WHO-EM/MAL/269/E/L
Distribution: Limited

Report on the

INTERCOUNTRY WORKSHOP ON QUALITY ASSURANCE OF LABORATORY DIAGNOSIS FOR MALARIA

TEHERAN, ISLAMIC REPUBLIC OF IRAN, 2-5 SEPTEMBER 2001

World Health Organization
Regional Office for the Eastern Mediterranean
Cairo, Egypt
2001

CONTENTS

1. INTRODUCTION

The Intercountry Workshop on Quality Assurance of Laboratory Diagnosis for Malaria was held in Teheran, Islamic Republic of Iran, from 2 to 5 September 2001. All 23 countries of the Eastern Mediterranean Region were invited to participate but unfortunately delegates from Djibouti, Iraq, Libyan Arab Jamahiriya, Somalia, Tunisia, and the Republic of Yemen could not attend.

The meeting was inaugurated by Dr M.M. Gouya, Director, Diseases Control, Ministry of Health and Medical Education, Islamic Republic of Iran. This was followed by a message from Dr Hussein A. Gezairy, WHO Regional Director for the Eastern Mediterranean, which was read on his behalf by Dr El Fatih El Samani, WHO Representative for the Islamic Republic of Iran (Annex 4).

Dr Hoda Atta, Medical Officer, Roll Back Malaria, WHO/EMRO, stated that the objectives of the meeting were as follows:

?? review microscopic methods of diagnosis of malaria;

?? evaluate the current state of quality assurance of laboratory diagnosis in malaria control programmes in Eastern Mediterranean Region countries; and

?? review and adopt regional guidelines for quality assurance.

Dr G. H. Edrissian, Islamic Republic of Iran, and Dr M. Zare, Teheran, Islamic Republic of Iran, were elected co-chairpersons who chaired on rotation. Dr A.E. Beljaev, WHO Temporary Adviser, was elected Rapporteur.

The plenary session started with general remarks by Drs A.E. Beljaev, D. Payne, G. H. Edrissian and H. Atta. All the speakers expressed the view that the quality of laboratory diagnosis of malaria in the countries of the Eastern Mediterranean Region was generally below expectations. They said that the EMRO initiative to convene the meeting was timely and it would be the first WHO regional workshop for decades dedicated specifically to quality assurance in malaria diagnosis. It was also hoped that the workshop would contribute to a badly needed standardization of laboratory procedure at country and international levels.

This introduction was followed by presentations from every country on the status of quality assurance in their country and three presentations on set themes:

?? Review of quality control methods for microscopic diagnosis of malaria as used in Malaria Eradication Programmes and in current malaria control laboratory practice. (Dr. A.E. Beljaev)

?? Review of non-microscopic diagnostic methods for malaria and their possible role in quality control. (Dr. D. Payne)

?? Establishing a sustainable system for monitoring and improving the quality of laboratory results in Ghana: Summary of a Regional In-Service Training Programme (RIST). (Dr. V. Bekoe)

Three working groups were formed, each for a group of countries with a similar type of malaria control programme:

?? Group 1: Countries that have achieved interruption of malaria transmission (Bahrain, Cyprus, Jordan, Kuwait, Palestine and Qatar).

?? Group 2: Countries where malaria is firmly under control and that are targeting eradication (Egypt, Morocco, Oman, United Arab Emirates and Syrian Arab Republic).

?? Group 3: Countries with a moderate endemicity and relatively well-established control programmes (Islamic Republic of Iran, Pakistan and Saudi Arabia) and countries with a serious malaria problem and/or threatened by epidemics and complex situations (Afghanistan and Sudan).

A field visit took place to Teheran reference laboratory, a district health centre laboratory in Islam Shahr, and the laboratory division and museum at the School of Public Health, Teheran University. The groups reconvened to discuss the findings of the field visit. The overall impression was positive although a number of shortcomings were identified such as non-utilization of phosphate buffer solution, insufficient thickness of thick blood film, and bench aids available, but not displayed.

A discussion followed of documents prepared by Drs Payne and Beljaev including a draft of the guide on laboratory diagnosis of malaria and laboratory quality assurance presented by Dr Beljaev. It was agreed that this latter document by Dr Beljaev might be accepted as a basis of a guide to be produced by EMRO on the laboratory diagnosis of malaria and its quality. Some modifications and additions were proposed and accepted. The part on quality assurance *sensu stricto* should be further developed, particularly by incorporating the document *Guidelines for principles of the establishment and maintenance of quality control in malaria diagnosis*, presented by Dr Payne as a statement on the policy of quality assurance. It was also recommended ensuring that this guide be in agreement with published documents on laboratory quality assurance, especially in terminology.

The meeting was closed by Dr. Zuhair Hallaj, Director, Control of Communicable Diseases, EMRO. A copy of the agenda, programme and list of participants are attached as Annexes 1, 2 and 3 respectively.

2. TECHNICAL PRESENTATIONS

2.1 Review of quality control methods for microscopic diagnosis of malaria

Correct microscopy includes examination of a thick blood film (TBF) stained by Giemsa stain (other stains are less robust) without fixation, at magnification 600×–1000×. A thin smear also stained by Giemsa is not mandatory, because it is 10–20 times less sensitive than the TBF, but may be useful in special cases such as high parasitaemia or rare species. An essential condition of staining is the use of phosphate buffer solution (PBS) to ensure a correct pH of 7.0 to 7.2. Before using a new stock solution, the process should be calibrated to find an optimal concentration of stain and timing.

Under standard conditions of examination, 100 fields are examined, and possibly more in special cases. A good place of the film is selected where there are 10–20 white blood cells (WBC) per field. Under these conditions, the amount examined would correspond to 0.2 microlitres (?l) of blood. The examination should continue even after finding a parasite, until the number of 100 fields examined is achieved so as to detect any mixed infections.

Standard conditions of reporting include indication of the species of the parasite and stages of development (the latter only for *P. falciparum*), with special reference to gametocytes. For other species, there is no need to indicate stages.

Quantification, i.e. measuring parasite densities, is an important part of the diagnosis. A number of methods of quantification may be used:

?? Average number of parasites per field (approximate) expressed in scores from 1 to 5. This method is most useful, being informative yet not requiring additional time for counting parasites.

?? Number of parasites counted per number of WBC and further recalculated per 1 µl using a standard (e.g. 8000 WBC per µl) or the actual number of WBC measured in parallel.

?? Number of parasites counted per number of red blood cells (RBC), which may be used only in very high parasitaemia using a thin smear: the results are expressed as a percentage of infected RBC or per 1 µl using the actual number of RBC measured in parallel.

The number of parasites for each species or stage (the latter in *P. falciparum* only) should be indicated separately. Quantification is essential for evaluation of the case as, in a parasitaemia of more than 100 000 parasites per ?l, the probability of a death increases sharply. The number of parasites is needed for evaluation of the response of parasitaemia to drugs and also is useful for analysing sources of errors in microscopic diagnosis.

Since gametocytes of *P. falciparum* appear later than asexual stages and may persist for weeks after the clearance of asexual parasitaemia, separate recording of sexual and asexual forms is essential for evaluation of falciparum cases, e.g. presence of gametocytes is an indication that the disease is no less than 10 days old and persistence of gametocytes after the clearance of asexual parasitaemia by blood schizontocides is not an indication of a drug failure.

Traditional microscopy is most reliable in an expert's hands, but in mass practice it is much less sensitive and precise due to a multitude of errors. These errors may occur in collection, processing the slide, examination, judgement and reporting. The sources of errors are many and may depend on the laboratory technician (due to inadequate skills or physical inability to do diagnostic work), substandard supplies, poor condition of microscopes or overload of work. It is extremely important that laboratory technicians and supervisors especially are able to identify errors and able to prevent and correct them.

Approaches to quality assurance in malaria eradication programmes developed in the 1950s–1960s and corresponded to the ideology of malaria eradication. During the attack

phase, the emphasis was on antivector operation and so little attention was paid to the quality of laboratory diagnosis. Only during the late attack, consolidation and maintenance phases did quality assurance of laboratory diagnosis become important. However, since the emphasis of the case detection machinery was on detection of the very last case of local transmission, detection of asymptomatic and oligosymptomatic cases was deemed extremely important. On the other hand, there was no preoccupation with the aspects related to clinical laboratory. The main activity was a re-examination of all the positive cases and a random sample (10%) of the negatives ones. Discrepancies considered important were mainly incorrect diagnosis of positives as negatives and vice versa, whereas much less importance was accorded to the correctness of species identification, and there was no emphasis on quantification.

Today the priorities of antimalaria programmes have changed dramatically. The main emphasis is now put on prompt treatment of clinical cases. There is not much emphasis on continuing transmission, except in some programmes that explicitly aim at eradication of malaria or those that have achieved interruption of malaria transmission over considerable parts of their national territories, such as the Islamic Republic of Iran or Saudi Arabia. Hence, asymptomatic cases are of little importance in most affected areas. A correct diagnosis of *P. falciparum* is important, whereas discrimination between *P. falciparum* and other species is of less importance. Much more attention should be paid to quantification in detection of (potentially) severe cases and monitoring of the response to drugs.

Unfortunately, despite the changing priorities, attitudes towards quality assurance in the countries of the Region have remained more or less the same as during the eradication era. In addition, in some programmes, quality assurance has practically been phased out. The shortcomings of quality assurance as implemented now at the central level (national, state or district) are mainly as follows:

?? quality assurance is mostly reduced to cross-checking in a central laboratory;

?? no regular visits by personnel from the centres to peripheral laboratories;

?? no facilities for maintenance of microscopes;

?? no follow up of the quality of laboratory chemicals;

?? no follow up of the adherence to the correct laboratory procedure; and

?? weak links with quality assurance in other branches of laboratory work.

Cross-checking, as implemented now, is itself far from perfect, as it is not done in a blind way. In addition, feedback, if sent, is only on the discrepancies in positivity and species and not on the quality of slide processing. Also evaluation is depersonalized as there is no continuous monitoring of individual technicians and laboratories.

The shortcomings of quality assurance done at the peripheral level are:

?? laboratory technicians are not interested in cross-checking, since they do not get helpful feedback;

?? supervisors in clinics often cannot give technical support to their malaria technicians;

?? supervisors from the central level do not visit laboratories personally;

?? technicians have not been trained to recognize and repair, when possible, malfunctions of their microscopes;

?? there are no efficient microscope maintenance services; and

?? technicians have not been trained to recognize errors in processing slides;

As a first step to improve the quality assurance system, cross-checking should be reorganized. It should be done in a blind way, with special reference to the correctness of diagnosis of species, forms for *P. falciparum*, parasite densities, quality of collection and staining, and analysis of the sources of errors. Time lags between different stages of blood preparation processing should be monitored to identify bottlenecks.

On the basis of improved cross-checking, continuous monitoring and evaluation of individual laboratories and technicians should be established. Feedback should not indicate only discrepancies of the diagnoses, but the possible sources of errors as well. Field visits should be done regularly to improve rapport between the central level and periphery and to solve problems on the spot.

The national level should assure quality maintenance of microscopes, good quality of chemicals and quality assurance-oriented training of staff of central and peripheral laboratories. In addition to teaching how to recognize species and forms, quantitative methods should be taught. Technicians should be able to interpret correctly laboratory findings that may serve as signs of severity. Technicians should be trained in the diagnosis of malfunctions of microscopes and simple methods of minor repairs. They also should be able to diagnose errors in processing slides and know how to prevent the errors.

The quality assurance system mainly needs an improvement in organization. This would require the investment of some additional funds, but this may be offset by improving cost–effectiveness.

2.2 Review of non-microscopic diagnostic methods for malaria and their possible role in quality control

Non-microscopic methods in diagnosis of malaria include serologic methods of antibody detection in sera that started developing in the early 1970s and antigen detection tests that were first tested in the early 1980s. Unlike antibodies, detection of antigens that may be antigens associated with infected RBCs or free soluble antigens in serum, plasma or urine is evidence of a current or recent infection. Among antigen detection tests, rapid diagnostic tests (RDT) based on detection of malaria parasite antigens in lysed blood by an absorbent dipstick technology using monoclonal technology has become quite practical and may be used in the programmes. They are commercially produced as diagnostic strips. There are three types of antigens that may be detected by commercial RDTs: (1) histidin-rich protein-2 (HRP-II), (2) parasite lactate dehydrogenase (pLDH), and (3) combination of histidin-rich protein-2 and other (unknown) pan-malarial antigen.

?? Histidin-rich protein-2 is a water-soluble protein found only in trophozoites of *P. falciparum.* Such tests as ParaSight F and ICT Malaria Pf (MalaQuick) are based on its detection. This test detects asexual parasites of *P. falciparum* only.

?? Parasite lactate dehydrogenase is found in all human malaria parasites. The correspondent test is OptiMAL Pf-Pv/Pm/Po. This test detects all stages of four species of human malaria and distinguishes between *P. falciparum* and the other three species, but not within the latter group.

?? The third group is represented by ICT Malaria Pf/Pv test.

With RDTs it is now possible to diagnose definitively all four types of human malaria. Their sensitivity is more than 90% in parasite densities more than 100 per ?l, and specificity is over 90%. It is worthwhile to note that parasitaemias slightly below 100 per ?l that are poorly detected by RDTs are, nevertheless, able to produce clinical symptoms in non-immune persons, especially in vivax malaria.

Some additional patented RDTs are currently in use or under development:

?? Path ICT Pf malaria test (pfHRP-2)
?? AMRAD Pf and Pv malaria test (pf/pvHRP-2)
?? BioSign Malaria rapid malaria antigen test (probably HRP-2)
?? Mozzimal Pf rapid malaria test (pfHRP-2)
?? Quickstrip onestep Pf malaria test (unknown but probably pfHRP-2).

The advantages of RDTs compared with microscopy are that RDTs are simpler to perform, faster (15–20 minutes), robust (little variation between users, low subjectivity), do not require equipment such as a microscope or electricity and require only minimal training to perform the test.

The shortcomings of RDTs concern gametocytes of *P. falciparum* as they are not detected by histidin-rich protein (HRP) methods and are not distinguished from asexual cells in pLDH. Concerning non-falciparum species, so far they are not detected by HRP methods or are detected but usually not distinguished between themselves in pLDH. The cost of RDTs is relatively high (US$ 0.60–2.50 per test). Interpretation is not always straightforward, since positive results may persist after treatment for up to two weeks in the case of HRP. Quantification is possible in principle, but not available so far.

2.3 Establishing a sustainable system for monitoring and improving the quality of laboratory results

As an example, a system developed in Ghana and called a Regional Laboratory In-Service Training Programme (RIST) was considered. The scheme came into existence in 1998 as a three-year programme (1999–2001) and is funded by the Department of International Development, United Kingdom. The introduction of this system was deemed important because of the feeling that the low quality of laboratory results in the country was leading to repeat

testing and mismanagement of disease. Its goal is improving the quality of laboratory services in Ghana through the establishment of a nationwide laboratory quality control system. The targets are to:

?? establish a sustainable, regionally owned (at the level of administrative regions of Ghana) and managed in-service training programme for laboratory staff at all levels;

?? ensure that all laboratory performance is of international standard using internal and external quality assurance networks; and

?? ensure that the upgraded laboratory services are utilized efficiently by clinicians to improve patient care.

The quality assurance cycle is to provide targeted training and monitor the quality of results in order to achieve results that are 100% accurate by international standards in all laboratories.

The RIST Programme adopted a bottom-up approach. Laboratory trainers were appointed in every region of the country. Six-monthly targets were established for regions after a baseline survey, and regionally designed training methods were developed. The programme has a dedicated budget of GBP 3000 per region per year, plus start-up resources.

The system is based on regular on-site, home based training. Continuous enhancement of laboratory skills is achieved thorough a national trainers' network. A quality assurance manual for district and subdistrict levels has been produced. The system is locally owned and responsive to needs and, at the same time, works in close collaboration with the Ministry of Health. Resources are targeted at addressing the quality of critical tests. Appropriate tools have been devised for monitoring laboratory performance.

Eighteen months after implementation, a baseline survey of all government laboratories has been conducted (205 laboratories with 760 technical personnel), and 93% of the personnel has been trained in laboratory tests targeted for phase 1 (haemoglobin, malaria, packed cell volume, sickle cell, stool, urine).

3. REVIEW OF THE STATE OF LABORATORY DIAGNOSIS IN COUNTRIES OF THE REGION

The review is based on a questionnaire that was distributed to the countries in May 2001 in preparation for this meeting and on the presentations of the participants. Nineteen countries responded to the questionnaire, namely Afghanistan, Bahrain, Cyprus, Djibouti, Egypt, Islamic Republic of Iran, Jordan, Kuwait, Morocco, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, United Arab Emirates and Republic of Yemen. The total number of laboratories in the countries surveyed is indicated in Table 1.

Table 1. Laboratories performing malaria diagnosis in 19 countries of the Region, 2001

Type of laboratory	Total number	Number performing malaria diagnosis	Percentage
Hospital	3169	2871	90.6
PHC	24 086	7411	30.8
Malaria clinic	1222	1121	91.7
Other	4463	832	18.6
Total	32 940	12 235	37.1

Out of 12 680 microscopists in the field, 561 (4.4%) had primary training and 1053 (8.3%) refresher training in 2000. The median duration of primary and refresher training was 15 and 7 days, respectively. The required period of training of two years is seldom achieved.

The private sector operates in malaria diagnosis in 14 (73.7%) of the surveyed countries, with 3902 laboratories performing malaria diagnosis (median: 22 per country). In some countries, laboratories that are private or belong to nongovernmental organizations. are, in fact, the main players in the field (e.g. in Afghanistan and Somalia).

Malaria reporting is mandatory in 10 (52.6%) countries, not required in 7 (36.8%), whereas data from 2 (10.5%) are missing. Training is in force in the private sector in 7 (36.8%) countries.

Written guidelines for blood collection and examination on malaria are available in 12 (63.2%) and unavailable in 3 (15.8 %) countries, while 4 (21%) failed to respond this question.

Seventeen (89.5%) countries use thick blood film, alone in 2 (10.5%) countries or with the thin smear in 15 (78.9%) countries. One (5.3%) country (Bahrain) uses a thin smear only and one (5.3%) country did not respond.

Blood preparations are made by technicians, blood collectors or nurses. Those responsible for blood taking are usually technicians, either alone (8 countries) or with other personnel (8 countries). In one country, blood preparations are made by blood collectors and in another by nurses (one country did not respond).

Glass slides are used once in 7 (36.8%) countries, twice in 3 (15.8%) countries and three or more times in 8 (42.1%) countries.

The method of staining is Giemsa stain in 18 (14.7%) countries (three of them also use Field's method). In 1 (5.3%) country, Leishman's stain is used. Use of phosphate buffer solution is mandatory in 13 (68.4%) countries and not in 5 (26.3%); information is missing from 1(5.3%) country. Despite it being mandatory, individual laboratories may often ignore the use of phosphate buffer solution. Phosphate buffer solution is used in the form of powder in 4 (21%) countries, tablets in 7 (36.8%) countries, or both in 1 (5.3%) country. Distilled water is used in 13 (68.4%) countries.

As a minimum number of microscopic fields to be examined, 100 was indicated by 13 (68.4%) countries, but 1 (5.3%) country each indicated 40, 25 and even 10 fields (no information given by three countries).

Problems with maintenance of microscopes are common. In 5 (26%) countries there is no system for maintenance. In other countries, maintenance is performed by the bioengineering department or other services of the Ministry of Health or private sector. Rapid diagnostic tests (mainly ICT) are used in 8 (42.1%) countries and the circumstances indicated for these tests were screening of travellers from East Africa and Sudan, screening of high risk blood donors, or in the absence of Giemsa stain. In some countries, the validity of rapid diagnostic tests has been tested against the traditional microscopic techniques. Rapid diagnostic tests have become popular in the private sector.

Parasite densities are evaluated only in 5 (26.3%) of the countries. Information required to be submitted by the laboratory on individual cases varies from country to country and is not always full and is sometimes redundant.

Systems for quality assurance are said to exist in 16 (84.2%) countries. They include one or several reference laboratories. Responsibility for quality assurance lies with the laboratory service in 5 (26.3%) countries, with the malaria service in 4 (21%) countries or with both in 6 (31.6%) countries. Activities consist mainly of cross-checking (usually 10% of negative slides and all the positives). Controlling of skills and knowledge of microscopists is mentioned by 10 (52.6%) countries and visits to laboratories by quality assurance staff by 11 (57.9%) countries. Feedback is sent to the central level laboratories in 13 countries and indicators of laboratory performance exist in 11 (57.9%) countries.

Although the discrepancy rate produced by cross-checking is generally low (median 3.5%), special checks give higher figures. Thus, a survey conducted in Khartoum State, Sudan showed that about 25% of the slides was reported to be false-positive or false-negative. This may be explained by the fact that routine cross-checking is not done in a blind way and there is a tendency to confirm negative slides if they are poorly processed, whereas, in fact, these slides should have been described as non-readable. This leads to suspicion by treating doctors of the results of microscopic diagnosis.

The most common deficiencies in slides received for examination, as identified in country reports and during the deliberations, are:

?? incorrect preparation of blood samples (insufficient blood in thick films, thin smears that are too thick, etc.);

?? incorrect processing due to poor stain, deviations from the technology (most often failure to use phosphate buffer solution, inconvenient source of water, wrong concentration or timing); as a result, preparations often contain debris, dirt, stain particles, and/or chromatin is poorly differentiated;

?? use of stains other than Giemsa (usually Leishman's stain) which are less robust; and

?? only a thin smear made, which is about 20 times less sensitive than a thick blood film.

The most common deficiencies in slide examination are:

?? insufficient number of fields examined (less than 100);

?? failure to calculate parasite densities; and

?? insufficient or redundant information given in the laboratory returns.

The main organizational problems are:

?? insufficient equipment, mostly microscopes that are often old and malfunctioning;

?? absence or insufficiency of equipment maintenance services in many countries;

?? problems with supplies, especially slides (hence, multiple recycling), reagents (multiple and not always trusted manufacturers), registration forms;

?? absence of bench aids;

?? absence or poor quality of written guidelines, especially in local languages;

?? absence of effective supervision and in-service training;

?? insufficient initial and refresher training;

?? inability to obtain specimens for development and maintenance of training collections, especially in countries with a relatively low level of local or imported malaria;

?? insufficient cooperation of antimalaria services with hospitals, especially with those in the private sector; and

?? emigration of experienced qualified cadre to other countries.

From this review, it is clear that the practice of laboratory diagnosis of malaria in the Region needs improvement in many respects. These improvements include:

?? using standard methods (by discarding methods other than Giemsa, ensuring obligatory examination of thick blood film, using phosphate buffer solution to ensure adequate pH, closely following the recommended procedure in general);

?? ensuring an adequate supply of Giemsa stock solution from reputable suppliers;

?? abandoning the practice of multiple recycling of glass slides;

?? enforcing standard reporting of results;

?? streamlining practices of reference laboratories; and

?? ensuring more purposeful functioning of quality assurance mechanisms and more helpful feedback to the peripheral laboratories.

4. RECOMMENDATIONS

To Member States

1. Strengthen quality assurance of malaria diagnosis at all levels.

2. Ensure implementation of the standard procedures for microscopic diagnosis of malaria in collaboration with the private sector, nongovernmental organizations and other partners.

3. Establish a mechanism to apply the quality assurance procedures for malaria diagnosis.

To WHO

4. Finalize and distribute guidelines for quality assurance, developed by EMRO and reviewed by the workshop, taking into consideration the recommendations of the working groups.

5. Assist Member States in application of quality assurance procedures according to the available resources.

6. Assist Member States in establishing a mechanism to apply the quality assurance procedures of malaria diagnosis.

Annex 1

AGENDA

1. Opening session
2. Review of the microscopic methods of diagnosis of malaria
3. Quality assurance systems in malaria control: evolution and current state in Eastern Mediterranean Region countries
4. Countries experience: drawbacks and ways of improvement
5. Review of guidelines for quality assurance
6. Closing session

Annex 2

PROGRAMME

Sunday, 2 September 2001

09:00–09:15	Registration
09:15–09:45	Opening session
	Message from H.E. Dr Massoud Pezeshkian, Minister of Health and Medical Education, Islamic Republic of Iran
	Message from Dr Hussein A. Gezairy, WHO Regional Director for the Eastern Mediterranean
	Introduction of participants Objectives and methods of work Election of officers
10:00–10:30	Quality assurance systems in malaria control: evolution and current status in the countries of WHO Eastern Mediterranean Region
	General remarks from Dr Beljaev, Dr Payne, Dr Edrissian, Dr Atta
10:30–11:00	Countries experience: drawbacks and ways of improvement
	Presentations from selected countries that have achieved interruption of malaria transmission and are at risk of malaria reintroduction (Bahrain, Cyprus, Jordan, Kuwait and Palestine)
11:00–11:30	Presentations from selected countries where malaria is firmly under control and are targeting eradication (Egypt, Morocco, Oman, Syrian Arab Republic and United Arab Emirates)
11:30–12:00	Presentations from selected countries with moderate malaria endemicity and well established control programmes (Islamic Republic Iran, Pakistan and Saudi Arabia)
12:30–13:00	Presentations from selected with highly endemic malaria and/or threatened by malaria epidemics and complex emergency situations (Sudan)
14:30–15:15	Review of quality control methods for microscopic diagnosis of malaria as used in Malaria Eradication Programmes and in current malaria control laboratory practice (Dr A. Beljaev)
15:15–16:00	Review of non microscopic diagnostic methods for malaria and their possible role in quality control (Dr D. Payne)
16:00–17:00	Discussion

Monday, 3 September 2001

09:00–09:30	Establishing a sustainable system for monitoring and improving the quality of laboratory results in Ghana: summary of a Regional In-Service Training Programme (RIST) (Ms V. Bekoe)
09:50–13:00	Review of the draft guidelines on quality control of malaria laboratory diagnosis Formation of four working groups: Group 1: Countries that have achieved interruption of malaria transmission Group 2: Countries where malaria is firmly under control Group 3: Countries with moderate endemicity and relatively well-established control programme Group 4: Countries with highly endemic malaria and/or affected or threatened by malaria epidemics
13:30–16:00	Continuation of working groups
16:00–17:00	Back to plenary session, closing remarks for day two

Tuesday, 4 September 2001

A	Site visit(s) to malaria control laboratory(ies) to see current diagnostic practice and quality control in the Islamic Republic Iran
B	Preparation of evaluation reports on diagnostic practice and quality control of malaria control laboratory(ies) visited

Wednesday, 5 September 2001

09:00–09:30	Discussions on the site visits and submission of working group presentations on relevance of findings to the drafted guidelines
09:30–10:30	Group work: finalization of workshop report on draft guidelines and recommendations for its application in the countries
10:45–12:15	Presentations of working groups and discussions
12:15–13:00	Recommendations
13:00–14:00	Closing session

Annex 3

LIST OF PARTICIPANTS

BAHRAIN
Ms Layla Abdullah Al Nashmie
Acting Head of Laboratories of Health Centres
Responsible for Quality Assurance of Laboratory Diagnosis for Malaria
Ministry of Health
Naim H.C. P.O. Box 42
Manama
Tel: 973248642
Fax: 973248601
e-mail: ainashme@batdco.co.bh
Home: 973772719

CYPRUS
Mr Yangos Kythreotis
Medical Laboratory Superintendent
Nicosia General Hospital
Department of Medical and Public Health Services
Nicosia
Tel: (357-2) 801676/331123
Fax: (357-2) 801697
e-mail: yainky@cypanet.com.cy

EGYPT
Dr Mohammed Atef Hassan
Physician in Bilharzia and Intestinal Parasites
Ministry of Health and Population
Cairo
Tel: (20-2) 7948187/7947199
Home: (20-2) 4904050
Fax: (20-2) 7948187 (MOHP)

ISLAMIC REPUBLIC OF IRAN
Dr Mohammad Zare
National Malaria Focal Point
Ministry of Health and Medical Education
Teheran
Tel: (021) 8821666
Fax: (021) 8300444
e-mail: zarem@hbi.dmr.or.ir
e-mail: zare100@yahoo.com

Dr Mohammad Reza Attari
Director of Disease Control
Ministry of Health and Medical Education
Tabriz
Tel: (0911) 2341312/2330309
Fax: (0411) 2330196

JORDAN

Dr Mohammed Obeidat
Director of Malaria Programme
Ministry of Health
Amman
Tel: (0962-6) 5694080
Fax: (0962-6) 5694080
e-mail: epigor@com.gov.jo

KUWAIT

Mr Francisco T. Banal
Laboratory Technician
Laboratory Department, Malaria Unit
Ministry of Public Health
Kuwait
Tel: (00965) 4848968
Fax: (00965) 4863713
e-mail: ft_banal@hotmail.com

MOROCCO

Dr Mohammed Lyagoubi
Chief, Parasitology Department
National Institute of Hygiene
Rabat
Tel: (0 212-37) 681653
Fax: (00 212-37) 772067
e-mail: mlyagoubi@hotmail.com

OMAN
Ms Fatma bint Saeed bin Salah Al-Harasy
Laboratory Technician
Department of Environmental Health and Malaria Eradication
Ministry of Health
Muscat
Tel: (00 968) 560019
Fax: (00968) 563887

PAKISTAN
Dr Anwar Zeb
Epidemiologist
Malaria Control Programme
Federal Ministry of Health
Islamabad
Tel: (0092-51) 9212545
Fax: (0092-51) 9212210
e-mail: anwar_55@yahoo.com

Dr Mahmoud Sultan Paracha
Epidemiologist
Malaria Control
Government of Baluchistan
Quetta
Tel: (0092-81) 9211459
Home: (0092-81) 821648
Fax: (0092-81) 822583
e-mail: mehmoud_paracha@hotmail.com

PALESTINE
Ms Maha Abu Rdaha
Public Health Laboratory
Ministry of Health
Palestinian National Authority
Ramallah
Tel: (00972) 22988055
Fax: (00972) 22988034
e-mail: m-rddaha@hotmail.com

QATAR

Ms Sheikha Abdulla Al-Marzouqi
Laboratory Department
Hamad Medical Corporation
P.O. Box 3050
Doha
Tel: (00974) 4392363
e-mail: asmaaomar@hotmail.com

Ms Asma Omar Al-Marwani
Technologist, Laboratory Department
Hamad Medical Corporation
P.O. Box 3050
Doha
Tel: (00974) 4392363
e-mail: asmaaomar@hotmail.com

SAUDI ARABIA

Mr Shami Hussain Ibrahim Al Ozaiky
Laboratory Specialist
Ministry of Health - Al-Qunfudah G.H.
Qunfudah
Tel: (009667) 7320206 (ext 298)
Fax: (009667) 7320291

SUDAN

Dr Abdel Latif Mohammed Salih Mohammed Khair
Department of Quality Assurance
National Malaria Administration
Federal Ministry of Health
Khartoum
Tel: (011) 776809

SYRIAN ARAB REPUBLIC

Ms Sabah El Qadri
Director of Parasitic Laboratory
Public Health Laboratories
Ministry of Health
Damascus
Tel: (963 11) 4454679/4451177
Fax: (963 11) 4442153

UNITED ARAB EMIRATES
Dr Abdel Aziz Mosaad
Director, Malaria Control Department
Ministry of Health
Sharjah
Tel: (009716) 5638811
Fax: (009716) 5638700
e-mail: almuthann@dr.com

WHO SECRETARIAT

Dr El Fatih El Samani, WHO Representative, Islamic Republic Iran,
Tel: 6700361/6708969, Fax: 6708969
e-mail: whoteh@who.un.or.ir

Dr Zuhair Hallaj, Director, Communicable Disease Control, WHO/EMRO
e-mail: hallajz@emro.who.int

Dr Hoda Atta, Medical Officer, Roll Back Malaria, WHO/EMRO
e-mail: attah@emro.who.int

Dr Andrei Beljaev, WHO Temporary Adviser, P.O. Box 90, Moscow Post 103051,
Russia, Tel: 0079021629148, Fax: 0079021629148
e-mail: beljaeve@mtu-net.ru

Dr David Payne, WHO/Short Term Consultant, 26 Clinton Road, Penarth, Vale of Glamorgan, CF64 3JD South Wales, United Kingdom
e-mail: drdavid@payne-who.freeserve.co.uk

Ms Veronica Bekoe, WHO Temporary Adviser, Public Health and Reference Laboratory, P.O. Box 300, Accra, Ghana, Tel: 233 21 661046–48, Fax: 233 21 500898
e-mail: vbekeo@hotmail.com

Dr Gholam-Hossein Edrissian, WHO Temporary Adviser, Professor of Medical, Parasitology, School of Public Health and Institute of Public Health Research, Teheran University of Medical Sciences, P.O. Box 6446, Teheran 14155, Islamic Republic of Iran, Tel: 611240-09, Fax: 6462267
e-mail: edrissian@yahoo.com

Mrs Maha Metwally, Senior Clerk (BUD), WHO/EMRO
e-mail: metwallym@emro.who.int

Mrs Jehane Khadr, SAS/DCD, WHO/EMRO
e-mail: khadrjs@emro.who.int

Annex 4

MESSAGE FROM DR HUSSEIN A. GEZAIRY, WHO REGIONAL DIRECTOR FOR THE EASTERN MEDITERRANEAN TO THE INTERCOUNTRY WORKSHOP ON QUALITY ASSURANCE OF LABORATORY DIAGNOSIS FOR MALARIA
Teheran, Islamic Republic of Iran, 2–5 September 2001

Distinguished guests, dear colleagues, ladies and gentlemen,

It gives me great pleasure to welcome you all to this workshop which is being held to review and discuss issues related to quality control of malaria laboratory diagnosis.

I wish at the beginning to thank the Government of the Islamic Republic of Iran for hosting the meeting. My special thanks go to His Excellency Dr Massoud Pezeshkian, Minister of Health and Medical Education, for the outstanding support provided to this workshop.

Ladies and gentlemen,

As you are aware, prompt and accurate diagnosis is the key to effective disease management, which represents one of the main interventions of the Roll Back Malaria initiative. Poor diagnosis continues to hinder effective malaria control. Up to now laboratory diagnosis of malaria has relied mainly on microscopy. This is a valuable technique when performed correctly; however, it is unreliable and wasteful when poorly executed.

Dear colleagues,

The Roll Back Malaria initiative emphasizes better application of existing tools and the development of new ones. In this context, during the past ten years, rapid diagnostic tests (RDTs) for malaria using immunochromatographic test strips have been developed. Such a development may offer a valid complement to microscopy, but microscopy is still the main diagnostic method for malaria. It is a key tool in the integrated management of disease in resource-poor settings.

Microscopy is generally good at the central level, but unfortunately it is often unreliable in peripheral and remote areas, where most of the cases of malaria occur. Several reasons are involved, including lack of resources, insufficient access to trained health providers, poor laboratory facilities and lack of supervision and feedback. This highlights the need for updating or establishing quality control systems to ensure better laboratory performance and, in turn, accuracy of diagnosis.

Dear colleagues,

As you know, quality control systems for malaria laboratory diagnosis were established in a number of countries during the era of malaria eradication. In this regard, this workshop is being held to review the current practices of quality control in laboratory diagnosis and to evaluate and update quality control systems in line with the new strategies of malaria control.

I sincerely trust that the present workshop will promote the diagnostic aspects of malaria control, which in turn will lead to better and more cost-effective disease management, and reduce the unnecessary and irrational use of antimalarial drugs, which contributes to the development of drug resistance.

I wish you every success and a pleasant stay in this hospitable and beautiful city of Teheran.