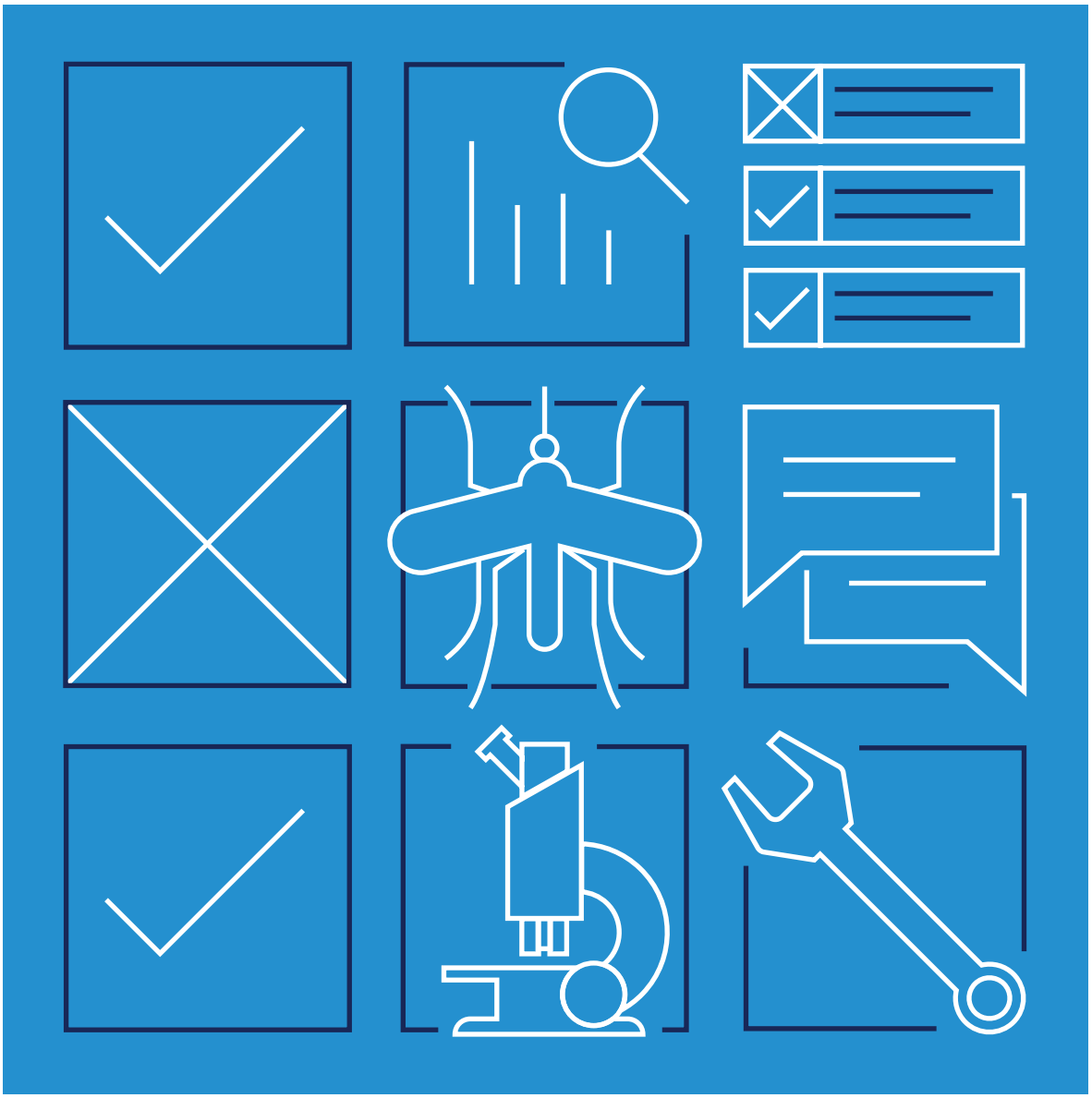
Malaria surveillance assessment toolkit

Implementation reference guide



World Health Organization

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Contents

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Acronyms

CHAI Clinton Health Access Initiative

DHIS District Health Information Software

DQA data quality assessment

DQR data quality review

HMIS health management information system

IDSR integrated disease surveillance and response

IPTi intermittent preventive treatment of malaria in infants

IPTp intermittent preventive treatment of malaria in pregnancy

IRB institutional review board

M&E monitoring and evaluation

MDA mass drug administration

MFL master facility list

MPR malaria programme review

NMP national malaria programme

NSP malaria national strategic plan

RDT rapid diagnostic test

SARA Service Availability and Readiness Assessment

SMC seasonal malaria chemoprevention

SOP standard operating procedure

WHO World Health Organization

Glossary

Definitions are from *Malaria surveillance, monitoring & evaluation: a reference manual (2)* and *WHO malaria terminology, 2021 update (3)*, unless otherwise referenced.

Term	Definition
Aggregated surveillance *(4)*	The practice of recording and/or reporting temporally aggregated data from all confirmed malaria cases in a given period. In most aggregated malaria case surveillance, cases are summed weekly or monthly and reported to district, provincial and national levels as a count of cases per health facility per unit of time.
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.
Case detection, active	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").
Case detection, passive	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 – that is, 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.

Case, malaria	Occurrence of malaria infection in a person in whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test. *Note:* A suspected malaria case cannot be considered a malaria case until parasitological confirmation. A malaria case can be classified as imported, indigenous, induced, introduced, relapsing or recrudescent (depending on the origin of infection); and as symptomatic or asymptomatic. In malaria control settings, a "case" is the occurrence of confirmed malaria infection with illness or disease. In settings where malaria is actively being eliminated or has been eliminated, a "case" is the occurrence of any confirmed malaria infection with or without symptoms.
Case-based surveillance *(5)*	The practice of recording and reporting patient-level data for all confirmed malaria cases. *Note:* In most case-based malaria case surveillance, each confirmed case is immediately notified to district, provincial and national levels. A full investigation of each case is undertaken to determine whether it was imported, acquired locally by mosquito-borne transmission (introduced, indigenous, relapsed) or induced.
Commodities tracking	The continuous and systematic collection, analysis and interpretation of data on malaria commodities (e.g. rapid diagnostic tests, treatment) to inform logistics and management of the supply chain.
Entomological surveillance	The continuous and systematic collection, analysis and interpretation of entomological data for risk assessment, planning, implementation, and monitoring and evaluation of vector control interventions.
Focus investigation	Collection of information to allow classification of a malaria focus (a defined, circumscribed area situated in a currently or formerly malarious area that contains the epidemiological and ecological factors necessary for malaria transmission) by type – that is, active, residual non-active or cleared. *Note:* Focus investigation may include epidemiological components (through case investigation or active case detection) or may be implemented on its own to understand entomological, environmental and intervention determinants of transmission. The objective is to identify the main features of the focus area, including the populations at greatest risk, the rates of infection or disease, the distribution of vectors responsible for malaria transmission and the underlying conditions that support transmission.

Health management information system (HMIS)	A system designed to record, store, retrieve and process health-related data in order to monitor and evaluate healthcare providers and organizations and support their key decision-making functions. This includes: • collecting and managing health and service delivery information at all levels; • verifying, processing and analysing the collected data; • drawing on indicators and relevant information to support programme management and decision-making; and • disseminating health information (e.g. annual reports, bulletins, websites).
Integrated disease surveillance and response (IDSR)	A reporting system and framework for integrating multiple surveillance and response systems for key notifiable diseases, and linking surveillance, laboratory and other data with public health action *(6)*.
Malaria surveillance	The continuous and systematic collection, analysis, interpretation and use of malaria and related data. *Note:* This may be a malaria-specific system or part of integrated disease surveillance (e.g. HMIS, IDSR system). It may be case based or use aggregated (weekly or monthly) reports. Malaria surveillance may also include additional strategies that inform planning, implementation and evaluation of the malaria programme, such as entomological surveillance, commodities tracking, intervention monitoring and evaluation, epidemic early warning and monitoring, and insecticide and drug resistance tracking.
Malaria surveillance assessment	A systematic approach to evaluating existing surveillance systems – that is, assessing performance of systems and understanding determinants of their performance – to provide actionable and prioritized recommendations on how to strengthen the surveillance system for malaria control and elimination.
Monitoring and evaluation	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 and making adjustments if necessary. 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; it is normally undertaken at specific times and focuses on the longer-term outcomes and impacts of programmes. The overall goal of monitoring and evaluation is to improve programme effectiveness, efficiency and equity.

Service delivery level	Term referring to all service delivery points for diagnosis and treatment (hospitals, public and private health facilities, laboratories, community health workers) at subnational levels (e.g. facility, district, region).
Subnational level	Term referring to all levels below the national level (e.g. province, region, state, district, commune).
Surveillance *(6)*	Continuous and systematic collection, analysis and interpretation of disease-specific data, and use of the data in planning, implementating and evaluating public health practice. *Note:* Surveillance can be done at different levels of the healthcare system (e.g. health facilities, the community), with different detection systems (e.g. case based: active or passive) and different sampling strategies (e.g. sentinel sites, surveys).

Executive summary

The World Health Organization (WHO) *Global technical strategy for malaria 2016–2030 (7)* emphasizes surveillance as a core intervention for accelerating progress towards malaria elimination across endemic settings. *Malaria surveillance, monitoring & evaluation: a reference manual (2)* provides guidance on principles and requirements for a strong malaria surveillance system. WHO recommends that national malaria programmes, with support from partner organizations, undertake malaria surveillance assessments to evaluate whether countries meet the requirements in the manual, leading to evidence-based and prioritized recommendations for strengthening of surveillance systems.

To date, malaria surveillance assessments have been implemented in many countries and in various transmission settings with the shared goal of improving surveillance system performance. However, past approaches and tools were not easily adaptable to all stages of the malaria transmission continuum and were not standardized across assessments. A Malaria Surveillance Assessment Toolkit was therefore developed, building on best practices from previous assessments. This involved aligning and adapting available tools into a single set of standardized tools, which can be used to conduct malaria surveillance assessments across all transmission settings. Use of these standardized tools allows comparison of results between countries and within the same country over time, enabling countries to track their progress towards surveillance system strengthening.

This *Malaria Surveillance Assessment Toolkit implementation reference guide* is a comprehensive reference document, as well as a step-by-step guide.

Part A: Overview

Background and rationale

The World Health Organization (WHO) *Global technical strategy for malaria 2016–2030 (7)* emphasizes surveillance as a core intervention for accelerating progress towards malaria elimination across endemic settings. Robust surveillance systems are needed to accurately and reliably track the burden of malaria, monitor the implementation of interventions aimed at reducing cases and deaths, and assess their impact.

The WHO document *Malaria surveillance, monitoring & evaluation: a reference manual (2)* provides guidance on the principles and requirements for effective malaria surveillance. Regular assessment of existing surveillance systems is a core principle recommended across the malaria transmission continuum.

What is a malaria surveillance assessment and why do it?

A malaria surveillance assessment is a systematic approach for measuring how well malaria surveillance systems are performing, and identifying and evaluating the determinants of their performance. In most endemic settings, malaria surveillance is fully integrated with surveillance of other diseases in the health management information system (HMIS); in other settings, there may be a separate malaria information system. A malaria surveillance assessment should be carried out on whichever system(s) capture malaria cases and deaths, and this could be part of a broader assessment of the HMIS. The results of malaria surveillance assessments can be used to provide actionable and prioritized recommendations on how to strengthen surveillance systems for malaria control and elimination. National malaria programmes (NMPs) and/or HMISs can use these results for programme planning and implementation. In elimination settings, a surveillance assessment can help the country to prepare documentation and check the quality of data before beginning the process for certification of malaria elimination.

When should a malaria surveillance assessment be done?

A malaria surveillance assessment can be undertaken at any time. It is recommended that an assessment is implemented as part of key NMP planning milestones such as a malaria programme review (MPR) and development of a national strategic plan (NSP). This is to ensure that key recommendations and associated activities for surveillance system strengthening are adequately prioritized and resourced by incorporating them into NSPs and Global Fund grant applications, as applicable. Following the initial surveillance assessment, more frequent, routine assessments may be undertaken (e.g. annually) to track progress towards surveillance system strengthening, provide feedback to surveillance staff and re-prioritize surveillance activities, as necessary. In elimination settings, it is recommended that an assessment is carried out before beginning the process for certification of malaria elimination.

Who should do a malaria surveillance assessment?

All malaria-endemic countries should undertake a surveillance system assessment, regardless of malaria burden. In elimination settings, it is recommended that a national assessment is carried out when there are fewer than 100 malaria cases per year and/or the country has reported zero cases for three consecutive years. The assessment should include whether a programme is in place to prevent re-establishment of malaria. In countries with more than

100 malaria cases per year, an elimination surveillance assessment can also be undertaken in areas where subnational elimination activities have been established.

Surveillance assessments should be carried out by NMPs and/or HMISs in countries, and may be supported by partners (WHO, donors and implementing partners). It is recommended that a steering committee of key malaria surveillance stakeholders is established for each assessment implemented.

Why was there a need to develop a Malaria Surveillance Assessment Toolkit?

Multiple malaria surveillance assessments have been implemented across malaria-endemic areas with the shared goal of enabling countries to improve surveillance system performance *(8, 9, 10)*. However, these assessments were implemented using different tools. Without standardized tools, it is difficult to compare results between countries, between regions within a country, or over time in a particular geographical area. A standardized Malaria Surveillance Assessment Toolkit was therefore developed.

What is the Malaria Surveillance Assessment Toolkit?

The Malaria Surveillance Assessment Toolkit provides a comprehensive but adaptable Assessment Framework and an associated standardized package of tools: guidance materials, data collection and analysis tools, and report documents.

These tools can be adapted for use throughout an assessment. Table 1 provides the complete list of tools and links to them. These tools could also be used as part of broader HMIS assessments.

What does the toolkit assess?

The toolkit primarily assesses how well the malaria surveillance system captures malaria cases and deaths in both burden reduction and elimination transmission settings. The toolkit can also be used for a high-level assessment of surveillance for malaria control interventions and strategies within the broader integrated surveillance system.

The toolkit assesses four objectives of malaria surveillance (Table 2):

(1) performance

(2) context and infrastructure

(3) technical and processes

(4) behaviour

Under each objective is a set of defined sub-objectives that further detail what malaria surveillance performance is and what drives that performance.

Under each sub-objective is a set of qualitative and quantitative indicators that are used to assess each sub-objective. Users can select which indicators to include in an assessment. Indicators have been categorized into priority and optional. "Priority indicators" are a minimum

set of metrics that should be included in all assessments conducted using the toolkit. These indicators provide standard outputs that will enable comparisons across countries and within countries over time.

Table 1. Contents of the Malaria Surveillance Assessment Toolkit [a]

Function	Tools	Description
Define scope	Assessment Framework Tool	A set of key objectives, sub-objectives and indicators that can be used to quantify and qualify strengths and weaknesses in the surveillance system. This tool should be used as the starting point in an assessment to define the scope of the assessment and the approach.
	Concept note and protocol	A template for the outline of a short concept note for refining the scope, methods, expected outputs and outcomes of an assessment, and a more detailed protocol outline required for comprehensive assessments.
	Surveillance assessment planning tool	A budgeting template to assist countries in developing a costed plan to undertake a comprehensive assessment.
Collect and analyse data	Desk Review Tool	A set of questions, tables, graphics and diagrams used to collect information and summarize what is known about malaria surveillance through document and data review, and optional interviews with surveillance programme staff and other relevant supporting partners.
	Data quality assessment tools	Tools and guidance for collecting and analysing data to specifically assess data quality at national, regional, district and service delivery levels.
	Question Bank	A library of questions that can be used to develop survey questionnaires for data collection at service delivery levels.
	Analysis tools	A set of shell tables in Microsoft Excel that are used to summarize the results from the survey.
Develop and prioritize recommendations	Technical brief and report outline	A report template for organizing, visualizing and interpreting results from the assessment. A technical brief is used to highlight a subset of priority results, whereas the complete report includes all assessment results.

[a] All tools are available for download from the WHO website.

Table 2. Overview of the Assessment Framework

Objective or sub-objective	Name	Description	Number of indicators
	Malaria surveillance outputs/performance		
1	**Performance**	**Measure the performance of the surveillance system**	**30**
1.1	**Surveillance system coverage**	Assess whether malaria cases and deaths are accurately captured by surveillance at each level of the health system	9
1.2	**Data quality**	Measure the quality of data collected at the service delivery level, and reported to subnational and national levels (completeness, timeliness, concordance and consistency)	14
1.3	**Data use**	Identify evidence of data-informed programme planning and use of data for decision-making	7
	Malaria surveillance inputs/determinants of performance		
2	**Context and infrastructure**	**Describe and evaluate contextual and infrastructural aspects of the surveillance that may influence performance. This includes an assessment of health sectors reporting, whether minimum data are captured for malaria control and interventions and strategies implemented in the country, information systems used, availability of and adherence to guidelines, human and financial resources, and infrastructure.**	**17**
2.1	**Surveillance sectors and strategies**	Describe surveillance for malaria control strategies and sectors reporting core indicators at each level of the health system, and evaluate definitions and algorithms used	4
2.2	**Information systems**	Describe information systems used for malaria surveillance, and evaluate their flexibility, acceptability, functionality and interoperability/integration	6
2.3	**Guidelines and standard operating procedures (SOPs)**	Evaluate the availability and content of key documents (guidelines, procedures, manuals and regulations) for malaria surveillance	2
2.4	**Resources**	Identify the staff, equipment and infrastructure required for malaria surveillance, and evaluate what is available at all levels of the health system	4
2.5	**Financial support**	Describe the budget available for malaria surveillance and identify any gaps	1

Objective or sub-objective	Name	Description	Number of indicators
3	**Technical and processes**	**Describe and evaluate processes and technical aspects of the surveillance system that may influence performance. This includes assessing processes, tools and personnel involved with the flow and use of data, from recording to response.**	**22**
3.1	**Case management**	Evaluate case management, including standardized use of case definitions and adequate commodities for testing and treatment	3
3.2	**Recording**	Describe and evaluate the data recording processes (e.g. tools, personnel and frequency for each point-of-care type)	4
3.3	**Reporting**	Describe and evaluate the flow of information through the surveillance system (e.g. tools, personnel and frequency at each level of the health system)	5
3.4	**Analysis**	Describe and evaluate the analysis process and expected outputs	3
3.5	**Quality assurance**	Describe and evaluate the activities, feedback processes and mechanisms in place to ensure data quality (e.g. data cleaning, supervision, data quality assessments, data review meetings, checking for duplicates and internal consistency)	4
3.6	**Data access**	Describe and evaluate access to data in the surveillance system (e.g. accessing database or requesting access, personnel, frequency)	3
4	**Behaviour**	**Describe and evaluate behavioural aspects of the surveillance system that may influence performance. This includes assessing governance structures and promotion of an information culture, as well as proficiency, motivation and accountability of staff involved in malaria surveillance within a country.**	**12**
4.1	**Governance**	Determine the governance structures in place for malaria surveillance, including documented planning, targets, organizational structure and external oversight	3
4.2	**Promotion of an information culture**	Determine the processes in place to promote a culture of data use and resulting perceptions among surveillance staff (e.g. whether staff are encouraged to use data, whether staff are motivated to produce quality data)	2
4.3	**Supervision**	Describe and evaluate the processes in place for supervision and management of surveillance staff	3
4.4	**Surveillance staff proficiency**	Determine the processes in place and resulting perceptions of job competence among surveillance staff (e.g. whether staff are competent in designated surveillance tasks; how staff gain competence, such as through training and job aids)	4

Data collection tools are designed to gather the data required to measure each indicator. Once the indicators for the assessment have been selected, the content of the tools is automatically selected to capture information only on those indicators. Some of the assessment tools may require additional country contextualization (e.g. changing variable names to those used in the country, translation into local languages; see section 1.3.2).

Using the toolkit

Assessment approach

The assessment scope (i.e. the selected transmission setting, malaria control interventions and strategies, and indicators) will determine the approach required for the assessment – rapid, tailored or comprehensive (Table 3). This will determine which data collection tools are required. For example, if a country wants to assess all indicators, a comprehensive assessment should be conducted, and all data collection tools would be required. It is recommended that all assessments, including those using a rapid approach, address priority indicators.

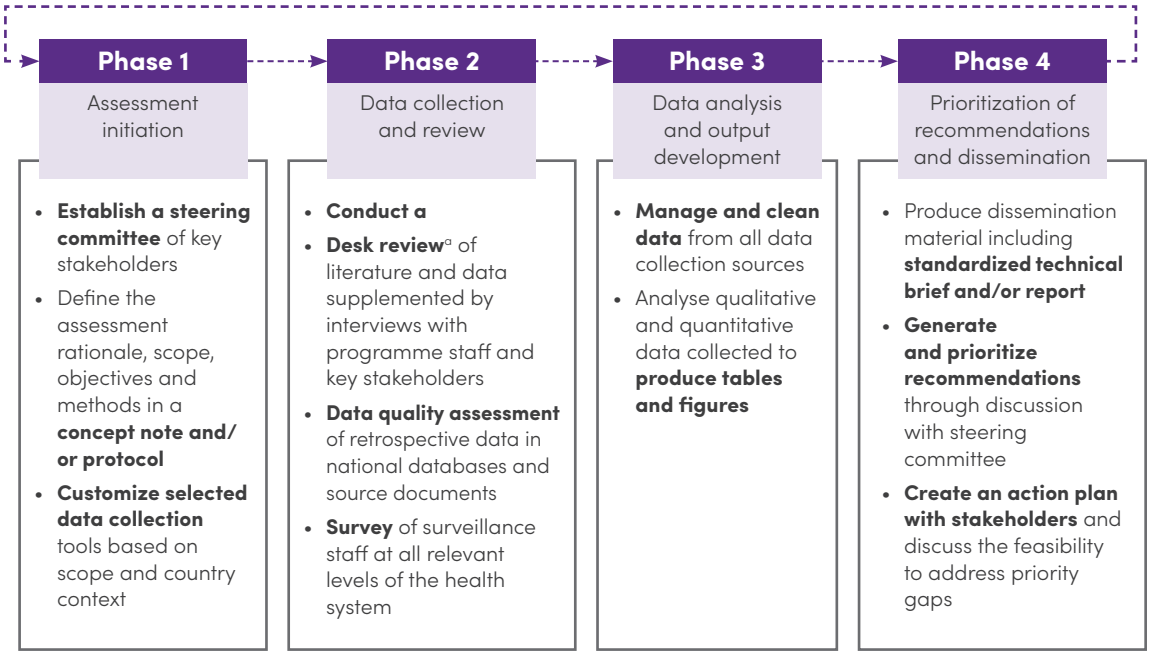
Table 3. Spectrum of assessment approaches using the toolkit

Approach	Rapid	Tailored	Comprehensive
Scope	Only priority indicators for surveillance of malaria cases and deaths by transmission setting (burden reduction and/or elimination), and priority indicators for other malaria control and intervention strategies implemented in the country selected for assessment	Priority indicators + user-selected optional indicators of interest for surveillance of malaria cases and deaths by transmission setting, and priority indicators for other malaria control and intervention strategies implemented in the country selected for assessment	All indicators for surveillance of malaria cases and deaths by transmission setting, and priority indicators for all other malaria control and intervention strategies implemented in the country
Methods	Primarily limited to desk review with a few essential site visits	Desk review and surveys at different levels of the health systems (i.e. national, subnational, a sample of facilities and community healthcare workers)	Desk review and surveys at different levels of the health system (i.e. national, subnational, a sample of facilities and community healthcare workers)
Estimated resource requirement	Low; 2–4 weeks	Medium/high: at least 3 months and up to 12 months depending on context	High: at least 3 months and up to 12 months depending on context
Suggested frequency	Once every 3–5 years in line with the MPR and NSP development. Annual in elimination settings or if desired in burden reduction settings to monitor progress towards improvements.	Once every 3–5 years in line with the MPR and NSP development. Annual in elimination settings depending on need and resources.	Once every 3–5 years in line with the MPR and NSP development. Annual in elimination settings depending on need and resources.

Implementation phases

A malaria surveillance assessment should be implemented in a country in four phases, as described in Fig. 1. The phases are recommended to be implemented in sequential order because each phase informs the phase that follows. The time and resources required to implement each phase will differ based on the scope and approach of the assessment.

Fig. 1. Implementation phases of a malaria surveillance assessment conducted using the toolkit



[a] The desk review may begin in phase 1 to inform the protocol or concept note.

Expected results of an assessment using the toolkit

Results for each indicator assessed may be presented in a dashboard, technical brief and/or report, or debrief presentation (Table 4).

Table 4. Methods of presentation of results of a malaria surveillance assessment

Method of presentation	Description
Dashboard of results for priority indicators	A set of results expected from all assessments conducted using the toolkit have been defined based on priority indicators and can be presented in a dashboard, which is available through the web application. The dashboard includes a scorecard that quantitatively summarizes (using a score) findings from priority indicators. The country can also add the reason for the score for each indicator by highlighting key achievements and challenges. A recommendation for strengthening surveillance can be included next to each indicator, if required. These scores summarized by sub-objective and objective can be compared between countries and over time on WHO regional and global dashboards.

Method of presentation	Description
Technical brief and/ or report of in-depth findings	Templates for dissemination of in-depth results include a summary of the methods, an in-depth description of assessment results (all indicators assessed), and narrative text to contextualize and interpret findings. Templates include example information systems and data flow diagrams. Prioritized recommendations should be included in these documents, once developed in collaboration with the steering committee, as well as an activity plan.
Debrief presentation	A slide set that includes background, methods, key results and recommendations

Results should be reviewed through a debrief presentation of key findings with the steering committee to collaboratively develop recommendations. Recommendations and associated activities will be prioritized in consultation with the NMP and other stakeholders, based on their impact and feasibility to strengthen surveillance systems. The prioritized recommendations can be used to inform action for surveillance system strengthening. Resulting activities can be followed up to track improvements over time.

Part B: Step-by-step implementation guide

This part details the steps and tools used for each phase of a malaria surveillance assessment. The tools in the toolkit are explained alongside the relevant step.

A malaria surveillance assessment is implemented in countries in four phases:

1. assessment initiation;
2. data collection and review;
3. data analysis and outputs; and
4. prioritization of recommendations and dissemination.

The four phases are outlined in Fig. 2, and the steps within each phase are summarized in Fig. 3. Each phase is described in detail in Table 5 and in the subsequent sections of this guide.

It is recommended that the phases are implemented in sequential order, because each phase informs the phase that follows. However, some overlap is expected between phases and steps; for example, some part of the desk review (step 2.1) will inform finalization of the protocol (step 1.2), and this will continue throughout the assessment, as new documentation becomes available. The process is cyclical, in that results from phase 4 inform the phase 1 of future assessments (Fig. 2).

Fig. 2. Phases of a malaria surveillance assessment conducted using the toolkit

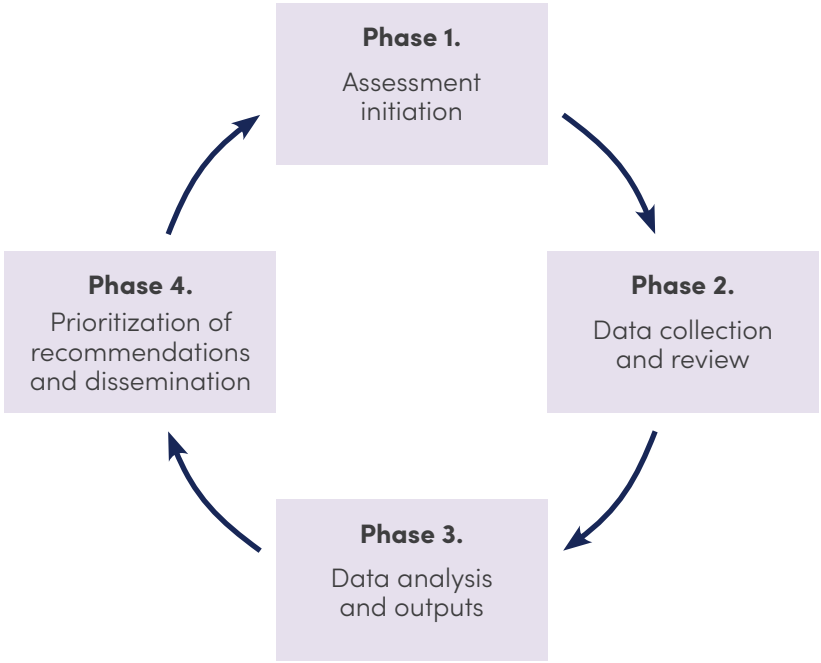


Fig. 3. Key steps in each phase of a malaria surveillance assessment conducted using the toolkit

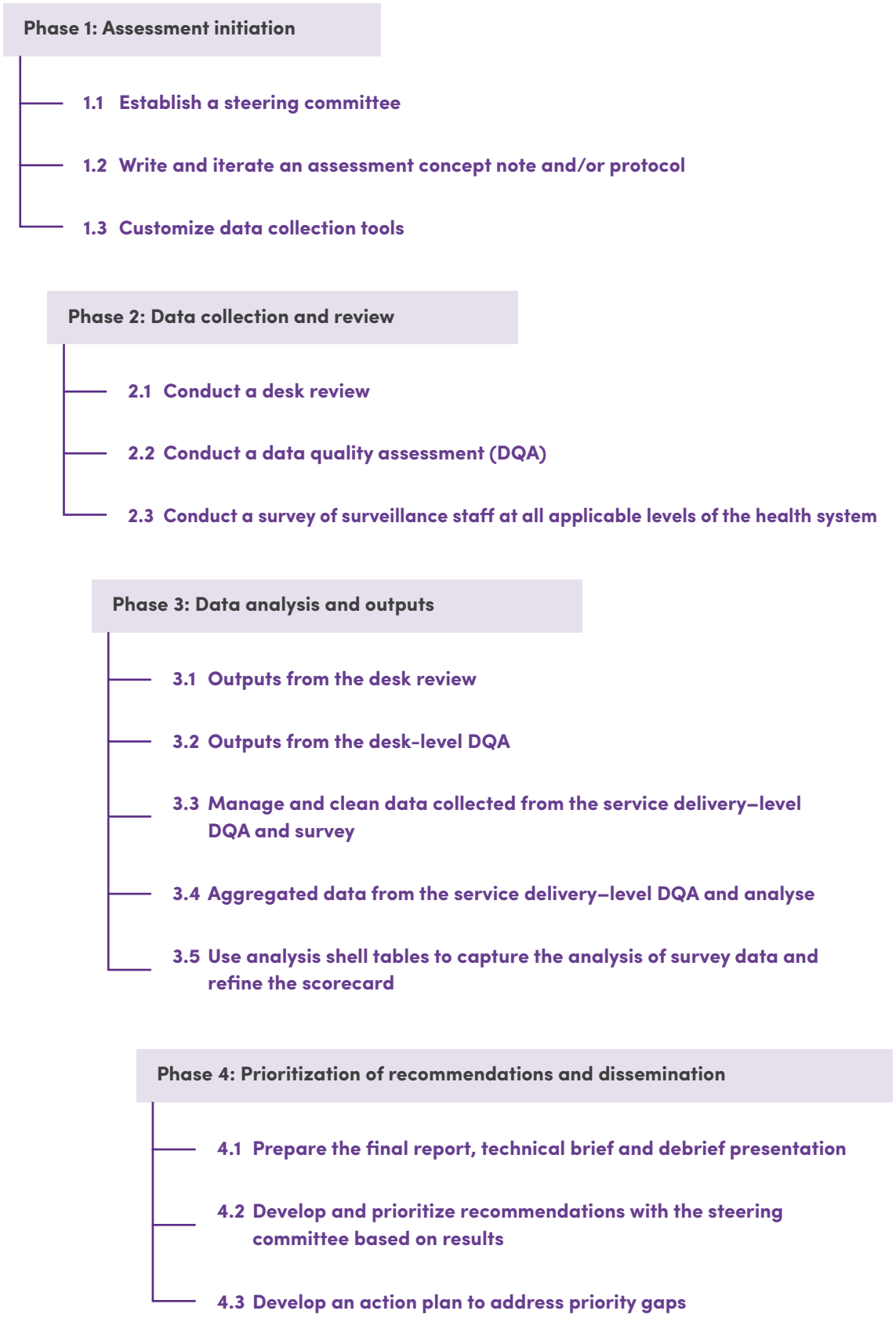


Table 5. Implementation checklist for key steps and deliverables for a malaria surveillance assessment conducted using the toolkit.

Steps	Completed
Phase 1: Assessment initiation	
1.1 Establish a steering committee of key stakeholders involved in the design and implementation of the assessment.	
1.1.1 Map stakeholder landscape (see Annex 1)	☐
1.1.2 Obtain buy-in and define roles and responsibilities for steering committee	☐
1.1.3 Introduce the malaria surveillance assessment and toolkit to stakeholders	☐
1.2 Write and iterate an assessment concept note and/or protocol	
The following steps should be carried out to complete the relevant sections in the concept note and/or protocol templates.	
1.2.1 Conduct an initial review of the past and current malaria surveillance situation	☐
1.2.2 Define the assessment scope and methods	☐
1.2.3 Define the sampling strategy of the assessment	☐
1.2.4 [Optional/as needed] Obtain a data-sharing agreement	☐
1.2.5 Prepare and obtain sign-off of estimated costs, resources and timelines	☐
1.2.6 [Optional/as needed] Submit application to institutional review board	☐
1.3 Customize data collection tools	
1.3.1 Select and filter content of data collection tools based on the scope and methods of the assessment	☐
1.3.2 [Optional/as needed] Contextualize and translate data collection tools	☐
Phase 2: Data collection and review	
2.1 Conduct a desk review	
2.1.1 Complete a document review using the Desk Review Tool	☐
2.1.2 Map out information systems, malaria recording and reporting tools, core variables and indicators in national databases	☐
2.1.3 Conduct key informant interviews with programmatic staff and stakeholders	☐
2.2 Conduct a data quality assessment (DQA)	
2.2.1 Select and compile data for core variables to be assessed for data quality	☐
2.2.2 [Optional/as needed] Post a request for proposal (or similar) for a data collection firm	☐
2.2.3 [Optional/as needed] Obtain sign-off on a data collection firm contract	☐
2.2.4 [Optional/as needed] Prepare, plan, and conduct Implementation training including piloting of data collection tools	☐

Steps	Completed
2.3 Conduct a survey of surveillance staff at all applicable levels of the health system (community health workers, health facilities and hospitals, and district/regional offices)	
2.3.1 Develop questionnaires using the Question Bank for each respondent type to be surveyed	☐
2.3.2 Conduct and monitor a survey of surveillance staff at all applicable levels of the health system	☐
Phase 3: Data analysis and outputs	
3.1 Outputs from the desk review	☐
3.2 Outputs from the desk-level DQA	☐
3.3 Manage and clean data collected from the service delivery–level DQA and survey	☐
3.4 Aggregated data from the service delivery–level DQA and analyse	☐
3.5 Use code and analysis shell tables to analyse survey data to refine scorecard estimates and produce other visualizations	☐
Phase 4: Prioritization of recommendations and dissemination	
4.1 Prepare the final report, technical brief and debrief presentation	☐
4.2 Develop and prioritize recommendations with the steering committee based on results	
4.2.1 Develop recommendations	☐
4.2.2 Use the prioritization matrix in the report outline to prioritize recommendations	☐
4.3 Develop an action plan to address priority gaps	
4.3.1 Disseminate the final report, as agreed upon with the NMP and steering committee, to in-country stakeholders and discuss the feasibility of measures to address priority gaps	☐
4.3.2 Create an action plan and incorporate activities into the MPR or NSP	☐

Phase 1: Assessment initiation

This phase includes discussions between the NMP, country partners and key stakeholders to determine the scope, objectives and methods of an in-country surveillance assessment, and to understand key surveillance gaps. The aim is to formulate a country-driven concept note and/or protocol to be submitted for ethical review, as necessary. The activities of this phase are to:

- identify existing surveillance assessment initiatives and surveillance strategies;
- map the stakeholder landscape, obtain buy-in from stakeholders, and agree on roles and responsibilities for the assessment;
- determine the scope, objectives and methods of the assessment;
- select the tools and content most relevant to the defined scope of work; and
- identify resources available and agree on overall timelines for the assessment.

1.1 Establish a steering committee of key stakeholders involved in the design and implementation of the assessment

Bringing stakeholders together and mobilizing them around the assessment is a critical first step towards successful implementation.

1.1.1 Map stakeholder landscape

One of the first activities is to identify which stakeholders are operating in the malaria surveillance space, and which surveillance strengthening activities are under way and supported by these stakeholders. The groups, individuals and organizations to consider are listed in Annex 1.

List the stakeholders involved in surveillance at all levels of the health system, then summarize the scope of work for each stakeholder. For each, list details such as name, description, interest in the assessment, resources available, and potential level of involvement in the assessment (Table 6).

This stakeholder map will be used throughout the assessment for activities such as setting up a steering committee for the assessment, determining who to interview, and determining who to include in processes for dissemination of results and action planning.

Table 6. Example of mapping malaria surveillance stakeholders

Name of stakeholder organization, group or individual	Stakeholder description[a]	Stakeholder's interest in the assessment[b]	Available resources[c]	Level of involvement in the assessment
Partner 1 (e.g. CHAI)	Evaluation of epidemiological, entomological and interventions surveillance systems	+ in favour O neutral – oppose	2 full-time staff and tablets for data collection	Invite to participate in key decision-making processes, such as vetting or approving the action plan and mobilizing resources to implement the action plan. Consult from time to time (informal or formal).
Partner 2				
Partner 3				
Partner 4				

[a] Primary purpose, malaria-specific activities, geographic scope of activities, time in the country, affiliation, funding source

[b] Support or oppose the assessment, to what extent, and why

[c] Staff, money, technology, information, influence

Adapted from *Performance of Routine Information System Management (PRISM) user's kit: moving from assessment to action.* Chapel Hill, NC: MEASURE Evaluation; 2018.

1.1.2 Obtain buy-in, and define roles and responsibilities for steering committee

From the stakeholders identified, a core group of stakeholders involved in surveillance strengthening activities should be approached to obtain buy-in for the assessment. These stakeholders can be mobilized to form a steering committee that will be involved in designing and assessing progress on implementation of the assessment. In some instances, existing surveillance and monitoring and evaluation (M&E) technical working groups may be used, rather than establishing a new steering committee, if all relevant stakeholders are included, expected responsibilities can be adopted and deliverables can be completed.

Staff from the NMP should be involved in the steering committee and take an active role in defining the assessment scope; data collection, validation and analysis; interpretation of results; and formulation of recommendations. Recommended NMP staff include:

- NMP manager;
- NMP data analyst or epidemiologist;
- NMP or HMIS M&E officer or data quality officer; and
- WHO National Professional Officer.

Roles of the steering committee could include:

- refining the scope, objectives, indicators and methods of the assessment;
- articulating the rationale for the assessment and expected outputs, according to the country's needs;
- supporting the planning, preparation and implementation of data collection for the assessment;
- conducting interviews;
- contributing to data analysis;
- assisting with interpretation of results;
- developing and prioritizing recommendations;
- participating in the dissemination and promotion of findings to inform surveillance strengthening action; and
- facilitating the development of an action plan with all surveillance stakeholders.

Deliverables from the steering committee include:

- action items from discussions at steering committee meetings;
- review of key documents (e.g. protocol, data collection tools, report); and
- final approvals of protocol, data collection tools and report.

1.1.3 Introduce the malaria surveillance assessment and toolkit to stakeholders

The malaria surveillance assessment and toolkit should be introduced to stakeholders. The **Introduction to the malaria surveillance assessment toolkit** presentation may be used or adapted for this introduction.

1.1.4 Prepare and obtain sign-off of terms of reference

Terms of reference should be drafted to highlight key participants, and responsibilities and deliverables of the steering committee. The terms of reference should be signed off by all members of the steering committee.

The steering committee should include donors investing in surveillance-relevant activities, ministry of health and NMP staff, implementing partners involved in surveillance and WHO.

To mobilize and coordinate these and other stakeholders, it is very useful to identify a high-level and influential country "champion" with decision-making powers. This could be someone within the NMP, the ministry of health or the national statistics office, or from a major programme area involved in health systems or malaria research in the country. The champion can help ensure that stakeholders understand fully the objectives of the assessment and how it fits into the overall process for surveillance strengthening and malaria control. Ideally, this champion will also advocate for, and take ownership of, the recommendations and next steps that result from the assessment.

1.2 Write and iterate an assessment concept note and/or protocol

The next step is to draft a concept note and/or protocol, which can be used to initiate discussions in the country; articulate key implementation activities and timelines; define and document the assessment scope, methods and sampling strategy; and estimate costs and timelines.

The toolkit includes a generic Concept Note Template and Protocol Template. Countries that wish to conduct a rapid assessment of the surveillance system can use a concept note, whereas more detailed assessments should be defined in a protocol. For comprehensive and tailored assessments, it may be necessary or helpful to put together a concept note before developing the full study protocol. The main difference between a concept note and a protocol are the order and level of detailed information provided on data collection procedures: the concept note is briefer, providing a summary for each of the sections listed below, whereas the protocol elaborates on the specifics.

Both documents include:

- background and rationale
- goal and objectives
- assessment scope
- methods
- expected outputs and outcomes
- ethical considerations
- workplan and budget.

Multiple iterations of the concept note or protocol may be expected at the initial stages of the assessment, based on stakeholder inputs.

In some cases, the Desk Review Tool (Box 2 in section 2.1) may be used to compile and organize information required to finalize the concept note or protocol, such as which sectors report case data, what other surveillance strategies are in place, and what information systems exist.

The following subsections give guidance on how to compile this information in coordination with the steering committee.

1.2.1 Conduct an initial review of the past and current malaria surveillance situation

To understand the malaria surveillance system in the country and why an assessment may be needed, a brief document review is suggested. Useful information includes:

- demographic, sociopolitical, financial and ecological drivers of malaria transmission in the country during the past 5 years;
- malaria epidemiology at national and subnational levels – this may be published in an annual report or MPR;
- surveillance strategies used and how they are implemented, including achievements and challenges – this information is normally outlined in the NSP;

- review of findings from any previous surveillance assessments, and any documentation on existing strengths and weaknesses in surveillance;
- relevant past, current and future surveillance strengthening initiatives – these may be available in the M&E plan; and
- rationale for the assessment.

This information can be organized in section 1 (Background and rationale) of the concept note or protocol.

1.2.2 Define the assessment scope and methods

When designing a surveillance assessment using the toolkit, the first step is defining the scope. This involves selecting the transmission setting for surveillance of malaria cases (burden reduction and/or elimination), the malaria control interventions and strategies used in the country for which to assess surveillance, and the indicators to include under each objective (Assessment Framework). These decisions will be driven by discussions between the NMP and partners, and should consider the information collated for the background and rationale, as well as available resources and expertise.

When starting to prepare for an assessment, the Assessment Framework Tool (Box 1) is the first point of reference. This tool allows users to define the assessment scope by selecting the following.

- The transmission setting for surveillance of malaria cases (burden reduction and/or elimination). The primary focus of the toolkit is surveillance of malaria cases in high-, moderate- and low-transmission settings (burden reduction), and/or elimination settings (includes case and focus investigations). If countries have subnational elimination activities, the surveillance assessment can be carried out using the elimination module for specific areas of the country and the burden reduction module for the rest of the country. In this situation, both burden reduction and elimination should be selected.
- The malaria control interventions and strategies used in the country for which to assess surveillance. The toolkit can be used within the broader integrated surveillance system for high-level assessment of:
  - intervention implementation surveillance – for chemoprevention (intermittent preventive treatment in pregnant women (IPTp), intermittent preventive treatment in infants (IPTi), seasonal malaria chemoprevention (SMC) and mass drug administration (MDA)) and vector control (insecticide-treated nets distributed through routine channels and/or mass campaigns, indoor residual spraying and larval source management);
  - commodity tracking;
  - entomological surveillance;
  - drug efficacy surveillance; and
  - genomic surveillance (drug resistance and *pfhrp 2/3* gene deletions).
- The goal of an assessment of these strategies is to understand what information is collected, and whether data are integrated and used along with routine surveillance data on malaria cases and deaths. The toolkit does not include data quality assessments or a survey for these strategies.
- The indicators to include in the assessment. Users can select indicators organized by sub-objectives under the objectives (1) performance, (2) context and infrastructure, (3) technical and processes, and (4) behaviour, as described in Table 2 of this document (in Part A).

A comprehensive assessment will include all indicators for surveillance of malaria cases by transmission setting and specific priority indicators for other malaria control interventions and strategies implemented in the country, whereas a rapid assessment will include only priority indicators. Additional selection steps are only required for tailored assessment approaches that include all priority indicators and a selection of optional indicators relevant to the country context.

Once a set of indicators is selected, the Assessment Framework Tool (Box 1) will indicate the most appropriate data collection methods to assess each indicator. A surveillance assessment conducted using the toolkit has two main methods of data collection: desk review and health facility surveys. These data collection methods are implemented at either national or service delivery levels (Table 7). For comprehensive or tailored assessments, key informant interviews of programme staff, and a data quality assessment (DQA) and/or survey of surveillance staff at service delivery levels should be carried out. For rapid assessments, all indicators can be assessed at desk level using the Desk Review Tool and the desk- level DQA. Some indicators may also be assessed at service delivery level through specific site visits; the country should decide which method is appropriate in the country context. In elimination settings, the rapid assessment requires both desk-level and service delivery–level components.

Table 7. Data collection methods and level of implementation

Data collection method	Implementation level	Tools	Process
Desk review	National	Desk Review Tool	Compile documents and data at the national level to review and describe surveillance system(s) Conduct key informant interviews at national and subnational levels, where appropriate
		Desk-level DQA and DHIS2 (District Health Information Software) dashboard[a]	Conduct initial DQA on retrospective data from national surveillance system(s)
Survey	Service delivery	Question Bank	Conduct interviews using questionnaires for each unit/ level to be surveyed
		Service delivery–level DQA[a]	Collect primary data from registers, and compare with aggregated reports from national/subnational level(s)

[a] In elimination settings, the DQA tools are combined.

This information can be summarized in sections 2 "Goal and objectives", 3 "Assessment scope" and 4 "Methods" of the concept note or protocol.

Box 1. Assessment Framework Tool

The Assessment Framework Tool is included in the toolkit to provide a standardized, yet modular, framework for malaria surveillance assessments that can be compared over time and across geographical areas. Use this tool to select the indicators under the four objectives that will be measured and tracked through the assessment. Detailed instructions are given in the tool itself.

Step 1. Select surveillance of malaria cases by transmission setting, and all malaria control interventions and strategies that are carried out in the country with surveillance.

Step 2. Select indicators under the relevant transmission setting based on priority category (priority indicators only = rapid assessment; all indicators = comprehensive assessment; priority indicators + selection of optional indicators = tailored assessment).

Step 3. Review and select methods required to assess each indicator, as necessary.

1.2.3 Define the sampling strategy of the assessment

For rapid assessments, a non-systematic approach to defining the sampling strategy is acceptable (see section 2.2.1).

Comprehensive or tailored assessments, where DQAs and/or surveys are planned at the service delivery level, will require systematic data collection and sampling of health facilities reporting malaria data. When a systematic DQA and/or survey is being implemented, the following need to be defined (Table 8):

- the sampling unit;
- the sampling frame;
- the calculation/formula and assumptions used to determine the sample size; and
- the sampling strategy (Table 8).

The sampling strategy may vary considerably from case to case, depending on the desired precision and type of estimates, the number of facilities and/or community healthcare workers in the country, and the specific objectives of the assessment.

It is recommended that a statistician is consulted to select an appropriate sampling strategy. Table 8 can be used as guidance for sampling for an assessment conducted using this toolkit.

It is recommended that the sample of health facilities used to conduct the service delivery–level DQA is the same as that for the healthcare worker interviews.

Table 8. Guidance on sampling strategy for service delivery–level data collection conducted for a comprehensive or tailored assessment

Sampling unit
For the service delivery–level DQA and surveys, the health facility is used as the sampling unit. For surveys, a fixed number of interviewees will be selected from the sampled health facilities.
Sampling frame
A sampling frame is a list of units (health facilities) from which the sample will be drawn. This should be determined as early as possible in the protocol development process in case a census is needed of facilities or other units to use as the sampling frame. A complete list of all facilities in a country (both public and private), with unique identifiers, should be used. This should include information on the relevant strata of interest: malaria transmission intensity, region/district, facility type, managing authority, and urban/rural designation for each facility. If a master facility list exists for a country, this can serve as the sampling frame. An initial list obtained from the ministry of health will usually need to be complemented with information from multiple other sources, such as private sector coordinating bodies; social ministries where non-governmental organizations register their activities; or directly from faith-based, private and government organizations. Where it is not possible to obtain a reliable sampling frame list of facilities, a dual-frame sampling methodology may be used *(12)*. This method combines a simple random sample of hospitals and large facilities with a sample of geographically defined areas in the country. Inclusion and exclusion criteria for participation in a surveillance assessment survey should be defined at the start. All health facilities that do not comply with the inclusion criteria should be removed from the sampling frame. For example, all service delivery points that provide malaria services would be included, except those that commenced in less than the past 3 months.
Sample size calculation
A methodology needs to be chosen to calculate a sample size for the service delivery surveys. The formula to calculate sample size that is used in the Service Availability and Readiness Assessment (SARA) *(13)* is recommended for the health facility–level surveys. The equation required to estimate the sample size is as follows. $n = [[(z^2 \times p \times q) + ME^2] / [ME^2 + (z^2 \times p \times q / N)]] \times d$ where: n = sample size z = confidence level at 95% ME = margin of error p = anticipated proportion of facilities with the attribute of interest q = 1 – p N = total number of health facilities in the sampling frame for the specific strata d = design effect

Parameter remarks:

n	sample size per strata
z	It is customary to use a 95% level of confidence, for which the corresponding value of Z is 1.96. Thus 2 × Z = 3.84.
ME	The margin of error is the amount of random sampling error in a survey's results. A margin of error of 15% is generally used.
p	Represents the "percentage of facilities with attribute X". For example, this can be the proportion of records submitted accurately and in time to DHIS2 (District Health Information Software). Some idea of the value of p is needed to use the formula to calculate sample size. The value of p used for the sample size calculation does not need to be very accurate (otherwise, there would be no need to conduct the survey), and it can be obtained from previous surveys conducted in the country, or from similar countries that conducted similar surveys. If p is not known, 0.5 can be used as a conservative estimate.
d	The design effect is a value that reflects the ratio of sampling variances, where the numerator is the variance of the sample design being used for the particular facility survey in question, and the denominator is the variance that would result if a simple random sample of facilities with the identical sample size had been used. The design effect reflects the effects of stratification, stages of selection and degree of clustering used in the facility survey. Generally, the clustering component, which is a measure of the degree to which two facilities in the same cluster have the same characteristic compared with two selected at random from the population of facilities, contributes the biggest effect. The design effect shows how unreliable the sample is compared with a simple random sample of the same size. For example, if the design effect were 1.2, the facility sample would have sampling variance 20% greater than an alternative design using simple random sampling. For a stratified sample drawn from a list frame without clustering, using the recommended sampling strategy for SARA, the design effect should be approximately 1.0. Therefore, it is recommended to use a value of d = 1.0 for a stratified list sample. If a different sampling strategy (e.g. a cluster sample) is used, the design effect could be higher. If a country has information from a previous survey that suggests the value of the design effect, this value should be used to calculate sample sizes. For the blend of list and area sampling mentioned earlier, it is recommended to use a value of d = 1.2.

Sampling strategy

The strategy that will be used to sample the number of units determined above needs to be chosen. Once the sampling frame has been established and the number of health facilities required per stratum has been identified, probability sampling principles are used to draw a selection of facilities for inclusion in the assessment. Usually, a multistage or stratified sampling plan is followed to ensure representation across various domains of the eligible facilities. In stratified random sampling, the sampling frame (the list of health facilities) is partitioned into strata (e.g. malaria transmission categories, regions, managing authorities, urban versus rural, combinations of these), which are then independently sampled.

Within each stratum, health facilities can be sampled using a probability proportional to size sampling to prioritize health facilities that, for example, report the highest number of malaria cases. Alternatively, health facilities can be selected at random (simple random sampling) from the list of health facilities for each stratum.

Replacements for facilities that are closed or otherwise cannot be accessed can be selected using the same method. This means that additional health facilities may be selected above the required sample size so that replacements are readily available. Alternatively, to facilitate logistics, the closest facility of the same type in the same geographical area can be selected.

Sampling strategy (cont.)

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Replacements for facilities that are closed or otherwise cannot be accessed can be selected using the same method. This means that additional health facilities may be selected above the required sample size so that replacements are readily available. Alternatively, to facilitate logistics, the closest facility of the same type in the same geographical area can be selected.

In elimination settings, the following criteria should be considered.

- Inclusion of all provinces, regions or districts that have active foci or ongoing transmission.
  - Health facilities should be stratified by the number of malaria cases reported (low, medium, high).
  - Both public and private health facilities should be included, as well as hospitals (or referral hospitals) and laboratories.
  - Interviews with all regional and district-level offices and a sample of community health workers should be carried out.
- Inclusion of provinces, regions or districts that have no malaria cases or sporadic cases.
  - Health facilities or laboratories that have reported cases in the past 3 years and a sample of health facilities or laboratories that have reported no cases should be included.
  - Health facilities could be stratified by risk of re-establishment of transmission in the defined geographical area, or malaria-free provinces, regions or districts could be stratified by the time when the last indigenous case occurred.
  - Both public and private health facilities should be included.
  - Interviews with all regional and district-level offices and a sample of community health workers should be carried out.
- Inclusion of declared malaria-free provinces, regions or districts.
  - Public and private health facilities should be included for review of vigilance in general services. For certification, it is important to assess whether a system is in place to sensitize and train physicians to suspect malaria based on symptoms, and follow up with testing.
  - Interviews with all regional and district-level offices should be included to review systems and reporting mechanisms, focusing on prevention of re-establishment and ensuring that any malaria case detected will be reported and investigated in a timely manner.

The country may wish to carry out interviews with all remaining provinces, regions and districts, including observing systems and mechanisms in place, to ensure that there is consistency throughout the country.

1.2.4 [Optional/as needed] Obtain a data-sharing agreement

A surveillance assessment involves analysis of retrospective data within malaria surveillance systems; therefore, if necessary, prepare a data-sharing agreement between NMPs and implementing partners. The data-sharing agreement should be drafted and signed by stakeholders who would have access to data and will be involved in data analysis, and should include the following.

- Detailed description of data points to be shared, including:
  - temporal and geographical disaggregation of the data needed, as well as other relevant metadata;
  - list of expected data sources; and
  - names of relevant owners of the data.
- Brief description of analysis to be conducted using the data.
- Summary of expected outputs.
- Explanation of how the outputs will be used and disseminated, including whether and where they will be published.
- Any relevant legal language particular to the partners involved.

1.2.5 Prepare and obtain sign-off of estimated costs, resources and timelines

Once the assessment scope, methods and sample are defined, the costs, resources and timelines for implementation can be estimated. These may vary widely by scope and country. The protocol and concept note include appendices for:

- a Workplan Template; and
- a Budget Template based on, and to be used alongside, the surveillance assessment planning tool.

The surveillance assessment planning tool is designed to assist countries in developing a costed budget for a comprehensive assessment. The tool includes a budgeting component which contains activities customizable to the country context, cost breakdown and allocation of units/persons to be costed for. The tool also includes a monthly and weekly planning schedule that countries can customize to fit country needs and timelines. The budgeting component allows countries to determine the amount of funds that will be required to carry out the assessment, as well as serve as a costing mechanism for this activity for future planning and integration.

For rapid assessments, costs are generally low. Countries should consider costs relating to the need for external consultants and for two stakeholder meetings that should be held at the beginning and the end of the surveillance assessment.

If the budget is not available for a surveillance system assessment under the current NSP, developing a concept note and/or protocol in advance of the next NSP development, or an MPR or mid-term review, can help to prioritize this assessment as a key activity for surveillance system strengthening.

This information can be summarized in sections 7 (Project oversight) and 8 (Workplan and budget) of the concept note and/or protocol.

1.2.6 [Optional/as needed] Submit application to institutional review board

This is only applicable to protocol submissions. Once the assessment protocol has been developed and reviewed by all relevant parties, including members of the steering committee, it should be presented to relevant institutional review board (IRB) committees, as relevant for the specific country and stakeholders involved. It is common for in-country IRB applications to take a few months to process; therefore, adequate planning should be under way as soon as a first draft of the protocol is available. IRB applications often require submission of draft data collection tools alongside the protocol; however, this may differ based on specific IRB committee requirements. Applicable IRB guidelines should be sought and reviewed in detail before submission.

Note that final customized and contextualized data collection tools from step 1.3 will need to be included in a final protocol submitted to the IRB.

1.3 Customize data collection tools

Finally, data collection tools can be adapted from those within the toolkit based on the specific scope, methods and approach of the assessment. These tools will also require country-specific contextualization. Once complete and agreed upon by the steering committee, these should be added to a final protocol for IRB submission.

1.3.1 Select and filter content of data collection tools based on the scope and methods of the assessment

Data collection tools are mapped to the indicators in the Assessment Framework Tool. Therefore, they can be filtered by adding or removing indicators. For the DQA component of the assessment, additional tailoring of tools will be required for the indicators and malaria-relevant variables that are selected for the assessment. Additional refinement may be necessary once data collection begins (e.g. information found in the desk review may be used to tailor questionnaires).In the current version of the toolkit, detail on how to filter the data collection tools is within the tools themselves. In version 2.0, this will be automated using the web application. More information on creating questionnaires from the Question Bank is available in section 2.3.1.

1.3.2 [Optional/as needed] Contextualize and translate data collection tools

All data collection tools require some adaptation for country-specific contexts. For example, the names of administrative units, surveillance staff roles, information systems and so on will vary between countries. Suggestions for where these adaptations may be required are within the tools themselves.

In addition, tools and supporting documents (i.e. concept note, protocol and questionnaires) may need to be translated into local language.

Phase 2: Data collection and review

A surveillance assessment conducted using the toolkit has two methods of data collection: desk review and survey. Based on the assessment scope and approach (rapid, tailored or comprehensive), one or both of these data collection options will be applicable.

Generally, the activities of this phase are to:

- compile existing documentation and data sets;
- map out malaria-relevant recording and reporting tools, variables and indicators;
- conduct a desk review and key informant interviews with programme staff;
- determine core malaria variables and indicators to assess for the DQA;
- request access to data from national databases;
- determine who will perform data collection activities, and recruit and train staff (if necessary);
- gather further information from the service delivery level; and
- conduct a survey of surveillance staff.

2.1 Conduct a desk review

To begin to understand the characteristics of the surveillance system and determinants of surveillance performance, a desk review of all available surveillance-related documents, guidelines and other literature, as well as some key data, should be completed. This review should be supplemented by key informant interviews with programme staff and surveillance stakeholders. Information can be summarized and organized into tables and figures in the Desk Review Tool, as described in Box 2. The process for the desk review should be consultative – that is, conducted alongside, or in communication with, technical or implementing partners, and working closely with the NMP and relevant stakeholders. It should also be iterative – that is, multiple updates made to the document as new information becomes available.

The desk review should be carried out for all surveillance assessments. It should ideally be started before the DQA to identify which source documents and national databases are used for surveillance of malaria cases and deaths. The desk review should also be completed before the survey so that the questionnaire response options can be modified based on information obtained in the desk review.

The following subsections give guidance on how to complete the desk review.

2.1.1 Complete a document review using the Desk Review Tool

All existing documentation and data should be compiled that are relevant to the assessment, based on the indicators selected, through engagement with relevant NMP personnel or partners, and online searches (see Annex 2). The Desk Review Tool indicates which documents

and data should be reviewed for each indicator. Note that names and availability of documents will vary by country.

It is particularly important that a master facility list (MFL) is requested and obtained. This is essential for assessments that will include a systematically sampled survey, where the MFL will serve as the sample frame. It is also necessary to evaluate whether all facilities on the MFL have reported cases to the national level. If the country does not have an MFL, note this as an immediate recommendation and defer to the WHO guidance for countries on strengthening their MFL *(14)*.

2.1.2 Map out information systems, malaria recording and reporting tools, core variables and indicators in national databases

All information systems, malaria recording and reporting tools, and variables from these tools and information systems or national databases should be mapped out. This involves identifying which systems, tools and variables exist, how they interact with each other and key gaps. This will require close collaboration and discussions with the NMP and/or ministry of health information teams.

Map information systems (Assessment Framework objective 2)

Develop a list of all information systems that capture malaria data and how they are, or are not, integrated. Use this to develop an information system diagram. Gather information on the key features of each system to allow identification of gaps and potential improvements in integration and interoperability.

Map tools for recording and reporting data (Assessment Framework objective 3)

Develop a list of the relevant recording and reporting tools used for malaria surveillance. It is important to note the dates that these tools were in use and when any changes in tools occurred. The coverage of each tool should also be documented – for example, whether specific tools are not standardized for the whole country and differ by health sector or geography. It is useful to obtain copies (e.g. screenshots) of these tools for reference and comparison.

Map core malaria variables and indicators that are collected and reported within information systems (Assessment Framework objective 3)

Annex 3 lists WHO-recommended core malaria variables and indicators that should be collected from routine surveillance for each strategy. These are often further disaggregated into categories (e.g. age, sex) or by health sector (e.g. public, private, community).

Obtain and review the list of all core malaria variables and indicators, along with their respective disaggregation, that are collected at service delivery, subnational and national levels. Note which data recording and/or reporting tool the variables originate from. If it is unclear which variables are used to calculate indicators, seek clarification from the NMP, ministry of health or respective database/information system managers.

Variable names or definitions may change over time. Note any changes, which will be important in interpreting the analysis later (e.g. confirmed cases changed from microscopy-positive only to microscopy-positive + rapid diagnostic test (RDT)-positive). Note that core malaria variables may not necessarily be specific to malaria (e.g. all-cause death).

Once variables and tools are mapped, the core variables for the DQA should be selected (see section 2.2).

2.1.3 Conduct key informant interviews with programmatic staff and stakeholders

Key informant interviews should be conducted with programmatic staff and various stakeholders involved in malaria surveillance to supplement the document review. A checklist of suggested interviewees is provided in Annex 1. The Desk Review Tool indicates which indicators should be assessed using key informant interviews. Qualitative analytical methods are not recommended because the interviews are not intended to be systematic, but rather aimed at filling knowledge gaps.

Surveillance staff sought for interviews will typically be national-level NMP, ministry of health and HMIS staff, as well as partners; however, interviews with subnational-level staff may be necessary in some contexts. The first step is to determine the interviewee list and objectives for each interview, given the interviewee's role in the malaria and/or surveillance programme, and the information gaps from the desk review that the person may be able to inform. For each interviewee or group, a separate interview guide should be developed based on questions provided in Box 2. Interviews may be conducted in person, over the phone or by teleconference, depending on what is feasible in the country. Interviews may be recorded for future reference.

Box 2. Desk Review Tool

The Desk Review Tool supports a desk-level review of malaria surveillance. Details on how to use the tool are provided in the tool itself.

The Desk Review Tool consists of a Microsoft Excel workbook that has tabs for each objective (and associated indicators) included in the Assessment Framework Tool. For each indicator, there are suggested documents to review, respondents to interview with questions, and a set of shell tables and figures that can be used to summarize and analyse the information and data compiled. The content can be filtered based on the indicators selected for the assessment.

Priority indicators that should be assessed for all other malaria control interventions and strategies are presented in a separate tab for each strategy.

2.2 Conduct a data quality assessment

Sound decisions are based on sound data. It is therefore essential to ensure that data are of good quality. A DQA is the process of evaluating data using specific data quality indicators (e.g. completeness, timeliness, consistency, concordance) to determine whether the data meet the quality required to support their intended use. A DQA using this toolkit will only be conducted for surveillance of malaria cases and deaths in both burden reduction and elimination settings. The toolkit does not provide DQA tools for assessment of malaria control interventions and strategies.

A DQA can be conducted at two levels:

- a desk-level analysis of the data that have been reported to national level (i.e. the data in national surveillance systems); and
- a service delivery–level assessment (or audit) to validate the data reported to the national level by using the primary source data (i.e. patient registers).

Both levels of assessment require extraction of retrospectively compiled data from national databases (e.g. HMIS, integrated disease surveillance and response (IDSR) system, malaria information system) for a specific period (suggested minimum of 3 years for a desk-level DQA and 3 months for a service delivery–level DQA in high-transmission settings, and up to 12 months in lower-transmission settings).

All surveillance assessments should include a desk-level DQA. The desk-level DQA does not require primary data collection. Routine surveillance data are extracted from the national malaria surveillance system and assessed for completeness, timeliness, consistency and concordance. In elimination settings, case-based data should be extracted. Although the assessment should be carried out on the primary national malaria surveillance system, if other systems also capture malaria cases and deaths, data should be extracted from these systems for comparison to ensure that cases and deaths are not being missed from the national malaria surveillance system. In elimination settings, it is particularly important to include data from an existing integrated disease reporting system such as an IDSR system or HMIS in the assessment, as this system is likely to become the primary reporting system for malaria once malaria has been eliminated.

The service delivery–level DQA (often termed an audit) requires primary data collection from primary data sources (e.g. patient registers, data collection forms) at the service delivery level. In burden reduction settings, data tallied from registers at health facilities is compared with aggregated data from weekly or monthly reports extracted from national databases. Comprehensive assessments should include a service delivery–level DQA with systematic sampling. Tailored and rapid assessments may wish to include a service delivery–level DQA with or without systematic sampling. In elimination settings, line-listed patient data extracted from the national malaria surveillance system should be compared with line-listed data from registers and case investigation forms for completeness and accuracy, checking that all diagnosed cases have been reported, assessing whether all confirmed cases are investigated and investigation forms can be located, and evaluating whether cases have been classified correctly.

The malaria surveillance assessment toolkit builds on the approach outlined in the WHO Data Quality Review (DQR) Toolkit *(15)*, which provides guidance for conducting a general DQA for health information systems, usually carried out by HMIS staff. The DQA that is part of this toolkit provides:

- additional standardized data quality indicators specific to routine malaria surveillance data;
- a more in-depth look at malaria-specific variables; and
- optional malaria-tailored tools for desk and service delivery levels.

The tools presented in this toolkit may not be required if tools or methods currently used to conduct DQA for the malaria programme in the country include the DQA indicators required for the assessment. Results from alternative DQA activities (e.g. recent HMIS DQA assessments or routine DQAs) may also be used rather than repeating data collection activities.

Furthermore, some surveillance platforms (e.g. District Health Information Software (DHIS2)) have built-in checks of data quality that can be used directly to examine DQA indicators.

The following subsections describe the steps for a malaria-specific DQA using the toolkit. Additional detail on the logistics and implementation of a service delivery–level DQA, such as roles and responsibilities, setting up a coordinating committee, timelines and budgets, are detailed in the WHO DQR implementation guide *(15)*.

2.2.1 Select and compile data for core variables to be assessed for data quality

All data quality indicators provided in the Assessment Framework Tool under sub-objective 1.2 (Data quality) are priority indicators and should be assessed. Data quality indicators are also summarized in Table 9.

Table 9. Data quality indicators and definitions

Indicator		Definition
Timeliness	of reporting	Percentage of expected reports received by the reporting due date in a specified time period
	of case notification reports	Percentage of case notification reports received <24 hours after detection, or as per guidelines
	of case investigation reports	Percentage of case investigation reports received <3 days after detection, or as per guidelines
	of foci investigation reports	Percentage of focus investigation reports received <7 days after detection, or as per guidelines
Completeness	of reporting	Percentage of expected reports that were received in a specified time period[a]
	of case investigation reports	Percentage of confirmed cases with a case investigation report
	of [1] core variables within reports	Percentage of reports received (or cases reported in elimination settings) in a specified time period where all core variables are complete
	of [1] core variables within registers	Percentage of registers (or cases reported in elimination settings) for a specified time period where all core variables are complete
Consistency	between selected [1] core variables	Percentage of reports received (or cases reported in elimination settings) in a specified time period where all [2] consistency checks between core variables are passed
	over time for [3] core indicator trends	Percentage of [3] core indicator trends that are consistent for a specified time period (suggested minimum is 3 years)

Indicator		Definition
Concordance	of [1] core variables between two reporting systems	Percentage of [4] core variable values that match between two reporting systems (or numbers of cases and deaths in elimination settings) in the same specified time period
	of [1] core variables between registers and reports[a]	Percentage of core variable values that match between registers and aggregated reports (or between line-listed patient data from the national malaria surveillance system and registers in elimination settings) in the same specified time period
Error in reporting[b]		Linked to concordance above; absolute value difference for each core variable between data source one (D1) and data source 2 (D2)

[1] Core variables are the minimum set of variables (referred to as data elements in DHIS2) that should be recorded in the malaria surveillance system and should be assessed for data quality. WHO-recommended core malaria variables for DQA are listed in Annex 4.

[2] Consistency checks between core variables are validation tests that ensure that the data collected make logical sense. Suggested consistency checks between core variables are listed in Annex 5.

[3] Consistency checks over time for core indicator trends are used to determine whether trends are consistent over time, or, where there are rapid changes, whether these changes can be explained. Rapid changes in data that cannot be explained indicate data quality issues. These checks should be conducted by plotting values for core indicators over time (month or year). Suggested checks using core indicators from malaria case surveillance are listed in Annex 6.

[4] Core variable values that match between two reporting systems are matching values for core variables that are reported in the primary malaria information system and values for the same variables reported to another information system (e.g. HMIS, IDSR system, laboratory, vital registration). The aim is to determine whether the primary case surveillance system has captured all cases and that the data are accurate.

[a] In elimination settings, if both aggregated and case-based systems exist, the number of notified confirmed cases from the two systems should be compared. Furthermore, if there are two systems capturing case-based data, the number of cases in the two systems should be compared. In countries where only one case-based system exists, the confirmed cases reported in the health facility registers should be compared with line-listed data extracted from the national surveillance system.

[b] These indicators require data collection at the service delivery level. Based on the objectives defined for the surveillance assessment and the resources and time available, a decision should be made on whether these will be assessed through systematic or non-systematic sampling.

Step 1. Identify which core variables will be used to assess data quality indicators

The first step is to identify which core variables are recorded and can be assessed for data quality. Refer to section 2.1.2 on how to map out core malaria variables and indicators in national databases, and recording and reporting tools.

Recommended core variables are listed in Annex 4. Countries should adapt the names in the variable list to those used by NMPs.

Issues to note for core variables selected include the following.

- Countries may select all or some malaria core variables from the recommended list, depending on availability. Additional variables of interest to a country can also be added. DQA tools can be customized to include these changes.
- Whether and when definitions for core variables have changed over time should be noted, because this may affect data quality of these variables.

- When comparing data between two information systems or between reports and registers, core variables need to be defined in the same way, and the geographical and temporal coverage of the systems must be the same (e.g. compare the same districts and the same time period).
- The following disaggregations are suggested:
  - by administrative unit (e.g. region, district) or health facility;
  - by time period (e.g. month, year);
  - by type of health facility (e.g. public, private, community); and
  - by outpatients versus inpatients if reporting forms are separate.

For some indicators, disaggregation may only be possible down to a certain level. For example, in high-burden settings where data are aggregated and reported in DHIS2 at a district level, completeness of core variables in reports can only be easily assessed down to district level through the desk-level DQA.

Step 2. Access or request data from national databases

Data can be directly accessed from national databases, or requested from the NMP, ministry of health or relevant database manager.

If data can be accessed directly from an information system (e.g. DHIS2), the data can be downloaded from the system. If data are extracted from DHIS2, accessing and extracting the data directly using the API may provide easier and faster access than using pivot tables.

If implementers do not have access to surveillance information system data, a request should be prepared for data access from the relevant ministry of health, the NMP, or other owners or managers of each malaria surveillance information system. The request should include:

- name and definition of variable or indicator, including calculations (numerator and denominator);
- geographical disaggregation needed (e.g. by district);
- temporal disaggregation needed (e.g. by month);
- time frame for which data should be extracted (e.g. 3 years, January 2017 to December 2019); and
- name of source document and information system from which the variables originate, if possible.

If possible, all relevant data should be requested within one data request to ensure efficiency. However, multiple requests may be required if subsets of data expected are missing.

It is recommended that data are extracted at the lowest administrative level possible within the system (for DHIS2 databases, this may be district in some countries and health facilities in other countries), and at the lowest temporal disaggregation available (e.g. weekly).

If there are multiple databases within a country (e.g. multiple instances of DHIS2), relevant data should be extracted from all available databases. Extractions from multiple databases should be as comparable as possible (e.g. a common geographical and temporal disaggregation).

If data quality checks and visualizations are already built into electronic systems, these can be used directly in the assessment without the need to extract and analyse the data separately. However, it is likely that some additional analysis beyond what is available through an existing system may be useful in most countries. Guidance on data analysis is provided in Phase 3 of this document.

Step 3. Conduct a desk-level DQA using the DQA Desk Level Assessment Tool

Extracted data can be pasted into the database template of the DQA Desk Level Assessment Tool, which is a Microsoft Excel workbook. Data quality indicators will be automatically calculated and displayed as graphics and tables at both the national and subnational levels. A summary table of all data quality indicators at the national level is also provided. Details on how to use the tool are included in the tool itself.

Step 4. Determine what data collection points will be included in service delivery–level DQA

Data collection from service delivery points may be done in parallel with the survey (see section 2.3), since the sampling frame is the same, or as part of routine supervision or other programmatic facility visits. Determine what facilities will be audited through the service delivery–level DQA. Detailed information on systematic sampling is in section 1.2.3.

For rapid or tailored assessments in burden reduction settings, a comprehensive DQA at service delivery level is not required, but it is important to gain an idea of key gaps and issues that can be addressed as part of surveillance system strengthening activities. In this case, two low-burden and two high-burden health facilities and/or community healthcare workers in two or three districts (or relevant subnational level) can be selected as part of the review. The NMP could use this as an opportunity to investigate facilities with known challenges, and to visit facilities that have good reporting and data quality to learn lessons from best practice. These visits can be used to assess data quality from patient register books and reporting tools, recording and reporting tools themselves, data flow, and verification/validation of responses from the desk review.

If the DQA is being implemented in an elimination setting, both the desk-level and service delivery–level DQA is required. Tools to assess both aggregated data (burden reduction) and case-based data (elimination) may be required if the country has a mix of aggregated and case-based surveillance systems.

Step 5. Designate staff for data collection and review activities, and initiate processes for appointing additional staff as needed

The minimum personnel required for a malaria assessment conducted using the toolkit are:

- assessment manager or lead for overseeing all applicable data collection activities (i.e. DQA, desk review and survey); and
- data analyst(s) to conduct document review and desktop retrospective DQA analysis.

If service delivery–level data collection (DQA and/or interviews) is conducted, additional personnel are needed:

- field supervisors;
- data collector(s);
- data analyst(s) to manage and analyse survey and DQA data; and
- data entry personnel (if data are collected using paper-based tools).

In some cases, service delivery–level data collection may be conducted alongside other planned or routine programme activities. If not, a data collection firm may be required to provide the human resources to undertake the survey and/or audit data recording and reporting material.

Step 6. Collect data from source documents for service delivery–level DQA

The DQA Service Delivery–Level Assessment Tool is used to collect primary data. This tool should be used for both systematic and non-systematic sampling to ensure consistency in approach and analysis. Details on how to use the tool are included in the tool itself. The tool is used to gather data from routine data collection tools (e.g. registers at service delivery levels) and compare it with aggregated reports received at the national or district level (health facility reports) in burden reduction settings, or with case-based data in elimination settings.

In burden reduction settings, the tool should first be populated with the aggregated report data for the health facility being assessed. The primary data for the same variables captured in the health facility register can then be entered for comparison. In elimination settings, the tool should be populated with case-based data extracted from the national malaria surveillance database and compared with cases in the registers or data collection forms.

The tools are adaptable, to allow core variables that have been selected to be added or to change names of existing core variables. It is important that the names of the core variables in the tool are changed to those used by the country. The data source can also be changed to allow data to be compared from different data collection sources (e.g. outpatients versus inpatients, health facility versus laboratory). The time frame recommended is 3 complete months in high-transmission settings and up to 12 months in low-transmission settings, ending with the month before data collection began.

Step 7. Collate the data into a national location for service delivery–level DQA using systematic sampling

Once the DQA Service Delivery–Level Assessment Tool has been completed for each facility selected, the data need to be compiled into one data set for analysis.

There are three options for this process.

- The DQA Service Delivery–Level Assessment Tool in Microsoft Excel can be programmed as an electronic data collection form (e.g. using the ODK data collection platform). This means that data collected from each service delivery point or subnational location can be entered, sent and automatically aggregated into a single database.
- A macro (developed by PATH) is available in Excel to aggregate individual DQA service delivery–level assessment workbooks from each service delivery point or subnational location into a single database.
- Data can be entered into a database (e.g. Access) manually or by another bespoke solution.

The final report should include a single set of DQA outputs, presented within the DQA dashboard of the DQA Service Delivery–Level Assessment Tool.

2.2.2 [Optional/as needed] Post a request for proposal (or similar) for a data collection firm

If an external data firm is being contracted to perform partial implementation of the assessment (e.g. primary data collection at the service delivery level), a request for proposal may be published to ensure a fair application and selection process. Such requests should be published as per country guidelines, using country-specific templates. However, the following content should be included:

- a brief overview of the assessment (can be extracted from the concept note);
- a table that summarizes the phases and activities that the data firm will be involved in;
- a description of relevant tools from the toolkit, and links to them;
- a list of specific activities that the data firm and supporting partners will perform;
- a list of deliverables expected from each party, along with timelines; and
- a summary of communication and reporting that is expected.

2.2.3 [Optional/as needed] Obtain sign-off on a data collection firm contract

For an external data firm to be successfully contracted, a signed contract is required (with signatures from all relevant parties – the contractor and the managing party). Contractual requirements and formats will differ between organizations; however, the following content should be included, in addition to relevant legal language required for the partners responsible:

- a list of specific activities that the data firm and supporting partners will perform;
- a list of deliverables expected from each party, along with timelines;
- a summary of communication and reporting that is expected;
- a detailed workplan; and
- a detailed budget.

2.2.4 [Optional/as needed] Prepare, plan and conduct implementation training, including piloting of data collection tools

Implementation training is required for comprehensive or tailored assessments that have primary data collection at the service delivery level. For implementation personnel (data collectors, supervisors, data entry personnel and data analysis personnel), comprehensive training is essential to ensure consistent and reliable completion of the malaria surveillance assessment. The overall objectives *(14)* of the training are to:

- ensure that personnel are familiar with the larger context and rationale for the assessment, key activities within the assessment and how they will be conducted;
- provide data collection teams with an opportunity to participate in practical exercises so that they can practise data collection using tools;
- ensure that personnel understand their roles and responsibilities in the survey, including specific tasks, timelines, reporting requirements and deliverables;
- ensure that personnel are aware of common issues that may arise during survey activities, and understand troubleshooting/problem-solving strategies to address these issues;

- ensure that personnel recognize the intrinsic value of good-quality data and are motivated to ensure data quality as part of their activities;
- support planning of data collection, supervision, data entry and analysis operations, and logistics.

Data collector and supervisor training should be organized just before implementation of primary data collection. However, data collectors should also pre-test and pilot tools during the process. Ideally, survey tools should be immediately updated and ready for use in the field.

2.3 Conduct a survey of surveillance staff at all applicable levels of the health system (community health workers, health facilities and hospitals, and district/regional offices)

A survey implemented using this toolkit involves undertaking structured interviews at various levels of the health system using the methodology of a systematic cross-sectional survey, to collect information on outstanding indicators or to validate information from desk-level assessment.

The survey may be administered to surveillance staff at subnational levels (district, regional), as well as to surveillance staff (often healthcare workers) at the service delivery level (including hospitals and health facilities) and at the community level (community health workers). A questionnaire should be developed and tailored for each of these health system levels (respondent types). The survey may be conducted in parallel or after the DQA at service delivery level. The sampling frame for the survey should be the same as for the DQA (see section 1.2.3 for more information on systematic sampling).

For rapid and tailored assessments, rather than conducting a systematic survey, non-systematic interviews are conducted as part of the service delivery–level DQA, with additional visits to key partners, if necessary. The aim is to validate information found in key documents, fill knowledge gaps and verify information that has been recorded as part of the desk review.

2.3.1 Develop questionnaires using the Question Bank for each respondent type to be surveyed

A survey conducted using the toolkit will use questionnaires developed using the Question Bank. The Question Bank is designed to provide a comprehensive list of questions corresponding to all applicable indicators in the Assessment Framework. The questions should be customized and organized into questionnaires for each country context and for all relevant levels of the health system. The steps for developing questionnaires are described in Box 3.

2.3.2 Conduct and monitor a survey of surveillance staff at all applicable levels of the health system

The standard steps involved in the survey are as follows.

1. Identify target interviewees. There may be several staff responsible for surveillance, in which case multiple interviews may be conducted to yield data that are representative for that facility or office. However, a single interview can be used if there is one staff member who can provide responses to questions as a representative of the unit of interest (e.g. facility).

2. Introduce data collection methods to the health facility, relevant care provider or surveillance staff. Data collectors should have a script or have been trained on introducing the purpose, objectives and overall content of the survey to those being interviewed so that they are informed about the process and able to consent to the interview. An example of an introduction between the interviewer and interviewee is provided within the Question Bank.
3. Obtain consent. Each questionnaire includes a section that confirms that consent has been obtained from each participant. Written or verbal consent must be obtained from all interviewees before conducting the interview.
4. Conduct the interview. Each interview should be conducted in the same way. The interview should not exceed the expected time stated in the training or field manual. Parts of the questionnaire may be implemented as a self-assessment – that is, provided to the interviewee to fill in themselves, rather than through an interview. Self-administered assessment tools can be gathered either during the first survey team visit or at another time.
5. Monitor data collection. During data collection (both the service delivery–level DQA and survey), it is recommended that data collection is monitored closely. Some best practices are described below.

Frequency

For the initial phase of data collection (e.g. 1 week), data submitted should ideally be reviewed at the end of each data collection day. End-of-day feedback should be provided to the data collection team, supervisors and teams responsible for updating data collection tools. After this phase, data monitoring checks can be less frequent.

Report

A short data monitoring report should be developed each day, which includes the following:

- summary of the number of data collection events, organized by data collection team and/or region/district (compared with what was expected in the initial plans);
- summary of missing, incorrect, incomplete or duplicate data;
- any other unexpected responses; and
- recommendations for how to correct course in the field and how to improve the data collection tool itself.

Box 3. Question Bank

The Question Bank provides a comprehensive list of questions corresponding to all applicable indicators in the Assessment Framework. The Question Bank is structured so that separate, tailored questionnaires can be developed for each level of the health system (respondent type) to be interviewed.

Questionnaires will require further country contextualization. Notes are provided within the Question Bank to indicate where this may be required. However, each questionnaire should be thoroughly reviewed, edited and piloted before implementation in a new context.

Steps for developing questionnaires from the Question Bank are as follows.

Step 1. Filter the Question Bank based on indicators

The Question Bank content can be filtered based on the indicators selected in phase 1 of the assessment using the "Indicator Number" column. Remove content that is not applicable to this assessment. This is done automatically if the Assessment Framework and Question Bank files have been linked (details are included in the tools themselves).

Step 2. Filter by respondent type

For each level of the health system to be included in the survey (subnational level – surveillance office/unit, service delivery level and community level), generate separate questionnaires using the "Respondent type" columns.

Step 3. Copy and paste, and contextualize questionnaires

Once the Question Bank is filtered for indicators and respondent type, copy the remaining questions and paste into either a Word document (for paper-based data collection) or Microsoft Excel (for data collection software such as ODK).

Additional formatting, country contextualization and translation to local languages will be required. Background information can be added to each questionnaire.

Phase 3: Data analysis and outputs

The toolkit provides guidance and tools for analysis of data collected from the desk review, the DQA and the survey. Most of the outputs are generated automatically from the tools. Expected outputs are described in Table 10.

Table 10. Expected outputs from data collection using the toolkit

Activity	Outputs	Tools and methods of analysis
Desk review	• Key tables and figures completed as part of the desk review. • Scorecard for priority indicators. Results from the desk review are used to determine whether priority indicators have been met, partially met or not met, based on specified criteria. These results are used to automatically populate a scorecard for each indicator and calculate composite scores for each sub-objective and objective. • Surveillance system diagrams on information systems and data flow	Tables and figures are included in the Desk Review Tool for each indicator. The scorecard is generated automatically for priority indicators based on the inputs for whether indicators have been met, partially met or not met. Diagrams should be generated by the country. Examples are provided in the toolkit.
DQA – desk level	• Tables and figures for each data quality indicator at the national and subnational levels • A summary table for each indicator at the national level • Scorecard	Tables and figures are automatically generated using the DQA Desk Level Assessment Tool, including the summary table at the national level. Alternatively, countries can use screenshots or download graphics from their own surveillance systems (details of other options are presented in Box 4). The scorecard in the Desk Review Tool can be completed manually for DQA indicators.
DQA – service delivery level	• Summary table for data quality indicators at the national level	Results aggregated at the national level should be entered into the summary table provided in the DQA Service Delivery–Level Assessment Tool.
Survey	• Survey response data presented in tables	Analysis shell tables to capture aggregated data at each health level for each question in the questionnaire are provided as part of the toolkit.

The activities of this phase are to:

- collate the outputs from the desk review and the desk-level DQA;
- clean and manage data collected from the service delivery–level DQA and the survey;
- analyse data collected from the service delivery–level DQA; and
- analyse data collected from the survey.

3.1 Collate outputs from the desk review

As described in section 2.1, data collected from document and data review, and interviews are organized in tables and figures in the Desk Review Tool. Selected tables and figures can be used directly as key outputs in the final report.

For priority indicators, a scorecard is automatically generated based on the inputs to the Desk Review Tool about whether an indicator as been met, partially met or not met. Results are calculated and displayed for each indicator, and composite scores are calculated for each objective and sub-objective. More detail is provided in the Desk Review Tool on the calculations used for each score. This scorecard is the final output, which should be used to identify key areas for improvement. The reasons for the score given to each indicator should also be captured, highlighting key achievements and challenges, as well as a recommendation for surveillance strengthening and improvement.

Surveillance system diagrams should be developed manually and presented in Microsoft PowerPoint. The diagrams should be reviewed and edited as information is gathered throughout the assessment. It is helpful to provide diagrams of the current situation on information systems and data flow, as well as diagrams of future plans and changes.

Tables, figures, the scorecard and the diagrams should be inserted in the technical brief and/or report templates and used in consultation with the steering committee to develop recommendations for surveillance strengthening.

3.2 Collate outputs from the desk-level DQA

The DQA Desk Level Assessment Tool provides automated outputs of tables and figures for each data quality indicator on a set of dashboards, which can be used directly in the final report. A summary table of national-level results for each indicator is also provided. A DQA dashboard has also been developed as part of the burden reduction malaria module in DHIS2; this displays the same outputs and therefore offers an alternative to using the DQA tool if the malaria module is installed in the country. There are also various options for analysing and visualizing results for the DQA, depending on country context (Table 11).

Table 11. Options for desk-level DQA analysis

	Option 1	Option 2	Option 3
Tool	Existing data quality dashboard that is part of the malaria surveillance system or WHO DQ dashboard in the DHIS2 malaria module	DQA Desk Level Assessment Tool	WHO DQ app
Requirements	Country has an electronic surveillance system with a data quality dashboard with all data quality indicators required for the assessment or Country has DHIS2 Country has WHO malaria module with all dashboards or in-country-developed malaria module installed for DHIS2, with or without data quality dashboard[a]	Country does not have a dashboard with all data quality indicators required for the assessment, so data must be extracted for analysis	Country has DHIS2 Country conducts DQR using WHO DQR app
Instructions	The country can use screenshots directly from the data quality dashboards for the report. If using DHIS2, the report function can be used to generate multiple graphs for each indicator. If the country has a DHIS2 malaria module that does not have the recommended data quality dashboard, this dashboard can be installed, and variables can be mapped to populate it. WHO can provide assistance.	Data required for analysis should be extracted from the surveillance system and pasted into the database template in the tool, which will automatically generate outputs.	The country can use screenshots directly from the DQR app. This app is primarily used by HMIS staff and looks at multiple diseases; therefore, not all malaria-specific indicators are available. It should therefore be used in conjunction with option 1 or option 2. The app provides the ability to drill down to the lowest geographical level to investigate the source of data discrepancies.

[a] If the WHO module does not exist or requires an update, or an in-country-developed malaria module is used that does not include a DQ dashboard, the current malaria module can be installed using **WHO Configuration Packages for DHIS2**. This would involve entering or importing retrospective data into the malaria module, which can be done using the documentation links in WHO Configuration Packages for DHIS2. In collaboration with WHO, the dashboard can be configured into the NMP's malaria module to conduct a DQA. Along with the dashboard, WHO provides guidelines for dashboard use and indicator interpretations.

3.3 Aggregate data from the service delivery–level DQA and analyse

To collect, compile and analyse data for the service delivery–level DQA, there are two suggested options.

- Use an Excel template with built-in macros – for example, a tool that PATH developed with Excel macros, which aggregates individual DQA service delivery–level assessment workbooks from each service delivery point or subnational location into a single database, and provides functionality for automated DQA analyses.
- Develop an electronic DQA service delivery–level data tally sheet (e.g. in ODK) that automatically compiles data into a central database, from which required analyses can be conducted.

The final report should include a single set of DQA outputs, combining results from both the desk-level and service delivery–level DQAs into a single dashboard. Instructions to produce the minimum set of suggested visualizations are provided in the DQA tool.

3.4 Manage and clean data from the survey

All quantitative data collected through the survey should be compiled into a single database for further analysis. There are two suggested options for this.

- Questionnaires programmed as electronic data collection forms (e.g. ODK) are completed, sent and automatically aggregated into a single database.
- Paper-based or Excel-based questionnaire data can be manually entered or collated into a single database.

Standard data management practice should be followed – for example, keeping all raw data files in a separate secure location, anonymizing sensitive information and maintaining a log of data-cleaning steps implemented.

3.5 Use analysis shell tables to capture results of survey data

An Excel workbook containing shell tables to capture analysis results for each indicator assessed in the survey is available. Each table is linked to the related indicator and question(s) used to assess that indicator. The workbook includes suggested disaggregation (e.g. by health facility type or subnational level); however, these should be adapted based on the sampling strategy used. Data tables may be created in statistical software such as R or Stata and formatted similarly to the analysis shell tables. These can then be copied or manually entered into the shell tables, where percentages are then automatically calculated. It is important to visualize data at the administrative level, which is the most useful for developing operational plans. Where relevant, data tables may be used to produce charts or maps that better illustrate results. It is recommended that results are viewed on maps or charts for performance indicators (objective 1) alongside indicators on drivers of performance (objectives 2–4) to get a better understanding of why performance may be poor in certain districts or regions.

Phase 4: Prioritization of recommendations and dissemination

This phase includes review of findings and development of recommendations for surveillance system strengthening. It also includes incorporating prioritized recommendations and an action plan into the final report, and disseminating results to all stakeholders involved in malaria surveillance, at the country and global levels.

The activities of this phase are to:

- produce material for dissemination, including a standardized report, a technical brief and a presentation;
- develop and prioritize recommendations through discussion between the NMP and key stakeholders;
- develop an action plan to address priority gaps; and
- evaluate the assessment itself to validate results, and inform further refinement of the toolkit and future implementations of malaria surveillance assessments.

4.1 Prepare the final report, technical brief and debrief presentation

Once assessment data have been analysed and results produced, these should be displayed along with narrative and interpretation in dissemination materials.

Templates for a technical brief and final report have been developed to support the systematic presentation of surveillance assessment results (Box 4). The debrief presentation and the technical brief highlight priority results, whereas the report serves as an outline for presenting all results from all indicators and strategies that may be included in the assessment.

Within each template, placeholders are provided to insert standardized outputs from the desk review, the DQA and the survey. These templates should be adapted according to the assessment scope and data collection methods selected.

Report templates include:

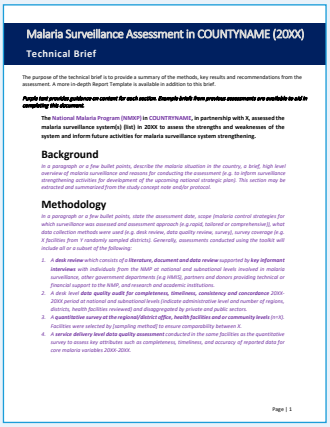
- detail on background, rationale, scope, objectives and methods, which can be extracted and summarized from the assessment concept note and/or protocol, including tables relevant to each section;
- the results section, which includes guidance on outputs to add from analysis, and how to describe and interpret results; and
- sections on generating and prioritizing recommendations based on results, which should be completed through a process with the steering committee (described in section 4.2).

The presentation should be used to initiate discussions between the NMP and stakeholders on the findings. It can also be used to develop and prioritize recommendations, and to rapidly disseminate results from the assessment to donors and other partners.

Multiple iterations of the technical brief and/or report may be expected as data become available, and based on NMP and relevant stakeholder inputs. The NMP should be happy with the final report before sharing it more widely with donors and other partners.

Box 4. Technical brief and report

The technical brief and report tools are included in the toolkit to support the dissemination of results from the assessment. The objective of these tools is to organize results and outputs. The tools also provide guidance for describing and interpreting results that will be presented to the steering committee to generate recommendations.



Malaria Surveillance Assessment in COUNTYNAME (20XX)

Technical Brief

The purpose of the technical brief is to provide a summary of the methods, key results and recommendations from the assessment. A more in-depth Report Template is available in addition to this brief.

Purple text provides guidance on content for each section. Example briefs from previous assessments are available to aid in completing this document.

The National Malaria Program (NMCP) in COUNTRYNAME, in partnership with X, assessed the malaria surveillance system(s) (list) in 20XX to assess the strengths and weaknesses of the system and inform future activities for malaria surveillance system strengthening.

Background

In a paragraph or a few bullet points, describe the malaria situation in the country, a brief, high level overview of malaria surveillance and reasons for conducting the assessment (e.g. to inform surveillance strengthening activities for development of the upcoming national strategic plan). This section may be extracted and summarized from the study concept note and/or protocol.

Methodology

In a paragraph or a few bullet points, state the assessment date, scope (malaria control strategies for which surveillance was assessed and assessment approach (e.g.rapid, tailored or comprehensive)), what data collection methods were used (e.g. desk review, data quality review, survey), survey coverage (e.g. X facilities from Y randomly sampled districts). Generally, assessments conducted using the toolkit will include all or a subset of the following:

1. *A **desk review** which consists of a **literature, document and data review** supported by **key informant interviews** with individuals from the NMP at national and subnational levels involved in malaria surveillance, other government departments (e.g HMIS), partners and donors providing technical or financial support to the NMP, and research and academic institutions.*
2. *A desk level **data quality audit for completeness, timeliness, consistency and concordance** 20XX-20XX period at national and subnational levels (indicate administrative level and number of regions, districts, health facilities reviewed) and disaggregated by private and public sectors.*
3. *A **quantitative survey at the regional/district office, health facilities and or community levels** (n=X). Facilities were selected by [sampling method] to ensure comparability between X.*
4. *A **service delivery level data quality assessment** conducted in the same facilities as the quantitative survey to assess key attributes such as completeness, timeliness, and accuracy of reported data for core malaria variables 20XX-20XX.*

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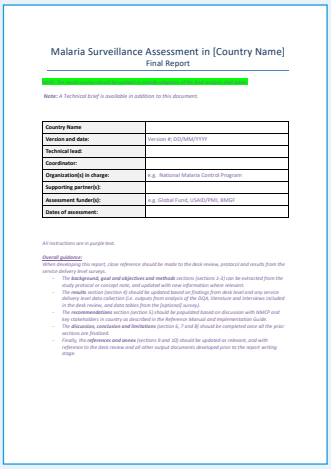
The technical brief is a short document highlighting key findings from priority indicators. This document provides the minimum expected dissemination material for an assessment conducted using the toolkit, and is structured to allow standardization across assessments.



Malaria Surveillance Assessment in [Country Name]

Final Report

Note: A Technical brief is available in addition to this document.

Country Name	
Version and date:	Version #, DD/MM/YYYY
Technical lead:	
Coordinator:	
Organization(s) in charge:	e.g. National Malaria Control Program
Supporting partner(s):	
Assessment funder(s):	e.g. Global Fund, USAID/PMI, BMGF
Dates of assessment:	

All instructions are in purple text.

Overall guidance:

When developing this report, close reference should be made to the desk review, protocol and results from the service delivery level survey.

- *The **background, goal and objectives and methods** sections (sections 1-3) can be extracted from the study protocol or concept note, and updated with new information where relevant.*
- *The **results** section (section 4) should be updated based on findings from desk level and any service delivery level data collection (i.e. outputs from analysis of the DQA, Verotrace and interviews included in the desk review, and data tables from the [optional] survey)*
- *The **recommendations** section (section 5) should be populated based on discussion with NMCP and key stakeholders in country as described in the Reference Manual and Implementation Guide.*
- *The **discussion, conclusion and limitations** (section 6, 7 and 8) should be completed once all the prior sections are finalized.*
- *Finally, the **references and annex** (sections 9 and 10) should be updated as relevant, and with reference to the desk review and all other output documents developed prior to the report writing stage.*

The report template covers all indicators that might be assessed using the toolkit, and therefore a comprehensive guide to organizing and interpreting results.

4.2 Develop and prioritize recommendations with the steering committee based on results

Upon completion of the analysis, evidence-based recommendations should be developed and prioritized.

4.2.1 Develop recommendations

To encourage and promote ownership of the assessment results and recommendations, a consultative process should be taken with the steering committee. This could be done during a debrief or high-level meeting.

- In advance of this meeting, the NMP and supporting partners should meet to discuss the key findings and suggested recommendations. Steering committee members should then be given a preliminary version of the technical brief or report (without the recommendations section completed) and/or the debrief presentation.
- During the meeting, steering committee members may review results from each sub-objective or indicator and develop appropriate recommendations.
- Following the meeting, further iteration of the technical brief and/or report may be required, based on steering committee feedback.

It may be useful to prepare suggested recommendations for sub-objectives or indicators to guide steering committee discussions.

4.2.2 Use the prioritization matrix in the report outline to prioritize recommendations

Recommendations should be prioritized based on potential impact and feasibility. A set of criteria can be used to prioritize recommendations; based on the defined criteria, each recommendation can be ranked as high priority (green), medium priority (yellow) or low priority (red) with regard to impact on surveillance performance and system attributes (Table 12). Recommendations can then be categorized as short, medium and long term, based on feasibility and resources available.

Finalized and prioritized recommendations should be added to the technical brief and/or report outline. This document can then be reviewed and signed off by the steering committee before being shared with a wider audience.

Table 12. Criteria and ranking definitions for prioritization of recommendations from a malaria surveillance assessment

Criterion	Criterion definition and categories	Rank definitions		
		High	Medium	Low
Impact	Impact on surveillance performance (i.e. surveillance system coverage, data quality and data use)	Significant improvement in performance	Some improvement in performance	Little to no improvement in performance
	Impact on system attributes (e.g. simplicity of the system)	>50% of system attributes will improve	10–50% of system attributes will improve	<10% of system attributes will improve
Feasibility	Time required for start-to-end implementation	Short term (within 3 months)	Medium term (3–12 months)	Long term (>1 year)
	Resources required (e.g. staff, funds, infrastructure)	Resources currently available to implement	Resources not in place but can be sourced with current budget	Resources are currently unavailable, and funding is required

4.3 Develop an action plan to address priority gaps

After evidence-based recommendations are generated and prioritized by the steering committee, the next step is to share the final report with all relevant stakeholders and develop an action plan for implementing surveillance strengthening interventions

4.3.1 Disseminate final report, as agreed upon with NMP and steering committee, to in-country stakeholders and discuss the feasibility of measures to address priority gaps

Once the technical brief and/or report, including prioritized recommendations, have been signed off by the steering committee (see section 4.2), these dissemination materials should be shared with relevant stakeholders supporting malaria surveillance beyond the steering committee, including relevant health and government departments, local and international partners in malaria, and donors. The aim is to obtain consensus and buy-in from all parties with a stake in malaria surveillance, who can advocate for, mobilize, or commit resources to, surveillance strengthening through relevant channels.

4.3.2 Create an action plan and incorporate activities into the MPR or NSP

Stakeholders should work together to develop a detailed action plan of surveillance strengthening activities associated with each recommendation from the surveillance assessment.

An action plan (Table 13) should list specific, realistic and achievable activities that address the recommendations prioritized from results of the malaria surveillance assessment *(11)*.

The purpose of developing an action plan is to:

- designate responsibilities and establish collaborations;
- allocate a budget and resources for each activity;
- ensure that activities are incorporated into subnational operational plans and the MPR or NSP; and
- track progress since the previous surveillance assessment and determine the impact of activities implemented to improve surveillance performance.

The process to develop the action plan is as follows.

- Bring together relevant decision-makers and surveillance experts. Brief them on the assessment results and suggested recommendations (if action planning is not done at the same time as dissemination).
- Identify activities to address each recommendation. The activities in the action plan should be at both the national and subnational levels.
- Once an activity has been identified, break it down into well-defined tasks. For example, it might be recommended that surveillance staff have real-time access to routine surveillance data. For this, the main activity determined may be to set up a DHIS2 server. First, network and internet connections must be set up, recording and reporting forms need to be configured, computers and tablets need to be procured, training needs to be planned, and so on. These activities should be listed as "tasks" in the Action Plan Template (see Table 13). This breakdown is necessary so that each task can be assigned during action planning to the relevant people or organizations and can be scheduled and costed. The result is a roadmap for the implementation of evidence-based recommendations.
- Determine timelines, responsible people and organizations, and required resources for each task (see Table 13). Activities and tasks in the action plan should be specific, measurable, achievable, relevant and time-bound (SMART). Responsibility for implementation of each activity should be assigned to a specific person or organization.
- Once finalized, the action plan can be used to follow up on the implementation of recommendations, actions and tasks with the responsible parties, following agreed timelines. The action plan should be included in the MPR or NSP.

Table 13. Action plan for implementing prioritized recommendations from the surveillance assessment

From assessment recommendations			From action planning exercise				
Sub-objective or indicator	**Recommendation**	**Priority level**	**Action**	**Tasks**	**Time frame**	**Responsible parties**	**Resources required (staff, infrastructure)**
List sub-objectives or indicators that were assessed. You may also include summary results, such as the scorecard, here. There may be more than one sub-objective or indicator per recommendation.	List recommendations from assessment Example: Provide real-time access to data for surveillance staff at all levels of the health system	List priority of recommendation (high, medium or low), determined by the steering committee	Determine the primary activities required to implement the given recommendation Example: Set up a DHIS2 server	Break down each activity into tasks Example: Configure recording and reporting forms Example: Establish network and internet connection Example: Procure computers and tablets Example: Plan and conduct training	Record specific dates (where possible), or short, medium or long term Example: Short; Q1 20XX	List the lead department, organization or person responsible, and any supporting partners Example: NMP	Approximate or cost each task, considering the personnel, equipment and infrastructure that will be required

Source: PRISM *(11)*.

References

1. Aqil A, Lippeveld T, Hozumi D. PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. Health Policy Plan. 2009;24(3):217–28. doi:10.1093/heapol/czp010.
2. Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/272284, accessed 4 May 2022).
3. WHO malaria terminology, 2021 update. Geneva: World Health Organization; 2021 (https://apps.who.int/iris/handle/10665/349442, accessed 4 May 2022).
4. Disease surveillance for malaria control: an operational manual. Geneva: World Health Organization; 2012 (https://apps.who.int/iris/handle/10665/44851, accessed 4 May 2022).
5. Disease surveillance for malaria elimination: an operational manual. Geneva: World Health Organization; 2012 (https://apps.who.int/iris/handle/10665/44852, accessed 4 May 2022).
6. Integrated disease surveillance and response technical guidelines, booklet one: introduction section. Brazzaville: WHO Regional Office for Africa; 2019 (https://apps.who.int/iris/handle/10665/325015, accessed 4 May 2022).
7. Global technical strategy for malaria 2016–2030, 2021 update. Geneva: World Health Organization; 2021 (https://apps.who.int/iris/handle/10665/342995, accessed 4 May 2022)
8. Malaria surveillance system performance in Mozambique: a comprehensive assessment. Malaria Consortium; 2018 (https://www.malariaconsortium.org/media-downloads/1169, accessed 24 June 2021).
9. Mercado CEG., Ekapirat N, Dondorp AM, Maude RJ. An assessment of national surveillance systems for malaria elimination in the Asia Pacific. Malar J. 2017;16:127. doi:10.1186/s12936-017-1774-3.
10. Lourenço C, Tatem AJ, Atkinson PM, Cohen JM, Pindolia D, Bhavnani D, et al. Strengthening surveillance systems for malaria elimination: a global landscaping of system performance, 2015–2017. Malar J. 2019;18:315 doi:10.1186/s12936-019-2960-2.
11. PRISM: Performance of Routine Information System Management Series. Chapel Hill: MEASURE Evaluation; 2018 (https://www.measureevaluation.org/resources/prism.html, accessed 4 May 2022).
12. Sampling manual for facility surveys for population, maternal health, child health and STD programs in developing countries, July 2001. Chapel Hill, NC: MEASURE Evaluation; 2001 (https://www.measureevaluation.org/resources/publications/ms-01-03.html, accessed 4 May 2022).
13. Service availability and readiness assessment (SARA): an annual monitoring system for service delivery : reference manual, version 2.2. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/handle/10665/149025, accessed 4 May 2022).
14. Master facility list resource package: guidance for countries wanting to strengthen their master facility list: facilitator guide for the MFL training. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/handle/10665/329492, accessed 4 May 2022).
15. Data quality review: module 1: framework and metrics. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/handle/10665/259224, accessed 24 June 2021).

Selected further reading

Analysis and use of health facility data: guidance for malaria programme managers. Working document. Geneva: World Health Organization; 2018. (https://www.who.int/publications/m/item/analysis-and-use-of-health-facility-data-guidance-for-malaria-programme-managers, accessed 4 May 2022).

Data quality review: module 2: desk review of data quality. Geneva: World Health Organization; 2017 (http://apps.who.int/iris/handle/10665/259225, accessed 4 May 2022).

Data quality review: module 3: data verification and system assessment. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/handle/10665/259226, accessed 4 May 2022).

Practical manual for malaria programme review and malaria strategic plan midterm review. Brazzaville: WHO Regional Office for Africa; 2019 (https://apps.who.int/iris/handle/10665/325003, accessed 4 May 2022).

Annexes

Annex 1. Suggested stakeholder and/or interview checklist

The table below is a suggested list of stakeholders for malaria surveillance. The positions and names of these roles will vary based on the country.

This table may be used as a reference for stakeholder mapping during the assessment initiation phase (only column 1), or as a list of suggested informants for interviews conducted during the desk review (columns 1–5).

For interviews, add or remove respondents as needed. For each respondent, add information about whether an interview has been requested, and the date and link to results of interviews completed. The summary can be used as a reference when completing the desk review.

Stakeholder or informant[a]	Interview requested	Interview completed	Date	Link to interview results
Ministry of health				
Senior advisers, coordinators and members of the ministry cabinet from the following:	☐	☐		
National malaria programme	☐	☐		
Division of health information section	☐	☐		
Other acute disease surveillance and response, disease control, immunization, maternal and child, family planning, and noncommunicable disease control programmes (as applicable)	☐	☐		
National reference laboratory				
Management of human resources, drugs, logistics and health finances	☐	☐		
Annual M&E and performance reviews	☐	☐		
Facility-based surveys	☐	☐		
National malaria programme				
Focal points (e.g. programme managers)	☐	☐		
Surveillance and M&E leads	☐	☐		
Case management leads	☐	☐		

Stakeholder or informant[a]	Interview requested	Interview completed	Date	Link to interview results
Commodity tracking leads	☐	☐		
Intervention surveillance focal points (e.g. vector control lead)	☐	☐		
Entomology surveillance leads	☐	☐		
Drug resistance leads	☐	☐		
Genomic surveillance leads	☐	☐		
Case and focus investigation leads	☐	☐		
National statistics office and vital registration				
Officials and analysts responsible for national population census	☐	☐		
Officials and analysts responsible for household surveys such as Demographic and Health Surveys, Living Standards Measurement Study, household surveys, and Multiple Indicator Cluster Surveys	☐	☐		
Officials and analysts responsible for vital registration and mortality reports				
Other leading demographers and statisticians	☐	☐		
Other ministries and governmental agencies				
People responsible for civil registration (typically ministry of the interior, home affairs or local government)	☐	☐		
People responsible for planning, monitoring and evaluation of social programmes	☐	☐		
People responsible for planning and/or population commissions	☐	☐		
Institutes of public health and universities				
Researchers and directors of demographic surveillance systems in the field of entomology, and those in other institutes and universities supporting malaria work	☐	☐		

Stakeholder or informant[a]	Interview requested	Interview completed	Date	Link to interview results
Donors				
Major bilateral and multilateral health sector and surveillance donors	☐	☐		
Global health partnerships such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, and the Global Alliance for Vaccines and Immunization	☐	☐		
Donors who finance activities of relevance, including:	☐	☐		
• Census and/or other large-scale national population-based surveys (e.g. Demographic and Health Surveys, Multiple Indicator Cluster Surveys, Living Standards Measurement Study) or health facility surveys (e.g. service provision assessment)	☐	☐		
• Vital registration system	☐	☐		
• Demographic surveillance system	☐	☐		
• Strengthening of the HMIS, surveillance and IDSR system	☐	☐		
• Annual health sector performance reviews	☐	☐		
• Systems for M&E of major disease control programmes	☐	☐		
United Nations organizations				
United Nations organizations active in malaria (e.g. United Nations Children's Fund, United Nations Development Programme, United Nations Population Fund, WHO, World Bank)	☐	☐		
Representatives of key nongovernmental organizations, civil society and private health care				
Senior advisers and coordinators from nongovernmental organizations (primarily surveillance implementing partners)	☐	☐		
Private health professional associations	☐	☐		
Associations of faith-based health providers	☐	☐		
Health advocacy groups	☐	☐		

[a] Change suggested respondents below to specific department and role titles in the country/implementation area

Annex 2. Suggested document checklist

The table below provides suggested documents to compile to complete a comprehensive review of literature, documents and dissemination materials. The availability and names of these documents will vary based on country context.

For each document, add information on title, authors and/or source (with internet link, if available), and publication date. Add rows for additional documents, as needed. Make a note of what documents could not be found and highlight gaps in what was readily available.

Document(s)[a]	Requested	Obtained	Author/source	Date
Strategic documents				
National health sector strategic plan	☐	☐		
National malaria strategic plans and funding needs	☐	☐		
National malaria annual report	☐	☐		
MPR/mid-term review	☐	☐		
Malaria annual work plan/operational plan	☐	☐		
Malaria monitoring and evaluation plan	☐	☐		
Organogram of NMP with clearly defined job descriptions and job roles	☐	☐		
Surveillance guidelines, protocols and standard operating procedures (SOPs)	☐	☐		
Malaria policies	☐	☐		
Monthly malaria surveillance bulletins and other feedback reports	☐	☐		
Malaria impact evaluations	☐	☐		
Health Accounts Country Platform (SHA 11)	☐	☐		
Epidemic and response guidance	☐	☐		

Document(s)[a]	Requested	Obtained	Author/source	Date
Health information system and general surveillance				
Health information strategy	☐	☐		
Policy documents on data protection and patient confidentiality (can be malaria-specific, or for HMIS or country wide-data governance policies), information on servers, back-up for electronic systems and encryption	☐	☐		
Legal documentation on malaria or infectious disease reporting where malaria is listed as a notifiable disease	☐	☐		
Reports of any previous malaria surveillance system evaluations or assessments	☐	☐		
Documents on overview of surveillance system or data repository	☐	☐		
Health information system technical guides, manuals and specifications (related to system technology)	☐	☐		
All available health facility and community health worker list with definitions (public, private, community)	☐	☐		
Master facility list, and health facility and community health worker mapping documentation (including health facility type: public or private)	☐	☐		
Recording and reporting				
Schematic diagrams of existing systems that collect malaria data, linkages between them, data flow with mode of reporting to each level or system, and frequency of recording and reporting	☐	☐		
Copies of all recording forms and tools that exist (electronic or paper)	☐	☐		
Internet link or hard copy of data recording and reporting guidelines (including recording and reporting definitions, and guidelines for case definitions)	☐	☐		
Training materials, including manuals, presentations, practical sessions and online training tools for staff involved in data collection and reporting at all levels	☐	☐		

Document(s)[a]	Requested	Obtained	Author/source	Date
Data quality				
List of data quality indicators	☐	☐		
National and subnational malaria surveillance assessment and data quality audit reports	☐	☐		
Data quality review guidelines	☐	☐		
Examples of reports, standard presentations or standard templates of graphs/tables for monitoring data quality indicators over time or from data review meetings	☐	☐		
Validation rules for electronic systems and list of automated checks	☐	☐		
Supervisory checklist	☐	☐		
SOPs for data validation	☐	☐		
Data analysis				
Data analysis tools (templates for data analysis, dashboards, routine reports)	☐	☐		
Monthly bulletins	☐	☐		
Malaria epidemic graphs	☐	☐		
Examples of outputs included (screenshots, reports, graphs, tables)	☐	☐		
Examples of outputs disseminated from the national level to subnational levels (screenshots, reports, graphs, tables, presentations, weblink)	☐	☐		
Stratification map based on malaria incidence	☐	☐		
SOPs for analysis and dissemination of outputs at each level	☐	☐		
Examples of decisions taken based on analysis of surveillance data	☐	☐		
Training materials or details of courses/workshops, including the agenda for training on data analysis and use	☐	☐		

Document(s)[a]	Requested	Obtained	Author/source	Date
Partner documents				
Assessments from other disease programmes that use the same integrated surveillance system	☐	☐		
Partner operational plans	☐	☐		
Routine data summaries relevant to malaria	☐	☐		
Entomology				
Insecticide resistance monitoring and management plan	☐	☐		
Insecticide resistance monitoring results	☐	☐		
Geocoordinates for sentinel sites	☐	☐		
Geocoordinates and start year of insectaries and colonies	☐	☐		
Entomological surveillance guidelines and SOPs	☐	☐		
Others? Specify:	☐	☐		
Commodity tracking				
Logistics management information system (LMIS) policy and strategy documents	☐	☐		
LMIS guidelines and SOPs	☐	☐		
Surveillance of intervention implementation				
Integrated vector control management plans	☐	☐		
Distribution plans and SOPs for long-lasting insecticidal nets (routine and mass campaign)	☐	☐		
Implementation plans and SOPs for indoor residual spraying	☐	☐		
Implementation plans and SOPs for larval source management	☐	☐		
SMC implementation plans and SOPs	☐	☐		

Document(s)[a]	Requested	Obtained	Author/source	Date
IPTi implementation plans and SOPs	☐	☐		
IPTp implementation plans and SOPs	☐	☐		
MDA implementation plans and SOPs	☐	☐		
Any other intervention plans and SOPs	☐	☐		
Other				
Surveys (e.g. Demographic and Health Surveys – estimate the % of cases in the past 10 years seeking treatment in the public, private formal or informal systems, or no treatment)	☐	☐		
Therapeutic efficacy studies or integrated drug efficacy studies	☐	☐		
Special study or research reports (e.g genomic surveillance)	☐	☐		
Mortality annual report	☐	☐		
Flow diagram for death registration in hospital and community, including copies of all standard documents used and training materials, if available, in ICD-10/11 coding	☐	☐		

[a] Change suggested documents below to specific names of relevant documents in the country/implementation area

Annex 3. Core malaria variables and indicators

Core variables	Burden reduction	Elimination
All-cause outpatients (including malaria)	✓	✓
Suspected malaria cases	✓	✓
Presumed malaria cases	✓	✓
RDT tested	✓	✓
Microscopy tested	✓	✓
Confirmed malaria cases	✓	✓
Confirmed malaria cases by species	✓	✓
RDT positive	✓	✓
Microscopy positive	✓	✓
All-cause inpatients (including malaria)	✓	✓
Malaria inpatients[a]	✓	✓
All-cause inpatient deaths	✓	✓
Malaria inpatient deaths	✓	✓
All malaria deaths	✓	✓
Confirmed malaria cases treated with antimalarial medicine (ACT)	✓	✓
Confirmed malaria treated with antimalarial medicine (first line + ACT)	✓	✓
P. falciparum cases treated with 1st-line treatment	✓	✓
P. falciparum cases treated with single low dose primaquine	✓	✓
P. vivax cases treated with chloroquine (CQ)[b]	✓	✓
P. vivax cases treated with primaquine (PQ) for radical cure[b]	✓	✓

Core variables	Burden reduction	Elimination
P. vivax cases treated with ACTs[b]		✓
Unique identifier/patient id		✓
Age		✓
Sex		✓
Nationality		✓
Location of patient residence		✓
Date of symptom onset		✓
Date of diagnosis		✓
Parasite species		✓
Date of treatment initiation		✓
Treatment prescribed		✓
Date of case notification		✓
Date of case investigation		✓
Date of focus investigation		✓
Date of (focus) response (if applicable)		✓
Likely period of infection identified		✓
Detailed travel history available (if applicable)		✓
Patient location during the likely period of infection identified and geolocated		✓
Case classification		✓
Method of case detection (PCD, reactive or pro-active case detection)		✓
Confirmed malaria cases notified		✓
Confirmed malaria cases investigated		✓

Core variables	Burden reduction	Elimination
Malaria cases with likely period of infection and location identified		✓
Confirmed malaria cases classified		✓
Confirmed malaria cases classified as local		✓
Confirmed malaria cases classified as indigenous		✓
Confirmed malaria cases classified as introduced		✓
Confirmed malaria cases classified as imported		✓
Foci identified		✓
Foci investigated (within the time limit specified by national guidelines)		✓
Foci classified		✓
Foci classified as active		✓
Foci classified as residual non-active		✓
Foci classified as cleared up		✓
Foci classified as cleared up + number classified as residual non-active		✓

ACT: artemisinin-based combination therapy

[a] In elimination settings, some countries require ALL patients infected with malaria to be hospitalized for at least the first 3 days of their treatment to ensure adherence. If this is the policy then this variable would not be collected.

[b] Only applicable in countries with *P. vivax* cases.

Core indicators for burden reduction and elimination settings

Cells in grey are core indicators for burden reduction settings only.

Theme	Indicator	Numerator	Denominator
Outpatients	Proportion of suspects tested	Number of suspected malaria cases who received a parasitological test (microscopy or RDT)	Number of suspected malaria cases
Outpatients	Number of patients tested for malaria	Number of suspected malaria cases who received either an RDT or a microscopy test	
Outpatients	Number of confirmed malaria cases	Number of malaria cases positive by microscopy or RDT, or Number of positive microscopy cases + number of positive RDT cases	
Outpatients	Number of presumed malaria cases	Number of presumed cases, or total malaria cases (confirmed + presumed) – (N malaria cases positive by microscopy and/or N malaria cases positive by RDT)	
Outpatients	Total malaria cases (confirmed + presumed)	Number of presumed cases + number of confirmed cases	
Outpatients	Test positivity rate	Number of microscopy- and/or RDT-positive malaria cases	Number of patients tested with microscopy and/or RDT
Outpatients	Proportion of *P. falciparum* cases	Number of malaria cases due to *P. falciparum*	Total confirmed malaria cases with a known species
Outpatients	Proportion of *P. vivax* cases	Number of malaria cases due to *P. vivax*	Total confirmed malaria cases with a known species
Outpatients	Crude case incidence	Number of positive microscopy cases + number of positive RDT cases	(Number of people at risk for malaria infection during reporting year) during 1 year × 1000

Theme	Indicator	Numerator	Denominator
Outpatients	Proportion of malaria outpatients	Number of malaria cases (confirmed + presumed)	Total number of all-cause outpatients
Inpatients	Number of malaria inpatients	Number of inpatient admissions or discharges for malaria	
Inpatients	Proportion of malaria inpatients	Number of inpatient admissions or discharges for malaria	Total number of inpatient admissions or discharges
Inpatients	Malaria outpatient admission rate	Number of malaria admissions or discharges	Total number of malaria cases
Inpatients	Inpatient malaria case incidence	Number of inpatient malaria cases	Mid-year number of people at risk for malaria infection during reporting year × 10 000
Deaths	Number of malaria inpatient deaths	Number of inpatient deaths due to malaria	
Deaths	Proportion of malaria inpatient deaths	Number of inpatient deaths due to malaria	Total number of inpatient deaths
Deaths	Inpatient malaria mortality rate	Number of inpatient deaths due to malaria	Mid-year number of people at risk for malaria infection during reporting year × 10 000
Treatment	Proportion of malaria cases treated with first-line treatment course (including ACTs)	Number of patients with confirmed malaria who received first-line antimalarial treatment according to national policy	Total number of malaria cases, found by both passive and active surveillance
Treatment	Proportion of malaria cases treated with an ACT course	Number of malaria cases treated with an ACT course	Total number of malaria cases, found by both passive and active surveillance
Treatment	Proportion of *P. falciparum* cases treated with primaquine	Number of *P. falciparum* cases treated with primaquine	Number of *P. falciparum* cases
Treatment	Proportion of *P. vivax* cases treated with primaquine	Number of *P. vivax* cases treated with primaquine	Number of *P. vivax* cases

Theme	Indicator	Numerator	Denominator
Data quality	Completeness of reporting	Number of reports received from health facilities in a specified time period	Number of reports expected from health facilities in the same specified time period
Data quality	Timeliness of reporting	Number of reports received from health facilities by the reporting due date in a specified time period	Number of reports expected from health facilities in the same specified time period
Data quality	Reporting completeness of core variables	Number of reports received in a specified time period with all core variables completed	Number of reports received in a specified time period

ACT: artemisinin-based combination therapy

Core indicators for elimination settings

Theme	Indicator	Numerator	Denominator
Case notification	Proportion of severe malaria cases	Number of severe malaria cases	Total confirmed malaria cases
Case notification	Total malaria deaths	Number of malaria deaths	
Case notification	Proportion of cases notified within N1 days	Number of cases notified in N1 days	Total number of confirmed malaria cases
Case investigation	Proportion of cases investigated within N2 days of diagnosis	Number of confirmed malaria cases investigated within N2, the number of days after confirmation, defined in the national guideline	Total number of confirmed malaria cases through passive case detection
Case investigation	Proportion of confirmed cases investigated	Number of confirmed cases investigated	Total number of confirmed malaria cases through passive case detection
Case investigation	Proportion of confirmed cases classified	Number of confirmed cases classified	Total number of confirmed malaria cases

Theme	Indicator	Numerator	Denominator
Case investigation	Proportion of local cases	Number of indigenous cases + number of introduced cases	Total number of confirmed malaria cases
Case investigation	Proportion of indigenous cases	Number of indigenous cases	Total number of confirmed malaria cases
Case investigation	Proportion of imported cases	Number of imported cases	Total number of confirmed malaria cases
Case investigation	Number of indigenous deaths	Number of indigenous deaths	
Foci investigation	Number of foci identified	Number of foci identified	
Foci investigation	Proportion of foci investigated	Number of foci investigated	Total number of foci in the registry in a year
Foci investigation	Proportion of foci investigated within N3 days of diagnosis	Number of foci investigated within N3 days of diagnosis	Total number of foci detected as new
Foci investigation	Proportion of foci with response within N7 days of diagnosis	Number of foci with response within N7 days of diagnosis	Total number of foci detected as new (eligible for response)
Foci investigation	Proportion of foci classified	Number of foci classified	Total number of foci in the registry in a 1-year period
Foci investigation	Proportion of foci classified as active	Number of foci classified as active	Total number of foci in the registry in a 1-year period
Foci investigation	Proportion of foci classified as residual non-active	Number of foci classified as residual non-active	Total number of foci in the registry in a 1-year period
Foci investigation	Proportion of foci classified as cleared	Number of foci classified as cleared	Total number of foci in the registry in a 1-year period
Foci investigation	Percentage of population living in active foci	Number of individuals living in active foci	Total population in the district

Theme	Indicator	Numerator	Denominator
Foci investigation	Proportion of foci with zero local cases	Number of foci classified as cleared up + number classified as residual non-active	Number of malaria foci identified
Foci investigation	Number of malaria foci that received any form of response	Number of malaria foci that received any form of response	
Epidemics	Number of epidemics for a particular population in a specific area and time	Number of epidemics defined on the basis of a threshold computed from past data (A. constant case counts, B. mean + 2 standard deviations, C. median + upper 3rd quartile, D. cumulative sum)	
Epidemics	Proportion of epidemics responded to for a particular population in a specific area and time	Number of responses to epidemics for a particular population, in a specific time area and time	Number of epidemics defined on the basis of a threshold computed from past data
Transmission intensity	Number of districts in very low, low, moderate, high transmission strata	Number of districts in very low, low, moderate, high transmission strata	
Transmission intensity	Number of health facilities reporting <3 cases per week	Number of health facilities reporting <3 cases per week	
Data quality	Timeliness of case notification reports: proportion of case notification reports received N1 hours after detection or as per guidelines (typically within 24 hours)	Number of case notification reports received N1 days after detection	Number of case notification reports
Data quality	Timeliness of case investigation reports: proportion of case notification reports received N2 days/hours after detection or as per guidelines (typically within 3 days)	Number of case notification reports received N2 days after detection	Number of case investigation reports
Data quality	Timeliness of foci investigation reports: proportion of foci investigation reports received N1 days/hours after detection or as per guidelines (typically within 7 days)	Number of foci investigation reports received N3 days after detection	Number of foci investigation reports

Annex 4. Core variables for DQA

Burden reduction settings

These are a subset of core variables, which may be selected from, added to or otherwise tailored for assessing data quality indicators.

Note that total malaria cases and confirmed cases may not be collected directly but may be a sum of other data variables, in which case the data variables directly collected (e.g. RDT-positive and microscopy-positive) should be used in the DQA. If variables are disaggregated further (e.g. by age and sex), it is also important to include this as part of the DQA.

Variable		Definition	Potential sources					Applicable data quality indicators			
			Outpatient	Inpatient	Laboratory	Antenatal care	Community health worker	Completeness	Consistency between variables	Consistency over time	Concordance
Priority											
1	**Total malaria cases (confirmed + presumed)**	Confirmed (malaria cases in which the parasite has been detected in a diagnostic test, i.e. microscopy, RDT or molecular diagnostic test) + Presumed cases (cases suspected of being malaria that are not confirmed by a diagnostic test)	✓	✓			✓	✓	✓	✓	✓
2	**Confirmed malaria cases**[a]	Malaria cases in which the parasite has been detected in a diagnostic test (i.e. microscopy, RDT or molecular diagnostic test)	✓	✓	✓			✓	✓		✓
3	**Microscopy tested**	Number of suspected malaria cases who received a microscopy test	✓	✓	✓			✓	✓	✓	✓

Variable		Definition	Potential sources					Applicable data quality indicators			
			Outpatient	Inpatient	Laboratory	Antenatal care	Community health worker	Completeness	Consistency between variables	Consistency over time	Concordance
4	**RDT tested**	Number of suspected malaria cases who received an RDT test	✓	✓			✓	✓	✓	✓	✓
5	**Microscopy-positive**	Malaria cases in which the parasite has been detected using microscopy	✓	✓	✓			✓	✓	✓	✓
6	**RDT-positive**	Malaria cases in which the parasite has been detected using an RDT test	✓	✓			✓	✓	✓	✓	✓
7	**All-cause outpatients**	Patients attending outpatients for any cause including malaria	✓					✓	✓	✓	
8	**All-cause inpatients**	Patients admitted to hospital for any cause including malaria		✓				✓	✓	✓	
9	**All-cause deaths**	Patients admitted to hospital who died from any cause including malaria		✓				✓	✓	✓	✓
10	**Malaria inpatients**	Patients admitted to hospital for malaria		✓				✓	✓	✓	
11	**Malaria inpatient deaths**	Patients admitted to hospital who died from malaria		✓				✓	✓	✓	✓

Variable		Definition	Potential sources					Applicable data quality indicators			
			Outpatient	Inpatient	Laboratory	Antenatal care	Community health worker	Completeness	Consistency between variables	Consistency over time	Concordance
Optional											
12	**Suspected malaria case**	Illness suspected by a health worker to be due to malaria generally on the basis of the presence of fever, with or without other symptoms. This should not be confused with presumed cases (see below).	✓				✓	✓	✓	✓	
13	**Presumed malaria cases**	Cases suspected of being malaria that are not confirmed by a diagnostic test	✓				✓	✓			
14	**IPTp 1–4**	Number of pregnant women who received 1–4 dose(s) of IPTp				✓		✓	✓		✓
15	**ANC 1–4**	Number of pregnant women who attended the antenatal clinic 1–4 times				✓		✓	✓		✓
16	**Confirmed malaria cases treated with first-line treatment courses (including ACT)**	Number of confirmed malaria cases who received first-line antimalarial treatment according to national policy	✓	✓				✓	✓		

ACT: artemisinin-based combination therapy

[a] WHO-recommended core indicator for cross-cutting DQR carried out by HMIS *(15)*. If the number of confirmed cases is not collected, total malaria cases can be substituted. If possible, confirmed cases should be disaggregated by RDT and microscopy. Molecular tests can also be included as a separate category, if relevant.

Elimination settings

These are a subset of core variables that can be extracted from the national malaria surveillance system, which may be selected from, added to or otherwise tailored for assessing data quality indicators.

Theme	Variable	Additional information	Core variables (completeness)	Consistency checks	Concordance
Patient details	**Method of case detection**	Cases identified through passive case detection, reactive case detection or proactive case detection	✓		
	Patient ID/system ID	This should ideally be a unique patient identifier (e.g. national insurance number) or if unavailable an ID that is captured in other systems or primary data sources (e.g. patient registers). If this is not available, use family name, first name and date of birth as core variables.	✓		
	Family name	Patient identifier			
Patient details	**First name**	Patient identifier			
	Date of birth	Patient identifier. If not available, age can be used as a proxy.			
	Age	Patient identifier. Patient's age is based on the date of birth provided. If age is unknown, a proxy can be used. All children aged 0–11 months should be indicated as zero.	✓		✓
	Sex	Patient identifier	✓		✓
	Nationality	Patient identifier. Patient's legal national identity.	✓		✓
	Location of patient residence	Patient identifier (address/village). Patient's address where they are currently staying at the time of presenting to the health facility.			
	Permanent home address (if different from above)	Residential address where the resident permanently resides. This will help in locating the patient. For service delivery DQA data extraction only.	✓		

Theme	Variable	Additional information	Core variables (completeness)	Consistency checks	Concordance
Location of treatment facility	**Health facility**	Reporting health facility or surveillance unit (includes public, private, mobile posts/district investigation units)			
	District	Reporting district			
	Province	Reporting province			
Diagnosis and treatment	**Date of symptom onset (dd/mm/yy)**	Date that patient began experiencing symptoms	✓	✓	✓
	Date of diagnosis (dd/mm/yy)	Date that malaria was confirmed by diagnostic test (RDT, microscopy, PCR, other)	✓	✓	✓
	Diagnosis confirmation method	RDT, microscopy, PCR, other	✓		
	Species identified	*P. falciparum, P. malariae, P. ovale, P. vivax, P. knowlesi,*	✓		✓
	Date of treatment initiation (dd/mm/yy)	Date that first dose of antimalarial treatment was given. This may be the same date as the date of diagnosis in some countries.	✓	✓	✓
	Treatment prescribed	Type of antimalarial treatment given	✓		
	Outcome of illness	Admitted, discharged, died, absconded	✓		✓
Case notification and investigation	**Date of case notification (dd/mm/yy)**	Date that case was notified	✓	✓	✓
	Recent travel within the country (Y/N, red response if Y)	Within the past 30 days	✓		
	Region/district name, town/village name of travel destination	Place that patient travelled to	✓		
	Last night (within country) (dd/mm/yy)	Date of the last night spent in area travelled to within country	✓		
	First night (within country) (dd/mm/yy)	Date of the first night spent in area travelled to within country	✓		

Theme	Variable	Additional information	Core variables (completeness)	Consistency checks	Concordance
Case notification and investigation	**Recent travel outside the country (Y/N, red response if Y)**	Within the past 30 days	✓		
	Country name of travel destination	Country that patient travelled to	✓		
	Last night (outside country)(dd/mm/yy)	Date of the last night spent in area travelled to outside country	✓		
	First night (outside country)(dd/mm/yy)	Date of the first night spent in area travelled to outside country	✓		
	Final classification	Indigenous, introduced, imported, recurrence, induced, not yet classified	✓		✓
	Case investigated (Y/N)	Index case was investigated (review and collation of information/ interview, screening of household members, neighbouring household investigations, routine focus investigation, response mechanisms for screening and vector control)	✓		
	Date of case investigation (dd/mm/yy)	Day on which index case was followed up at household level	✓	✓	✓
	Location of case investigation (GPS coordinates)	Location of likely source of infection	✓		
Routine foci investigation	**Date of focus investigation (dd/mm/yy)**	Date of routine focus investigation	✓	✓	✓

Annex 5. DQA consistency checks between core variables

Burden reduction settings

Priority variables			
1	RDT tested	≥	RDT positive
2	Microscopy tested	≥	Microscopy positive
3	All-cause outpatients	>	Total malaria cases
4	All-cause inpatients	>	Malaria inpatients
5	All-cause deaths	>	Malaria inpatient deaths
6	Confirmed malaria cases[a]	≥	Confirmed malaria cases treated with first-line treatment courses (including ACT)
Optional variables			
7	Suspected cases	≥	Microscopy tested + RDT tested
8	Malaria cases, all ages	>	Malaria cases, <5 years
9	$IPTp_{x+1}$	>	$IPTp_x$ (where x = dose 1–3)
10	ANC_X	≥	$IPTp_x$ (where x = visit or dose 1–4)
11	Sum of malaria species	≤	Confirmed malaria cases

ACT: artemisinin-based combination therapy

[a] WHO-recommended consistency check between related indicators to be included in a DQR across several diseases carried out by HMIS *(15)*.

Elimination settings

Variable			
1	Date of symptom onset (dd/mm/yy)	≤	Date of diagnosis (dd/mm/yy)
2	Date of diagnosis (dd/mm/yy)	≤	Date of treatment initiation (dd/mm/yy)
3	Date of diagnosis (dd/mm/yy)	≤	Date of case notification (dd/mm/yy)
4	Date of case notification (dd/mm/yy)	≤	Date of case investigation (dd/mm/yy)
5	Date of case investigation (dd/mm/yy)	≤	Date of focus investigation (dd/mm/yy)

Annex 6. DQA consistency checks over time for core indicators

These indicators are not usually recorded directly in a surveillance system database (e.g. DHIS2) but are calculations based on core variables collected. Consistency over time should be measured for at least the previous 3 years.

Burden reduction settings

	Indicator	Definition	Numerator	Denominator
1	**Proportion of malaria outpatients**	Proportion of all patients attending outpatients facility that are presumed or confirmed malaria cases (number of malaria cases)	Number of malaria cases (confirmed + presumed)	Total number of all-cause outpatients
2	**Proportion of malaria inpatients**	Proportion of all patients admitted to hospital with malaria	Number of inpatient admissions or discharges for malaria	Total number of inpatient admissions or discharges
3	**Proportion of malaria inpatient deaths**	Proportion of all inpatient deaths that were due to malaria	Number of inpatient deaths due to malaria	Total number of inpatient deaths
4	**Test positivity rate**	Proportion of positive results among all tests performed by microscopy and/or RDT	Number of microscopy- and/or RDT-positive malaria cases	Number of patients tested with microscopy and/or RDT
5	**Slide positivity rate**	Proportion of positive results among all microscopic tests performed	Number of microscopy-positive malaria cases	Number of patients tested with microscopy
6	**RDT positivity rate**	Proportion of positive results among all RDTs performed	Number of RDT-positive malaria cases	Number of patients tested with an RDT
7	**Proportion of suspects tested**	Proportion of patients with suspected malaria who received a parasitological test (microscopy or RDT)	Number of suspected malaria cases who received a parasitological test (microscopy or RDT)	Number of suspected cases of malaria (or suspects = tested + presumed cases if suspected malaria cases are not collected directly from the OPD register)

Elimination settings

Consistency over time for core indicators	
1	Number of confirmed malaria cases notified
2	Number of confirmed malaria cases investigated
3	Number of confirmed malaria cases classified
4	Number of confirmed malaria cases classified as local (indigenous + introduced)
5	Number of confirmed malaria cases classified as indigenous
6	Number of confirmed malaria cases classified as introduced
7	Number of confirmed malaria cases classified as imported
8	Number of malaria cases due to *P. falciparum*
9	Number of malaria cases due to *P. knowlesi*
10	Number of malaria cases due to *P. malariae*
11	Number of malaria cases due to *P. ovale*
12	Number of malaria cases due to *P. vivax*

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