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Malaria control in Africa :
guidelines for the evaluati

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ACSI-CCCD Technical Coordinator
International Health Program Office
Centers for Disease Control and Prevention
Atlanta, Georgia 30333

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Malaria Control in Africa:
Guidelines for the Evaluation of
National Programs

Marianne BARUTWANAYO, Diawara BASSALIA, André BIRABUZA,
Charles DELACOLLETTE, Moussa KEITA, Nestor MADJI,
A. Sideye MAIGA*, Hamissou MAOUDE, Hilaire NDIHOKUBWAYO,
Joseph NIANGUE, SIDI MOHAMED O. Mohamed Lemine, E-Dieudonné YAZIPO

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Atlanta, Georgia 30333

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I. Introduction

Malaria is one of the most serious public health problems in Africa. One million deaths from malaria occur annually in African children less than 5 years of age. Malaria morbidity and mortality continue to rise and the situation is exacerbated by the recent occurrence of epidemics and the continued spread of parasite resistance to chloroquine and other antimalarial drugs.

Actions taken by African countries to address this problem often have not had the desired impact. As a result, a group of concerned African countries initiated a systematic process to improve the effectiveness of national malaria control programs.

What were the principal steps of that process?

- In June 1991 in Bobo-Dioulasso (Burkina Faso), a group of African experts meeting under the sponsorship of the World Health Organization (WHO), with the support of the U.S. Centers for Disease Control and Prevention (CDC), developed a framework for improved malaria control policy.
- In May 1992 in Abidjan (Côte d'Ivoire), the same technical group examined how the implementation of these policies should be supported through the development of national program plans.
- In March 1993 in Brazzaville (Congo), a WHO working meeting proposed guidelines for the evaluation of programs and the establishment of health information systems for malaria surveillance. This meeting was conducted within the framework of the global strategy for malaria control defined during the Ministerial Conference in Amsterdam in October 1992.
- In September 1993, a working meeting held in Bujumbura resulted in the present document. Based on their experiences, 12 malaria control program managers from 7 countries of francophone Africa met and developed a practical approach for the evaluation of national programs.

The evaluation of public health programs, defined as the «systematic collection and use of data to improve health programs and guide the allocation of resources», remains a fundamental component of malaria control programs.

Participants in the Bujumbura meeting also defined an approach to evaluation characterized by the following points:

- Evaluation must be the responsibility of program managers at all levels, and therefore must be carried out from within the program.
- Evaluation must be an integral part of malaria control programs conducted at regular intervals through the use of appropriate methods and indicators and in accordance with program objectives, activities, and resources.
- Evaluation must be more broadly recognized as an essential tool for program management, allowing for early detection of and response to problems.

This approach to evaluation is a useful and necessary complement to more traditional approaches, which usually are conducted at long intervals by experts from outside the program.

These guidelines are designed not only to facilitate and encourage evaluation from within programs, but also to reinforce the skills of managers. They provide program managers with key indicators appropriate for use in the African context. The indicators proposed in the guidelines are accompanied by a commentary explaining why each indicator was selected and how it might be used by national programs.

II. Evaluation and its Principles

A. Types of Evaluation. There are several types of program evaluation, including:

- 1) *Evaluation of program implementation.* This type of evaluation (also called monitoring) allows measurement of the process of carrying out activities necessary for program implementation.
- 2) *Evaluation of program effectiveness.* This type of evaluation is the subject of this document. Effectiveness evaluation is often based on the use of indicators, and measures the progress of the program towards two types of objectives: a) impact objectives, which describe expected decreases in malaria-associated morbidity and mortality as a result of program activities; and b) outcome objectives, which specify improvements in behaviors or services as a result of the program.
- 3) *Operational research.* This type of evaluation answers questions related to the interventions and services of the program; for example, the cost effectiveness of an intervention or the efficacy of different antimalarial drugs.
- 4) *Periodic program reviews.* This type of evaluation is designed to synthesize information obtained through other evaluation activities as the basis for program planning and replanning.

B. Indicators. Indicators are quantitative measures that can be repeated over time to evaluate progress towards achievement of the objectives. They are normally expressed as numbers, proportions, percentages, or rates. In certain well-defined situations, such as the presence or absence of a national policy or plan, indicators can be expressed as a «yes» or «no» rather than as a quantitative score.

The choice of indicators must be based on the following:

- their validity, i.e., the extent to which the indicator constitutes an accurate and true measure of the phenomenon under study
- their reliability, i.e., the extent to which the measures obtained are consistent in diverse applications or over time
- their ability to detect, within a reasonable period of time, changes resulting from successful program implementation
- their ability to produce data that can be interpreted easily
- their usefulness for guiding program modifications
- their feasibility for use by a national program, given available resources

Among the indicators used in effectiveness evaluations, impact indicators appear at first glance to have advantages over outcome indicators because they measure directly the reductions in morbidity and mortality that are the ultimate objectives of the program. However, the utility of impact indicators is limited by the absence of a uniform clinical definition of malaria, and the fact that the majority of malaria patients are not seen in health facilities. Outcome indicators, on the other hand, are based on more reliable data (such as the availability of antimalarial drugs or the performance of health workers) and measure variables whose improvement should lead to a decrease in the epidemiologic impact of malaria. For this reason, outcome indicators appear preferable to impact indicators for the evaluation and management of programs at this time.

C. Selection of 12 Key Indicators. Since most malaria control programs in Africa share the same concerns, we have selected key indicators that will permit national managers to evaluate their programs and share their experiences. These indicators cover some essential aspects of malaria control in sub-Saharan Africa and constitute a common framework that can be used by most programs. Based on this framework, national programs will be able to develop additional indicators that are better adapted to their concerns and circumstances.

These 12 key indicators, while imperfect, satisfy in the best way possible the selection criteria listed above. They were chosen on the basis of the managers' experience, and following field tests in Burundi.

III. Key Indicators for Evaluation of National Malaria Control Programs

A. Impact Indicators

<p>1. <i>Morbidity attributed to malaria</i> Cases of malaria among target groups diagnosed annually in health facilities</p>
<p>2. <i>Proportional morbidity attributed to malaria</i> Cases of malaria among target groups diagnosed annually in health facilities divided by Cases diagnosed annually for all causes among target groups in health facilities</p>
<p>3. <i>Hospital mortality attributed to malaria</i> Deaths attributed to malaria among target groups reported in hospitals annually</p>
<p>4. <i>Proportional hospital mortality attributed to malaria</i> Deaths attributed to malaria among target groups reported in hospitals annually divided by Deaths for all causes among target groups reported in hospitals annually</p>

B. Outcome Indicators

<p>5. <i>Diagnosis of fever</i> Target group patients seen in health facilities for whom the health worker determines whether a fever was present at any time during the previous 3 days divided by Target group patients seen in health facilities</p>
<p>6. <i>Correct microscopic diagnosis</i> Health facilities that perform microscopic diagnosis of malaria in which a correct diagnosis is made for more than 90% of slides examined divided by Health facilities that perform microscopic diagnosis of malaria</p>
<p>7. <i>Treatment in health facilities</i> Cases of uncomplicated malaria diagnosed among target groups who are treated in accordance with national policy in health facilities divided by Cases of uncomplicated malaria diagnosed among target groups in health facilities</p>

8. *Early consultation for febrile children*

Mothers of febrile children seeking treatment
in health facilities who report that the fever began during the previous 24 hours

divided by

Mothers of febrile children seeking treatment in health facilities

9. *Availability of antimalarial drugs*

Health facilities covered by the program
with no stock-outs of antimalarial drugs during a given period

divided by

Health facilities covered by the program

10. *Chemoprophylaxis during pregnancy*

Primiparas who report during their first post-partum visit
that they have followed a course of chemoprophylaxis in accordance with national policy

divided by

Primiparas seen for their first post-partum visit

11. *Utilization of insecticide-impregnated bednets*

Members of the target group who report that they slept
under an insecticide-impregnated bednet the previous night

divided by

Members of the target group

12. *Speed of health information system*

Health facilities whose monthly reports of fever cases and deaths
are received at the next higher level
of the health system within 10 days after the end of the report month

divided by

Health facilities

C. Process Indicators

Process indicators, while essential for evaluating program implementation, have not been developed in this document. Because implementation differs among programs, each country will need to develop indicators that are most useful and practical for them.

D. Comments on the Key Indicators

General remarks

- The target groups are specified in the policy of each country. In most countries of sub-Saharan Africa, children less than 5 years of age constitute the priority target group.
- Most of these indicators have a denominator that refers to total populations (for example, «health facilities», «mothers»). If needed, the indicators will be measured in representative samples appropriately selected from among the total population.

1. Morbidity attributed to malaria

Cases of malaria among targets groups diagnosed annually in health facilities

This indicator attempts to quantify the toll of malaria in terms of disease and socioeconomic cost. It can suggest trends in malaria-associated morbidity, particularly when interpreted in combination with the indicator of proportional morbidity (see below). As is the case for all impact indicators, it can justify the need for and importance of the malaria control program.

Data to support this indicator can be obtained from routine health information system reports. The diagnostic criteria for malaria and the target groups are defined in the national policy of each country.

The reliability and validity of this indicator are limited because the diagnostic criteria for malaria can vary among different countries and even between different health workers in the same country.

This indicator (as well as the indicator on absolute mortality) is not written as a proportion, as would have been desirable. The most useful denominator would have been «the target groups served by the health facilities» but, because population estimates are unavailable or outdated in most endemic countries and the rate of health facility utilization may vary over time, the resulting proportions would be imprecise.

While annual incidence is traditionally used in morbidity reports, other report periods can be chosen if they are preferable for program management and evaluation.

Key Indicators for Evaluation of National Malaria Control Programs

2. *Proportional morbidity attributed to malaria*

Cases of malaria among target groups diagnosed annually in health facilities
divided by
Cases diagnosed annually for all causes among target groups in health facilities

This indicator can help managers plan their programs and forecast the resources needed for the case management of malaria. When interpreted in combination with data on absolute morbidity (see above), it can reveal general trends. Its limitations are similar to those described for the previous indicator.

3. *Hospital mortality attributed to malaria*

Deaths attributed to malaria among target groups reported in hospitals annually

This indicator is designed to reflect the ultimate impact of malaria—that is, death. Supporting data are frequently available in health information systems. Because data obtained in referral health facilities are usually based on a more accurate diagnosis than those in peripheral facilities, the reliability of this indicator is expected to be better than that of the morbidity indicators. Nevertheless, in most countries, the indicator will register only a fraction of the total deaths associated with malaria, most of which occur outside of health facilities. Mortality surveys in communities (for example, by verbal autopsy) could provide additional information, but are costly and the data obtained are not necessarily reliable.

Another problem of reliability is the fact that malaria can cause death by severe anemia, coma, or other conditions not necessarily reported as being due to malaria. Such errors in classification could be reduced by revising the diagnostic classification systems used in mortality reports.

Two other aspects of malaria's impact that are not reflected in the key indicators are severe malaria and hospital case fatality rates. Severe malaria does not constitute a separate diagnostic category in most health information systems in Africa, and supporting data would therefore be difficult to obtain. Case fatality rates in hospitals are influenced by several factors (e.g., access to health services, cultural factors influencing the place of death, and, most importantly, quality of care) and therefore have only limited validity.

Key Indicators for Evaluation of National Malaria Control Programs

4. *Proportional hospital mortality attributed to malaria*

Deaths attributed to malaria among target groups reported in hospitals annually
divided by
Deaths for all causes among target groups reported in hospitals annually

This indicator is designed to produce data that will help managers plan interventions needed to improve the case management and prevention of malaria.

5. *Diagnosis of fever*

Target group patients seen in health facilities for whom the health worker determines whether a fever was present at any time during the previous 3 days
divided by
Target group patients seen in health facilities

Case management is a priority intervention in most malaria control programs in Africa, and includes four components: diagnosis, treatment, patient education, and referral. This indicator provides managers with information on a fundamental aspect of the clinical diagnosis of malaria as specified by WHO: determination by the health worker of the presence or recent history of fever. Malaria is a widespread, potentially fatal, but treatable disease in Africa. Every contact with the health system by a member of a target group should therefore be used as an opportunity to identify and treat fever, the primary clinical feature of malaria.

This indicator, measured by observing health workers in health facilities, is subject to the biases inherent in this method. In particular, health workers may perform better than usual when they know they are being observed.

6. *Correct microscopic diagnosis*

Health facilities that perform microscopic diagnosis of malaria in which a correct diagnosis is made for more than 90% of the slides examined
divided by
Health facilities that perform microscopic diagnosis of malaria

This indicator is designed to produce information on the quality of microscopic diagnosis, an important component in the diagnosis of therapeutic failures and severe malaria. Supporting data can be obtained by well-trained technicians re-examining a sample of slides that have previously been examined by the staff of the health facility, and arriving at a criterion-based judgment about the overall quality of the resulting diagnosis. The principal limiting factor in the

measurement of this indicator will be the availability of personnel qualified to perform the re-examination.

The criterion proposed (more than 90% correct diagnoses) may need to be adapted by individual national programs. Each country will also need to define appropriate criteria for microscopic diagnosis (simple distinction between positive and negative samples, or classifying by parasite species, stages, and densities).

7. *Treatment in health facilities*

Cases of uncomplicated malaria
diagnosed among target groups who are treated in accordance with national policy in health facilities
divided by
Cases of uncomplicated malaria diagnosed among target groups in health facilities

This indicator is designed to measure the quality of treatment for cases of uncomplicated malaria diagnosed in health facilities. Supporting data can be obtained by observing the performance of health workers.

Managers should try to ensure that the cases observed are representative of all fever cases presenting at the health facilities being evaluated. (For example, observations conducted during a measles epidemic should be excluded.)

8. *Early consultation for febrile children*

Mothers of febrile children seeking treatment
in health facilities who report that the fever began during the previous 24 hours
divided by
Mothers of febrile children seeking treatment in health facilities

A critical element in the case management of malaria is the rapid treatment of febrile patients. Mothers, in particular, must recognize fever as a potentially serious problem for their children and seek treatment at a health facility within 24 hours after fever onset. This indicator can serve as a direct measure of mothers' health-seeking behavior (at least among those who utilize health facilities), and as an indirect measure of the effectiveness of patient education efforts at health facilities.

Although a community, rather than a facility-based measure, would include mothers who do not have access to or use health facilities, facility-based data can be obtained efficiently as a part of larger health facility surveys addressing several indicators.

Key Indicators for Evaluation of National Malaria Control Programs

Supporting data for this indicator can be obtained through interviews with mothers who bring their febrile children to a health facility for treatment. Only mothers of children brought to the facility for the first time during the current fever episode should be interviewed. An open question should be posed by the interviewer to the mother; for example, «When did the fever start?» Answers given by mothers can then be coded as either more than 24 hours or less.

Results for this indicator may be biased by the mothers' inability to recall the time of fever onset or by systematic underreporting of the time since onset because mothers understand that rapid presentation is «correct».

9. Availability of antimalarial drugs

Health facilities covered by the program
with no stock-outs of antimalarial drugs during a given period
divided by
Health facilities covered by the program

Most national policies in Africa recommend that the first dose of antimalarial drugs be provided to patients during their visit to the health facility. It is therefore important that facilities have appropriate antimalarial drugs in stock in sufficient quantities to provide treatment to all patients with fever.

The frequency of stock-outs (periods when no drug is available) may serve as a useful indicator of the availability of antimalarial drugs. Under some circumstances, however, the presence or absence of stock-outs can be difficult to interpret. For example, in some situations, health workers may ration limited stocks to ensure that drugs will remain available for certain target groups or to avoid criticism by their supervisors. In other situations, all facilities could continue to report stock-outs in spite of successful efforts by the program to increase drug availability, because the indicator is not sensitive enough to detect decreases in the duration or frequency of stock-outs.

Alternative indicators, such as the number of days during which all patients received appropriate antimalarial treatment in the health facility or the number of days without stock-outs during a given period, should be considered, depending on the level of development of the program.

Managers must select the indicator that is most appropriate for the current stage of their program, and anticipate the need to change indicators as the program develops.

10. *Chemoprophylaxis during pregnancy*

Primiparas who report during their first post-partum visit
that they have followed a course of chemoprophylaxis in accordance with the national policy
divided by
Primiparas seen for their first post-partum visit

Chemoprophylaxis during pregnancy has been adopted as an intervention strategy by many programs in Africa. The objective of this strategy is to decrease the incidence of abortions, premature births, and low birth weights due to malaria during pregnancy, particularly in primiparas.

This indicator was selected because of the relative ease with which supporting data can be collected by national programs. However, mothers may not be able or willing to report accurately their adherence to the regimen prescribed.

In countries where the national policy recommends chemoprophylaxis for all pregnant women (and not only primigravidae), the indicator will have to be revised accordingly.

11. *Utilization of insecticide-impregnated bednets*

Members of the target group who report that they slept
under an insecticide-impregnated bednet the previous night
divided by
Members of the target group

An increasing number of countries are promoting the utilization of insecticide-impregnated bednets as a promising strategy for decreasing malaria-associated morbidity and mortality. This indicator is designed to provide managers with information about the extent of bednet use among targeted populations.

However, the validity of measurements for this indicator may be subject to recall or reporting biases. The recall bias has been minimized by limiting the reporting period for bednet use to the night preceding the interview. National programs may wish to extend the time interval covered by the indicator.

Similarly, the time period during which the survey is conducted (for example, high or low transmission period) could affect bednet utilization rates, and should be taken into account when scheduling data collection.

12. Speed of health information system

Health facilities whose monthly reports of fever cases and deaths
are received at the next higher level
of the health system within 10 days after the end of the report month
divided by
Health facilities

The effectiveness of public health programs depends in part on the rapid response of their health information systems. Reasonably rapid response is particularly important in areas with potential for malaria epidemics, where an increase in malaria cases and deaths could signal an emerging problem. This indicator is designed to measure the speed with which facility-level reports arrive at the next-highest level of the health system. Using the date when the report arrives rather than the date when it is sent takes into account communication delays that may affect the availability of information for use in decision making.

The 10-day time interval can be adapted to the needs and reporting systems of each country.

IV. Sources of Data and Methods

Data needed to support the 12 key indicators can be obtained through the use of three basic methods. Each is described briefly below:

A. Abstraction of Data from the Health Information System

The four impact indicators can be measured through routine morbidity and mortality reports completed as a part of the health information system in most African countries. These indicators should be measured based on all health facilities (morbidity) or all hospitals (mortality) in the country or in the geographical areas covered by the evaluation. Data to support the indicator on the rapid response of the health information system will also be obtained using this method.

In some countries, the program manager may decide that data obtained from the health information system are not yet of adequate quality for use as a source of indicator data. When this occurs, mortality and morbidity data can be collected directly from health facility records or reports, either during routine supervisory visits or through a special survey. If sufficient resources are not available to collect these data in all health facilities, a more limited number of sentinel facilities might be used to monitor trends in indicator levels.

B. Observations and Interviews in Health Facilities.

Data to support the five indicators of case management quality (i.e., clinical diagnosis, microscopic diagnosis, treatment, early consultation for febrile children, and availability of antimalarial drugs) can be obtained through visits to health facilities either during routine supervision or during specially-designed surveys. The following activities can be conducted in each health facility visited:

- re-examination of slides to assess the quality of parasitologic diagnosis
- observations of consultations to assess whether the health worker determines the past or current presence of fever (by history and/or physical examination), and if the health worker treats febrile patients correctly
- interviews with mothers to assess the timeliness of consultations for febrile children
- review of stock records to assess the availability of antimalarial drugs

Data collected through routine supervision offer an opportunity for immediate feedback and performance improvement. The results can then be summarized periodically for use in program evaluation and in planning inservice training.

Data on the quality of case management can also be obtained through special surveys when necessary. Such surveys require additional resources and the development of a protocol and data collection instruments. These added demands are sometimes justified because such surveys offer the only means of obtaining needed data. If a survey is conducted, the manager should select a representative sample of health facilities based on the number of febrile patients in the target group (most frequently, children) seen in each facility. A team of 2-3 well-trained persons can visit one facility per day and obtain the data needed to support the case management indicators. Surveys in health facilities can be repeated every one or two years, depending on whether program activities are expected to have resulted in changes in indicator levels.

The indicator related to chemoprophylaxis during pregnancy is also based on data obtained in health facilities. However, post-partum visits are not necessarily conducted at the same time or in the same locations as consultations for fever, precluding the collection of these data at the same time as those for the case management indicators. Procedures for collecting supporting data for this indicator will need to be developed by individual country programs.

C. Community Surveys.

Most national malaria control programs in Africa include prevention activities at the community level, and it is important that these interventions be included in program evaluations. Among the 12 key indicators discussed in these guidelines, only the utilization of impregnated bednets requires a community-based survey. The sample of communities for this effort should be limited to those targeted for bednet interventions. Survey costs might be reduced by including questions on bednet utilization in surveys of the target communities carried out by other programs or for other purposes.

As for the two other methods, the frequency of data collection will vary, based on the planned malaria control activities of the national program.

V. Management of Evaluation Activities in Programs

As for other components of malaria control programs (training, supervision, or supplies, for example), evaluation must be planned and implemented using sound management principles. A practical approach is to proceed in a series of steps, in which managers will do the following:

- 1) define or select a limited number of useful indicators as part of an overall program evaluation plan. This plan must specify the sources of data and the frequency of indicator measurement. These guidelines have been designed to help managers accomplish this first step.
- 2) develop a functional system for managing evaluation activities. This system should use existing resources whenever possible, and should build on the experiences of other countries and health programs.
- 3) select, train, and supervise personnel assigned to evaluation activities.
- 4) assure the quality of the evaluation results. This can be achieved through periodic assessments of data quality, through reviews of records conducted during supervisory visits, or through specific quality control activities (for example, repeat interviews with random subsamples of persons previously interviewed during a survey).
- 5) ensure that the evaluation data resulting from different sources are systematically translated into information that is useful and easily accessible to managers at all program levels.
- 6) develop mechanisms and timetables to ensure that evaluation results are used for program decision making.

VI. Conclusion

Evaluation is often neglected in the development of malaria control policies and programs. This situation must be corrected. When correctly designed and implemented, evaluation offers a powerful management tool that allows the improvement of programs.

The need for evaluation has been the focus of the Bujumbura meeting at two levels. At a conceptual level, the meeting emphasized that evaluation should be an integral component of malaria control programs, carried out by managers at all levels, at intervals sufficiently frequent to permit feedback and continuous improvement of programs. At a practical level, the meeting has resulted in the development of these guidelines and proposed key indicators. These 12 indicators encompass the essential aspects of malaria control, and can be adopted as common elements to allow the sharing of experiences and comparisons of progress among different programs.

This document also includes some practical advice on methods that can be used to collect the data needed to support the key indicators and on the management of evaluation activities. The brief discussions are designed to raise fundamental questions about the practical aspects of program evaluation and may need further attention and development as evaluation takes its rightful place within national programs.

We invite program managers from other countries, as well as the institutions that collaborate with them, to consider this approach to evaluation and to test the proposed key indicators under the conditions that prevail in their countries. Their reactions, comments, and findings can be sent to the authors (see p.17). This communication can provide the basis for continued efforts to improve malaria control programs in Africa through well-managed evaluation activities and through sharing of the rich experiences of the countries involved.

Dr. Charles

(LMTC)

B.P. 337

Bujumbura

BURUNDI

Dr. Charles DELACOLLETTE

Conseiller Technique

Projet Lutte contre les Malaria

Transmissibles et Carencielles

Section Lutte contre le Paludisme

B.P. 337

Bujumbura

BURUNDI

Technical Advisor

Project for the Control of Communicable

Diseases and Malnutrition Deficiencies

Malaria-Consel Section

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List of Authors

Mme. Marianne BARUTWANAYO
Biologiste-Conseiller Technique
Projet Lutte contre les Maladies
Transmissibles et Carentielles
Section Lutte contre le Paludisme
B.P. 337
Bujumbura
BURUNDI

Dr. Diawara BASSALIA
Coordonnateur National Adjoint du
Programme de Lutte contre
le Paludisme
Institut National de Santé Publique
B.P. V 47
Abidjan
COTE D'IVOIRE

Dr. André BIRABUZA
Directeur du Projet de Lutte contre
les Maladies Transmissibles
et Carentielles
(LMTC)
B.P. 337
Bujumbura
BURUNDI

Dr. Charles DELACOLLETTE
Conseiller Technique
Projet Lutte contre les Maladies
Transmissibles et Carentielles
Section Lutte contre le Paludisme
B.P. 337
Bujumbura
BURUNDI

Biologist-Technical Advisor
Project for the Control of Communicable
Diseases and Malnutrition Deficiencies
Malaria Control Section

Assistant National Coordinator
Malaria Control Program
National Institute of Public Health

Director
Project for the Control of Communicable
Diseases and Malnutrition Deficiencies

Technical Advisor
Project for the Control of Communicable
Diseases and Malnutrition Deficiencies
Malaria Control Section

List of Authors

Dr. Moussa KEITA
Coordonnateur National de Lutte
contre le Paludisme
Ministère de la Santé Publique
et des Affaires Sociales
B.P. 817
Conakry
GUINEE

National Coordinator for Malaria Control
Ministry of Public Health and Social Affairs

Mr. Nestor MADJI
Chef de Section Paludisme
Direction de la Médecine Préventive
et de Lutte contre les
Grandes Endémies (DMPGE)
B.P. 783
Bangui
CENTRAFRIQUE

Chief, Malaria Section
Directorate of Preventive Medicine and
Control of Major Endemic Diseases

Dr. A. Sideye MAIGA
Coordonnateur National du Programme
Paludisme, Institut National de
Recherche en Santé Publique
(INRSP)
B.P. 1771
Bamako
MALI

National Coordinator
Malaria Program
National Institute of Public Health
Research

Dr. Hamissou MAOUDE
Directeur des Etablissements de Soins
Directeur de Tutelle du Programme
National de Lutte contre le Paludisme
Ministère de la Santé Publique
B.P. 623
Niamey
NIGER

Director of Health Facilities
Director, Malaria Control Program
Ministry of Public Health

List of Authors

Dr. Hilaire NDIHOKUBWAYO
Coordonnateur National du Programme
de Lutte contre le Paludisme
PEV-CCCD
B.P. 337
Bujumbura
BURUNDI

National Coordinator
Malaria Control Program
EPI/CCCD

Dr. Joseph NIANGUE
Coordonnateur National du Programme
de Lutte contre le Paludisme
Direction de la Santé Communautaire
Ministère de la Santé et
de la Protection Sociale
06 B.P. 861
Abidjan 06
COTE D'IVOIRE

National Coordinator
Malaria Control Program
Directorate of Community Health
Ministry of Health and Social
Protection

Dr. SIDI MOHAMED O. Mohamed Lemine
Chef de Service des Maladies
Transmissibles
Ministère de la Santé et des
Affaires Sociales
B.P. 4636
Nouakchott
MAURITANIE

Chief, Department of Communicable
Diseases
Ministry of Health and Social Affairs

Dr. Eucher-Dieudonné YAZIPO
Chef de Service de Lutte contre
les Grandes Endémies (DMPGE)
B.P. 783
Bangui
CENTRAFRIQUE

Chief
Service for the Control of
Major Endemic Diseases