Federal Democratic Republic of Ethiopia
Ministry of Health

Surveillance, Monitoring and Evaluation Manual for Malaria Elimination in Ethiopia

February 2017
Addis Ababa

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Preface

The effort towards eliminating malaria requires robust surveillance, monitoring and evaluation system. As Ethiopia is keen towards eliminating malaria by the year 2030, the country is highly committed to establish a surveillance, monitoring and evaluation system, which facilitates malaria elimination efforts. Public health emergency management (PHEM) and its successful experiences will be used as a springboard to develop a surveillance system that is quick to respond along the entire elimination path. Learning from best practices and new evidences, the surveillance system will be reoriented accordingly.

The aim of this manual is to guide all health cadres involved in surveillance, monitoring and evaluation of malaria elimination program. Establishment of database at district, regional and national levels with rapid channel of communication is instrumental to achieve the objective of the surveillance system. The surveillance system will make use of modern electronic technology to provide real time data to all implementers and partners.

The surveillance system will also be functional across the spectrum of malaria elimination path from optimization to elimination activities to achieve and then maintain zero indigenous cases. The focus will be on system establishment and human capacity development during the optimization phase as well as on compilation and analysis of aggregated data. A case-based surveillance system will be fully implemented in the elimination phase.

While developing this manual, local and international guidelines have been referred and local knowledge and experiences are incorporated.

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List of Abbreviation

ABER	Annual Blood Examination Rate
ACT	Artemisinin-based Combination Therapy
ACD	Active Case Detection
ACIPH	Addis Continental Institute of Public Health
API	Annual Parasite Incidence
CHAI	Clinton Health Access Initiative
EPHI	Ethiopian Public Health Institute
G6PD	Glucose-6-Phosphate Dehydrogenase
HC	Health Center
HEP	Health Ex tension Program
HEW	Health Extension Workers
HF	Health Facility
HMIS	Health Management Information System
HP	Health Post
ICCM	Integrated Community Case Management
IRS	Indoor residual spraying
ITN	Insecticide Treated Net
LLIN	Long Lasting Insecticidal Nets
LSM	Larval Source Management
MACEPA	Malaria Control and Elimination Partnership in Africa
SM&E	Surveillance, Monitoring and Evaluation
MERG	Monitoring and Evaluation Reference Group
NAA	Nucleic Acid Amplification
OPD	Out Patient Department
PATH	Partnership for Appropriate Technology in Health
PCD	Passive Case Detection
PCR	Polymerase Chain Reaction
PHEM	Public Health Emergency Management
PMI	President's Malaria Initiative
RCD	Reactive Case Detection
RDTs	Rapid Diagnostic Tests
RDQA	Routine Data Quality Assurance
RHB	Regional Health Bureau
SBCC	Social Behavioral Change Communication
SMS	Short Message Service
SOP	Standard Operating Procedure
TIRS	Targeted Indoor Residual Spraying
TLSM	Targeted Larval Source Management
TMDA	Targeted Mass Drug Administration
TPR	Total Positivity Rate
USAID	United States Agency for International Development
WHO	World Health Organization

Glossary

This glossary is adapted from WHO's "A Framework for Malaria Elimination", which is published in 2017. The glossary contains all key terms incorporated in this manual.

Case detection:	One of the activities of surveillance operations, involving a search for malaria cases in a community. ***Note:*** *Case detection is a screening process in which the indicator is either the presence of fever or epidemiological attributes such as high-risk situations or groups. Infection detection requires use of a diagnostic test to identify asymptomatic malaria infections.*
Active case detection:	Detection by health workers of malaria cases at community and household levels, sometimes in population groups that are considered at high risk. Active case detection can consist of screening for fever followed by parasitological examination of all febrile patients or as parasitological examination of the target population without prior screening for fever. ***Note:*** *Active case detection may be undertaken in response to a confirmed case or cluster of cases, in which a population potentially linked to such cases is screened and tested (referred to as "reactive case detection"), or it may be undertaken in high-risk groups, not prompted by detection of cases (referred to as "proactive case detection").*
Passive case detection:	Detection of malaria cases among patients who, on their own initiative visit health services for diagnosis and treatment, usually for a febrile illness.
Case investigation:	Collection of information to allow classification of a malaria case by origin of infection, i.e. imported, indigenous, induced, introduced, relapsing or recrudescent. ***Note:*** *Case investigation may include administration of a standardized questionnaire to a person in whom a malaria infection is diagnosed and screening and testing of people living in the same household or surrounding areas.*
Annual blood examination rate:	The number of patients receiving a parasitological test for malaria (blood slide for microscopy or malaria rapid diagnostic test) per 100 population per year.
Case-based surveillance:	Every case is reported and investigated immediately (and also included in the weekly reporting system).
Confirmed malaria:	Malaria case (infection) in which the parasites has been detected in diagnostic test, i.e. microscopy, rapid diagnostic test or a molecular diagnostic test
Presumed malaria:	Case suspected of being malaria that is not confirmed by a diagnostic test

Suspected malaria:	Patient illness suspected by a health worker to be due to malaria. The criteria usually include fever for residents in malarious area and fever with a history of travel to endemic areas for those residing in non-malarious areas. All patients with suspected malaria should receive a diagnostic test for malaria, by microscopy or a rapid diagnostic test.
Autochthonous:	A case acquired locally by mosquito-borne transmission
Imported:	Malaria case or infection in which the infection was acquired outside the area in which it is diagnosed
Index case:	A case of which the epidemiological characteristics trigger additional active case or infection detection. The term "index case "is also used to designate the case identified as the origin of infection of one or a number of introduced cases.
Indigenous:	Any case contracted locally with no evidence of importation and no directly transmission from an imported case
Induced:	A case the origin of which can be traced to a blood transfusion or other form of parenteral inoculation but not to transmission by a natural mosquito born inoculation.
Introduced:	A case contracted locally, with strong epidemiological evidence linking it directly to a known imported case (first generation local transmission),
Locally acquired:	A case acquired locally by mosquito-borne transmission
Malaria case:	Occurrence of malaria infection in a person in whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test
Relapsing case:	Malaria case attributed to activation of hypnozoites of *P. vivax* or *P. ovale* acquired previously
Case management:	Diagnosis, treatment, clinical care and follow-up of malaria cases.
Case notification:	Compulsory reporting of detected cases of malaria by all medical units and medical practitioners, to either the health department or the malaria elimination service (as laid down by law or regulation).
Certification of malaria-free status:	Granted by WHO after it has been proven beyond reasonable doubt that the chain of local human malaria transmission by *Anopheles* mosquitoes has been fully interrupted in an entire country for at least 3 consecutive years.
Control charts:	Figures summarizing information on key malaria indicators collected by surveillance for regular, periodic review by malaria control program personnel.
Elimination:	Interruption of local transmission (reduction to zero incidence of indigenous cases) of a specified malaria parasite species in a defined geographical area as a result of deliberate activities. Continued measures to prevent re-establishment of transmission are required.
Endemic:	Applied to malaria when there is an ongoing, measurable incidence of cases and mosquito-borne transmission in an area over a succession of years.
Epidemic:	Occurrence of cases in excess of the number expected in a given place and time.

Eradication:	Permanent reduction to zero of the worldwide incidence of infection caused by all human malaria parasites species as a result of deliberate activities. Intervention are no longer required once eradication has been achieved.
Malaria-free:	Describes an area in which there is no continuing local mosquito-borne malaria transmission and the risk for acquiring malaria is limited to infection from introduced cases
Malaria reintroduction:	Malaria reintroduction is the occurrence of introduced cases (cases of the first –generation local transmission that are epidemiologically linked to a confirmed imported case) in a country or area where the disease had previously been eliminated.
Focus (Foci):	A defined, circumscribed locality situated in a currently or former malarious area containing the continuous or intermittent epidemiological factors necessary for malaria transmission. Foci can be classified as endemic, residual active, residual non-active, cleared up, new potential, new active or pseudo.
Gametocyte:	The sexual reproductive stage of the malaria parasite present in the host's red blood cells.
Hotspot:	Geographically discrete household or group of households that maintain malaria transmission throughout the year at significantly high rates than their surroundings
Intervention:	Activity undertaken to prevent or reduce the occurrence of a health condition in a population. Examples of interventions for malaria control include the distribution of insecticide-treated mosquito nets, indoor residual spraying with insecticides, and provision of effective antimalarial therapy for prevention or curative treatment of malaria.
Mass drug administration	Administration of antimalarial treatment to every member of a defined population or every person living in a defined geographical area (except those for whom the medicine is contraindicated) at approximately the same time and often at repeated intervals
Line list:	Information on cases recorded in rows and columns, with data for each case in columns across one row. The information may include case identification number; demographic factors (patient's name, address, age, sex); clinical factors (date of attendance, type of test, test result, treatment received); intervention factors (house sprayed, insecticide-treated net ownership, preventive therapy).
Receptivity	Receptivity of an ecosystem to transmission of malaria ***Note:*** *A receptive ecosystem should have e.g. the presence of competent vectors, a suitable climate and a susceptible population.*
Surveillance (elimination programs)	That part of the program designed for the identification, investigation and elimination of continuing transmission, the prevention and cure of infections and final substantiation of claimed elimination.
Transmission season:	Period of the year during which mosquito-borne transmission of malaria infection usually takes place.

1. Introduction

Political commitments, intensified investments and control efforts in the past decade in Ethiopia have led to remarkable decline in malaria burden. The number of peripheral health facilities diagnosing and treating malaria cases, and outpatient and inpatient capacity at health centers increased dramatically. Household ownership of at least one ITN and/or households sprayed with IRS increased to 71% in 2015. In return, between 2006–2011 malaria morbidity and mortality have reduced by >50% and >60%, respectively[1]. The frequency and magnitude of malaria epidemics have also substantially decreased. Moreover, there has not been a national scale malaria epidemic since 2004. The achievements made so far encouraged the Government of Ethiopia to consider the inception and re-orientation of the national malaria control program towards sub-national malaria elimination targets with the endeavor of nationwide elimination by 2030. To meet this goal a new malaria elimination roadmap specific to the country's context has been developed. The roadmap outlines the technical and operational measures and procedures.

To achieve malaria elimination goal, the following four phases have been framed in the roadmap:

Surveillance, monitoring and evaluation (SM&E) is a critical component of elimination in guiding the deployment of specific interventions and in monitoring and evaluation of progress and impact. An effective malaria SM&E system will enable the program to: identify areas or population groups most affected by malaria (high risk); identify trends in cases and deaths that require additional intervention; and assess the success of control and elimination measures. Therefore, this separate manual on SM&E for elimination has been developed to provide detailed guidance on the tools, procedures, personnel and structures required to generate information necessary in each of the phases of the elimination path outlined above.

The objectives of the surveillance manual are as follows:

1. To guide the surveillance approaches and tools to be employed in all phases of the elimination path
2. To guide deployment of interventions and monitor their implementation
3. To assess outcomes and impact; and evaluate progression across the elimination path

2. Surveillance systems in the elimination path

Surveillance approaches employed in the different phases of the elimination path will be additive and progressive. The system will gradually build from compilation and analysis of aggregated data in the optimization phase to case-based surveillance in the elimination phase. Once incidence is relatively low, i.e. in the pre-elimination/elimination phase, the system will ensure that all sectors including the public health facilities, community-based treatments and private practitioners report regularly to ensure that the bulk of symptomatic infections are captured. Identification, responding, recording and reporting of cases and foci will be an important activity of the pre-elimination and elimination phases. Ultimately, certification of malaria elimination by WHO will depend on the quality of surveillance and its documentation.

Program management reorientation will be required to implement these activities. These could include legislations, recruitment of surveillance staff; training and re-orientation of

[1] Maru Aregawi et al, Time Series Analysis of Trends in Malaria Cases and Deaths at Hospitals and the Effect of Antimalarial Interventions, 2001–2011, Ethiopia. PLOS ONE, 2014, 9 (11)

staff on practices, attitudes, supervisions and accountability; setting up laboratory quality assurance systems; introducing and redesigning of registers and reporting forms.

The surveillance system usually involves:

Case definitions, diagnostic method, case identification and reporting at different phases of the elimination path presented as follows.

2.1 Surveillance in optimization phase

Optimization implies intensification of the existing antimalarial interventions in terms of quality, targeting, and utilization. Districts will be classified as eligible for optimization when they exhibit either of the following: (1) they reach an API of "5" to "10", (2) they have low test positivity rates (TPRs) of 5–10% for all ages, and (3) an API greater than 5 but are located within a cluster of districts with an API of 5–10 within the same administrative zone.

The surveillance system during optimization phase will depend solely on: i) passive case detection PCD), ii) temporal and spatial trend analysis of aggregate data, iii) monthly summary of key indicators; and iv) weekly monitoring of cases. The data elements and indicators relevant to the optimization phase are listed in Tables 2 and 3, respectively.

- *Case definition:* malaria case, is defined as case confirmed positive with either RDT or microscopy (at any stage of the parasite) with or history of fever and/or other clinical symptoms suggestive of malaria.
- *Diagnosis:* Quality assured microscopy and RDTs will be used as the bulk of the cases are going to be detected through Passive Case Detection (PCD).
- *Aggregate data reporting and analysis*: Registers of individual cases and weekly reports should be maintained at the health facility level. But given the high frequency of malaria cases, and the relatively limited resources, malaria surveillance systems rely on aggregate data being reported to and used by district and higher administrative levels.
- *Malaria inpatient cases and deaths audit:* At selected health facilities case-based surveillance of malaria in-patient cases and death audits should be undertaken with the aim of understanding and responding to cases of severe disease. In addition, audit of inpatient cases could also inform program weaknesses related to preventive interventions, treatment seeking behavior, or referral systems.
- *Monthly summarization and visualization:* At health facility, district, zonal and regional levels, cases and deaths should be summarized on a *monthly* basis in order to assess the success of interventions and identify trends that need an urgent response.
- At the district and higher levels, cases and deaths will be summarized *monthly* in order to assess the impact of interventions and identify trends that require urgent response. Analysis is undertaken disaggregated by corresponding lower level (e.g. district by health facility catchment area; zones by district, regions by zone).

Table 1. Data elements to be recorded through passive case detection at health facility level

Health Post Level	Health Center/ Hospital Level

• Date (DD/MM/YY)
• Name of Client
• Sex (Male/Female)
• Pregnancy status (PW=pregnant women, NPW=not pregnant women, NA=not applicable)
• Age
  • Age in completed year for adult (>5)
  • Age in month for children (<5years)
• Phone number
• Permanent Address
  • Woreda
  • *Kebele*
  • Village
  • House number
  • Name of Head of Household
• How did the client get the service (Self, Home visit, Referred by HDA, Referred by other)
• Sign and Symptoms
• Fever (Yes/No)
• Temperature (C^0)
• Onset of fever (<24 hours, ≥24 hours)
• Any travel history in the past 30 days (Yes/No)
• If travel history is yes, where?
  • Region
  • Woreda
  • Kebele
• New or repeat (within 2 weeks)
• RDT Results (Negative, Pf, Pv, Mixed)
• Diagnosis result other than Malaria
• Drug provided (AL, AL+sdPQ, CQ, CQ+PQ, QN, other)
• Referred (Yes/No)
• Reason for referral
• Remark
	• Date (DD/MM/YY)
	• Name of Client
	• Sex (Male/Female)
	• Pregnancy status (PW=pregnant women, NPW=not pregnant women, NA=not applicable)
	• Age
	  • Age in completed year for adult (>5)
	  • Age in month for children (<5years)
	• Phone number
	• Permanent Address
	  • Woreda
	  • Kebele
	  • Village
	  • House number
	  • Name of Head of Household
	• Fever (Yes/No)
	• Temperature (C0)
	• Onset of fever(<24 hours, >24 hours)
	• Any travel history in the past 30 days (Yes/No)
	• If travel history is yes where?
	  • Region
	  • Woreda
	  • Kebele
	• New or repeat (within 2 weeks)
	• Diagnostic Method (Microscopy, RDT)
	• RDT Results (Negative, Pf, Pv, Mixed)
	• Diagnosis result other than Malaria
	• Drug provided (AL, AL+sdPQ, CQ, CQ+PQ, QN, other)
	• Referred (Yes/No)
	• Reason for referral
	• Remark

In addition to Table 1, the data elements and indicators listed in Tables 3 & 4 are also relevant to the optimization phase and should be monitored and analyzed.

2.2 Surveillance in pre-elimination phase

The purpose of this phase is to further reduce transmission and introduce additional approaches and tools to the optimization interventions. Districts will be classified as eligible for pre-elimination when they exhibit either of the following: (1) they have an API of 1–5 or lower, (2) they have a low TPR of 1–5% for all ages, and (3) they have built systems and program capacity through the optimization step; and they are located within a zone designated for subnational elimination.

The surveillance system during pre-elimination phase will introduce new practices to the system in addition to the passive case detection: i) passive case detection (PCD), ii) foci-based surveillance to *identify and investigate foci*, iii) case-based surveillance (line-listing of all patients) at later phase of pre-elimination and if number of cases are few; and iv) monthly summarization of indicators relevant to pre-elimination in addition to the indicators monitored in optimization will be undertaken (Table 4 and 5; Annex 1.2).

- Diagnosis: health centres and hospitals will employ quality assured malaria microscopy as they have better skilled personnel. In health posts and in other health facilities where quality assured microscopy cannot be carried out, only quality assured RDTs will be used. All febrile cases (suspected cases of malaria based on standard criteria) should be tested for the presence of parasites in the blood and reporting should be complete.
- Case summarization and visualization: Analysis and visualization should also be undertaken based on the proposed list of indicators and standard graphs (Tables 4 and 5; Annex 1.1) by health facility catchment area (kebele) and by district in order to identify and target the relatively higher transmission areas, i.e. hotspots and intensify activities.
- Foci-based surveillance: Spatial aggregates of cases by sub-Kebele level will lead to identification of foci. At this phase, districts will start enumerating the list of foci. This will be followed by prioritization and investigation of the foci based on the case load they contribute (API) and outcome of entomological surveys to employ timely interventions. At this phase full details of each case will not be necessary. Until the number of foci are few, this activity will be limited to foci listing, investigation and response.
- Line listing of inpatient cases and deaths: At the health facility level, case-based surveillance of malaria in-patient cases and deaths should be undertaken with the aim of responding to cases of severe disease and tracking the target of near zero deaths. In addition, line listing and investigation of inpatient cases will also inform potential program weaknesses related preventive interventions, treatment seeking behavior, or referral systems.

2.3 Surveillance in elimination phase

The purpose of this step is to attain zero local cases. It is a step meant to further and intensify the surveillance system that has, with targeted interventions, become a core intervention aimed at achieving interruption of local transmission. Districts will be classified as eligible for elimination when (1) they have an API less than one, (2) they have been successfully transforming surveillance systems into core interventions through the pre-elimination phase, (3) they are located within a cluster of districts designated for the elimination phase that share boundaries.

In this phase, cases occur sporadically or in distinct foci. Therefore, building on the surveillance practices established in the pre-elimination, more stringent and advanced surveillance activities will be introduced. At this phase sub-national elimination must have advanced and shrunk the map remaining with only a few cases per year. Therefore, the following surveillance measures will be introduced in to the system: i) *immediate notification and reporting* of each case and timely *classification* of cases and foci.

- *Diagnosis:* RDTs and microscopy can be used to detect almost all symptomatic infections and many but not all asymptomatic infections. More sensitive diagnostic methods, such as polymerase chain reaction (PCR) and other molecular techniques, are used to detect asymptomatic infections with very low parasite densities. More sensitive methods such as PCR will be used for evaluation/ confirmation of zero case reporting.

- *Case-investigation and classification*: When the number of cases in the district become very few, registers of individual cases will be maintained at health facility level and line-lists of all confirmed cases (irrespective of severity) will be forwarded to district level monthly. Case investigation involves patient demographic information, dates of events, type of case detection, symptoms, history of current illness including diagnostic test results and treatment, travel history to assess origin of infection and the possibility of onward transmission. Cases then will be classified as local (indigenous, introduced, relapsed and induced) or imported based on WHO elimination manual [2] Such classification of cases will then lead to detection of possible hotspot/s to be followed with classification of the foci (hotspot). Example: if a district with 100,000 population has 200 patients per month (from 20 health facilities) within 6-month transmission period, corresponding to an API of 12 cases per 1000 population. That means each health facility will investigate 60 cases per year. In this cases should be graphed *weekly* to identify trends that require attention, and mapped by village to identify clusters. Weekly case based monitoring charts will also need to be employed.

- *Foci-based surveillance:* The foci will be investigated and classified (see foci investigation and classification section).

- *Line listing of all cases:* At health facility level case-based surveillance of malaria in-patient cases and deaths should be undertaken with the aim of responding to cases of severe disease and tracking the target of near zero death. In addition, line listing and investigation of inpatient cases will also inform potential program weaknesses related preventive interventions or treatment seeking behavior or referral systems.

At the later phase of the elimination (when subnational elimination is near completion), imported cases may comprise a significant proportion of all cases and may contribute to re-establishment of transmission in areas in which it had previously been interrupted. The program will investigate each case to ascertain whether or not it is imported or locally acquired and undertake appropriate control measures.

2.4 Surveillance in prevention of re-introduction

The national malaria program will be strategically positioned or streamlined into the integrated or general health services as this will be the main apparatus of disease surveillance in this phase. Regular training and monitoring activities or vigilance with immediate notification systems will be compulsorily maintained. Every imported case in a receptive area will be defined a potential focus, where active case detection and possibly vector control may be warranted.

At this phase the following will be the focus of surveillance activities:

- Early detection of imported malaria cases that pose a risk for renewed transmission (where possible and necessary screening of persons entering the country at certain border crossings or by house or work-place visits may be considered). Similarly, until elimination of the disease achieved at the country level, internal importation of cases from the ongoing transmission settings to areas where transmission is interrupted will be detected and managed. But such cases are considered as local cases only – they are NOT considered as imported cases (refer to a framework of malaria elimination 2017, p.37).

- Continuous vigilance to ensure that imported cases do not lead to re-introduction of transmission;

- Maintain capacity for immediate notification, case investigation and radical cure of all cases; and monitor changes in the levels of receptivity and vulnerability

- Cross-border surveillance, information exchange, and collaboration

[2] Disease surveillance for malaria elimination: an operational manual. WHO. 2012. ISBN 978 92 4 150333 4

3. Methods for case detection

As the health service (both public and private) coverage expands nearly reaching all populations, passive case detection is generally the preferred method for detecting malaria cases, because it is part of the package of curative services offered to the population. However, active case detection may be needed in areas where populations have limited access to facilities, in particularly high risk settings (such as new settlements due to population movement, mining, etc.), optimized control interventions are insufficient to eliminate malaria, or in situation when the malaria control program desires to assess the prevalence of asymptomatic infection in the community.

3.1 Passive case detection

Passive case detection (PCD) is the detection of malaria cases among people who go at their own initiative to a health service provider to get treatment, usually for febrile disease.

Therefore, the criteria for parasitological testing of suspected malaria cases will be as follows:

- Persons staying in endemic areas or in active foci: all patients with fever or a recent history of fever
- Persons in non-endemic areas: patients with unexplained fever and a history of travel to areas at risk of malaria, within the country or abroad

In addition, more detailed criteria will be put in place towards the later phase of the elimination. These will include:

- Individuals with a history of malaria in the past 3 years and an increase in temperature;
- Recipients of blood donations who have fever during the 3 months after the transfusion;
- Patients with fever, malaise and chills;
- Persons with anaemia of unknown cause;
- Patients with hepatomegaly and/ or splenomegaly;

The criteria chosen should be disseminated widely to all health providers with periodic reminders.

All passive case detection activities will be documented on registers standardized by the national program recording all patients tested with patient demographic data, test types and results and basic clinical data.

Spatial analysis of the PCD data will be conducted and clustering of cases will guide identification of foci in a district which in return will help in tailoring response or interventions. Given the fact that malaria transmission is highly seasonal and lasts few months, foci identification will be done well in advance before the transmission season.

The application of PCD entails the following key activities:

a. Review and analysis of the surveillance data to identify the foci (including temporal analysis)

b. Foci investigation using on site entomological assessment to identify and record breeding sites

c. Assess other risk factors such as population movement particularly to and from high transmission areas

d. Weekly analysis for identification of clustering of cases and epidemics monitoring

3.2 Active case detection

Active case detection (ACD) is the detection by health workers of malaria infections outside usual health service settings among population groups that are considered to be at high risk. ACD can be conducted by parasitological testing in patients with present or recent fever, or in a defined population group without prior fever screening (mass blood testing).

ACD can be proactive case detection, when it is a regular or continuous activity and reactive case detection, when it reacts to a certain event and is maintained for a limited period.

Reactive case detection:

This is a detection of cases with or without symptoms by health workers at community or household level in a population at risk. RCD is triggered by a case or a cluster of cases (local or imported) from passive case detection and is complementary to the PCD. RCD will be used to fill gaps to detect malaria infections as early as possible and clear parasite reservoir by tMDA. Accordingly, mass drug treatment will be applied to interrupt transmission in foci where cases are reported.

Proactive case detection:

This is triggered by experts' opinion or local authorities targeting certain segments of a population. It is a detection of cases with or without symptoms by health workers in areas that are:

- Areas underserved by existing health services, such as migrant workers and tribal populations; and
- Areas where breeding sites are not well known or defined and clusters of cases are reported.

This may involve house to house testing and treatment using ad hoc investigation team or establishing new public sector malaria testing and treatment posts in active foci. Health posts or health workers, including health development army, may have to be added in foci with persistent local malaria transmission eligible for proactive case detection. These malaria treatment posts would serve both surveillance and control functions. Such proactive case detection (with house-to-house visits) will be held at regular interval (every month) until replaced with PCD. Refer to proactive case detection SOP for details.

ACD in a new or existing foci will involve the following:

a. Case notification to the next level (using case notification form)

b. Parasitological testing of all individuals (screening) with or without fever residing within 100-meter radius

c. Foci investigation (triggered by the cluster of cases) including:

- Breeding sites using entomological assessment
- History of transmission in the foci to determine new or old foci
- Risk of vulnerability and receptivity
- Resources available in the foci for response

The cases and deaths reported from such ACDs will be included in the surveillance system with special remark to distinguish from cases detected with PCD.

Box 1. Guidance on organization of active detection through house-to-house visits.

Organizing active case detection by house-to-house visits

1. Local health care providers or mobile teams list the targeted population by household with the assistance of the local authorities. There should be complete coverage of the target population. People in temporary contact with the target population should also be included e.g. transport workers, construction workers, seasonal agricultural workers and military. Attention should be given to people in outlying hamlets and clandestine groups such as illegal immigrants.
2. A plan of visits should be developed and the population should be informed of the dates and times. Visits usually occur once every 2 weeks during the malaria season. They should be conducted when the family members are most likely to be home (before or after work or school).
3. During the visit household members are asked about recent history of fever and chills. There is no rule for the recall period. Fourteen days (used in surveys for malaria control) is probably suitable in most settings. Body temperature can be recorded but usually not important.
4. In case of current or recent fever, blood should be taken and examined promptly by RDT on the spot. Slides or filter-paper blood spots are carefully labelled and sent to a quality assured laboratory.
5. Patients detected with malaria are immediately treated and cases and foci are epidemiologically investigated.
6. Results are recorded in a register that includes identification number, date of blood taken, presence of current or recent fever laboratory results, history of recent travel, treatment and follow up. The register should be similar to the one used in PCD and include all persons, from whom a blood sample was taken.

4. Methods for case and focus investigation and classification

Case and focus investigations should be undertaken for each confirmed case of malaria detected in an area with transmission risk. These field investigations aim to determine whether or not an infection was acquired locally and therefore whether or not there is ongoing local malaria transmission. If the case is likely to establish a new focus, a focus investigation should be done together with the case investigation as they are complementary.

Case and foci investigation and classification will start during the elimination phase as the number of the cases are much fewer and foci are much more delineated.

Adopting the Chinese approach [3] the '1-3-7' targets to guide and monitor case reporting, investigation, and response, respectively: reporting of malaria cases within one day, their confirmation and investigation within three days, and the appropriate public health response to prevent further transmission within seven days. These metrics will underscore the need for timely follow-up.

Box 2. The 1-3-7 Strategy to Guide and Monitor Malaria Surveillance & Response

4.1 Case investigation and classification

Epidemiological classification of malaria cases is crucial in malaria elimination, as it is a basis for the classification of foci and for making decisions for selecting surveillance and interventions.

Case investigation includes patient demographic information, dates of events, type of case detection, symptoms, history of current illness including diagnostic test results and treatment, travel history and other malaria risk factors to assess origin of infection and the possibility of onward transmission.

Each notified case of confirmed malaria leads to a case investigation in the field, reporting of malaria cases within 1 day, their confirmation and investigation within 3 days, and the appropriate public health response to prevent further transmission within 7 days. The field investigation consists of obtaining the details of the confirmed case; and reviewing the details of cases reported previously in the same locality, obtaining information on potential malaria vectors from the vicinity of the case; and active case detection in populations thought likely to harbour parasites.

The aim of the field investigation is to determine whether an infection was acquired locally and therefore whether there is ongoing local malaria transmission. If the new case occurs in a known active focus, a focus investigation will have already been done, and the case will be used to update the focus record.

The 1-3-7 Strategy

1: ***Case reporting within one day***. Any confirmed and suspected malaria cases must be reported to the web-based health information system within 24 hours of diagnosis by the local health-care provider.

3: ***Case investigation within three days***. All malaria cases should be confirmed and visited by the SA/HEW/PHCU, where the case is reported within three days, to determine where the case originated (local or imported). In some settings, this can be conducted at the time of diagnosis with further confirmation during the focus investigation.

7: ***Focus investigation and action within seven days.*** Investigation should be conducted as soon as possible. If local transmission is possible or confirmed, targeted action to seek out other infections and reduce the chance of onward transmission is completed within seven days by the Health post/PHCU/District.

[3] Citation: Cao J, Sturrock HJW, Cotter C, Zhou S, Zhou H, et al. (2014) Communicating and Monitoring Surveillance and Response Activities for Malaria Elimination: China's "1-3-7" Strategy. PLoS Med 11(5):

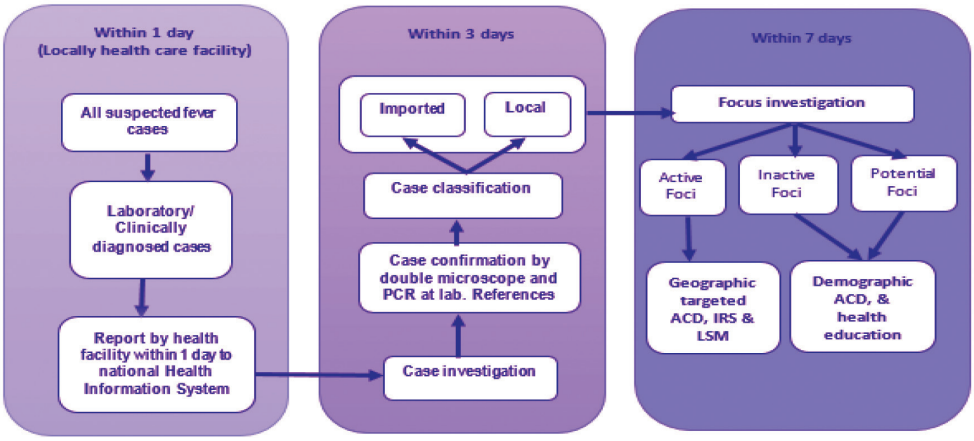

Figure 1: Schematic of the chain of events conducted within the 1-3-7 time windows

Confirmation and classification of imported versus local (relapsing versus new) will be undertaken towards the later phase of the elimination path using more advanced diagnostic tools (biomarkers). Cases that reflect more local transmission should be assigned as local rather than imported or relapsing to avoid any risk and ensure effective response.

- Cases will be classified as local (indigenous, introduced, relapsed and induced) or imported based on Annex 2. Such classification of cases will then lead to detection of possible foci or hotspot/s to be followed with investigation and classification of the foci.

Similar registers should be maintained for active PCD and ACD to ease recording.

4.2 Foci investigation

Focus will be defined as circumscribed locality in a currently or formerly malarious area with the continuous or intermittent epidemiological factors necessary for malaria transmission.

The district/intermediate level malaria focal point will be responsible for ensuring that all foci are investigated and that reports for all foci are available and kept up-to-date. A standard form should be used (example in Annex 3). The investigating team consists of the intermediate (in the health system) or district-level malaria focal point, an entomologist or a trained mosquito collector, field assistants trained in interview techniques and blood collection, local health facility personnel and community volunteers including HDA. The team should assemble and review the following information:

1. *Malaria case investigation*. A case investigation form is completed for each confirmed malaria case (Annex

2. *Epidemiological data from previous cases in the same village, locality, or focus*. Including age, sex, occupation, timing and species as well as maps of the location of cases. Classification, if available.

3. *Additional data from active case detection*. After a review of the data collected in active case detection is planned to help determine the origin of a case and to detect epidemiologically linked cases. The team leader must decide:

   - The populations to be screened within *100-meter* radius- areas with index case/s and populations living within relevant breeding sites.
   - Criteria for testing - those with fever or entire population groups

Once the field investigation is complete, the team should determine, if local transmission is occurring and provide a final classification of the case and focus. The district malaria focal point, in consultation with higher level experts, will prepare a response plan according to the results of the investigations.

Copies of the completed case and focus investigation forms with the line-list records of active case detection should be sent by the district team to the zonal and higher levels of the program and the reporting health facility. Local health staff, community volunteers, community leaders and other relevant local actors such as employers are briefed about the situation and the response plan.

Once a malaria case has been detected in a receptive area (either with PCD or ACD), a focus investigation should be carried out to describe the area, where malaria occurred and delineate the area and populations at risk.

The focus investigation should include collection of:

- Adult mosquitoes to incriminate the species responsible for transmission (may also include insecticide susceptibility)
- Actual or potential breeding sites
- Area to be covered by a first round of active case detection and entomological investigation.

The findings may lead to a confirmation or modification of the initial delimitation in a process.

A map should be drawn with standard, recognized keys, to show:

- Geographical features for malaria transmission (rivers, water bodies, forests, roads, altitude);
- Location of all households, highlighting cases detected in the last 3 years;
- Vector breeding places and possible sites of transmission;
- Geo-coordinates of main features of the focus (both in paper and electronic maps) ;
- Geographic coverage of interventions including ACD and vector control, testing and treatment

Appropriate mapping tool will be deployed to enhance mapping.

4.3 Foci classification

Upon completion of all the investigation the team should classify the focus or foci. Taking the terminologies provided in the WHO elimination framework as a basis, foci classifications has been simplified (for ease of applicability in the case of Ethiopia) into three as follows:

a) *Active foci:* foci with ongoing local transmission.

b) *Residual non-active:* areas with recent transmission history.

c) *Cleared-up foci:* No local transmission in an area within the past 3 years.

The classification of the focus helps in identifying which basic measures are needed (Table 2), but this should be complemented with the information obtained from the focus investigation. The sample forms for detailed foci investigation and classification are given in Annex 3. Once investigated, the focus should be classified into one of three types as shown in Table 2.

Table 2. Types of malaria foci with operational criteria and recommended interventions

Classification			**Recommended minimum standards of intervention**	
Type	**Definition**	**Operational criteria**	**Case detection**	**Vector control**
Cleared	A focus with no transmission and no cases	A focus with no local transmission for 3 consecutive calendar years under adequate surveillance	PCD is maintained with on-site supervision once a month during high transmission season and once every two months during low transmission season. Additional ACD for at-risk mobile populations entering the area. A 5% ABER will be the minimum.	Promotion of LLINs as personal protection measures in receptive border areas.
Residual non-active	A focus where transmission interrupted recently (1-3 years ago)	The last locally acquired case(s) was detected in the previous calendar year or up to 3 years earlier.	PCD maintained and ACD will be performed in some selected areas as deemed necessary	Maintain vector control interventions when epidemiological situation dictates
Active	A focus with transmission	Locally acquired cases have been detected within the current calendar year.	PCD as in a cleared-up focus. ACD covering the entire focus or defined risk-groups. The number and frequency of rounds depends on the situation.	100% LLINs; at least 85% coverage with IRS; tMDA in high risk-foci; tLSM

The focus classification should be updated periodically. Since malaria transmission in Ethiopia is seasonal, the classification of foci will be reviewed at end of each malaria transmission season. A register of foci, paper and electronic, will be maintained at district and higher levels.

5. Surveillance platforms, tools, analysis and reporting

5.1 Surveillance platform

The health information system used for surveillance of malaria elimination should be part of the integrated surveillance system in the country. The current national health management information system (HMIS) captures all diseases and health conditions and provides only limited data elements for each of the diseases. In addition, inadequate timeliness and completeness make the system less suitable to monitor disease trends and assess progress reliably. The public health emergency management (PHEM), an integrated reporting system, is currently used for tracking weekly based aggregated surveillance data by health facility on selected notifiable diseases including key malaria indicators. The system is more timely and complete making it a suitable surveillance tool for the initial phases of the elimination efforts. However, it lacks disaggregated data by type of diagnostic test used although these data elements exist at the lower level. Thus, the malaria component in the tool will be revised to accommodate key data elements for elimination. Eventually, a surveillance tool useful for later phases of malaria elimination (Phase 2 and above) that accommodates all the indicators including foci and case-based detection and investigation will be developed. This may be modular tool distinctly linked to the HMIS.

5.2 Data recording

For the PCD, the integrated registers will be progressively revised to incorporate all data elements required for all the phases of the elimination path. Similar registers should be maintained for active case detection, recording the location where testing was done and, if applicable, the identification number of the focus.

All the data from these registers should be entered on electronic formats designed by the national program. Electronic data entry should take place minimum at the district/cluster level during initial phase of optimization and where possible at the health facility level, where the data were generated.

For areas in elimination phase when cases are fewer, every case should be reported immediately to the next level and national program with available electronic system for example web-based notification form. A system for SMS reporting of cases will be incorporated into electronic surveillance system to avoid delay in the event of internet interruption.

5.3 Data elements

The data elements that need to be included in the data collection forms and used in the different phases of the elimination path will be different as per provided in the Table 3 below. These data elements are critical for the interpretation of trends of malaria cases and deaths. The first 19 data elements exist at the lower level in the health facilities and what is required is channeling them upwards using a revised tool. The program will use this minimum list and identify the data elements that are missing in the current PHEM or future systems and include them progressively.

Table 3. List of minimum data elements to be collected and analyzed in elimination path

Category	Data elements	Optimization	Pre-elimination	Elimination	Prevention of re-introduction
Surveillance	Number of health facilities expected to report			Including private sector	
	Number of health facilities reporting (disaggregate by malaria outpatients, inpatients and deaths)			Outpatient	
	All-cause outpatient cases				
	All-cause inpatient cases				
	All-cause death				
	Suspected cases				
	Total malaria cases				
	Cases tested with microscopy				
	Cases positive with microscopy				
	Cases tested with RDT				
	Cases positive with RDT				
	P. falciparum (microscopy)				
	P. vivax (microscopy)				
	Mixed infection (microscopy)				
	P. falciparum (RDT)				
	P. vivax (RDT)				
	Mixed infection (RDT)				
	Inpatient malaria cases				
	Malaria deaths				
	Number of foci identified (list of foci)				
	Number of foci investigated				
	Number of foci classified				
	Number of cases identified in the case-based surveillance				
	Number of cases investigated				
	Number of cases classified				
Treatment	Number of *P. falciparum* cases treated with single dose primaquine and ACT				
	Number of *P. vivax* cases tested for G6DP deficiency before treatment with primaquine				
	Number of *P. vivax* cases that are positive to G6DP deficiency				
	Number of *P. vivax* cases treated with primaquine (14 days) under DOT				

6. Monitoring and evaluation in elimination path

Monitoring and evaluation for core antimalarial interventions in-terms of coverage, quality and targeting is key and will be monitored to inform the optimization process and beyond (see Annex 6 for further M&E information).

6.1 Health facility level

Case registers: In addition to the demographic and patient address including patient's mobile number, outpatient and inpatient registers fulfilling the minimum data elements in Table 3 will be availed in all health facilities.

Case reporting (notification): Each confirmed malaria should be immediately notified to the next level.

Case Investigation: For each confirmed case of malaria a case investigation form should be completed. Both case notification and investigation may be simultaneously undertaken.

Focus Investigation: For each new focus identified a focus investigation form should be completed (Annex 3.1). For each new malaria case identified in an existing focus, the focus information should be updated.

Each health facility should undertake the minimum data analysis and standard graphs (see data analysis and visualization section).

6.2 District level

The malaria team at district level should keep the following records:

1. Monthly aggregate data by health facility (and weekly where necessary)
2. Case-based registers from all services by PCD and ACD. All confirmed cases should be entered into the database whether or not the field investigation has been undertaken. The initial registration of all positive cases becomes the denominator for cases that should be investigated.
3. District and *kebele* level demographic data to calculate monthly and annual blood examination rates.
4. A register of relevant health structures, staffing, services including all facilities and laboratories undertaking malaria testing including community health workers (HEWs). The register should be updated annually. It provides denominator data for assessing the completeness of surveillance.
5. National malaria laboratory quality assurance data including results of retesting and of proficiency panels.
6. Malaria case investigation forms.
7. Foci database (list of foci).
8. Foci investigation forms (Annex 2).
9. Foci register with changes in status over time.
10. Reports of activities such as mobile teams for active case detection or other assessments
11. Entomological database containing an inventory of *Anopheles* breeding sites, species, vector density and bionomics, seasonality and maps of the area.
12. Vector control and intervention database containing information on all interventions as well as advocacy communication and social mobilization (ACSM).
13. Entomological surveillance data. Entomological data from district reports on Anopheles breeding sites including species, density, bionomics, seasonality and maps.
14. All periodic and annual reports and district analyses during the last 5 years including feedback given.
15. Maps disaggregating case and foci investigation and classification; and changes over time.

6.3 Repository/source database

In addition to the surveillance platform, a malaria database will be developed for strategic compilation and updating of interventions including data on IRS, LLINs, entomology, insecticide resistance, therapeutic resistance, finances, human resources, population, master list of health facilities, survey results, health facility surveys and special studies and others. Such compilation will avoid fragmentation of data and enable the program to conduct enhanced epidemiological analysis and interpretation. It will also facilitate preparation of regular reports and bulletins (monthly, quarterly, biannual and annual). This database will be progressively improved along with the evolution of the elimination.

6.4 Data quality

Data inconsistency remains a challenge. The PHEM assesses timeliness and completeness by health facility but not by disease-specific data elements. Health workers do not adequately value data as an important component of disease control. During the optimization, systematic training and supervision on recording, record keeping and data management will be undertaken. Data quality reviews including on management of records and availability of standard data registers and reporting forms with the standard set of data elements will be intensified (Annex 4).

6.5 Stratification and mapping

In all the phases, annual surveillance data mainly API and TPR will be used to stratify localities by different intensity of malaria transmission. The purpose of stratification is to improve targeting and intensify interventions to areas with relatively high transmission in optimization and foci in pre-elimination and elimination phases. It also helps to monitor progress and impact over time. A stratification and mapping tool for temporal and spatial analysis malaria and other related data will be developed based on key indicators (API, TPR; and targeted vector control interventions: LLIN, IRS, LSM) to be used across all levels. The tool should also allow for mapping of breeding sites, households with a cluster of cases. The tool may have different forms or modalities suited to skills and feasibility by level and elimination phase.

6.6 Monitoring epidemics

As interventions are intensified and malaria intensity reduces significantly, malaria epidemics could be more pronounced. More sensitive epidemic monitoring tools will be introduced. As baseline, the immediate recent three years 75% median or C-sum (if more sensitive threshold is needed) of confirmed malaria cases and test positivity rate will be used as an epidemic threshold during optimization phase. In the pre-elimination and elimination phases as the number of cases become fewer, simple counts of cases and comparison with immediate year may be applicable (Annex 1.3).

6.7 Indicators

To monitor access and operational coverage of interventions and capacity of the programs at all levels, the key program indicators indicated below will be monitored to inform the optimization and adjustments will be done accordingly. In addition, pre and post shipment quality assurance of antimalarial commodities (antimalarial drugs, RDTs, insecticides, LLINs, reagents, quality microscope, etc.) will be instituted to be done in collaboration with FMHACA, EPHI and PFSA.

Table 4. Description of selected indicators recommended for monitoring malaria elimination

Indicator	Numerator	Denominator	Data source	Frequency	Responsible
Impact indicators					
Malaria parasite prevalence	Number of malaria positive cases	Total number of people tested	MIS	Every 3/4 yrs	FMOH/EPHI
Malaria mortality rate	Number of death due to malaria	Population at risk	HMIS	Annually	FMOH
Outcome indicators					
Percentage of health facilities with 100% suspected cases tested according to national policy	Number of health facilities tested 100% of suspected cases	Total number of health facilities	Health facility survey	Quarterly	RHB/ FMOH
Malaria testing rate	Number of cases tested for malaria	Total number of suspected cases for malaria	Health facility register / HFS	Annually	DHO
Percentage of confirmed outpatient malaria cases that received appropriate antimalarial treatment according to national policy	Number of confirmed outpatient malaria cases who received first line antimalarial treatment according to national policy	Number of confirmed outpatient malaria cases	Health facility survey	Quarterly	District Health Office
Malaria test positivity rate (Disaggregated by RDT and microscopy)	Number of confirmed malaria cases disaggregated by RDT and microscopy	Number of suspected malaria cases parasitological tested for RDT and microscopy	HMIS	Annually	DHO
Malaria report availability rate	Number of health facilities actually reported in a given period of time	Total number of health facilities expected to report in a given period of time	DQA report	Quarterly	HMIS and NMCP
Malaria reporting timeliness rate	Number of health facilities that submitted surveillance reports on time to the woreda	Number of health facilities in a woreda expected to report	DQA report	Quarterly	PHEM/HMIS
Malaria reporting completeness rate	Number of reports submitted by health facilities that have complete data elements.	Total number of reports expected from health facilities with complete data elements.	DQA report	Quarterly	PHEM/HMIS
Percentage of health facilities with 100% consistent report	Number of health facilities with 100% consistent report	Total number of health facilities assessed	DQA report	Quarterly	PHEM/HMIS
Percentage of health facilities with EMC	Number of health facilities with updated EMC	Total number of health facilities	HF report	Quarter	RHB
Percentage of districts with 100% foci list	Number of districts identified 100% of foci list	Total number of districts	Foci assessment report	Annually	DHO/ HEWs
Percentage of districts transiting to next phase of elimination	Number of districts transited to next phase	Total number of districts expected to transit next phase	HF report	3-5 years	FMOH/ RHB
Percentage of index cases traced and followed up	Number of index cases traced and followed up	Total number of index cases	Case investigation register	Monthly	HF report
Percentage of reported foci identified, fully investigated classified and managed	Number of reported foci identified, fully investigated classified and managed	Total number of reported foci	Case investigation & classification register	Monthly	HF report

Indicator	Numerator	Denominator	Data source	Frequency	Responsible
Impact indicators					
Malaria parasite prevalence	Number of malaria positive cases	Total number of people tested	MIS	Every 3/4 yrs	FMOH/EPHI
Malaria mortality rate	Number of death due to malaria	Population at risk	HMIS	Annually	FMOH
Percentage of health facilities with confirmed outpatient malaria cases that received appropriate antimalarial treatment according to national policy	Number of health facilities with confirmed outpatient malaria cases who received first line antimalarial treatment according to national policy	Total number of health facilities	Health facility survey	Quarterly	RHB/ FMOH
Percentage of districts analyzing core surveillance indicators	Number of districts analyzed 100% of core surveillance indicators	Total number of districts	HIS	Weekly/ Monthly	DHO
Percentage of facilities in a district conducted data quality audit	Number of facilities in district conducted data quality audit	Total number of facilities in a district			
Percentage of districts covered with targeted IRS operation	Number of districts sprayed with targeted IRS	Total number of districts eligible for targeted IRS	IRS Assessment report	Annually	RHB/FMOH
Percentage of households in designated target areas that received quality spraying through an indoor residual spraying campaign in the last 12 months	Number of households in designated target areas sprayed in the last 12 months	Number of households in designated target areas	IRS assessment report	Annual	DHO
Percentage of the population-at-risk covered by indoor residual spraying	Number of persons protected by indoor residual spraying	Number of persons at risk for malaria	IRS assessment report	Annual	DHO
Percentage of unit structure with quality IRS verified through bio-assay test	Total number of unit structures who meet the standard through bio-assay	Total number of unit structures sampled	Bio-efficacy reports	Annually	Regional Health Bureau
Percentage of households plastered after IRS spraying (Re-plastering rate)	Number of Households plastered after IRS application within 6 months period	Total number of households sprayed in the area	Household survey	Annual	DHO
Percentage of households with at least one insecticide-treated net for every two people at risk	Number of households with at least one ITN for every two people	Number of household surveyed	Household survey	Annual	DHO/ HEWs
Observed percentage of individuals who slept under an insecticide-treated net the previous night	Number of individuals who slept under an ITN the previous night	Number of individuals who spent the previous night in surveyed households	Early morning survey	Annually	HEWs
Proportion of Households with at Least One ITN	Number of households surveyed with at least one ITN	Total number of households surveyed	Household survey	Annual	DHO/ HEWs
Proportion of Population with Access to an ITN within their Household	Total number of individuals who could sleep under an ITN if each ITN in the household is used by two people	Total number of individuals who spent the previous night in surveyed households	Household survey	Annual	DHO/ HEWs

Indicator	Numerator	Denominator	Data source	Frequency	Responsible
Impact indicators					
Malaria parasite prevalence	Number of malaria positive cases	Total number of people tested	MIS	Every 3/4 yrs	FMOH/EPHI
Malaria mortality rate	Number of death due to malaria	Population at risk	HMIS	Annually	FMOH
Proportion of Population that Slept under an ITN the Previous Night	Number of individuals who slept under an ITN the previous night	Total number of individuals who spent the previous night in surveyed households	Household survey	Annual	DHO/ HEWs
Proportion of Children under Five Years Old Who Slept under an ITN the Previous Night	Number of children under five years old who slept under an ITN the previous night	Total number of children under five years old who spent the previous night in surveyed households	Household survey	Annual	DHO/ HEWs
Proportion of Pregnant Women Who Slept under an ITN the Previous Night	Number of pregnant women who slept under an ITN the previous night	Total number of pregnant women within surveyed households	Household survey	Annual	DHO/ HEWs
Proportion of existing ITNs used the Previous Night	Number of ITNs in surveyed households that were used by anyone the previous night	Total number of ITNs in surveyed households	Household survey	Annual	DHO/ HEWs
Proportion of Households with at Least One ITN and/or Sprayed by IRS in the Last 12 Months	Number of households that have at least one ITN and/or have been sprayed by IRS in the last 12 months	Total number of households surveyed	Household survey	Annual	DHO/ HEWs
Proportion of Households with at Least One ITN for Every Two People and/or Sprayed by IRS within the Last 12 Months	Number of households with at least one ITN for every two people and/or have been sprayed by IRS in the last 12 months	Total number of households surveyed	Household survey	Annual	DHO/ HEWs
Percentage of people who know the cause of, symptoms of, treatment for or preventive measures for malaria	Number of people who cite the cause of, symptoms of, or preventive measures for malaria	Number of people surveyed	Household survey, MIS	Annually or above	DHO/EPHI
Percentage of districts covered with LSM	Number of districts covered with LSM	Total number of districts eligible for targeted LSM	LSM report	Monthly	RHB
Percentage of breeding sites treated with larvicide weekly	Number of eligible breeding sites treated with larvicide weekly	Total number of eligible breeding sites	LSM report	Weekly	DHO/ HEWs
Proportion of health facilities without stock-outs of key commodities for diagnostic testing	Number of health facilities without stock outs of key commodities for diagnostic testing	Total number of health facilities proving malaria diagnosis service	HIS, DQA report	Quarterly	DHO/ HC
Proportion of health facilities without stock-outs of first line antimalarial treatments	Number of health facilities without stock outs of first line antimalarial treatments	Total number of health facilities proving malaria treatment service	HIS, DQA report	Quarterly	DHO/ HC
Number of studies of insecticide efficacy completed according to WHO protocol	Number of studies of insecticide efficacy completed according to WHO protocol	None	Sentinel site reports	Annually	EPHI and partners
Number of studies of drug efficacy completed according to WHO protocol	Number of studies of drug efficacy completed according to WHO protocol	None	Sentinel site reports	Annually	EPHI and partners

Analysis

Currently, limited data analysis is conducted at all levels and focus is limited to trends of aggregated data. Data should be regularly analyzed by lowest administrative level. Spatial and temporal analysis and interpretation of core indicators listed in Table 5 below will be systematically and regularly undertaken. The results of the analysis will be used to guide adjustments of interventions and stratification.

Table 5. List of minimum indicators to be analyzed in each phase of the elimination

Indicator	Optimization	Pre-elimination	Elimination	Prevention of re-introduction
Case incidence per 1000	*	**	***	
Inpatient malaria case incidence per 10,000	*	**		
Malaria death rate per 100,000	*	**		
Slide positivity rate (microscopy)	*	**	***	
Test positivity rate (RDT)	*	**	***	
Annual parasite incidence (API)	*	**	***	
Annual blood examination rate	*	**	***	
Percentage of *P. falciparum* and *P. vivax* over time	*	**	***	
Proportion of malaria cases (of all outpatient cases)	*	**	***	
Proportion of inpatient malaria (of all inpatient cases)	*	**	***	
Proportion of malaria deaths (of all deaths)	*	**	***	
Population at risk (of total population)	*	**	***	
Non-malaria outpatient cases (all-cause outpatients minus confirmed malaria cases)	*	**	***	
Non-malaria inpatient cases (all-cause inpatients minus inpatient malaria cases)	*	**	***	
Non-malaria inpatient cases (all-cause deaths minus malaria deaths)	*	**	***	
Proportion of foci investigated (list of foci)		**	***	****
Proportion of foci classified (of all investigated)			***	****
Proportion of cases investigated (of all cases detected)			***	****
Proportion of cases classified (of all investigated)			***	****
Reporting completeness disaggregated by outpatient, inpatient and malaria deaths	*	**	***	

*indicators for optimization;**indicators for pre-elimination;***indicators for elimination;****indicators for PoR

6.9 Data presentation and visualization

Standard graphs reflecting the above indicators, complemented with stratification and mapping, will be developed and interpreted routinely at all levels. These indicators and graphs will also be used as checklist for supervision.

For optimization phase:

a. Outpatient confirmed malaria cases versus non-malaria outpatient cases (incidence if numbers are high or absolute if few) (double axis)
b. positivity rate by RDT and Microscopy (double axis)
c. Inpatient cases vs non-malaria inpatient cases (double axis)
d. Malaria deaths vs non-malaria deaths (double axis)
e. Annual blood examination rate
f. Percentage of *P. falciparum* and *P. vivax* over time (double axis)
g. Proportion of malaria cases (of all outpatient cases)
h. Proportion of inpatient malaria (of all inpatient cases)
I. Proportion of malaria deaths (of all deaths)
J. Population at risk (of total population by administration level)
K. Reporting completeness by outpatient, inpatient and malaria deaths (consistency based on sampling)
L. Epidemic monitoring chart using three years threshold (Annex 1.3)

Sample standard graphs of these indicators are plotted in Annex 1.1.

For the pre-elimination and elimination phases:

In addition to the above, more importantly standard graphs of the following will be needed for these phases.

a. Proportion of foci investigated
b. Proportion of cases investigated
c. Proportion of local or indigenous cases and imported (double axis)

Sample standard graphs of these indicators are plotted in Annex 1.2.

6.10 Surveillance reports

Three types of reporting and data flow will be employed: immediate, monthly, and annual involving health facility, district, zone, region and national malaria program. Weekly surveillance will be applied in areas that are epidemic-prone. Paper and electronic data and report sharing will be applied. When electronic system is fully rolled nationwide reliably, paper based data will be kept at health facility and district level only as back up. At a minimum, reports will include the analysis outputs and standard graphs provided above. More narratives particularly on case and foci investigation and epidemiological profiling of areas will be encouraged.

7. Programmatic requirements for surveillance systems in elimination path

The following requirements for surveillance systems in elimination path will be fulfilled:

Legislation: Establishment of surveillance systems for elimination takes time and involves updating of legislation, infrastructure, establishing new surveillance system components (case and foci investigation, active case detection, laboratory quality control), recruitment, reorientation and training of staff and educating the public.

Since subnational elimination will start in the selected 239 districts, the country will operate two malaria surveillance systems in parallel for some years: one for districts designated for elimination and the other for those districts in control phase. Such approach allows piloting of the new surveillance system in limited areas and improvement of the surveillance system before its nationwide application. The following areas will be initiated and strengthened:

Legislation to ensure that:

- malaria is mandatorily notifiable disease immediately (for the later phase of elimination) and provide guidelines on recording and reporting malaria cases
- parasite-based testing for malaria and quality assurance systems for testing
- regulate participation of the private sector in surveillance and treatment

- regulate treatment and follow-up of confirmed malaria cases and
- regulate marketing and use of antimalarial medicines

Staffing: In preparing for the elimination phase, it will be necessary to recruit several additional staff for the field work functions and to invest considerably in cascade training.

National level: The national level will be responsible for policy and decision-making, coordination, supervision, monitoring and evaluation of the program management and progress. It will be staffed by epidemiologists, parasitologists, entomologists, data managers, data entry clerks, logisticians and administrators. The National Reference Laboratory is normally separate and has the responsibility for establishing quality assurance for diagnostic testing.

Zonal and Regional level*:* an elimination unit will be required comprising of epidemiologists, parasitologists, laboratory technician, entomologists, data manager and logistician or administrator.

District level: elimination unit comprising of epidemiologist/surveillance officer, entomologist and data manager will be required at minimum for data collection, case and foci investigation, trend analysis and response.

Health post level: Apart from existing staffing additional workforce should be deployed to involve in ACD and other, additional works required during elimination. HEWs on board will support and lead the elimination process but also are engaged in routine HEP program.

Creating malaria testing and treatment posts in active foci: When ACD is necessary (see criteria for conducting ACD), temporary health posts involving HEWs and other health workers will be established for vector control regular screening and treatment at intervals. This may be in persistent foci or new foci where local malaria transmission.

Involvement of the private sector: In the elimination phase, using the legislation to be put in place, malaria testing will be limited to those facilities that participate in the national quality assurance program. All private-sector facilities immediately notifying persons with a positive test and report on number of patients monthly to the district. Those private facilities with no quality assured diagnosis should refer suspected patients for testing to a qualified facility. Private pharmacies should refer all suspected malaria cases to laboratories certified to test for malaria. The national malaria program will provide private health facilities and pharmacies with the algorism of malaria treatment and referral channels.

Reorientation of staff: Systematic training on elimination, diagnostic testing, PCD, ACD, reporting and analysis will be undertaken at all levels. This will also be complemented with periodical supervision and mentoring.

Laboratory support for surveillance and quality assurance. All laboratory diagnostic services should be free of charge to the patient at public and private facilities. All laboratories that conduct testing for malaria should be part of a quality assurance network.

Supportive Supervision: Supportive supervision is a process that promotes quality at all levels of the health system by strengthening relationships within the system, focusing on the identification and resolution of problems, and helping to optimize the allocation of resources promoting high standards, teamwork, and better two-way communication. A cornerstone of supportive supervision is working with health staff to establish goals, monitor performance, identify and correct problems, and proactively improve the quality of service. Together, the supervisor and health workers identify and address weaknesses on the spot, thus preventing poor practices from becoming routine. Supervisory visits are also an opportunity to recognize good practices and help health workers to maintain their high-level of performance. Supportive supervision steps or approaches are shown in Figure 2.

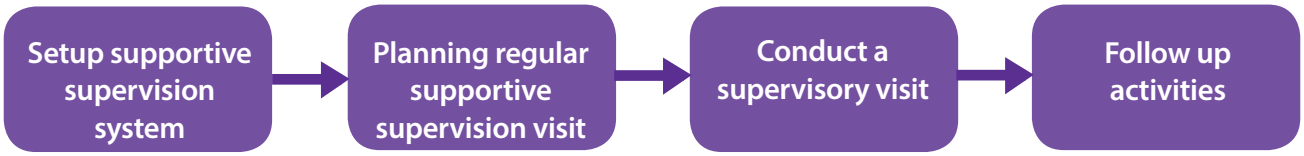

Figure 2. Supportive supervision steps

a. Setting up a supportive supervision system

The three main 'Rs' for an effective supportive supervision system are:

1. Right supervisors: a core set of supervisors, well trained on supportive supervision techniques and with updated information and skills on malaria issues.
2. Right tools: availability of working materials and job aids to update skills of health workers during supervision visits, and checklists and forms for recording recommendations and following up.
3. Right resources: sufficient vehicles, per-diem, time allocated for supervision and follow-up.

b. Planning regular supportive supervision visits

Planning for supportive supervision visits should be an integral part of the annual/quarterly work-planning exercise. It is important to look at the data when you plan for supervision visits.

The plan should indicate:

- Where to visit
- When to visit
- What to cover during the visit

c. Conducting a supervisory visit

During a supervisory visit to the health facility, the supervisor should conduct the following main steps.

1. Collecting information.
2. Problem-solving and feedback.
3. On-job training.
4. Recording the results of supervision.

d. Follow-up activities

- What to do after a supervision visit
- Conducting follow-up visits

Steps for the follow-up visit include:

- Reviewing the supervisor's report from the previous visit and continuing to work on the issues raised in the report;
- Telling health workers what you have learned from the previous visit, in order to avoid repeating the same information;
- Observing health workers to see if bad behaviours or attitudes have been corrected and, if it is the case, congratulating them;
- Highlighting the observations from the previous visit that have not changed and noting that these items still need to be followed up;
- Checking if any perceived lack of improvement is due to hidden problems that need to be addressed;
- Fulfilling promises made at the previous visit (i.e. if supplies or technical information/ documentation had been promised).

Supervisory checklists will be inevitable and will have standard comprehensive supportive supervision checklist addressing all phases of elimination.

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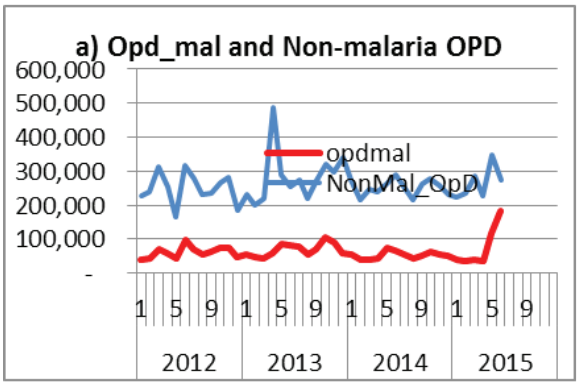
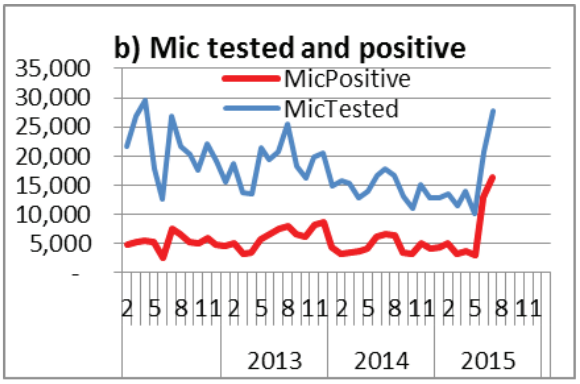
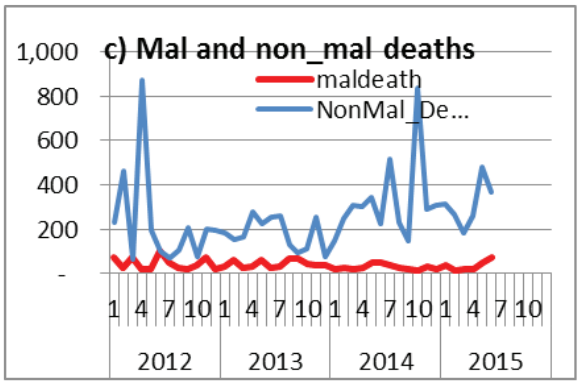
9. Annexes

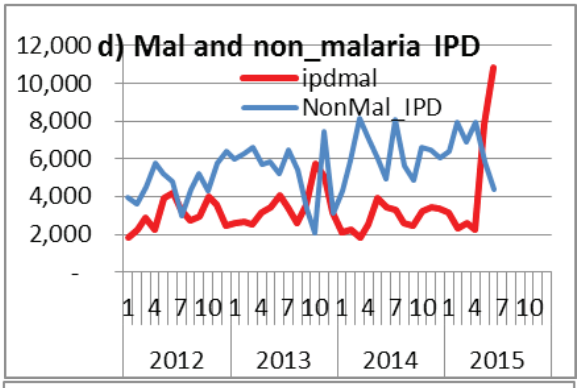
Annex 1. Sample standard graphs by malaria indicators

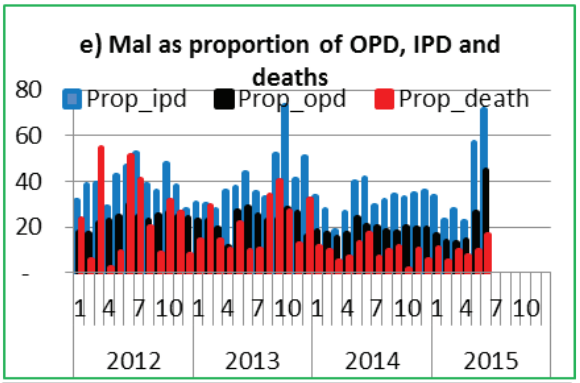
Annex 1.1 Sample minimum and standard graphs for assessing trends in optimization phase

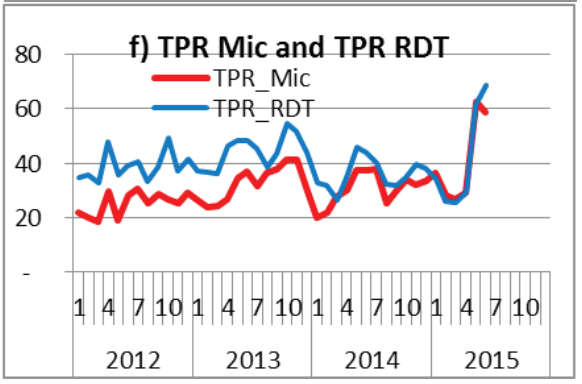


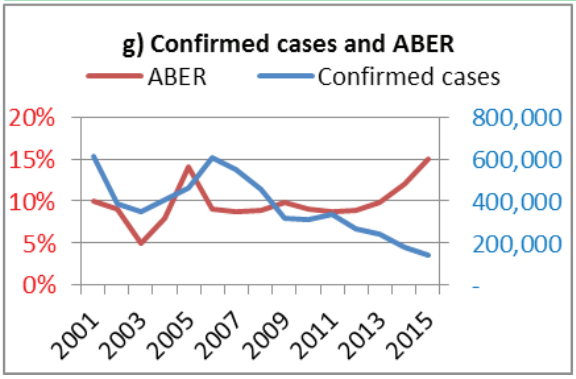


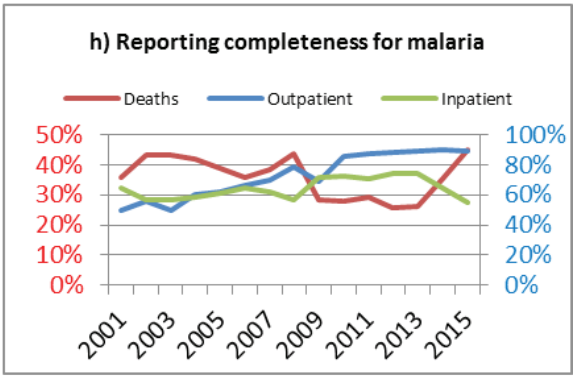




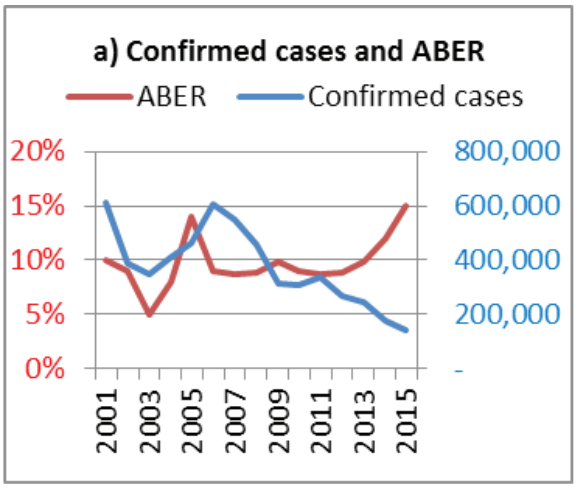


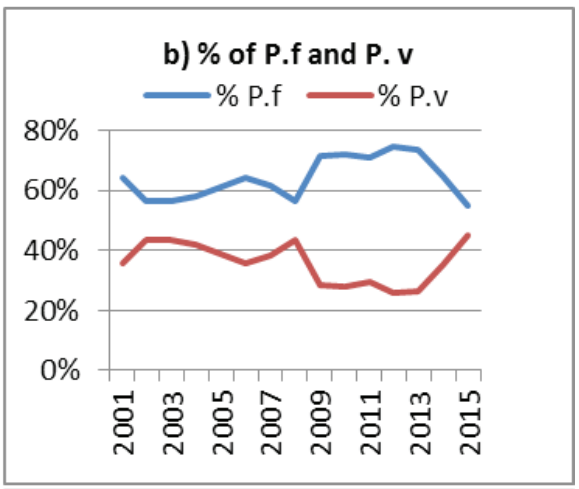


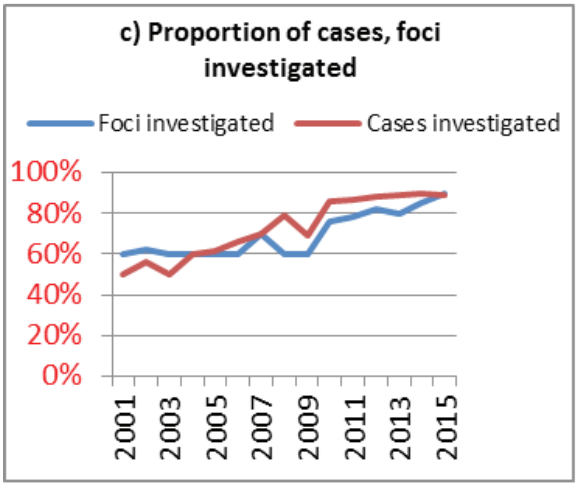


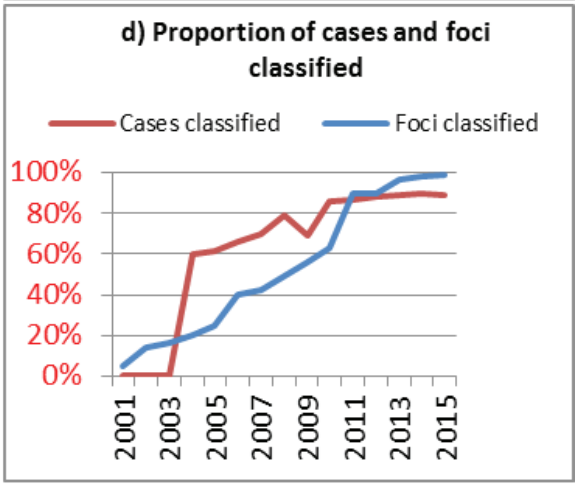


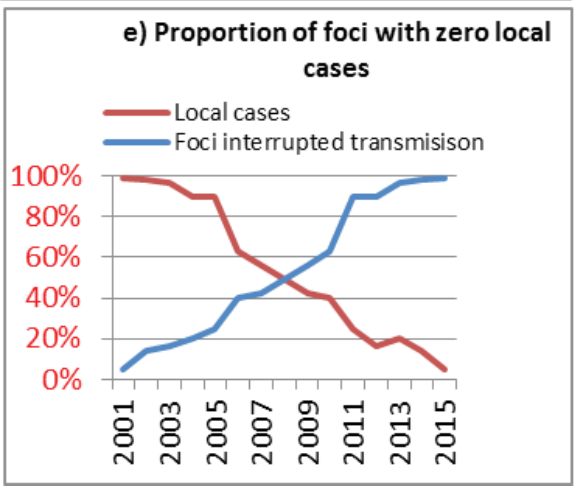
Annex 1.2 Sample minimum and standard graphs for assessing trends in pre/elimination phase

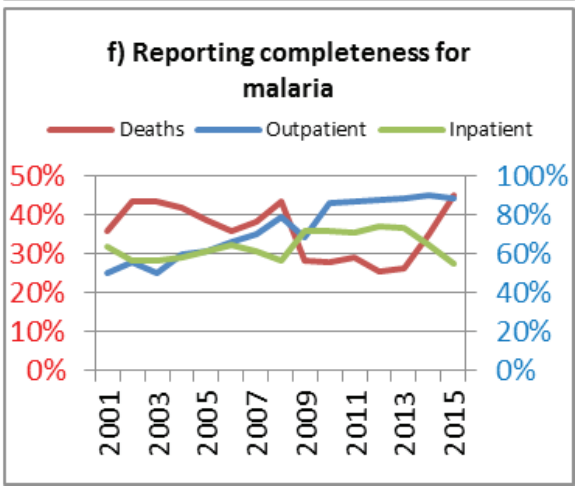




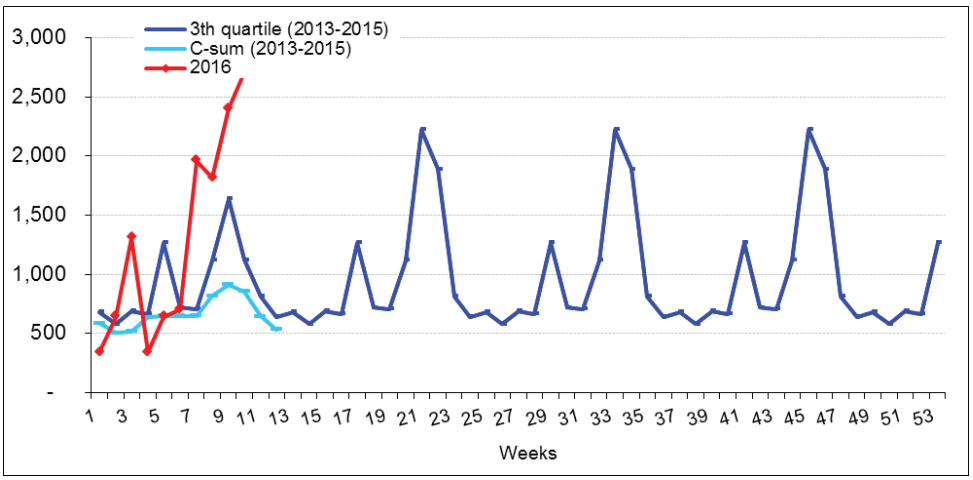








Annex 1.3 Sample weekly epidemic monitoring graphs for assessing trends in all phases (three-year threshold is proposed to be applied as incidence of earlier years would underestimate current trends and miss epidemics)



Annex 2. Case investigation and classification

Annex 2.1 Case Classification

After a case has been investigated it is classified into one of the following categories.

1. *Local case:* due to ongoing mosquito-borne transmission and acquired within the country (also called autochthonous case).

   Local cases may be introduced - contracted locally as a first generation from an imported case (the vector being infected from an imported case) – or *indigenous* - contracted locally from any other category of case, including introduced (second or higher generation from an imported case). It is often difficult to distinguish introduced from indigenous cases and doing so rarely has operational implications. Attempting to differentiate can be useful for pedagogical purposes, when training staff in surveillance. However, it is not necessary to demand this in routine reporting, even in the elimination phase.

   In rare cases, people have been infected by anophelines, which have escaped from laboratories. Such cases should be considered as local, although details of such occurrences must be brought to the immediate attention of the national malaria program and the researchers concerned. The measures to be taken of course depend on the risk that the escaped mosquitoes could establish themselves in the environment, where they were released.

2. *Relapsing case* - a case contracted locally before cessation of local transmission. Relapsing cases can be true relapses or cases with prolonged incubation period caused by hypnozoites of *P. vivax* or *P. ovale*. [Not recrudescence of *P. falciparum* or *P. malariae* originating from previously undetected blood forms, in which the primary attack was suppressed or unrecognized. [It becomes too confusing, if we call recrudescence relapsing cases. However, it is obvious that Pm can show up years after transmission was interrupted] Note that relapses of imported cases are not categorized under relapsing cases, because the fact that they are relapses has no implications for focus classification or the measures to be taken. In areas with ongoing malaria transmission, relapses can generally not be distinguished from other locally acquired cases; recent infection must be assumed. For areas in which active transmission is considered to have ceased, the investigation team must assess whether the infection was acquired before the interruption of transmission, in which case the focus is potential. If there is any doubt, such cases should be considered as local, which means that the focus is active again or transmission was never interrupted.

3. *Cases imported from within the country*. In many countries it is necessary to specify whether locally acquired cases originated within a focus or from another part of the country. Such cases are also known as internally imported. A variable on the case investigation form (Annex 2) records this information. Such cases should

be reported as local in the locality, where they originated (the localization may require good collaboration between malaria staff in different parts of the country), and in the final tally of cases reported over a year in a given country, they should not be recorded in the place where they were detected. However, the epidemiological consequences of their presence, where they were detected (and possibly at other places, where the patient stayed between infection and detection) should be drawn. If such cases are reported as belonging to the place of detection, the classification can be complicated, as it becomes necessary to operate with several classes indicating whether the origin was in the same administrative 1st, 2nd or 3rd degree unit.

4. *Imported case*. Imported from outside the country. The origin of imported case can be traced to a known malarious area outside the country to which the case has travelled or to an imported. In areas with ongoing local transmission elimination programmes should reserve the category imported for exotic parasite species and very recent arrivals from endemic countries, within the past 3 months. For all other cases occurring during the transmission season, it is prudent to assume local origin of the infection.

"Airport malaria" case. Airport malaria cases result from the arrival of infected vectors on aircraft coming from malaria endemic area, where the disinfection measures have not been fully effective. Such cases are usually, but not always observed near airports. Careful investigation is required to rule out other modes of transmission. Such cases can be classified together with imported cases. The same should apply to malaria cases caused by infected mosquitoes, which have crossed national borders. Again in such cases, careful investigation is needed and if there is any doubt, the case should be considered as local.

5. *Induced case* – not due to mosquito-borne transmission. Induced cases may arise from a congenital infection or by contamination with infected blood. Such cases are easy to classify if the person lives and works in an area with no known transmission for many years and has a history of blood transfusion or other exposure from blood that could have transmitted malaria such as sharing of syringes or needles among drug addicts. The incubation period after contamination with infected blood (at least for needle sticks) ranges from 4 to 17 days with a median of 12 days. Induced cases never give rise to true relapses, as there are no hypnozoites.

Box 3 Key for classification of malaria confirmed cases

Further information on deciding between classifications is provided in Box 1.

1. How was the case contracted? • By blood • By mosquito	**Induced case** **Go to 2**
2. Where was the case contracted? • Outside the country? • Inside the country, but by imported mosquito, e.g. airport malaria • Inside the country by locally bred mosquitoes	**Imported case** **Imported case** **Go to 3**
3. Which parasite caused the case? • P. falciparum or P. malariae • P. vivax or P. ovale	**Local case** **Go to 4**
4. When was the case contracted? • Less than 6 months ago • 6 months – 5 years ago in an area, where transmission has since ceased	**Local case** **Relapsing case**

Box 4 Operational aspects of classification of cases

Distinguishing between imported and local cases.

The probability that a case has been imported is related to several factors including:

- **The timing of the travel to and from endemic areas.**
    - The usual delay between an infectious bite and a primary clinical attack is 7 to 30 days. The minimal incubation period (time from inoculation to onset of symptoms) of malaria in humans is around 7 days for *P. falciparum* and 10 days for *P. vivax*, so detection of malaria parasites within 0-5 days of initiating travel would indicate that the person was infected before travelling.
    - People who have lived in malaria-free areas for 2 or more years and have less anti-malaria immunity are likely to have clinical symptoms shortly after the incubation period.
    - As time between returning from travel to an endemic area and the detection of the malaria infection increases beyond 6 months, the probability that the case is imported declines, and the probability that the case is local increases. Experience in many countries indicates that nearly 50% of imported cases in travellers occur within 1 month of return to the country of residence and up to 75% within 3 months.
- **The probability of local transmission in the area of living and working.**
    - If a person lives and works in a place without local malaria transmission for many years, with good surveillance, and there was clear history of travel to an area of known transmission within 6 months of documented infection, classification of the case as "imported" is straightforward. Conversely, if the patient lived in a focus with recent local transmission, the probability that the case is imported is less. The decision to classify a case as imported versus local transmission depends on the balance of the factors discussed above, where it is prudent to adopt the more conservative classification.
- **The parasite species**
    - P. falciparum infections can last for up to 24 months, but several febrile episodes would be expected during that period.
    - P. vivax and possibly P. ovale relapses may occur up to 5 years after inoculation, but most are seen within 3 years. The rationale for classification of a relapsing case is strengthened by a history or documentation of P. vivax or P. ovale infection in the past in patients that did not receive radical treatment.
    - P. malariae can recrudesce from persistent latent blood infection after many years. If an isolated P. malariae case is observed several years after transmission was assumed to be interrupted, the epidemiological consequence is the same as for a relapsing case, but the case should be reported as local. Such occurrences have become rare in recent years probably because of the susceptibility of P. malariae to widely used antimalarials.

Annex 2.2 Samples of case investigation and classification forms

Malaria case investigation and classification form

Patient details	
Case number:	
Case history	
Date history taken: Location history taken:	
History provided by: Relation to patient:	
Name of patient:	
Sex: Age: Current nationality:	
Full present home address:	
Home GPS coordinates:	
WHEN did the infection take place?	
Reason for diagnostic test	
Passive case detection - Active case detection -	
Contact survey - Population-based survey -	
Symptoms:	
Date of onset of first symptoms of current clinical episode:	
Blood sample	
Sample taken by:	
Name of health facility: Clinician's name:	
Rapid diagnostic test	
Performed by: Date:	
Result:	
Manufacturer of test: Batch number:	
Microscopic examination	
Performed by: Date:	
Laboratory name: Location:	
Staining method:	
Plasmodium species: Parasite density:	
Gametocytes present (P. falciparum only) Yes - No -	
Molecular testing and polymerase chain reaction results	
Performed by: Date:	
Laboratory name: Location:	
Geographical origin of infection:	
Link to previous attacks:	
Antimalarial treatment	
Type of medicine: Doses: Dates:	
Treatment outcome:	
Previous clinical episodes	
Date: Locality:	
Symptoms:	
Laboratory test results:	
Antimalarial treatment	
Type of medicine: Doses: Dates:	
Treatment outcomes:	

WHERE, HOW, and FROM WHOM did the infection possibly take place?	
Length of residence at present home address:	
If residence at present home is less than one year: previous home addresses within past year, including dates:	
Current occupation: Place of work:	
Recent travel history to known endemic area (including residual active or new active foci) in the country, in as far as this included possible dusk-dawn exposure to mosquito bites:	
Recent contact with known imported malaria cases (provide details):	
Did patient travel overnight away from home since the onset of the current clinical episode and before completion of treatment: Yes □ No □ (If yes, provide exact places visited, dates):	
Travel to foreign endemic country • Within the past year (for P. falciparum infection) Yes □ No □ • Within the past three years (for *P. vivax* infection) Yes □ No □	
Type of preventive measures taken during the above-mentioned travel to endemic areas/ countries:	
If chemoprophylaxis taken - drug name, dose and duration:	
Blood transfusion within past three months: Yes □ No □	
Preliminary conclusion	
Malaria infection likely acquired at (specify locality and source):	
Possible onward transmission	
Entomological studies carried out: Yes □ No □	
Carried out by:	
Remarks:	
Date onset of symptoms: Plasmodium species:	
Case classification: Classified by: Name & Position: Reviewed by: Name & Position:	
Investigation undertaken by: Position:	
Follow-up actions	
Signature: Date:	
Did patient travel overnight away from home since the onset of the current clinical episode and before completion of treatment: Yes □ No □ (If yes, provide exact places visited, dates):	
House of patient (type of construction, indoor residual spraying):	
Entomological studies carried out: Yes □ No □	
Carried out by:	
Remarks:	
Case classification	
Date onset of symptoms: Plasmodium species:	
Case classification: Classified by: Position: Reviewed by: Position:	
Follow-up actions Actions taken:	
Investigation undertaken by: Position:	
Signature: Date:	

Annex 3. Sample foci case investigation and classification

Annex 3.1 Sample form for foci investigation

Basic information	
Name of the focus settlement (town, Kebele):	
District:	
Region:	
Description of the locality	
Type of environment in relation to possible receptivity (e.g. urban/ rural, altitude, main geographical features) and	
vulnerability (e.g. close to endemic area across neighboring district or international border):	
Type of population in relation to possible vulnerability(e.g. migration patterns, presence of large numbers of temporary	
workers, typical travel histories):	
Mapping	
Should include location of:	
• Focus and its geographical limits	
• Households with malaria cases in past three years	
• Health facilities	
• Breeding sites	
• Access routes	
• Other important features	

Annex 3.2 Sample form for foci classification

Chronological questions	Classification based on WHO's elimination framework	Simplified classification (in Ethiopia's context)
1. Are the conditions suitable for transmission of malaria?		
• No, none throughout the year	Pseudo-focus	Non active
• Yes, for a period that is sufficient for maturation	Go to 2	
of sporozoites		
2. Is there a history of recent transmission (e.g. during the past three years)?		
• No	Go to 3	
• Yes (presence of introduced and/or indigenous cases)	Go to 7	
3. Are cases present?		
• Yes	Go to 4	
• No	Cleared-up focus	Non active
4. Is effective infection of mosquitoes possible?		
• Yes	Go to 5	
• No (e.g. an imported case arrived during a seasonal break of transmission and received antigametocyte treatment before the onset of effective infectivity)	Cleared-up focus	Non active
5. Which categories of cases are present?		
• Only induced, imported or relapsing cases	New potential focus	Non active
• Other categories also present (introduced or indigenous)	Go to 6	
6. Are indigenous cases present?		
• No	New active focus; only introduced	Non active
• Yes	New active focus; indigenous cases	Active endemic
Present		
7. Are indigenous cases present?		
• No	Residual non-active focus	Non-active
• Yes	Go to 8	
8. How effectively is transmission controlled?		
• Transmission is effectively controlled	Residual active focus	Non active
• No effective control	Endemic focus	Active endemic

Annex 3.3 Sample form for updating foci classifications

District:
Region:

Years	Number of foci classified as:		
	Active foci	Residual non-active foci	Non active foci
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Year 6			
Year 7			
Year 8			
Year 9			
Year 10			

Annex 4. Standard operating procedure for routine data quality assurance

National programs are working towards achieving ambitious goals and measures by improving the management and having strong monitoring and evaluation (M&E) systems that produce quality data related to program implementation.

The objective of routine data quality assurance (RDQA) is:

- To assess and improve the quality of malaria-related data collected at the health facility and reported into the PHEM/HMIS database.
- To correct data incorrectly reported in the PHEM/HMIS database.
- To assess the compliance of malaria diagnostics and treatment.
- Develop an action plan to implement corrective measures to strengthen data management and reporting and to improve data quality
- Strengthen the capacity of Zone, woreda, Hospitals, Health Center and Health post staffs in data management and reporting
- Build Zone and woreda-level capacity to assess data quality during routine supervision.
- Build capacity of Zone, Woreda and Health Center officers to assess data quality during routine supervision.

1.1 Forms and tools required:

Health facility data are key tools to generate data for validation. Particularly at health post level, registers are available for under-fives only due to ICCM program. Otherwise, for adults there is no standardized register and HEWs use plain books by creating their own data elements.

Therefore, having a standardized OPD register at health post for adults is inevitable. The Amhara malaria elimination project has developed OPD register and rolled out in all health posts of demo districts.

When planning to conduct RDQA the following data sources should be referred:

- Above 5 OPD register book/Tally sheet
- Under 5 register book/ ICCM register
- Newborn register book
- HEW field registration book
- HEWs weekly report
- Family folder

1.2 Data quality audit tools

- Facility-level Data Quality Audit tool
- Data Quality Audit Tally sheet

1.3 Procedures and organization of field work

1. Develop timeline and logistical plan for data validation visits to health facilities
2. In a separate Excel-based RDQA tool for each of the selected health facilities, for the selected time period enter PHEM/HMIS data into the tab "PHEM/HMIS Data", then hide the tab (to avoid accidental alteration of data and to not influence recording of extracted data from source documentation).
3. Schedule data quality audit visits with Health facilities
4. At health facility, introduce RDQA team and objectives of visit
5. Interview the health facility data manager to determine procedures followed to diagnose, treat, and document malaria cases,
6. Locate all patient registers, or other records that are used by the Health facility to document information about malaria diagnosis and treatment
7. Extract data from each patient register to complete paper tally sheets to tally the data elements prescribed below for each week during the selected period of review.

7.1 From OPD register, tally and record on tally sheet for each week (the following are examples) :

- Total OPD cases
- Total Pf
- Total Pv
- Total mixed etc…

7.2 From DQA tally sheets, enter all data elements for each week in Source column on Data Validation tab of DQA tool in Excel

8. On the Data Quality Results tab in the electronic data capture tool, identify discrepancies between the PHEM/HMIS reported Data and the data collected via paper tally sheets for the selected period.
9. RDQA team reviews and discusses results found on the Data Quality Results tabs and decides what to present to and discuss with health facility staff.
10. Gather health facility staff to present findings. Focus on positive aspects of data reporting and then identify problem areas. Take notes from discussion. Where there are discrepancies between the source data and what was reported to PHEM/HMIS Database. Provide feedback to facility staff on where they can make improvements to their reporting, if necessary. Based on the findings and recommendations for each develop an action plan. Encourage continuation of reporting of high quality data. Remind staff of who reviews and uses the data and how this data is used locally, nationally, and globally. Answer any final questions the staff may have and thank them for receiving the team.
11. Thank the Health facility staff for their time and contribution
12. Repeat at next facility
13. Submit summary report and sent feedback to supervised facilities.

Instruction sheet to be developed, but here is an incomplete and simple description of how the process might work. Worksheets currently filled with dummy data.

Worksheet "HMIS/PHEM reported Data", to be completed before arriving at health facility:

a. Enter information in the first 3 rows: start date for period of data to be validated, facility name, district, validator, date of validation

b. Enter data from HMIS/PHEM reported for Weeks and data elements indicated

Worksheet "Data Validation form", to be completed at health facility using original data sources:

1. Enter tallied data for each data element for each week (data element tally form to be developed)
2. Enter source of data for each data element

Worksheet "Data Quality Results", to be reviewed by data validation team and health facility staff:

1. Select whether data was submitted to HMIS/PHEM report on time (still need to verify how this will happen for HMIS/PHEM systems that don't seem to be recording submission date)
2. Identify weeks and data elements with errors
3. Review data quality indicators

DE = Data Element

Woreda: _____ Kebele: _____ HealthPost:_____

Week	Date	From source registers tally and enter totals for each data element for each week being audited (Example)																						
		DE 1	DE 2	DE 3	DE 4	DE 5	DE 6	DE 7	DE 8	DE 9	DE 10	DE 11	DE 12	DE 13	DE 14	DE 15	DE 16	DE 17	DE 18	DE 19	DE 20	DE 21	DE …	
W1																								*W1*
W2																								*W2*
W3																								*W3*
W4																								*W4*
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Data Validation by week

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Data Validation by week

Qes	Data Element	Year (YYYY) week no.		Year (YYYY) week no.		Year (YYYY) week no.		Year (YYYY) week no.		Year (YYYY) week no.		Year (YYYY) week no.		Comments
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Routine Data Quality Assurance data validation form

Data Element (Example)	Total Source	Total Reported	Error	% weeks reporting	% weeks accurate

Annex 5. Cross-border collaboration

Regional example of inter country/cross border collaboration: the emergency response to artemisinin resistance in the Greater Mekong Sub Region (ERAR GMS)

Experience from malaria eliminating countries suggest that achieving and sustaining malaria free status is not only dependent upon the robustness of tools and systems in place, but also on how best the threat of importation is managed[2]. Although the risk of malaria re-establishment through importation is universal, because of the globalization of traffic and trade, having malaria elimination setting closer to high burden countries means that more effort will be required, particularly in areas where population migrations are common such as in the Greater Mekong Sub Region (GMS).

Like other endemic regions, during the late-1950s and '60s the GMS participated in the WHO coordinated Global Malaria Eradication Program (GMEP). Among the factors that prevented the GMS from achieving the goal of malaria eradication were the convergence of resilient vectors and population movement in the forests and forest-fringes of Southeast Asia. This was in all the realization that local solutions and adaptations are important, in order to improve effectiveness of global programs.

From 2006-7, WHO recognized the emerging resistance to artemisinins on the Cambodia-Thailand border as a potential threat to malaria control worldwide. A containment project (ARCE) was initiated in Cambodia and Thailand with support from Bill & Melinda Gates Foundation (BMGF). Containment operations initially involved only two countries.

The intensified activities in Tier 1[5] areas under ARCE led to a decline in the number of malaria cases, but the level of artemisinin resistance increased.[6] In 2009-10 artemisinin resistance was recognized to have emerged in Viet Nam and in Myanmar. A Global plan for artemisinin resistance containment (GPARC) was launched in 2010.[7]

In response to the threat posed by the emergence of artemisinin resistance, WHO has, in 2011, developed the Global Action Plan for Artemisinin Resistance Containment (GPARC) which describes the strategies to tackle artemisinin resistance. Following an assessment of the response to the threat in the GMS, WHO launched in April 2013, the Emergency Response to Artemisinin Resistance in GMS Regional Framework of Action (2013 – 2015), and established a regional hub in Cambodia. The aim of the initiative is to preserve the efficacy of ACTs as an effective tool for the treatment of P. falciparum malaria, by coordinating actions, strengthening technical leadership and catalyzing resource mobilization. The framework identifies priority areas and actions required at sub national, national and supra national levels.

Recently, mutations putatively linked to delayed clearance have been identified in the Kelch propeller domain of the parasite (K-13). Using the new molecular technique, it has now been documented that artemisinin resistance emerged much earlier than previously thought, and is both spreading and emerging independently in several sites. For example, it is now known that the majority of mutant parasites found in Myanmar did not spread from Western Cambodia. K-13 mutant parasites were also detected in Southern Lao PDR in 2013. Thus, what appeared to be a problem for 2 countries initially considered under the ARCE project, has extended to 5 countries?

Beside increase in its complexity, the initiative also called for a tighter coordination and cross border coordination, particularly along the borders, with migrant and mobile populations been identified as high risk groups for malaria and drug resistance spread. These, together with the emergence of ACT resistance in certain provinces of Cambodia have prompted the shift of strategy from containment to that of malaria elimination. The strategy which was launched in May 2015 was developed through an open process involving all the GMS countries and their partners. Dealing with the

[4]WHO (2014). From malaria control to malaria elimination: a manual for elimination scenario planning

[5] Tier I: Areas where there is credible evidence of artemisinin resistance; Tier II: Areas with significant inflows of people from tier I areas, including those immediately bordering tier I; Tier III: Areas with no evidence of artemisinin resistance and limited contact with tier I areas.

[6] Maude A. et al. (2009). The last man standing is the most resistant: eliminating artemisinin-resistant malaria in Cambodia. Malar J. 8: 31. doi: 10.1186/1475-2875-8-31

[7] WHO (2011). Global plan for artemisinin resistance containment. http://www.who.int/malaria/publications/atoz/artemisinin_resistance_containment_2011.pdf

problem with a regional perspective has enabled quick identification of emerging threats and rapid adaptation of the strategy.

Implementation of the new strategy will also benefit from a number of best practices under the ERAR initiative. Among these are harmonized surveillance systems through the use of similar case definitions, allowing comparability across countries; the development of joint action plans to improved access to malaria services along the borders; the development of cross border malaria between China and Myanmar; the development of tri lingual IEC/BCC materials for use across the borders; the establishment of a web based regional data sharing platform; and several coordination activities in areas of pharmaceutical systems strengthening[8]. World Health Organization is currently supporting the GMS to establish an effective governance mechanism, both at national level and in the region.

Annex 6. Monitoring and evaluation framework

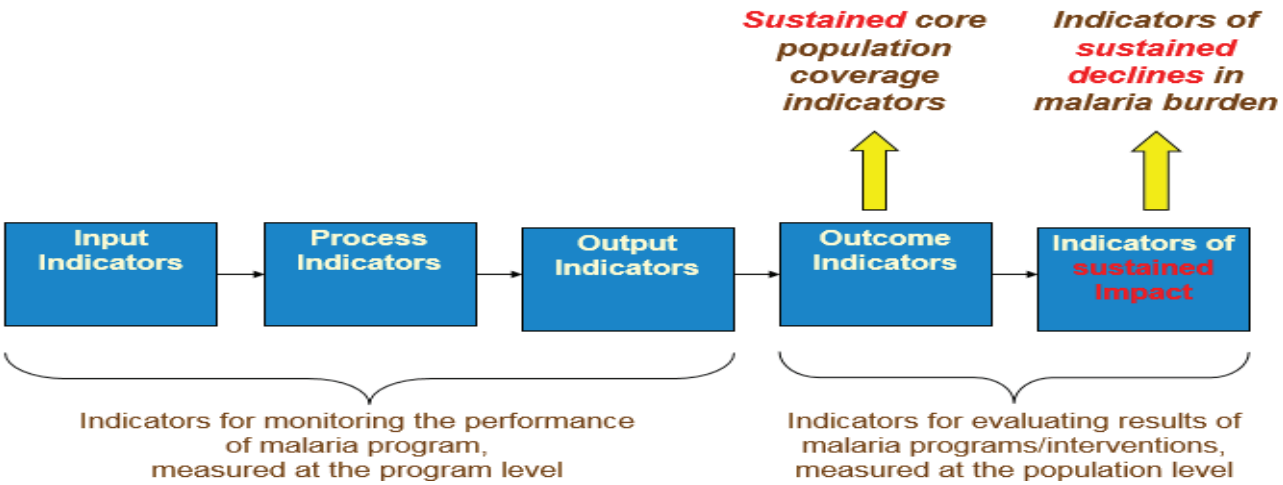
Monitoring is a continuous process of gathering and using data on program implementation with the aim of ensuring programs are proceeding satisfactorily or making adjustments, if necessary. It often uses administrative data and tracks inputs, processes and outputs, although it can also consider program outcomes and impacts.

Evaluation is a more comprehensive assessment of a program, which is normally undertaken at discrete points in time and focuses on the longer term outcomes and impacts of programs. The overall goal of M&E is to improve program efficiency, effectiveness and equity. M&E may be focused on local initiatives as well as measuring program effectiveness at the national and regional levels. Ideally, M&E tools can be used to demonstrate to planners and other decision-makers that program efforts have had measurable impacts on the outcomes of interest. M&E can also provide insight as to where resources are being used most efficiently versus where new strategies should be considered. Different types of survey methods will be deployed to monitor progress of core interventions and program monitoring. Among these Household survey, Health Facility Survey, Malaria indicator survey, Monitoring efficacy of antimalarial drugs, Monitoring efficacy of antimalarial insecticides and Health information system are few.

The Monitoring and evaluation (M&E) model developed by RBM Monitoring and Evaluation Reference Group – MERG) illustrates the general M&E components that need to be addressed by any national malaria control program. Ethiopia also adopted MERG framework and the following figure provides an example schematic of the level and function of indicators typically used for M&E. While monitoring generally collects data on a regular basis (weekly, monthly, quarterly or annually), evaluation occurs over a longer time frame.

The current national health management information system (HMIS) captures all diseases and health conditions and provides only limited data elements for each of the diseases. In addition, inadequate timeliness and completeness make the system less suitable to monitor disease trends and assess progress reliably. The public health emergency management (PHEM), an integrated reporting system, is currently used for tracking weekly based aggregated surveillance data by health facility on selected notifiable diseases including key malaria indicators. The system is more timely and complete making it a suitable surveillance tool for the initial phases of the elimination efforts. However, it lacks disaggregated data by type of diagnostic test used although these data elements exist at the lower level. Thus, the malaria component in the tool will be revised to accommodate key data elements for elimination.

[8] WHO 2015. Mobile and migrant populations and malaria information systems



Indicator framework for M&E in context of sustained impact and evaluation

Surveillance information