresher trainings	-	-

Summary

- All eight Western Pacific Region countries which responded claimed to have SOPs on the following: (1) Preparation of water buffered to pH 7.2; (2) Preparation of Giemsa working solution (or any other staining solution that they normally use); (3) Collection of finger-prick blood and preparation of thick and thin films; (4) Collection of venepuncture and preparation of films from venous blood collected in tubes with anticoagulant; (5) Labelling blood films; (6) Recording and reporting of microscopy results; (7) Giemsa staining of blood films (or using any other stain that they normally use); and (8) Microscopy examination of thick and thin blood films for identification of malaria parasites.
- One Western Pacific Region country in each item declared that they did not have a written procedure on the following: (1) Preparation of Giemsa stock solution (or any other staining solution that they normally use); (2) Preparation of water buffered to pH 7.2 with buffer tablets; (3) Cleaning and storing of microscope slides; (4) Malaria parasite counting; and (5) Use, case and maintenance of microscopes.
- No laboratory had an SOP on the Ebola virus inactivation during staining of blood films with Giemsa stain in their roster of procedures. One laboratory asserted that they had additional SOPs on other procedures like detection of malaria using PCR and LAMP.

IB. Appraisal of SOPs among countries in the Western Pacific Region (enumeration)

WHO Western Pacific Region Countries			
	List of SOPs and other documents/requirements that can be taken on the field visit	**List of SOPs that you have, but are not included in the WHO SOPs**	**SOPs that you think are needed**
Cambodia	Yes, like supervision list	Yes, but under helminthic methods	I need to clarify all of checklist more than I did, will follow strictly for work
China	Malaria control and prevention manual, construction of malaria diagnostic reference laboratory manual	None	None
Papua New Guinea	Outreach training and supportive supervision checklist (checklist should have summary page to be given to the health centre/site and the health office too) Documentation SOP Blood film preparation SOP (both thick and thin film) Staining (blood staining) SOP Examination of blood film SOP Quality assurance SOPs	-	
Solomon Islands	Slides for cross-checking (mini bank) Data entry forms (case management) Supplies and management WHO bench aids LED light (microscopy) light source manual Microscopy maintenance checklist form QA & QC supervisory checklist	LED light (microscopy light source) manual Microscopy maintenance manual	Standard microscopy refresher training manual (guidelines) A standard laboratory design for all peripheral level laboratories with standard cabinets, benches and chairs A standard slide bank to be prepared by high level and quality laboratories like RITM to be distributed to countries that lack proper banks Training of nurses for blood smear preparation
Vanuatu	No	No	-
Viet Nam	Checklist Report on Supervisory visit included: cross-checking, competency assessment (five slides examination), training and re-training, equipment and supply, record and report (logbook and reporting form)	-	-

IIA. Appraisal of SOPs among countries in the Southeast Asian Region (checklist)

WHO South-East Asia Region Countries ***"Does your country/laboratory have this SOP?" and other comments***					
	India	Myanmar	Nepal	Thailand	Timor Leste
MM-SOP-02: Preparation of Giemsa stock solution	✓	✓	✓	**X**	**X**
	India does not use Giemsa stock solution; instead JSB stain is used; solution for stain preparation is available		Ready to use Giemsa stock solution		
MM-SOP-03a: Preparation of water buffered to pH 7.2	✓	✓	✓	**X**	**X**
	For JSB stain		Ready-made; ready to use		
MM-SOP-03b: Preparation of water buffered to pH 7.2 with buffer tablets	**X**	✓	**X**	✓	**X**
	No separate SOP; included in SOP for staining				
MM-SOP-04: Preparation of Giemsa working solution	**X**	✓	✓	✓	✓
	For JSB, available	All our SOPs conform to the manuals provided by the WHO	Procure by market	We have the preparation of 10% Giemsa working solution only	3% Giemsa working solution, 10% Giemsa working solution
MM-SOP-01: Cleaning and storing of microscope slides	✓	✓	✓	✓	✓
			National and local level; single use of slides		New slides and used slides; wrapping cleaned slides
MM-SOP-05a: Collection of finger-prick blood and preparation of thick and thin blood films	✓	✓	✓	✓	✓
	Examples of good/correctly made and wrongly made smears with figures		Any other private sector we are promoting and performing finger prick blood sample	Same	Preparation blood smear only

MM-SOP-05b: Collection of blood by venipuncture and preparation of blood films from venous blood collected in tubes with anticoagulant	**X**	✓	✓	**X**	✓
	No SOP for this		Any basic health laboratories and private sector are used in blood films are venipuncture		Unwritten document
MM-SOP-06a: Labelling malaria blood films	✓	✓	✓	✓	✓
	This is included in the SOP for collection of finger prick blood and preparation of thick and thin smear		According to WHO quality assurance manual versions 1 and 2	We mention ID of patient, ID office, date	Unwritten document
MM-SOP-06b: Recording and reporting of microscopy results	✓	✓	✓	✓	✓
	Mainly slides for malaria reporting and recording including reporting of individual results		Recording and reporting of microscopy result according to MM-SOP-06b		Unwritten document
MM-SOP-07a: Giemsa staining of malaria blood films	✓	✓	✓	✓	✓
	Staining with JSB; _____; combined SOP for examination only		Prepare Giemsa staining procured by market	Almost same	105 and 3% staining methods handout
MM-SOP-07b: Ebola virus inactivation during staining of blood films with Giemsa stain	**X**	✓	**X**	**X**	**X**
		All our SOPs conform to the manuals provided by the WHO	In Nepal, nobody is suffering from Ebola virus		
MM-SOP-08: Microscopy examination of thick and thin blood films for identification of malaria parasites	✓	✓	✓	**X**	✓
	Common SOP for staining and examination and counting; picture of artefacts given	All our SOPs conform to the manuals provided by the WHO	Examine the slide systematic manner according to quality assurance manual versions 1 and 2	We have guidelines	Written document, handout

MM-SOP-09: Malaria parasite counting	-	✓	✓	✓	✓
	Combined with SOP for staining and not separate		Near future we are starting	Need to confirm detail	Written document, handout
MM-SOP-12: Use, care and maintenance of microscopes	✓	✓	✓	✓	✓
	More elaborate, defines the parts of microscope also		Proper use, care and maintenance of microscopes		Written document, handout
Other SOPs	Electronic balance; for weighing pH meter Cleaning and maintenance of glassware Storage and transport of blood smears Crosschecking Preparation of QA slides SOPs on supervision for ensuring competency and performance of lab technicians Quality audit	We are in the process of developing and revising the following SOPs: NCA PT Slide-banking	According to government of Nepal and WHO guidelines	Cross-checking (Regional random 10% malaria negative slide and 100% of positives)	Crosschecking of positive slides for external QA; QC of RDT test kits

Summary:

- All five South-East Asia Region countries who responded claimed to have SOPs on the following: (1) Cleaning and storing of microscope slides; (2) Collection of finger-prick blood and preparation of thick and thin films; (3) Labelling malaria blood films; (4) Recording and reporting of microscopy results; (5) Giemsa staining of blood films (or using any other stain that they normally use); (6) Malaria parasite counting and (6) Use, case and maintenance of microscopes.
- At least two South-East Asia Region countries declared that they did not have a written procedure on the following: (1) Preparation of water buffered to pH 7.2; (2) Preparation of Giemsa working solution (or any other staining solution that they normally use); (3) Collection of venepuncture and preparation of films from venous blood collected in tubes with anticoagulant; (5) Microscopy examination of thick and thin blood films for identification of malaria parasites; (6) Preparation of Giemsa stock solution (or any other staining solution that they normally use); and (7) Preparation of water buffered to pH 7.2 with buffer tablets.
- One laboratory had an SOP on the Ebola virus inactivation during staining of blood films with Giemsa stain in their roster of procedures. One laboratory asserted that they had additional SOPs not mentioned on other procedures like use of electronic balance, cleaning and maintenance of glassware, storage and transport of blood smears, cross-checking of slides/slide rechecking, preparation of QA slides, supervision and maintenance of competency of laboratory technicians and laboratory audit.

IIB. Appraisal of SOPs among countries in the Southeast Asian Region (enumeration)

WHO South-East Asia Region Countries			
	List of SOPs and other documents/requirements that can be taken on the field visit	**List of SOPs that you have, but are not included in the WHO SOPs**	**SOPs that you think are needed**
Myanmar	Collection of finger prick blood Preparation of thick and thin films Preparation of Giemsa working solution and buffered water Labelling microscopy slides Staining microscopy slides Recording and reporting malaria parasites Density counting of malaria parasites Storage and transportation of slides	All our SOPs refer to the WHO manuals	Proficiency testing programme (a more detailed description which includes statistical components) Guide to prepare consent forms Detailed description of developing and managing slide banks
Nepal	We are preparing the supporting supervision guidelines and checklist	We are preparing SOPs visit list that include WHO quality assurance manual according to version 2, 1	-
Thailand	Guidelines Buffer tablets pH meters Giemsa Checklist	No	In SOP we are not available in (1) choice
Timor Leste	Supervision SOPs Panel slides SOPs	Cross-checking of routine slides to external QA	Cross-checking of routine slides for external QA QC of RDT test kits

ANNEX 6

GROUP WORK RESULT OF FIELD VISIT

Group members:

1. Anupkumar Anvikar (India)
2. Naly Kham Insou (Lao PDR)
3. Noor Md Yusuf (Malaysia)
4. Dhana Prasad Paudel (Nepal)
5. Ram Balak Raya (Nepal)
6. Lee Sang-eun (Republic of Korea)
7. Peter Lenis (Vanuatu)
8. Theerayot Kobasa (Thailand)

Facilitators:

1. Ronald Espina (Philippines)
2. Jennifer Luchavez (Philippines)

Objectives:

1. Learn the steps in planning and carrying out OTSS.
2. Identify problems and issues in the laboratory and microscopists/s.
3. Establish trust and good relationship between the supervisor and malaria laboratory staff to make learning conducive, which in turn can lead to improvement in performance.

General information on the laboratory/facility:

- Malaria laboratory of Antipolo City Health Center is a government laboratory;
- located at M. Santos street, Antipolo City, Rizal;
- city health officer: Dr Concepcion Lat; and
- malaria microscopists:
    1. Nenita L. Bagabagon – BSc Medical Technology graduate; 20 years of experience; results of eye test three years ago is good; and
    2. Christina S. Suaver – BSc Medical Technology graduate; 16 years of experience; results of eye test three years ago is good.

Documentation:

- used Bench Aids for Malaria Microscopy 2010 for SOP;
- registry form;
- no internal QC log sheet; logbook is maintained; and
- recommendations: support use of internal QC log sheet; maintain the use of logbook.

Procedure:

- observation of the following practices: blood film preparation, blood film staining; and
- recommendations:
    - use buffered water;
    - exercise caution when fixing thin smears to avoid the vapour of methanol from auto-fixing the thick smears;
    - make sure that a dark/amber bottle is used when aliquoting the buffer; and
    - label all bottles with appropriate labelling.

Competence:

- review of slide cross-checking: regularly practiced; only informal feedback (no data to show);

- review of proficiency testing: done regularly (twice a year); only informal feedback (no data to show); and all samples are in duplicate so that one will be given to the validator centre and one to be kept as reference slide.
- Recommendations
    1. Documentation of official feedback must be implemented.
    2. Certification of competency of microscopists should be displayed.
    3. A poster of total samples received and examined should be displayed for general knowledge.
    4. If possible, make more positive smears for future reference and other purposes (training, replacement of broken slides, etc.).
    5. If possible, every patient with fever needs to be tested for malaria – and not only patients with symptoms of malaria.

Number of slides	11 (1 January–23 June 2016)
Parasite detection agreement	100%
False positives	0
False negatives	0
Number of true positives	1
Species identification agreement	100%
Parasite density agreement	100%
Poorly prepared thick film?	0%
Poorly prepared thin film?	0%
Staining poor?	0%
Presence of artefacts?	0%
Number of auto-fixed slides	Slightly auto-fixed smears on some slides

Quality Assurance:

- laboratory complied with Bench Aids of Malaria Microscopy 2010;
- no QA or QC guidelines;
- no formal protocol for analysis and to address gaps in internal QC; and
- proficiency testing or external quality assessment is performed.

Laboratory Environment/Set-up:

- too hot and humid surroundings;
- small, congested space; and
- recommendations: seek to provide air ventilation and try to acquire more laboratory space.

Biosafety:

- Air ventilation
- Guidelines on the disposal of waste materials

Equipment, Reagent and General Supply:

- more than enough supply; and
- recommendations: ensure that expiry dates are checked; ensure that there is no shortage of supplies – keep records of all materials and supplies.

ANNEX 7

COUNTRY PRIORITY ACTIVITIES/PLANS FOR THE QA OF MALARIA MICROSCOPY

Country	Plans	Schedule *(if indicated)*
South-East Asia Region countries		
India	Do sample collection for malaria slide bank	-
	Adapt and finalize SOPs and discuss with an expert group	-
	Conduct trainings for state and regional level cross-checkers (about 50) by the country experts followed by ECA and certification by WHO expert	September 2016
	Test SOPs during training/ECA	-
	Link peripheral level laboratories to the state/regional and central level	-
	Implement revised QA in entire country based on the country in a phased manner (training, national certification, EQAS)	January 2017
Timor Leste	Develop manual of national SOPs for malaria microscopy adapted from the WHO – to be approved by NHL and NMCP	-
	Collect samples for malaria slide bank – proposal to be approved by NHL and NMCP	Still seeking approval
	Conduct supervisory visits based on the principle of OTSS – translate to the local language	To implement immediately after translation
	Plan national training for regional and district senior laboratories – participate in the ECA this year (NHL and NMCP)	-
	Conduct EQA (indirect panel-testing) – to be agreed by NHL and NMCP	Still seeking approval
	Prepare buffered water (at pH 7.2) – to be approved by NHL and NMCP	Still seeking approval
	Observe border screening at Indonesia and Timor Leste – to be approved by NHL and NMCP	Still seeking approval
Thailand	Conduct refresher training for malaria microscopy for 32 peripheral-level microscopy centres	May-June 2016
	Conduct refresher training for malaria microscopy and strengthening QA in the regional and national level	July 2016
	Participate in ECA	August 2016
	Establish national core team for MM	-
	Prepare slide for PT and training, prepare Thai version of SOPs	September 2016
	Conduct refresher training for Malaria Microscopy for peripheral level 300+ MC and Checker	October-December 2016
Nepal	Observe regular cross-checking of slides	-
	Regularly train on malaria microscopy (including refresher trainings)	-
	Conduct regular supervision	-
	External quality control (SOP and QA, according to WHO guidelines)	-
	Work with two partners (WHO and Save the Children) in malaria elimination activities	-
	Establish a slide bank	-
Myanmar	Conduct refresher training for senior laboratory technicians	For two weeks
	Conduct competency training for senior VBDC laboratory technician and hospital laboratory technician	For one week
	Conduct QA Workshop for senior VBDC laboratory technician	For 3 days

	Conduct supervision in malaria microscopy	-
	Participate in ECA	August 8–12, 2016
Western Pacific Region Countries		
Cambodia	Participate in ECA	Expect 3 years
	Conduct refresher training in malaria microscopy while following SOP – 1 province per year	-
	Conduct supervision through malaria slide cross-checking and reporting	For immediate implementation
Vietnam	Consolidate and revise SOPs where necessary	-
	Establish National Core Group (for planning, training, and national competency assessment or NCA)	-
	Conduct NCA	-
	Conduct refresher training for microscopists	-
	Monitor supply of buffer and equipment	-
	Carry out OTSS	-
Vanuatu	Carry out routine supervisory visit	Twice a year
	Do cross-checking of provincial slides for elimination and quarterly for control provinces.	Every month
	Organize panel-testing (positive slides from the national)	Every 3 months
	Participate in ECA	-
	Strengthen RDT base diagnosis in peripheral	-
	Establish slide bank	-
	Conduct refresher trainings based on the WHO Learner's Manual	-
Solomon Islands	Strengthen microscopy-based diagnostic services	
	Strengthen RDT-based diagnostic services	-
	Strengthen QA for microscopy and RDT-based diagnosis	-
	Strengthen drug supply management	-
	Procure antimalarial drugs	-
	Strengthen laboratory supply management	-
	Conduct supportive supervisory visits to the provinces	-
	Continuous monitoring of antimalarial drug efficacy (first line treatment)	To begin by September
	Improve and sustain the function of QAP at all levels	-
	Strengthen the supply system at all levels	-
	Liaise with international partners for technical assistance	-
	Establish a national slide bank in the country	-
	Strengthen human capacity through trainings	-
	Continue to facilitate WHO/ECA trainings	-
Papua New Guinea	Establish slide bank	-
	Establish panel-testing for malaria microscopy in the country	-
	Draft SOPs as adapted from the new version of the WHO manual	-
Malaysia	Cross-checking • To overcome the hurdle of making on site evaluations (time and cost) – to further develop according to the scheme of OTSS • Disperse WHO certified microscopists to all regions as a reference point for all states	-
	Training • Unified module for all training forms • To disseminate training modules to trainers at all levels • SOP for an annual NCA in progress for improvements • Involve all WHO ECA certified microscopists in training activities	-

	Proficiency testing • Expanding the scope of tests • Expansion of slide bank • Including the individual microscopists • Creating a database	-
Lao PDR	Sustain the project on malaria slide-banking at (now with 27 cases with 200 slides per case)	-
	Conduct refresher training on malaria microscopy for staff in district health centre	-
	Monitor and evaluate the QA system in the provincial and district level	-
	Develop SOP for maintenance of malaria microscope	-

ANNEX 8

POST-TEST QUESTIONNAIRE

Date	
Name	
Country	

Instruction: Choose the best answer to each question. Write the corresponding letter of your answer on the space provided before each question.

Answer	Question
D	1. The monitoring of the performance of reagents is known as: A. Quality Assurance B. Crosschecking C. Validation D. Quality Control
C	2. Blood films for malaria diagnosis are best prepared using A. EDTA blood B. Heparinised blood C. Capillary blood D. Citrated blood
A	3. What are the components of Giemsa stock solution? A. Absolute Methanol, Glycerol and Giemsa powder B. Methanol, Glycerol and Methylene blue C. Methanol, Glycerol and Eosin D. Ethanol, Glycerol and Giemsa powder
C	4. Participation in an EQA is one important element of a functioning QA system for malaria microscopy. EQA means: A. External Quality Assurance B. Extended Quality Assurance C. External Quality Assessment D. None of the above
C	5. If you have counted less than 99 parasites after 503 white cells, stop the count and record the results as the number of parasites per how many WBCs? A. 500 WBCs B. 200 WBCs C. 503 WBCs D. 203 WBCs
B	6. In malaria microscopy, one important step to ensure that the laboratory sample and data corresponds to the patient is termed as: A. Quality control B. Correct labelling C. Accurate reporting D. Proper staining

D	7. What are the methods of trainings for malaria microscopy? A. WHO training manual and assessing competence B. Refresher and Re-training C. E- training and E- learning D. All of the above
C	8. What is the ideal pH of the buffered water? A. 6.9 B. 7.5 C. 7.2 D. 6.0
A	9. All are key elements of a functioning quality assurance system for malaria microscopy except one: A. Parasite counting B. Cross-checking or validation of malaria blood films C. Supervision D. Training E. Equipment maintenance and calibration
E	10. All statements about Standard Operating Procedures or SOPs are correct except one: A. Must be available in the laboratory – either as hard copy of e-copy B. Must be consistent with laboratory policy C. Should be concise, but contain all required information D. Must be strictly adhered to E. Can be modified by any laboratory staff
C	11. What do you call the well maintained equipment that is essential requirement for malaria microscopy? A. Binoculars B. Magic glasses C. Compound binocular microscope D. Tally counter E. All of the above
B	12. What is the required minimum QC sample size for malaria slide cross-checking per month? A. 25 samples of blood films B. 10 samples of blood films C. 10% of samples negative for malaria D. All samples positive for malaria only
B	13. In establishing National Competency Assessment, what level of microscopists should be involved as facilitator of the training? A. Strictly Level A only B. Level A and B C. Level C and D are acceptable D. All of the above
B	14. What is the meaning of OTSS? A. Outreach Training and Support System B. Outreach Training and Supportive Supervision C. Outreach Training and Systems Strengthening D. All of the above
B	15. Participating laboratories of a proficiency testing (PT) programme are given the freedom to analyse PT samples according to any manner or protocol that the laboratory personnel wishes to follow. A. True B. False C. Cannot be determined D. Undecided
B	16. In preparing malaria blood films, the ideal angle of a spreader slide to make the thin blood film is A. 30^{o}

	B. 45^o C. 60^o D. 90^o
D	17. The following statements about cleaning and storage of microscope glass slides for malaria are true except: A. Dirty and scratched slides can result to poorly prepared blood films which can affect diagnosis. B. Slides that are slightly-scratched and considered unsuitable for malaria blood films can be used for other tests. C. Wearing of gloves can prevent accidental cuts during washing D. Glass slides with malaria blood films should be recycled and therefore needs to be washed and cleaned.
B	18. In preparing malaria blood films from samples that might be infected with the Ebola virus, the following reagent is used to deactivating agent: A. 70% Methanol B. 5% Triton X-100 C. 10% Giemsa solution D. None of the above
C	19. How many years is the validity of the External Competency Assessment (ECA) Certificate? A. 2 years B. 2–3 years C. 3 years D. 4 years
A	20. In mixed infections or infections by more than one species, it is recommended to count all the species together (sexual and asexual stages). A. True B. False C. Both D. Cannot be determined
B	21. On the care and maintenance of the microscope, the following must be done on a daily basis except for one: A. After each use the objective should be wiped with lens paper to remove the oil. B. The microscope should be placed in the transport box. C. The low power objective should be lined with the stage after each use. D. The power switch should be turned off when the microscope is not in use.
A	22. What is the minimum number of thick film high power (oil immersion) fields that should be examined before that film can be declared negative or no malaria parasites seen? A. 100 B. 200 C. Whole field D. Whole film
B	23. What is the method used for rapid staining of malaria blood films? A. 3% of Giemsa working solution for 45–60 minutes B. 10% of Giemsa working solution for 10–15 minutes C. 3% of Giemsa stock solution D. 10% of Giemsa stock solution

C	24. How many millilitres (mL) of Giemsa stock solution is needed to prepare a 100 ml of Giemsa working solution in 10% staining method? A. 90 mL B. 20 mL C. 10 mL D. 100 mL
	25. Have your expectations been met? Why or why not?

ANNEX 9

INDIVIDUAL RESULTS IN THE PRE- AND POST-TEST AND (MOCK) MICROSCOPY ASSESSMENT

PARTICIPANT	Country	Pre-test score (%)	Post-test score (%)	Microscopy practical (%)
Kim, Ms Marath	Cambodia	13 (52)	10 (40)	16 (89)
Mam, Ms Montha	Cambodia	11 (44)	9 (36)	16 (89)
Sun, Mr Dingwei	China	12 (48)	20 (80)	11 (61)
Khaminsou, Dr Naly	Lao PDR	10 (40)	19 (76)	11 (61)
Phommasansack, Ms Manisack	Lao PDR	8 (32)	20 (80)	15 (83)
Sangaran, Ms Kumuthamalar	Malaysia	18 (72)	24 (96)	16 (89)
Md Yusuf, Dr Noor Azian	Malaysia	15 (6)	19 (76)	7 (39)
Mina, Mr Harry	Papua New Guinea	13 (52)	12 (48)	7 (39)
Gaudi, Ms Carolyn	Papua New Guinea	16 (64)	24 (96)	17 (94)
Lee, Dr Sang-eun	Republic of Korea	14 (56)	20 (80)	14 (78)
Fafale, Mr Hulston Adam	Solomon Islands	18 (72)	19 (76)	16 (89)
Taraihaka, Mr Eric	Solomon Islands	13 (52)	20 (80)	14 (78)
Lenis, Mr Peter	Vanuatu	15 (60)	19 (76)	15 (83)
Nguyen, Dr Quy Anh	Viet Nam	13 (52)	20 (80)	13 (72)
Nguyen, Ms Thi Thanh Tram	Viet Nam	12 (48)	23 (92)	12 (67)
Anvikar, Dr Anupkumar	India	17 (68)	21 (84)	11 (61)
Wattal, Dr Suman Lata	India	17 (68)	22 (88)	---
Bo, Mr Win	Myanmar	15 (60)	13 (52)	12 (67)
Myat Aye, Ms. Tin	Myanmar	14 (56)	13 (52)	15 (83)
Paudel, Mr Dhan Prasad	Nepal	7 (28)	16 (64)	7 (39)
Ray, Mr Ram Balak	Nepal	8 (32)	16 (64)	13 (72)
Kobasa, Mr Threerayot	Thailand	16 (64)	18 (72)	12 (67)
Saejeng, Ms Aungkana	Thailand	18 (72)	21 (84)	15 (83)
Gomes, Mr Antonio	Timor Leste	12 (48)	14 (56)	15 (83)
Rangel, Mr Gregorio	Timor Leste	9 (36)	14 (56)	10 (56)

ANNEX 10

TRAINING EVALUATION

The purpose of this form is to provide you with an opportunity to give feedback on the assessment you have just attended. This evaluation is important because it gives information to improve this activity.

Instructions: Please circle the appropriate number and offer any comments you may have about the course.
1 – Poor 2 – Fair 3 – Good 4 – Very Good 5 – Excellent
You do not have to write your name if you would rather not.

A. Overall assessment of the training activity	**RATING**				
The training covered relevant subject matter according to the stated objective. If you disagree with this, which subjects/topics should have been given more coverage? Comments:	1	2	3	4	5
The trainers/facilitators for the training had sufficient knowledge and teaching ability to provide the necessary skills and competence. Comments:	1	2	3	4	5
The time allotted to each part of the training was adequate relative to the total time available. If you disagree with this, which particular topic/activity should have been given more time? Comments:	1	2	3	4	5
B. Assessment: Unknown slides					
The unknown slides for species identification used were satisfactory. Suggestions for improvement:	1	2	3	4	5
The unknown slides for parasite counting used were satisfactory. Suggestions for improvement:	1	2	3	4	5
The objectives of the training were satisfactorily achieved. Comments:	1	2	3	4	5
C. Overall evaluation of the training					
7. What overall rating would you give to this training course?	1	2	3	4	5
8. With regard to this assessment, state the following: the three aspects that impressed you most favourably: _____ _____ _____ the three aspects that impressed you least favourably: _____ _____					
9. Do you have any additional comments or suggestions regarding any aspect of the training? If so, please write them down below.					

Feedback of Participants:

Aspects that impressed the participants MOST favourably:

- Proficiency testing
- OTSS
- Parasite counting
- Overall organization
- Competence of microscopists
- Commitment of WHO for improving malaria diagnosis
- Assessment of blood smear
- Slide-banking
- Faculty
- Accommodation and food
- Teaching materials and location
- Infrastructure within the study
- Field visit
- Set-up of QA activity
- Slide ID
- Good management
- Good teaching
- Time management
- All lecturers very good
- RDTs
- Practiced slide banking
- All trainers knowledgeable
- Well prepared
- Teamwork exhibited
- Punctuality has improved
- Practiced slide banking
- All trainers knowledgeable
- Well prepared
- Teamwork exhibited
- Punctuality has improved

Aspects that impressed the participants LEAST favourably:

- Traffic jam
- Food
- Not enough time for microscopy

Suggestions for improvement:

- 2-week training
- I need to do this training
- Satisfied with the topic covered
- To present OTSS findings
- Arrange 1-day practical fieldwork

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Western Pacific Region