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Background document for Session 8

Monitoring and Evaluation of the Global Technical Strategy for Malaria 2016–2030 and Action and Investment to defeat Malaria 2016–2030

August 2016, Geneva, Switzerland

Contents

1. Introduction

The WHO *Global Technical Strategy for Malaria 2016–2030* (GTS) and the Roll Back Malaria (RBM) Partnership's *Action and Investment to defeat Malaria 2016–2030* (AIM) provide a vision of how endemic countries can accelerate progress towards malaria elimination. These documents emphasize (i) the need for universal access to interventions for malaria prevention, diagnosis and treatment, (ii) that all countries should accelerate efforts towards malaria elimination, and (iii) that malaria surveillance should be a core intervention. The GTS and AIM share the same global targets for 2030 and milestones for 2020 and 2025,[1,2] as shown in Table 1:

Table 1.
Goals and milestones of the GTS and AIM

Vision – A world free of malaria

Goals	Milestones		Targets
	2020	2025	2030
1. Reduce malaria mortality rates globally compared with 2015	≥40%	≥75%	≥90%
2. Reduce malaria case incidence globally compared with 2015	>40%	≥75%	≥90%
3. Eliminate malaria from countries in which malaria was transmitted in 2015	At least 10 countries	At least 20 countries	At least 35 countries
4. Prevent re-establishment of malaria in all countries that are malaria-free	Re-establishment prevented	Re-establishment prevented	Re-establishment prevented

The purpose of this document is to describe how the GTS and AIM will be monitored and evaluated. It (i) contains a list of recommended indicators along the continuum from high transmission to elimination, (ii) suggests milestones for the development of information systems, (iii) describes how information from these systems should be used to influence decision-making and programme performance, and (iv) defines institutional responsibilities for the monitoring and evaluation of the GTS and AIM.

This document is intended for managers of national malaria programmes and health information systems who wish to set up or adapt surveillance, monitoring and evaluation systems to be aligned with the GTS. It is also relevant to other implementing partners and financiers of malaria programmes or information systems development.

[1] Countries will set their own national or subnational targets, which may differ from the global targets.
[2] The Sustainable Development Goals also include a target for malaria for 2030, namely, "to end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases". Ending the epidemic for malaria is interpreted as securing a 90% reduction in malaria incidence and mortality rates and eliminating malaria from at least 35 countries.

2. The aims of monitoring and evaluation

Monitoring and evaluation[3] (M&E) are critical to achieving the objectives of the GTS and AIM, and central to malaria programme implementation in endemic countries. In such settings, it is important to assess the malaria situation of a country or area and establish plans that make the most effective use of resources – either to eliminate or reduce the public health impact of malaria. As plans are implemented, they need to be periodically reviewed to assess whether programme activities are on track and achieving the desired outcomes, or whether they need to be adjusted (see Section 7).

While high quality and timely information is critical for programme planning and implementation, it is not the sole preserve of malaria programme managers. Information can be used to lobby external stakeholders for the required resources. The performance of malaria programmes can also be enhanced by making information from programme planning and monitoring more widely accessible. Public disclosure of information enables politicians, patients and citizens to monitor the services they are financing, and encourages managers to be more responsive to their clients' needs. Accordingly, the AIM emphasizes a high degree of participation and consensus building in the development, implementation and monitoring of malaria plans.

The primary purpose of malaria programme data is to support decision making and action at the local level, but information generated at the country level is also used to inform progress at the international level through reports produced by WHO and the UN. Such data also inform international financiers of malaria programmes and are an important determinant of future funding flows.

Box 1.
Major uses of monitoring and evaluation

Monitoring and evaluation can accelerate progress towards malaria elimination if used:

- to advocate for investment in malaria programmes in line with the malaria disease burden in a country or subnational area;
- to allocate resources to populations most in need in order to achieve the greatest possible public health impact;
- to regularly assess whether plans are progressing as expected or whether adjustments in the scale or combination of interventions are required;
- to account for the funding received and to enable the public, their elected representatives and donors to determine if they are obtaining value for money;
- to evaluate whether programme objectives have been met and to learn what has worked and not worked, so that more efficient and effective programmes can be designed.

[3] Monitoring is a continuous process of gathering and using data on programme implementation (weekly, monthly, quarterly or annually), with the aim of ensuring that programmes are proceeding satisfactorily or, if necessary, making adjustments. The monitoring process often uses administrative data to track inputs, processes and outputs, although it can also consider programme outcomes and impacts. Evaluation is a more comprehensive assessment of a programme, normally undertaken at discrete points in time and focused on the longer term outcomes and impacts of programmes. The overall goal of M&E is to improve programme effectiveness, efficiency and equity.

3. The epidemiological transition to malaria elimination

Many countries and areas are undergoing reductions in malaria transmission[4] due to the increased implementation of malaria interventions and socio-economic change. As this transition occurs, the epidemiology of malaria is likely to change in the following ways:

- The numbers of severe cases and deaths will decrease;
- The number of uncomplicated malaria cases will decrease;
- Malaria transmission will become more focal;
- The age distribution of cases, severe cases and deaths becomes more evenly distributed across age groups and reflects degree of exposure;
- Populations will become less immune, and the risk of epidemics and associated mortality will increase;
- Imported cases may represent an increasing fraction of the overall incidence.

The goals and possibilities of surveillance, monitoring and evaluation also evolve throughout this transition (see Table 2), such that:

- In areas of high transmission, programme monitoring and evaluation is mostly based on aggregate numbers, and actions are undertaken at a population level to ensure that all populations have access to services and there are no adverse disease trends.
- In areas with low or moderate transmission, there is greater heterogeneity in the distribution of malaria. As a result, it is important to identify the population groups most affected by the disease and to target interventions appropriately. This will be facilitated by mapping of cases and foci and analysis of case distribution at community level. As transmission is reduced, the risk of epidemics also increases; thus more frequent analysis of cases at health facility level is needed to allow early detection of potential outbreaks.
- As progress is made towards elimination, prompt detection of, and response to new cases and foci, is critical. Individual cases of infection or clusters of cases, need to be investigated in order to understand risk factors, eliminate foci of transmission and maintain malaria-free status. Surveillance systems become more complex and resource-intensive, and additional skills, training and activities are required.

[4] The term 'high transmission' has usually been used to indicate hyper- and holoendemic malaria (parasite prevalence in children aged 2–9 years > 50%), 'moderate transmission' to indicate mesoendemic malaria (10–50% parasite prevalence) and 'low transmission' to indicate hypoendemic malaria (parasite prevalence < 10%). For consistency, the threshold of 10% is used to characterize low transmission in this document and to provide a general guide as to the types of malaria surveillance possible at different levels of malaria endemicity. The thresholds are not, however, fixed, and surveillance strategies for low-transmission settings might sometimes be more appropriate when parasite prevalence is < 5%, for example, rather than < 10%.

Table 2.
Changes in malaria epidemiology and surveillance systems in the transition to malaria elimination[5]

Transmission	High & moderate	Low	Very low
Parasite prevalence (2–9 yrs)	>10%	<10%	
Incidence	Cases and deaths common and concentrated in <5yrs Limited temporal variation Limited geographical variation	Cases and deaths less common and distributed according to exposure Variable within and between years Risk of epidemics Geographical heterogeneity Concentrated in marginal populations	Cases sporadic Relapses and imported cases a high proportion of the total Focal distribution
Fevers	Proportion of fevers due to malaria relatively large, often >30%	Proportion of fevers due to malaria small, <10%	Proportion of fevers due to malaria very small
Health facility attendance	High proportion due to malaria	Low proportion due to malaria	Very few due to malaria
Vectors	Efficient	Controlled efficient/ inefficient	Controlled efficient/ inefficient
Aims of programme	Mortality and case reduction	Case reduction	Transmission elimination
Resources	Low expenditures per head Low-quality and poorly accessible services	Widespread availability of diagnostics and treatment	High expenditures per case with resources to investigate each case
Data recording	Aggregate numbers	Aggregate numbers List of admissions → cases	Case details
Investigation	Inpatient cases	Inpatient cases → all cases	Individual cases

[5] Adapted from *Disease Sureveillance for Malaria Control : An operational manual*, World Health Organization, Geneva, 2012.

4. Recommended indicators along the continuum to elimination

The GTS highlights a minimum set of 14 outcome and impact indicators according to which progress in malaria control and elimination should be monitored. The AIM recommends five indicators covering financing and governance. This document builds on these recommended indicators to define the core set of indicators that will be used to track malaria programmes globally, as shown in Table 3. The indicators consider:

(i) the resources available for malaria control (programme financing, commodities);

(ii) levels of service provision (intervention coverage);

(iii) the populations affected by malaria and trends in disease;

(iv) the performance of systems for surveillance, monitoring and evaluation.

While the majority of indicators are relevant at global and national levels (and frequently sub-national level), some indicators are primarily intended for use at national level and will not be used to track global progress. These are highlighted with an asterisk.

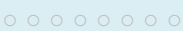
Eight indicators (numbered 18 to 25) concern the performance of systems for surveillance monitoring and evaluation. In addition to these indicators a set of bench-marks or milestones is presented in Section 6 of this document. The status of surveillance systems against these milestones will be assessed periodically (at least every 5 years) to provide additional insight into the development of effective systems for surveillance, monitoring and evaluation. One of the indicators specified in the AIM has been included in this category (country web-sites allowing access to geographically disaggregated data on malaria incidence or prevalence and interventions).

The indicators listed in Table 3 may not reflect the programmatic strategies used in all settings. For example, intermittent preventive therapy (IPTp) and seasonal malaria chemoprevention (SMC) are only used in certain high-transmission areas, whereas case investigation is generally only carried out as a programme approaches elimination.

Notes: excludes SMC, malaria vaccines, mass drug administration (MDA) and larviciding. No specific indicators for treatment of severe malaria.

Table 3. Recommended indicators along the continuum to elimination. Indicators highlighted in the AIM are shaded green while those from the GTS are shaded blue. Indicators that are relevant for national level monitoring but will not be used for global monitoring are shown with an asterisk (*). The relative importance of an indicator in different settings is indicated by the intensity of the dots. Indicators obtained through household surveys have red dots, while indicators obtained through routine health information systems have grey dots. Detailed specifications of the indicators, a description of when they should be used, data collection methods, and issues related to their interpretation are provided in Annex 1.

	Indicator[1]	Applicability of indicator by transmission setting[2]		
		High transmission	Low transmission	Elimination/ prevention re-establishment
	Inputs			
1	Malaria expenditure per capita for malaria control and elimination	●●●●●●●●	●●●●●●●●	●●●●●●●●
2	Funding for malaria relevant research	●●●●●●●●	●●●●●●●●	●●●●●●●●
3	Number of top-10 registered corporations that invest in malaria*	●●●●●●●●	●●●●●●●●	○○○○○○○○
	Outcome			
4	Proportion of population at risk that slept under an insecticide-treated net (ITN) the previous night	●●●●●●●●	●●●●●●●●	○○○○○○○○
5	Proportion of population with access to an ITN within their household	●●●●●●●●	●●●●●●●●	○○○○○○○○
6	Proportion of households with at least one ITN for every two people	●●●●●●●●	●●●●●●●●	○○○○○○○○
7	Proportion of households with at least one ITN	●●●●●●●●	●●●●●●●●	○○○○○○○○
8	Proportion of existing ITNs used the previous night	●●●●●●●●	●●●●●●●●	○○○○○○○○
9	Proportion of population at risk potentially covered by ITNs distributed*	●●●●●●●●	●●●●●●●●	○○○○○○○○
10	Proportion of targeted risk group receiving ITNs	●●●●●●●●	●●●●●●●●	●●●●●●●●
11	Proportion of population at risk protected by indoor residual spraying (IRS) in the previous 12 months	●●●●●●●●	●●●●●●●●	○○○○○○○○
12	Proportion of targeted risk group receiving IRS*	●●●●●●●●	●●●●●●●●	●●●●●●●●
13	Proportion of households with at least one ITN for every two people and/or sprayed by IRS in the previous 12 months	●●●●●●●●	●●●●●●●●	○○○○○○○○
14	Proportion of pregnant women who received ≥3 doses of intermittent preventive therapy (IPTp)	●●●●●●●●	○○○○○○○○	○○○○○○○○
15	Proportion of pregnant women who received 2 doses of IPTp	●●●●●●●●	○○○○○○○○	○○○○○○○○
16	Proportion of pregnant women who received 1 dose of IPTp	●●●●●●●●	○○○○○○○○	○○○○○○○○
17	Proportion of pregnant women who attended antenatal care (ANC) at least once	●●●●●●●●	○○○○○○○○	○○○○○○○○
18	Proportion of malaria cases detected by surveillance systems	●●●●●●●●	●●●●●●●●	●●●●●●●●

19	Proportion of children under 5 with fever in the previous 2 weeks for whom advice or treatment was sought			
20	Proportion of detected cases contacting health services within 48 hours of developing symptoms			
21	Proportion of cases investigated and classified (programmes engaged in elimination)*			
22	Proportion of foci investigated and classified (programmes engaged in elimination)*			
23	Proportion of expected health facility reports received at the national level			
24	Annual blood examination rate*			
25	Percentage of case reports received <24 hours after detection*			
26	Proportion of patients with suspected malaria who received a parasitological test			
27	Proportion of children under 5 with fever in the previous 2 weeks who had a finger or heel stick			
28	Proportion of patients with *P. vivax* or *P. ovale* malaria who received a test for G6PD deficiency			
29	Proportion of health facilities without stockouts of key commodities for diagnostic testing*			
30	Proportion of patients with confirmed malaria who received first-line antimalarial treatment according to national policy			
31	Proportion of *P. vivax* and *P. ovale* patients who received radical cure treatment			
32	Proportion of children under 5 with fever in the previous 2 weeks for whom advice or treatment was sought			
33	Proportion of treatments with ACTs (or other appropriate treatment according to national policy) among febrile children <5			
34	Proportion of health facility months without stockouts of first-line treatments*			
	Impact			
35	Parasite prevalence: proportion of population with evidence of infection with malaria parasites			
36	Malaria case incidence: number of confirmed malaria cases per 1000 persons per year			
37	Malaria test positivity rate*			
38	Number of foci by classification*			
39	Malaria mortality rate: number of malaria deaths per 100 000 persons per year			
40	Proportion of inpatient deaths due to malaria*			
41	Number of countries that have newly eliminated malaria since 2015			
42	Number of countries that were malaria-free in 2015 in which malaria has been re-established			

5. Role of routine systems and surveys

Multiple data sources are used in malaria monitoring and evaluation, including routine information systems, household and health facility surveys, sentinel sites and other special data collection efforts as needed (Box 2). The role and relative importance of these data sources change as programmes proceed from high transmission to malaria elimination.

Routine systems: In high-transmission settings, malaria accounts for a large proportion of health service attendance, and malaria information systems are necessarily embedded within integrated health management information systems. Simple and efficient recording and reporting systems are also needed to track vector control activities, notably ITN distribution and IRS coverage. Systems are also required to track resistance to insecticides and antimalarial drugs. In lower transmission settings, malaria-specific reporting systems are needed to satisfy the additional information demands for targeting and monitoring interventions among particular risk groups and foci.

Surveys: Information obtained from routine information systems is complemented by data from health facility and household surveys. Surveys can provide data on some indicators that cannot be measured with programmatic data, particularly indicators that require population level denominators such as coverage of interventions and parasite prevalence. Surveys can also enhance the interpretation of information gathered from routine information systems. For example, surveys may help to ascertain the percentage of patients with a febrile illness who attend public sector health facilities, thus providing information on the coverage of surveillance systems. Surveys may also be used to validate the data collected from routine systems.

The design of surveys changes with the intensity of malaria transmission. In high-transmission settings, nationally representative surveys enable the assessment of programme coverage and parasite prevalence across a country. In lower transmission settings, nationally representative surveys may be less useful and surveys better targeted at those populations most at risk.

The relevance of indicators and the feasibility of obtaining particular information through a survey also change with malaria transmission intensity. For example, parasite prevalence among children under 5 years of age is a relevant indicator in high-transmission settings because these children have a high risk of acquiring malaria, while prevalence in adults is generally low. It is also practical to obtain information from children under 5, as they are more likely to be at home during a household survey and available for a malaria test. In low-transmission settings, measuring parasite prevalence in children under 5 may not be very informative, as, in general, these children do not represent a high-risk group. It may therefore be preferable to examine prevalence among all age groups in such settings (although it may be more difficult to obtain a representative sample of school children and working adults, as they may not be at home when a survey is done). When transmission is low, however, a much larger sample size is required to measure prevalence and attention is, in any case, more often directed to measuring the incidence of symptomatic cases through routine health information systems.

The decision as to whether or not to measure parasite prevalence – and which age groups to cover – rests on weighing the potential benefits of obtaining the information (including the ability to more precisely identify the population groups most affected by malaria) against the costs of undertaking the survey (i.e., the increased sample size necessary, the diagnostic tools available and the potential to reach particular population groups), and considering the alternative uses to which such resources could be allocated.

Box 2.
Key information captured from routine health information systems, health facility surveys and household surveys

Routine health information systems

- Information on health facility resources
- Information on the use of health services and disease trends
- Information on patients treated by community health workers

Health facility surveys

- Information on the availability of staff, equipment and consumables to deliver services
- Verification of health facility service statistics (proportion of patients tested and treated with appropriate antimalarial medicines)

Household surveys

- Information on population coverage of services
- Information on patients not using government health services
- Information on population infection or anaemia rates

Sentinel sites and special studies

- Treatment efficacy studies
- Entomological surveillance
- Demographic surveillance sites

6. Milestones for development of systems

6.1 Case reporting

The initial phases of building an effective malaria information system will focus on ensuring good-quality data. This involves making sure that all patients with suspected malaria receive a diagnostic test, that cases are correctly classified according to the test result, that there is a quality management system for both microscopy and rapid diagnostic tests (RDTs), and that registration of and reporting from health facilities are complete and consistent. The quality of surveillance systems must be monitored continuously by maintaining an up-to-date list of operational health facilities, keeping track of which facilities have submitted the required reports, following up on missing reports, reviewing the data submitted, following up on incomplete or erroneous data, and providing positive feedback to health facilities that submit timely, complete and accurate data. In many settings community based case management and case reporting is an increasingly important component of service delivery and surveillance and it will be important to ensure the quality of diagnosis and reporting from community agents through training and supportive supervision from a linked health facility. Attention should be placed on ensuring improvement, and ultimately attainment of 100%, in two indicators, namely: the percentage of suspected cases that receive a diagnostic test and completeness of reporting. If data are incomplete, analyses of malaria morbidity and mortality may initially have to be confined to those health facilities that report data consistently, until reliable data can be obtained from all facilities.

As malaria becomes more focal and concentrated in particular population groups, analysis of indicators by health facility or population group is needed to target resources more precisely. Since malaria may be concentrated in marginalized populations, such as those living in remote border areas, migrant workers and tribal populations, programmes may need to find innovative ways to obtain information on these groups in order to design locally relevant programmes.

In low-transmission settings, data must also be reviewed more frequently at the health facility level in order to detect outbreaks as soon as possible. Epidemics may be more likely in areas where malaria has been successfully controlled but where efficient vectors remain than in areas with low levels of transmission due to environmental factors or inefficient vectors. Managers should be alert to malaria outbreaks and be ready to intensify control measures in some locations in order to prevent or contain outbreaks. As programmes approach elimination they identify and aim to clear remaining foci of malaria.

6.2 Case investigation

In the initial phase of control, it is recommended that each severe malaria case and death be investigated at the health facility level with the support of district staff, in order to identify and address programme weaknesses (such as poor ITN coverage, delays in seeking treatment and stockouts of antimalarial medicines). As transmission is reduced and the number of severe cases decreases, the opportunities for intensifying the investigation into severe cases and deaths increase. It becomes possible to establish a district-wide register of all severe cases, with which to investigate and eliminate future cases, and address programme weaknesses.

As transmission decreases even further, malaria programmes at the district level can begin to establish registers of all confirmed malaria cases reported in the district. These registers can contain information on the background characteristics of each case (e.g., location, age, sex, occupational group). Analysis of such registers can help to identify which population groups are most affected, to better target interventions and further accelerate malaria control. As programmes approach elimination case investigation helps to distinguish between locally acquired and imported cases and therefore whether there is ongoing local malaria transmission.

6.3 Heterogeneity in programme implementation

Malaria control may progress more rapidly in some parts of a country than in others; the strategies for surveillance may therefore vary. For example, some districts may rely exclusively on reporting aggregate cases, while others may supplement this with details of individual cases. Indeed, some parts of a country may be pursuing elimination. Therefore, they must identify the origin of each case in order to intensify control measures in specific localities and ensure that transmission is halted at the earliest possibly opportunity.

Table 4 provides milestones for systems development for different epidemiological settings; these milestones are considered to be achievable by 2020. The attainment of these milestones is a particular focus in the monitoring and evaluation of Pillar 3 of the GTS: the strengthening of surveillance systems.

Table 4: Milestones for disease surveillance systems development

		High transmission	Low transmission	Elimination/ Prevention of re-establishment
Data generation	Diagnostic testing	Documented criteria for which patients should get a test		
		All suspected cases get tested in public sector, private sector engaged	All suspected malaria cases get tested	All suspected malaria cases get tested
	Data recording	Health facilities have registers as recommended (with age, sex, type of test, species, village etc.)		Case investigation form
		Health facilities have current guidelines for the diagnosis, treatment and reporting of malaria cases		
	Case investigation	All deaths	All severe cases	All cases - including reactive case detection
	Master list of health facilities/ reporting units	Public sector list updated within 2 years	Public & private facility list updated within 1 year	Public & private facilities current
	Catchment/ target populations	Catchment/ target populations up to date		Populations of foci known
	Household surveys	Care-seeking behaviour measured every 3 years	Care-seeking behaviour measured every 5 years	
	Parasite prevalence	Parasite prevalence measured every 3 years	Prevalence every 3 years - in high-risk groups	
	Resistance monitoring	Therapeutic efficacy testing of all antimalarial medicines undertaken every 2 years		
		Insecticide resistance monitoring undertaken every year		
Reporting	Information reported	Monthly numbers of tests performed by test type		
		Monthly numbers of cases by age group, test type, species	Monthly/ weekly numbers of cases	Immediate notification of cases
				Reporting of cases by classification
				National case register in place
	Reporting rates	Reporting rates systematically tracked		
		Null values reported when nil cases or health facility closed		
		Reporting rates 80%+ from public health facilities	Reporting rates 100% from public health facilities	Reporting rates 100% from public health facilities
			80% of reports within 1 week of due date	100% of reports submitted within 24 hours of case detected

		High transmission	Low transmission	Elimination/ Prevention of re-establishment
		Household survey to estimate % cases in private sector	Reporting 80%+ from formal private health facilities	Reporting rates 100% from private health facilities
Information use	Analysis	5 core charts used at district & higher levels		Tracking of individual cases and foci
		Geographic display of indicators by district	Display of indicators by sub-district/ village	Geographic display of indicators by household
		Annual progress report of all indicators		
	Disaggregation	Data available by health facility	Data available by village/ risk group	Data available by focus/ household/ individual
	Dissemination and feedback	Quarterly feedback of key indicators from HQ using scorecard		Real-time feedback of key indicators from HQ
		Publically accessible country web-site allowing access to disaggregated data on programme coverage and malaria incidence or prevalence		
Other	Coding systems	Common or linkable codes across systems	Common or linkable codes across systems	Common or linkable codes across systems
	Quality assurance	Lot quality assurance undertaken for RDTs		
		Health facilities undertaking microscopy participate in QA review by reference laboratory		All +ve slides & 10% of -ve slides rexamined
	Legislation		Malaria a notificable disease	Malaria a notificable disease
	Staffing	Health facility and community health workers participate in continuing education/on the job training in malaria case management and notification every two years		

7. Use of information

It is essential that information collected is used in ways that improve programme impact. To that end, two major uses for this information include programme planning, and programme monitoring and evaluation.

7.1 For programme planning

A principal use of information is to develop a Malaria Strategic Plan (MSP) which defines the goals and objectives of a malaria programme, how they will be achieved and the resources required. The MSP should describe the roles of different stakeholders in the implementation of the plan, and set targets for monitoring progress and ensuring accountability.

The MSP should allocate available resources to the most effective interventions and to populations most in need, in order for reductions in malaria incidence and mortality to be maximized and wastage of resources minimized. A key approach to optimizing malaria responses within a country or territory is stratification, whereby a country or area is divided into smaller units in which where different combinations of interventions are delivered.

An MSP typically covers a period of 5 years. Its establishment is usually preceded by a review of the malaria situation in the country (the "malaria programme review"), which takes into account:

- The population groups most affected by malaria, in order to understand where malaria case incidence and mortality are highest and whether certain population groups are particularly affected. Information on the geographical distribution of malaria can be obtained from an analysis of reported case incidence and mortality rates, and presented in tables or maps. When interpreting geographical variation in reported malaria incidence or mortality rates, it is important to take into account variation in the proportion of the population that uses public health facilities, the extent of diagnostic testing and health facility reporting rates. Hence, it can be useful to tabulate or map general patient attendance, annual blood examination and health facility reporting rates alongside tables or maps of disease incidence. It may also be useful to examine geographical variation in test positivity rates or proportional malaria attendance, since these may be less distorted by variation in general patient attendance, diagnostic testing or health facility reporting rates. If available, data from household surveys can provide information on (i) if and where patients seek care for fever and thus the extent to which routine surveillance systems capture all malaria cases, and (ii) parasite prevalence, in order to help identify the populations most affected by malaria. It is also important to note particular risk factors associated with areas of higher incidence or mortality, including predominant vector and parasite species and population behaviours.

Figure 1. Timing of Malaria Strategic Plan and malaria programme reviews

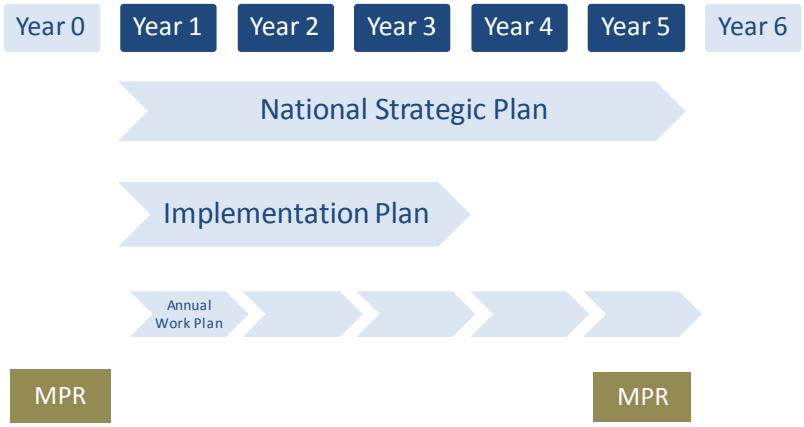
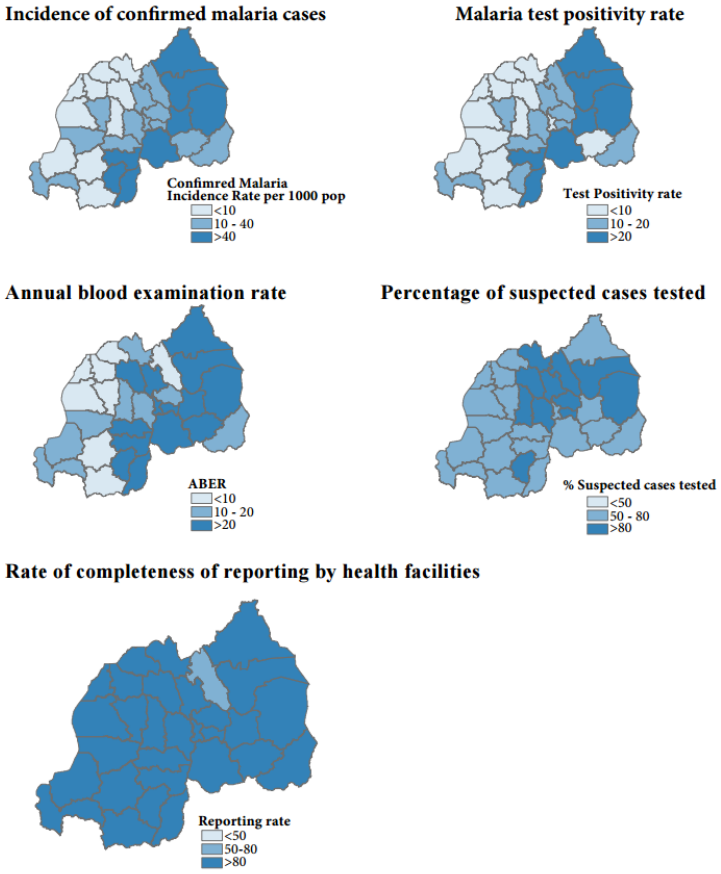


Figure 2. Examining the geographical distribution of malaria. Mapping of indicators allows programme managers to assess whether programme performance or malaria trends vary by geographical area and to determine whether malaria prevention, testing or treatment activities should be focused on particular geographical areas. Regional differences in the numbers of cases and deaths due to malaria might reflect the underlying epidemiology, the extent of malaria interventions, or diagnostic and case reporting practices. In the example below, higher case incidence rates are observed in eastern parts of the country, with higher annual blood examination rates and percentages of cases tested. Nonetheless, the same areas have a higher incidence rate as suggested by higher test positivity rates. Variation in the completeness of reporting may be due to communication delays or resource gaps in particular regions.

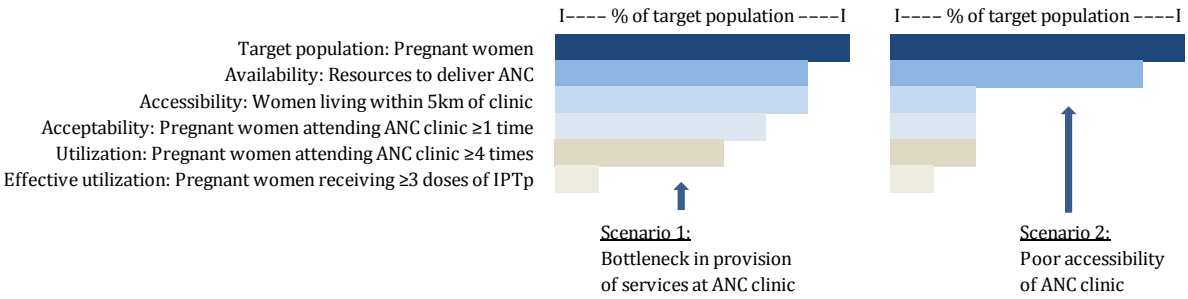


- Changes in disease incidence: Trends in the number of malaria cases, admissions and deaths reported may reflect change in malaria transmission and disease incidence in the population. However, they can also be influenced by changes in accessibility to health services, diagnostic testing practices and health facility reporting. Therefore, WHO recommends examining a set of six "control" charts that not only show changes in malaria incidence, but also factors that might influence observed trends (Figure 3). If there are too many gaps in routinely reported data to be able to assess malaria trends, it may be necessary to undertake a special study to retrospectively examine records of patient attendance in a sample of health facilities. If available, data drawn from 2 or more years of household surveys can provide information on changes in care-seeking behaviour and parasite prevalence.

Figure 3. Examining malaria trends. Trends in general patient attendance, annual blood examination rate and health facility reporting rates should be examined alongside trends in malaria disease incidence. It is useful to examine trends in test positivity rates or proportional malaria attendance, since these may be less distorted by changes in general patient attendance, diagnostic testing or health facility reporting rates. In the example below, there are fewer malaria cases, inpatients and deaths in the most recent months (graph 1). However, this trend could be due to less reporting and diagnostic effort in the same time period (graphs 4 and 5). Such a pattern is common and suggests that efforts are needed to improve the timeliness of reporting. There is also scope to increase the percentage of patients with suspected cases who receive a diagnostic test.

- Coverage of malaria interventions: It is useful to examine intervention coverage by geographical area or population risk group in order to assess whether or not interventions have been targeted appropriately. It is also useful to examine different stages in the delivery of interventions in order to identify the bottlenecks affecting service provision. In the two scenarios in Figure 4, the proportions of pregnant women receiving four or more doses of IPTp are the same – and low – but the reasons for the low coverage differ. In the first scenario on the left, while the utilization of ANC services is good, women do not receive multiple doses of IPTp, suggesting that the services on offer at antenatal clinics may need to be improved. In the second scenario, the utilization of antenatal clinics is poor, suggesting that more fixed or mobile antenatal clinics may be needed. Information on the coverage of malaria interventions can be obtained from (i) routine reporting systems, (ii) household surveys and (iii) health facility surveys.

Figure 4.
Identifying bottlenecks in malaria programmes



- Resources required and available for achieving programmatic targets: Information on programme financing should include both domestic and international financing. All malaria-specific expenditures should be included, e.g., commodities (ITNs, RDTs, ACTs etc), equipment (microscopes, vehicles), staffing (malaria managers, IRS sprayers) and activities (training, supervision). If expenditures that are shared with other programmes can be readily apportioned to malaria programmes, they can also be added to malria specific expenditures. If not, then a focus on malaria-specific expenditures is often sufficient for assessing trends in malaria investments and their impact on programme coverage. It is also useful to examine programme financing by geographical area or population risk group.

7.2 For programme monitoring and evaluation

The national malaria strategic plan should be monitored at regular intervals to assess whether programmes are proceeding according to plan or whether adjustments are required. Data for programme monitoring are usually obtained from routine health information systems, since programmes must be continuously monitored. Data from health facility and household surveys may, however, complement those from routine systems, e.g., in comparing the values of indicators obtained from routine systems and household surveys.

Managers at the national level should review indicators at least every quarter. Annual reviews should also be undertaken before budgets are prepared; mid-term reviews may be conducted to assess interim progress; and a final programme review should be undertaken before the next strategic plan is developed. The final malaria programme review (and mid-term review) would benefit from data from health facility surveys, household surveys and other special studies and these surveys and studies should be timed to contribute to the review(s).

In reviewing indicators, managers should ask specific questions regarding the progress of malaria programmes. The precise questions will depend on the local operational context, but are likely to include:

- Are programme coverage targets being met, or are particular interventions experiencing problems? For example, are targets for the percentage of suspected cases tested being met?
- Have there been important changes in the values of indicators over time? For example, has there been a decrease in the number of children receiving ITNs through immunization clinics? Of particular interest is whether the numbers of cases and deaths are being reduced or whether problems are being experienced in some locations, necessitating the modification of the programme. Managers should also be alert to potential epidemics.
- Are there particular bottlenecks in the delivery of services? For example, is there a large difference in the number of pregnant women receiving 1st and 3rd doses of IPTp?
- Are particular health facilities or geographical areas experiencing problems or doing well?

These questions can be answered easily if data are presented in such a way that indicators can be compared (i) with targets, (ii) across time, (iii) with other indicators, and (iv) between geographical areas. Other comparisons may also be informative, e.g., between different types of facilities or providers of services.

Managers at the health facility and district level need to review indicators on a monthly basis or even more frequently. Feedback on the status of selected key indicators should be communicated to districts and health facilities on a monthly or quarterly basis and include private health facilities where possible. It can be useful for district teams to be engaged in data analysis, presentation, and interpretation to improve buy-in and performance, and to enhance program capacity. It is important for data to be summarized in ways that enable staff in health facilities and districts to readily assess facilities' performance. Data may be presented through a dashboard, the ranking of districts or facilities, or colour coding of indicators according to their values.

Programme monitoring and surveillance should not be confined to malaria programme managers and implementers. Other government departments, elected leaders, community members and donors have a stake in ensuring the high quality of malaria programmes and need to be able to assess the operations they are supporting. If involved in the review process, these stakeholders can help to ensure that malaria programmes are responsive to populations' needs, and that malaria control and elimination are promoted as a development priority.

Figure 5. Comparison of districts
To be designed

8. Roles and responsibilities

8.1 International monitoring

Global progress in the reduction of mortality and morbidity and the eventual elimination of malaria will be tracked using countries' systems for surveillance, monitoring and evaluation. Progress will be monitored through the indicators outlined in this document (Table 3). Attention will also be given to the attainment of the milestones for systems development (Table 4).

Countries and partners are encouraged to ensure that data for these indicators are available at appropriate time points over the course of the GTS and AIM by ensuring adequate investments in routine information systems, and household and health facility surveys.

WHO and other partners will support endemic countries in strengthening their systems for surveillance, monitoring and evaluation, in line with the requirements of the GTS and AIM. This support will be aimed at improving the quality, availability and management of malaria data, and optimizing the use of such data for decision making and programmatic responses. Countries will also be supported in developing nationally appropriate targets and indicators to facilitate the subregional monitoring of progress.

WHO, in line with its core roles, will monitor regional and global malaria trends, and make these data available to countries and global malaria partners. WHO will monitor the implementation of the GTS and AIM, and regularly evaluate progress towards the milestones and goals set for 2020, 2025 and 2030 in an annual report and other periodic reports. It will support efforts to monitor the efficacy of medicines and vector control interventions, and – to this end – maintain global databases for the efficacy of medicines and insecticide resistance. It will regularly report to the regional and global governing bodies of the Organization, the United Nations General Assembly, and other United Nations bodies.

8.2 Development and review of guidance

WHO will set, communicate and disseminate normative and implementation guidance to support the development of effective systems for malaria surveillance, monitoring and evaluation. WHO's will convene a Technical Expert group (TEG) to provide advice to WHO on i) choice of indicators for monitoring the financing, coverage, quality and impact of malaria control interventions at the national and global level; ii) approaches for strengthening the capacity of member states to generate and use key information; and iii) strategies for obtaining, synthesizing and disseminating information on the indicators globally. It will ensure that guidance is responsive to the rapidly changing malaria context and regularly updated to incorporate innovative tools and strategies that are proven effective. The TEG will include representatives from country programmes and other major stakeholders.

The TEG will work closely with other partner groups from the RBM Partnership, whose primary responsibility is to support countries in the translation and implementation of WHO normative guidance. Partners will provide continuous input to the TEG on countries' priority SME needs and feed these back to the TEG for the revision/development of normative guidance.

By 2030, malaria morbidity and mortality are expected to be reduced dramatically compared to 2016, with the future eradication of malaria in sight. In this context, it will be increasingly necessary to establish a global monitoring system to systematically track and eliminate the remaining cases and foci of malaria. Regional efforts to monitor progress and share data, as exemplified by APLMA, ALMA, the Mekong and E8, have the potential to carve a path towards this goal.

9. Annexes

9.1 Reference list of indicators

Notes: The final document will have a more complete description of indicators, explaining the purpose of the indicator, and include more details on numerators and denominators. For now, the description is limited to numerators, denominators, data sources and breakdowns. Definitions have been made as consistent with previous guidance as possible.

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
Input Indicators						
1	Malaria expenditure per capita	Malaria expenditure (domestic and international)	Population at risk of malaria	Routine administrative systems	Domestic (government, private sector, household) vs international, programme area, geographic area, time (year)	Direct malaria expenditures are sufficient if expenditures shared with other programmes cannot be readily apportioned to malaria.
Outcome Indicators						
2	Proportion of population that slept under an ITN[6] 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	Geographic area, urban/rural, wealth index, educational status, gender, pregnancy status, age group (<5, 5–19, 20–45, 45+), household size	
3	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	Geographic area, urban/rural, wealth index, household size	
4	Proportion of households with at least one ITN for every two people	Number of households with at least one ITN for every two people	Total number of households surveyed	Household survey	Geographic area, urban/rural, wealth index, household size	
5	Proportion of households with at least one ITN	Number of households surveyed with at least one ITN	Total number of households surveyed	Household survey	Geographic area, urban/rural, wealth index, household size	
6	Proportion of existing ITNs used the previous night	Number of ITNs in surveyed households that were used by someone the previous night	Total number of ITNs in surveyed households	Household survey	Geographic area, urban/rural, wealth index, household size	

[6] An ITN is 1) a factory-treated net that does not require any treatment (an LLIN), or 2) a net that has been soaked with insecticide within the previous 12 months (see Reference Section 3.1 for explanation of revised definition).

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
7	Proportion of population at risk potentially covered by ITNs distributed	Number of ITNs distributed in past 3 years * 1.8	Population at risk of malaria	NMCP records, census	Geographic area, time	
8	Proportion of targeted risk group receiving ITNs	Number of ITNs distributed to risk group	Number of people in risk group	NMCP records, census	Geographic area, risk group (e.g. antenatal clinic attenders, migrant populations)	
9	Proportion of population at risk protected by indoor residual spraying (IRS) within the previous 12 months	Number of people protected by IRS in the previous 12 months	Population at risk of malaria	NMCP records, census	Geographic area, time (year)	
10	Proportion of targeted risk group receiving IRS	Number of people in the targeted risk group protected by IRS in the past 12 months	Number of people in risk group	NMCP records, census	Geographic area, risk group (e.g. population in per-urban areas, those living in active focus)	
11	Proportion of households with at least one ITN for every two people and/or sprayed by IRS in the previous 12 months	Number of households with at least one ITN for every two people and/or sprayed by IRS in the previous 12 months	Total number of households surveyed	Household survey	Geographic area, urban/rural, wealth index, household size	
12	Proportion of pregnant women who received ≥3 doses of IPTp	Number of pregnant women who received ≥3 doses of IPTp	Number of expected pregnancies	Routine health information system, census	Geographic area, time (year and month)	
13	Proportion of pregnant women who received 2 doses of IPTp	Number of pregnant women who received 2 doses of IPTp	Number of expected pregnancies	Routine health information system, census	Geographic area, time (year and month)	
14	Proportion of pregnant women who received 1 dose of IPTp	Number of pregnant women who received 1 dose of IPTp	Number of expected pregnancies	Routine health information system, census	Geographic area, time (year and month)	
15	Proportion of pregnant women who attended antenatal care at least once	Number of first antenatal clinic visits	Expected number of pregnancies	Routine health information system, census	Geographic area, time (year and month)	

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
16	Proportion of patients with suspected malaria who received a parasitological test	Number of suspected malaria cases receiving a parasitological test	Number of suspected cases of malaria	Routine health information system, health facility surveys	Geographic area, type of facility, time (year and month)	
17	Proportion of children under 5 with fever in previous 2 weeks who had a finger or heel stick	Number of children under 5 with fever in the previous 2 weeks who had a finger/heel stick	Total number of children under 5 who had a fever in the previous two weeks	Household survey	Geographic area, urban/ rural, wealth index, educational status of mother, gender	
18	Proportion of patients with *P. vivax* or *P. ovale* malaria who received a test for G6PD deficiency	Number of patients with *P. vivax* or *P. ovale* malaria who received a test for G6PD deficiency	Number of patients diagnosed with *P. vivax* or *P. ovale*	Routine health information system, health facility surveys	Geographic area, type of facility, time (year and month)	
19	Proportion of health facility months without stockouts of key commodities for diagnostic testing	Number of health facility months without stockouts of key commodities for diagnostic testing	Number of health facility months	Routine health information system, health facility surveys	Geographic area, type of facility, time (year and month)	Includes stockouts of RDTs and/ or microscopy consumables that prevent patients from receiving a diagnostic test. A stockout is defined as 7 days or more (not necessarily consecutive) of stockout. This may depend on the strength of the supply system.
20	Proportion of patients with confirmed malaria who received first-line antimalarial treatment according to national policy	Number of patients with confirmed malaria who received first-line antimalarial treatment according to national policy	Total number of confirmed malaria cases, including both passive and active surveillance	Routine health information system, health facility surveys	Geographic area, type of facility, parasite species, time (year and month)	
21	Proportion of persons with *P. vivax* and *P. ovale* infections who received radical cure treatment	Total number of persons with a confirmed *P. vivax* or *P.ovale* infection who received radical cure treatment	Total number of persons with confirmed *P. vivax* or *P. ovale* infections	Routine health information system	Geographic area, type of facility, time (year and month)	See above

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
22	Proportion of children under 5 with fever in the previous two weeks for whom advice or treatment was sought	Number of children under 5 with fever in the previous two weeks for whom advice or treatment was sought	Total number of children under 5 with fever in the previous two weeks	Household survey	Geographic area, urban/ rural, wealth index, educational status, gender	
23	Proportion of all malaria treatments that are with ACTs (or other appropriate treatment according to national policy) among febrile children <5	Number of children under 5 with fever in the previous two weeks who received an ACT (or other appropriate treatment according to national policy)	Total number of children under 5 with fever in the previous two weeks who received any antimalarial medicine	Household survey, health facility surveys	Geographic area, urban/ rural, wealth index, educational status, gender	
24	Proportion of health facility months without stockouts of first-line treatments	Number of health facility months without stockouts of first-line treatments	Number of health facility months	Routine health information system, health facility surveys	Geographic area, type of facility, time (year and month)	A stockout defined as 7 days or more (not necessarily consecutive) of stockout. This may depend on the strength of the supply system.
25	Completeness of health facility reporting	Number of reports received from health facilities	Number of reports expected from health facilities (number of health facilities multiplied by the number of reports expected per health facility over period)	Routine health information system	Geographic area, type of facility, time (year and month)	Some countries will include Community health worker - level reporting. Systems need to include zero reporting. A due date is implied by the indicator, e.g., by the 15th of the following month for reports from health facility to the district level.

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
26	Annual blood examination rate	Number of patients receiving a parasitological test over a year	Mid-year number of persons at risk for malaria		Geographic area/foci, risk group, active vs. passive, time (year and month)	Some past guidance has suggested that the annual blood examination rate should be about 10% in order to provide reliable trends, but the empirical evidence supporting such a target is not strong. In high-transmission settings, the rate is likely to greatly exceed 10% due to passive case detection alone.
27	Proportion of detected cases contacting health services within 48 hours of developing symptoms	Number of cases contacting health services within 48 hours of developing symptoms	Total number of passively detected malaria cases		Geographic area/foci, risk group, time (year and month), type of facility	
28	Percentage of case reports received <24 hours after detection	Number of case reports received <24 hours after detection	Total number of malaria case reports		Geographic area/foci, risk group, time (year and month), type of facility	
29	Proportion of malaria cases detected by surveillance systems	Number of confirmed malaria cases identified through active and passive surveillance activities over a 1-year period x 1000	Estimated number of malaria cases over a 1-year period x 1000		Geographic area, time (year)	
30	Proportion of cases investigated and classified	Total number of malaria cases in the national case register with fully completed case investigation forms	Total number of malaria cases in the national case registry		Geographic area/foci, risk group, time (year and month), type of facility	

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
31	Proportion of foci investigated and classified	Total number of new potential and active foci in the national foci register that have received full investigations within the previous year	Total number of foci in the national foci register		Geographic area/foci, time (year)	
Impact Indicators						
32	Parasite prevalence	Number of persons with malaria infection detected by rapid diagnostic test or microscopy	Total number of persons tested for malaria parasites by rapid diagnostic test or microscopy		Geographic area, urban/rural, wealth index, educational status, gender	In high-transmission settings, this indicator is usually only measured for children <5
33	Malaria case incidence (Annual Parasite Index)	Number of confirmed malaria cases identified through active and passive surveillance activities over a 1-year period x 1000	Mid-year number of persons at risk for malaria infection during reporting year		Geographic area/foci, risk group, active vs. passive, age, sex and species When approaching elimination: indigenous, introduced, imported by nationality, induced	May report numbers of cases when incidence is low
34	Malaria test positivity rate	Number of confirmed malaria cases	Number of patients receiving a parasitological test		Geographic area/foci, risk group, active vs. passive, age, sex and species	Test positivity of passive/active case detection and microscopy; RDTs should always be reported separately
35	Number of foci by classification (active, residual, cleared and pseudo)	Number and population of foci by classification (active, residual, cleared and pseudo)		Foci registry		
36	Malaria mortality rate: number of malaria deaths per 100 000 persons per year	Number of malaria-specific deaths reported in the previous year x 10 000	Mid-year number of persons at risk for malaria infection during the reporting year		Geographic area, age, sex, risk group and species	May report numbers of cases when mortality rate is low
37	Proportion of inpatient deaths due to malaria	Number of inpatient deaths due to malaria	Total number of inpatient deaths		Geographic area, age, sex	

	Indicator Name	Numerator	Denominator	Source	Breakdown	Comments
38	Number of countries that have newly eliminated malaria since 2015	Number of countries with malaria in 2015 that have subsequently reported zero indigenous cases for 3 consecutive years				
39	Number of countries that were malaria-free in 2015 in which malaria has been re-established	Number of countries that were malaria-free in 2015 that have subsequently reported epidemiologically linked indigenous cases for 3 consecutive years				