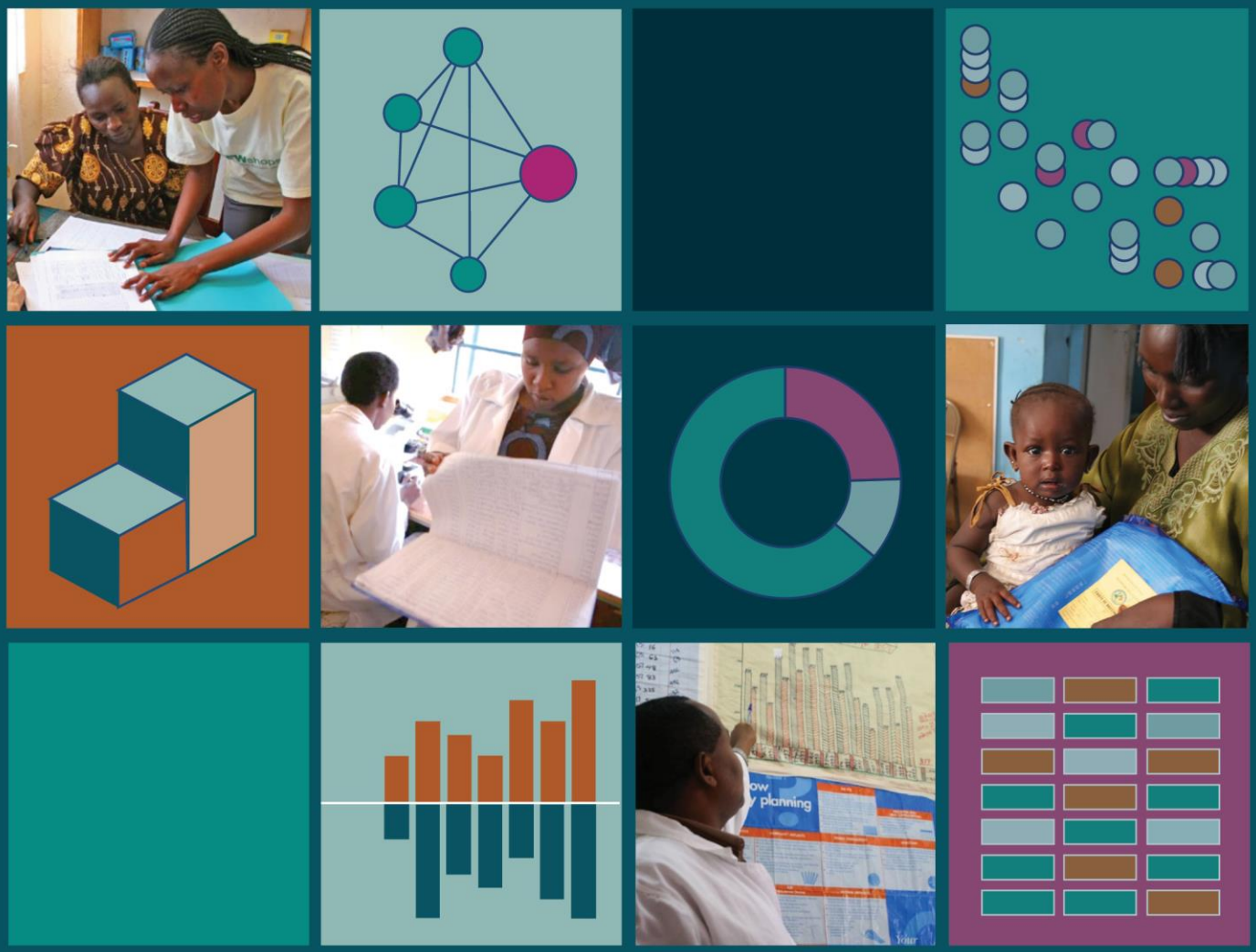

Surveillance, Monitoring, and Evaluation of Malaria Programs

Online Course

2020

USAID FROM THE AMERICAN PEOPLE

U.S. President's Malaria Initiative

CDC

MEASURE Evaluation

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MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, North Carolina 27516 USA
Phone: +1-919-445-9359
measure@unc.edu
www.measureevaluation.org

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FIGURES

TABLES

ABBREVIATIONS

ACT	artemisinin-based combination therapy
AIM	Action and Investment to Defeat Malaria 2016–2030
ANC	antenatal care
API	annual parasitic incidence
BCC	behavior change communication
CDC	Centers for Disease Control and Prevention
DDT	dichloro-diphenyl-trichloroethane
DHIS2	District Health Information Software, version 2
DHS	Demographic and Health Survey
DiD	difference-in-difference
DQA	data quality assessment
FSAT	focal screening and treatment
GIS	geographic information system
GMAP	Global Malaria Action Plan
GTS	Global Technical Strategy for Malaria 2016–2030
HDSS	health and demographic surveillance system
HIS	health information system
HMIS	health management information system
IDSR	integrated disease surveillance and response
IPTp	intermittent preventive treatment in pregnancy
IQR	interquartile range
IR	intermediate result
IRB	institutional review board
IRS	indoor residual spraying
ITN	insecticide-treated net
LLIN	long-lasting insecticidal net
M&E	monitoring and evaluation
MDA	mass drug administration
MDGs	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
MIS	Malaria Indicator Survey

MSAT	mass screening and treatment
NMCP	national malaria control program
NMEC	National Malaria Elimination Center
NMP	national malaria program
NMS	National Malaria Strategy
NMSP	national malaria strategic plan
PMI	U.S. President's Malaria Initiative
PfPR	Plasmodium falciparum parasite rate
RBM	Roll Back Malaria Partnership
RDT	rapid diagnostic test
RHIS	routine health information system
RTS,S	RTS, S/AS01
SDGs	Sustainable Development Goals
SMART	specific, measurable, appropriate, realistic, and time-based
SMC	seasonal malaria chemoprevention
SME	surveillance, monitoring, and evaluation
SO	strategic objective
SP	sulfadoxine-pyrimethamine
SSA	sub-Saharan Africa
SWOT	strengths, weaknesses, opportunities, and threats
TES	therapeutic efficacy surveillance
UN	United Nations
USAID	United States Agency for International Development
VA	verbal autopsy
WHO	World Health Organization

MODULE 1:

OVERVIEW OF MALARIA

MODULE 1: OVERVIEW OF MALARIA

This module provides an introduction to the basics of malaria, including what malaria is and how it is transmitted, an introduction to the epidemiology and burden of malaria, an overview of the global efforts to control malaria, and a description of the main interventions for malaria control and prevention.

Module Objectives

By the end of this module, you will be able to:

- Describe malaria and how it is transmitted
- State how malaria transmission is associated with climate
- Describe the general epidemiology of malaria
- Describe the global burden of malaria
- Describe the global efforts to control and eliminate malaria
- Describe the different types of malaria interventions

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Malaria Basics

Malaria is a parasitic infection that is transmitted to humans by the bite of female Anopheles mosquitoes.

There are five parasite species that transmit malaria infection to humans: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium knowlesi*. *P. falciparum* and *P. vivax* are the most common species, and *P. falciparum* is the most deadly of the five. P. *falciparum* causes 99.7 percent of estimated malaria cases in sub-Saharan Africa, 62.8 percent in Southeast Asia, 69 percent in the Mediterranean, and 71.9 percent in the Pacific region. P. *vivax* represents 74 percent of malaria cases in South America (World Malaria Report 2018).

Mosquitoes mainly feed and rest indoors; the peak biting time is in the late evening. They breed in shallow collections of fresh water, such as puddles.

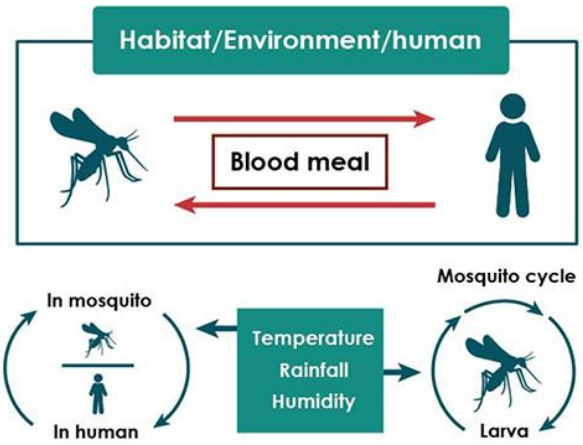
Everyone is susceptible to malaria infection; however, pregnant women and children under five bear the greatest burden of malaria. Young children under the age of five are vulnerable because they have not yet developed protective immunity against the most severe forms of the disease. Pregnant women and their newborns also are vulnerable because malaria infection can increase the risk of miscarriage and low birth weight, as well as maternal and newborn death.

Malaria Transmission

People are infected with malaria after they are bitten by a female Anopheles mosquito that is infected with one of the plasmodium parasites. The parasite enters the human blood stream and goes to the liver. In the liver, the parasite matures and replicates before being released back into the bloodstream. This is referred to as the incubation period, during which the person does not experience any symptoms. The onset of symptoms typically occurs 9 to 30 days after a person has been bitten by an infected mosquito.

There are many factors related to the vector, parasite, human host, and conditions within the environment that influence the transmission of malaria. For example, transmission is highly dependent upon the climatic conditions, such as the amount and pattern of rainfall in an area, temperature, and humidity.

Figure 1. Malaria transmission cycle



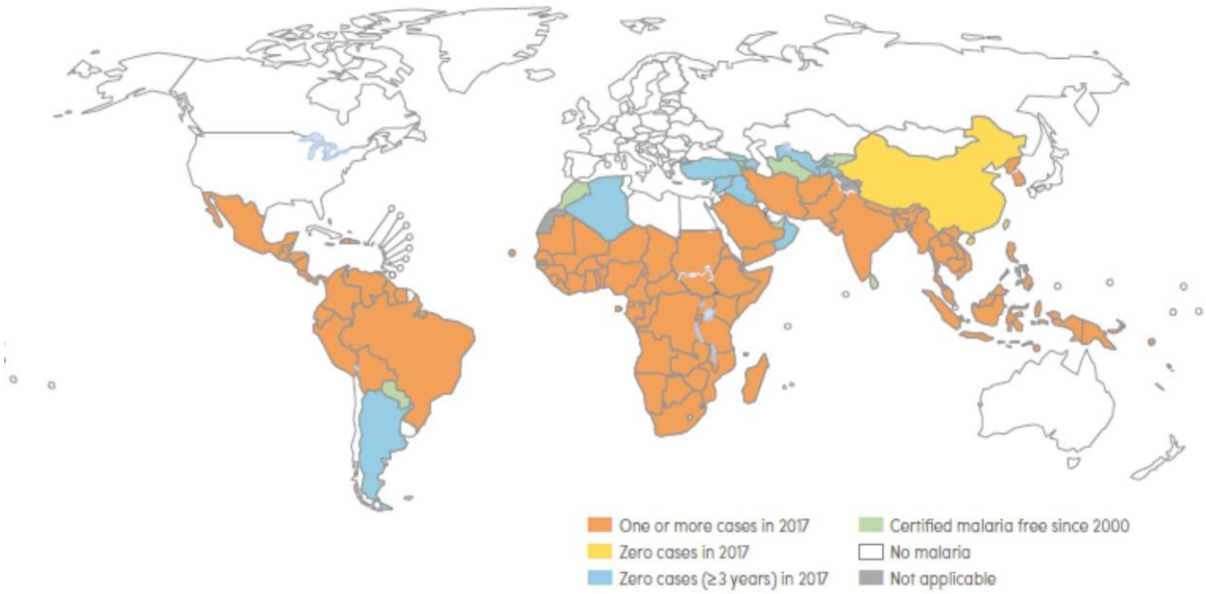
© MEASURE Evaluation's regional anglophone malaria SME course, 2017

In many places, transmission is seasonal, meaning that it only occurs or occurs more frequently during certain times of the year and not necessarily year-round. Often there is a peak of malaria transmission during and right after the rainy season. Transmission can also vary within a country, with certain areas affected year-round, seasonally, or not at all. Lastly, transmission can vary from year to year within a location. Thus, tracking transmission is very complex and requires information regarding many of the factors described above, including rainfall, temperature, and humidity, among others. Altitude is another factor that influences transmission. At higher altitudes, malaria transmission will not occur.

Where Malaria Is Prevalent

Malaria is prevalent in tropical and subtropical climates and is found throughout Central and South America, sub-Saharan Africa, the Eastern Mediterranean, and Asia. Currently, 87 countries are malaria endemic with ongoing transmission. Of these, 10 are currently on track to meet their objectives for elimination by 2018.

Figure 2. Malaria in the world

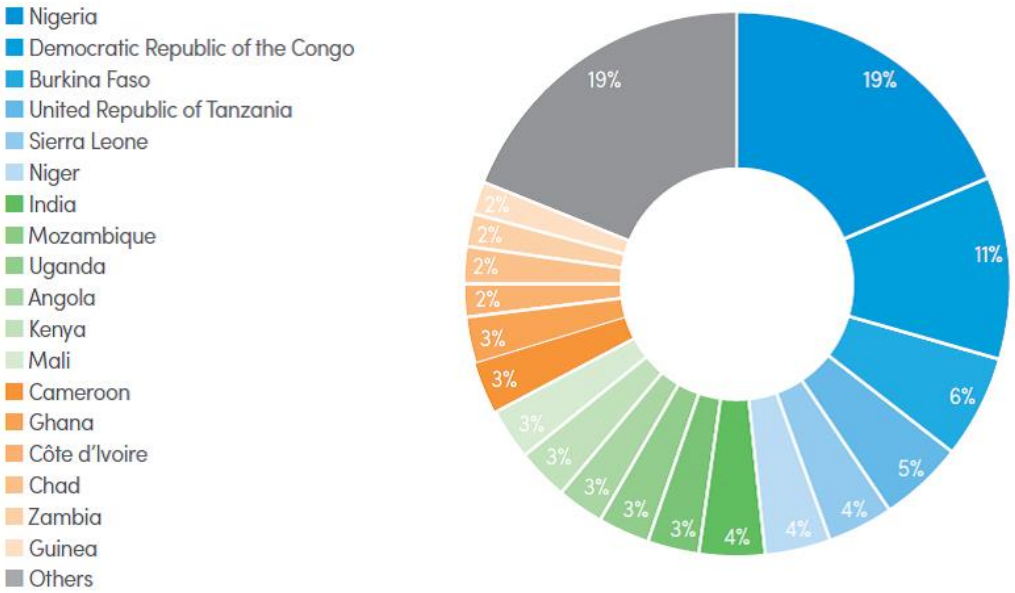


Source: World Malaria Report, 2018

Burden of Malaria

Half of the world's population (3.2 billion people) is at risk of malaria. In 2017, there were about 219 million malaria cases worldwide and nearly 435,000 deaths due to malaria. Fifteen countries, all in sub-Saharan Africa except India, carry 80 percent of the global malaria burden.

Figure 3. Percentage of estimated malaria deaths by country, 2018



Source: World Malaria Report, 2018

Most of the malaria burden is found in sub-Saharan Africa, accounting for an estimated 92 percent of malaria cases and 93 percent of deaths worldwide. It is estimated that 74 percent of the population lives in areas that are highly endemic, and 19 percent of the population lives in epidemic-prone areas.

The economic costs of malaria are tremendous. It is estimated that malaria causes a 1.3 percent loss in gross domestic product growth per year for Africa. It also results in a total of US$12 billion in direct losses per year. Around 40 percent of public health spending in Africa is for malaria. The average household spends greater than 10 percent of its yearly income on malaria prevention and treatment. The global technical strategy for malaria estimates that $6.5 billion is needed per year to achieve global malaria control and elimination goals; however, major gaps in funding make it impossible to reach global targets. In 2016, only $2.7 billion in global contributions were received, leaving a $3.8 billion shortfall.

Due to the large scale-up of malaria prevention and control interventions over the past 17 years, and particularly within the past 10 years, the malaria burden has decreased overall worldwide. In 2017, an estimated 219 million cases of malaria occurred worldwide, compared to 237 million cases in 2010, suggesting a reduction of 18 million cases. The estimated malaria incidence rate has decreased globally by 17 percent, from 76 cases per 1,000 population at risk in 2010 to 59 cases per 1,000 population at risk in 2017. The World Health Organization (WHO) South-East Asia Region recorded the largest decrease (59%), but in the WHO America region, the incidence increased due to malaria transmission in Brazil, Nicaragua, and Venezuela. The WHO Africa Region remains at 219 cases per 1000 population at risk since 2016. Between 2000 and 2016, mortality rates from malaria have decreased significantly.

Efforts to Control Malaria

To understand the efforts to control malaria today, it is important to recognize the history of the disease and previous efforts to control and eradicate it.

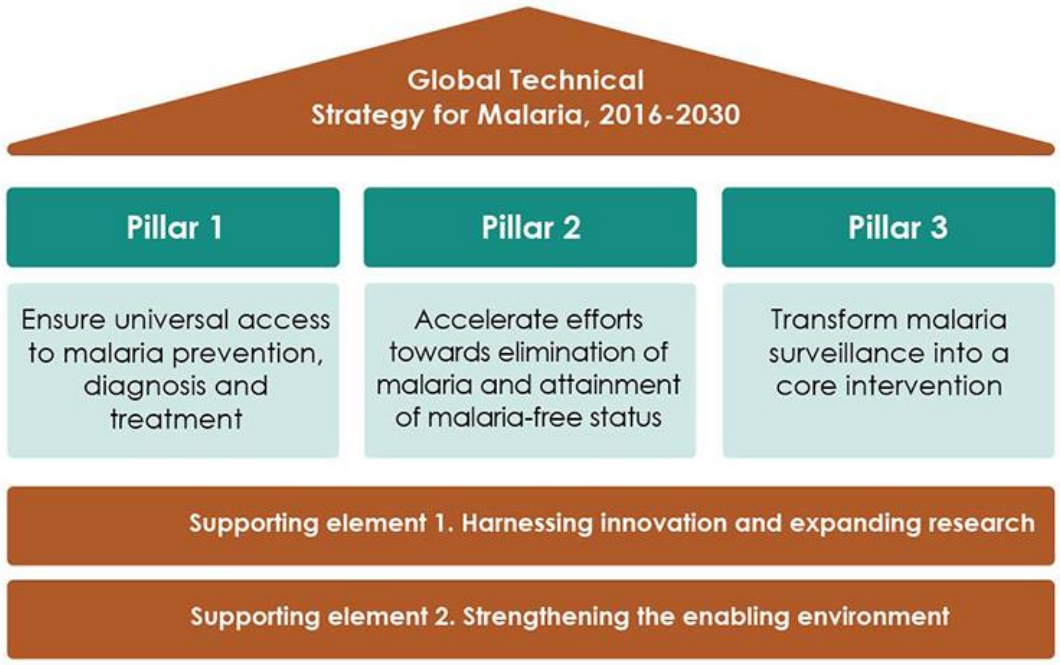
In 1955, WHO launched the Global Malaria Eradication Campaign. The campaign was successful in eliminating malaria from a number of countries but failed to achieve its ultimate goal of global eradication. Within less than two decades, however, it was recognized that a time-limited eradication program was not practical for all countries, and the focus of the program shifted from eradication to malaria control.

During the 1970s and 1980s, malaria received very little attention. It reemerged as a major international health issue again in the 1990s. With new attention and focus on malaria control, a global malaria control strategy was adopted in 1992. The Roll Back Malaria Partnership, created in 1998, is the global framework for implementing coordinated action against malaria.

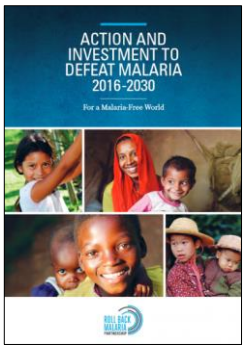
In 2000, the Abuja Declaration was signed by 44 malaria-afflicted countries in Africa, declaring their commitment to the effort to halve malaria mortality in Africa by 2010. The Millennium Development Goals (MDGs) were also created that year, with MDG 6 reflecting the increased efforts toward malaria control. MDG 6 resulted in a decrease of malaria incidence by 37 percent globally and malaria deaths by 60 percent. However, serious bottlenecks remain providing full access to malaria prevention, diagnostic testing, and treatment mainly in sub-Saharan Africa. To build on the success of the MDGs, world leaders adopted 17 Sustainable Development Goals (SDGs) in 2015. Goal 3.1 and 3.2 focus on reducing global maternal and child mortality respectively.

In addition, WHO's Global Technical Strategy for Malaria, 2016–2030 provides a comprehensive framework for countries to develop their programs to accelerate toward malaria elimination. The strategy focuses on the three pillars below:

Figure 4. The three pillars of WHO's global malaria strategy



In alignment with these pillars, RBM developed an operational document with milestones and targets, called RBM's Action and Investment to Defeat Malaria 2016-2030 (AIM). All these initiatives are responsible for the increased efforts and funding for malaria control and prevention over the last 15 years, which have included USAID/PMI, the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), the Bill & Melinda Gates Foundation, and the World Bank.



Malaria Prevention and Control Interventions

Malaria prevention and control efforts focus primarily on reducing human contact with mosquitoes, reducing the overall reservoir of infected people, and reducing the mosquito population through vector control mechanisms.

The most effective strategies used worldwide are vector control, chemoprevention, case management and malaria surveillance. Vector control prevents mosquitos from acquiring or passing on an infection through the use of insecticide-treated nets (ITNs) or long-lasting insecticidal nets (LLINs) and the indoor residual spraying (IRS) of households. Chemoprevention suppresses and prevents infections in humans through intermittent preventative treatment for pregnant women (IPTp) and seasonal malaria chemoprevention (SMC). Case management detects, diagnosis, treats, and cures infections using safe and quick diagnostic testing and effective and timely treatment. Malaria surveillance detects and investigates all malaria infections to prevent secondary infections. Because each country's malaria context is unique, its combination and focus of interventions will vary based on what is most appropriate for its particular context.

Insecticide-Treated Nets

ITNs and LLINs reduce human contact with mosquitoes by providing a protective shield between the mosquito and the human host during the evening, when mosquitoes typically feed. ITNs, when used appropriately and consistently, reduce all-cause mortality by 17 percent and malaria cases by 50 percent at full coverage. The main difference between ITNs and LLINs is that LLINs maintain effective levels of insecticide for at least three years, whereas ITNs typically are effective for 12 months.

Indoor Residual Spraying

IRS involves spraying the inside of the house, including the walls and roofs, with insecticides to reduce human-mosquito contact. High coverage of IRS within a community provides increased protection for the entire community, including the households that were not sprayed.

Intermittent Preventive Treatment

IPTp entails administering an antimalarial drug (currently sulfadoxine-pyrimethamine) to women during their pregnancy to prevent and control malaria. It is recommended that IPTp be given to pregnant women during each scheduled routine antenatal care visit beginning in the second trimester, with doses given at least one month apart.

Seasonal Malaria Chemoprevention

The goal of SMC is to prevent malaria infection by maintaining therapeutic blood levels through malaria treatment during the period of peak transmission by giving sulfadoxine-pyrimethamine and amodiaquine

to children ages 3–59 months, every month up to a maximum of four doses. The distribution is primarily done by going door-to-door in most countries.

Case Management

Effective case management entails ensuring access to diagnostic testing and effective and timely treatment. Prompt parasitological confirmation, either by microscopy or rapid diagnostic tests (RDTs), is recommended in all patients with suspected malaria prior to starting treatment. Prompt and effective treatment entails receiving antimalarial treatment within the first 24 hours after the onset of symptoms of malaria. The best available treatment, particularly for *P. falciparum,* is artemisinin-based combination therapy (ACT).

Malaria Surveillance

Surveillance has been adopted as a full-fledged malaria intervention. It aims to detect all infections of malaria and investigate each case of infection to ensure that each case detected is treated quickly to prevent secondary infections. This makes it possible to track diseases and respond programmatically while making decisions based on the data collected.

Other Interventions

Malaria vaccines, such as the RTS,S vaccine, are currently being developed and tested in various countries. Mass drug administration (MDA), mass screening and treatment (MSAT), focal screening and treatment (FSAT), therapeutic efficacy surveillance (TES), sensitive polymerase chain reaction (PCR) testing, and larviciding are also under development.

Success Story: Zanzibar

The story of malaria in Zanzibar represents one of the greatest achievements to date in sub-Saharan Africa in the fight against malaria. For many years, malaria was Zanzibar's number one public health problem. Malaria in Zanzibar was characterized by perennial stable transmission, with seasonal peaks during and immediately after the rainy seasons. In 2003, malaria accounted for 52 percent of cases and 53 percent of deaths among all inpatients. Drug resistance was high, with treatment failure rates found to be around 60 percent.

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Over the past decade, the island of Zanzibar has experienced a rapid decrease in its malaria burden. Since 2010, malaria prevalence on the island has dropped from as high as 70 percent to its current rate of less than 1 percent. The accelerated decrease is attributable to the large scale-up of malaria control and prevention activities.

In 2003, the Zanzibar Ministry of Health and Social Welfare changed malaria treatment guidelines for uncomplicated malaria from chloroquine and sulfadoxine-pyrimethamine to the much more effective ACTs. In 2003, ACTs were made available free of charge in all public health facilities, greatly increasing access to malaria treatment. By 2007, RDTs were also made available in health facilities, further expanding coverage of diagnostic testing.

Zanzibar has also had widespread distribution of LLINs, and several rounds of IRS have been conducted. These efforts have resulted in a dramatic increase in coverage of ITNs and IRS, with the island successfully achieving universal access to ITNs. A strong surveillance, monitoring, and evaluation (SME) system, designed and implemented by the Zanzibar Malaria Elimination Programme, has further led to the successful control and reduction of malaria. The story of Zanzibar demonstrates that successful control and reduction of malaria burden is possible in Africa, when large-scale coverage of the main malaria control interventions is combined with effective political and donor support. Due to these efforts and successes, Zanzibar has shifted from a malaria control program to one that is now focused on elimination of malaria.

Changing Context

Progress is being made to reduce malaria burden through increased intervention coverage, surveillance, and understanding of local malaria transmission settings within countries. Improvement of the malaria SME system is key to achieving elimination. Yet there are still challenges stalling progress. Remaining challenges include:

- Emergence of parasite resistance to antimalarial medicines (artemisinin and partners) and mosquito resistance to insecticides
- Discovery of new type of exophilic mosquitos
- Poor health system performance
- Lack of sustainable and predictable international and domestic funding
- Disruptive service delivery due to natural factors (excessive rain or earthquakes) and political conflicts
- Climate change

Major progress has been made in existing interventions. New interventions have been added to the suite to help in malaria control. Yet, progress is stalling, not because interventions are ineffective, but because there is still not enough global funding going toward malaria control and elimination. Until the $3.8 billion gap is met, it will be difficult to move toward eliminating malaria.

Module 1 Assessment

Questions

Correct answers are provided on the next page.

1. Which species of malaria parasite are more prevalent in sub-Saharan Africa?

    a. *Plasmodium malariae*
    b. *Plasmodium falciparum*
    c. *Plasmodium vivax*
    d. *Plasmodium ovale*

2. Which groups are the most vulnerable to malaria infection? *(Select all that apply.)*

    a. Children under five years of age
    b. Men ages 18 years and older
    c. Women who are pregnant
    d. Children ages 5–18 years
    e. Women ages 15–49 years

3. Which of the following factors influences malaria transmission risk?

    a. Humidity
    b. Temperature
    c. Rainfall
    d. All of the above

4. In which region of the world is the burden of malaria the greatest?

    a. Southeast Asia
    b. Eastern Mediterranean
    c. Africa
    d. Latin American and the Caribbean

5. Which of the following is NOT one of the main malaria control and prevention strategies?

    a. Using insecticide-treated nets
    b. Administering antimalarial drugs to pregnant women who are at risk of malaria
    c. Spraying the outside of houses with insecticides
    d. Spraying the interior walls of houses with insecticides

6. Making up for the US$3.8 billion deficit in funding for malaria control interventions would help achieve malaria elimination.

    True or false

Correct Answers

Correct answers are noted in bold.

1. Which species of malaria parasite are more prevalent in sub-Saharan Africa?

   b. *Plasmodium falciparum*

   In sub-Saharan Africa, malaria is mainly caused by *Plasmodium falciparum*, although *P. ovale* and *P. malariae* are also present.

2. Which groups are the most vulnerable to malaria infection? *(Select all that apply.)*

   a. Children under five years of age
   c. Women who are pregnant

   Everyone is susceptible to malaria infection; however, pregnant women and children under five bear the greatest burden of malaria.

3. Which of the following factors influences malaria transmission risk?

   d. All of the above (humidity, temperature, and rainfall)

   Transmission is highly dependent upon the climatic conditions, such as the amount and pattern of rainfall in an area, temperature, and humidity.

4. In which region of the world is the burden of malaria the greatest?

   c. Africa

   The majority of the malaria burden is found in sub-Saharan Africa. It is estimated that 74 percent of people living in Africa live in areas that are highly endemic, and 19 percent of the population lives in epidemic-prone areas.

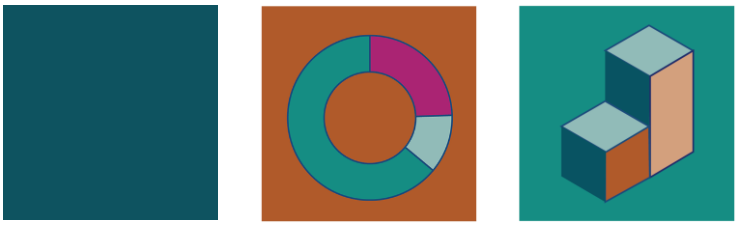
5. Which of the following is NOT one of the main malaria control and prevention strategies?

   c. Spraying the outside of houses with insecticides

   The primary methods for prevention include insecticide-treated nets or long-lasting insecticide treated nets, indoor residual spraying of households, intermittent preventative treatment for pregnant women, and prompt and effective treatment with antimalarial drugs.

6. Making up for the $3.8 billion deficit in funding for malaria control interventions would help achieve malaria elimination.

   True



MODULE 2:

USING DATA FOR DECISION MAKING

MODULE 2: USING DATA FOR DECISION MAKING

This module covers the purpose and scope of surveillance, monitoring, and evaluation (SME) for malaria programs and the importance of using data for decision making.

Module Objectives

By the end of this module, you will be able to:

- Identify the purpose and scope of SME
- Describe the importance of using data to inform decisions
- Identify strategies for overcoming barriers and ensuring that health-related data are being used to make decisions

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Introduction to Surveillance, Monitoring, and Evaluation

SME refers to a process by which data are collected and analyzed to provide the information necessary for effective program planning and management.

Table 1. Definitions of surveillance, monitoring, and evaluation

Surveillance	Monitoring	Evaluation
An ongoing, systematic, and continuous assessment of the health of a population, focusing on improving collected information to be used for action	Involves the routine tracking of progress of the implementation of a program's activities and changes in program performance over time. It can be thought of as continuous oversight of the implementation of a program's activities. The purpose of monitoring is to allow the program's stakeholders to understand whether the program is achieving its objectives and using its resources efficiently.	Intends to measure how well the program activities have met their expected objectives and whether the changes in the outcomes observed can be attributed to the program. Evaluation entails the process of determining the worth or significance of a program or intervention.

Quiz Question

Is it monitoring or evaluation? A country director from Ghana is interested in finding out whether scaling up the distribution of insecticide-treated nets (ITNs) and long-lasting insecticide-treated nets (LLINs) and indoor residual spraying in the northern region has had an impact on the number of malaria cases detected in health facilities in the region.

- Monitoring
- Evaluation

Answer: Evaluation. The country director is interested in understanding the impact of the malaria program on reducing the number of malaria cases in the region, which is best measured through an evaluation. Monitoring tracks the program's progress and implementation; it does not measure the impact of a program.

Surveillance

Surveillance is a systematic and continuous approach to collecting data for analysis and interpretation of a health issue for decision making. It consists of four main activities:

- Collecting relevant data
- Aggregating and tabulating data
- Analyzing and interpreting data
- Disseminating and using data and results

Surveillance answers the question: What are we following/tracking?

Examples are events related to health programs (morbidity, mortality, drug efficacy, and insecticide efficacy). Module 11 discusses malaria surveillance in more detail.

Monitoring

Monitoring seeks to establish whether the resources invested (inputs), the activities undertaken, the quality of those activities (processes), and the number of activities performed (outputs) are proceeding according to plan. Monitoring includes the regular collection and analysis of data to assist in timely decision making, aid in program planning and management, ensure accountability, and provide a basis for evaluation and learning.

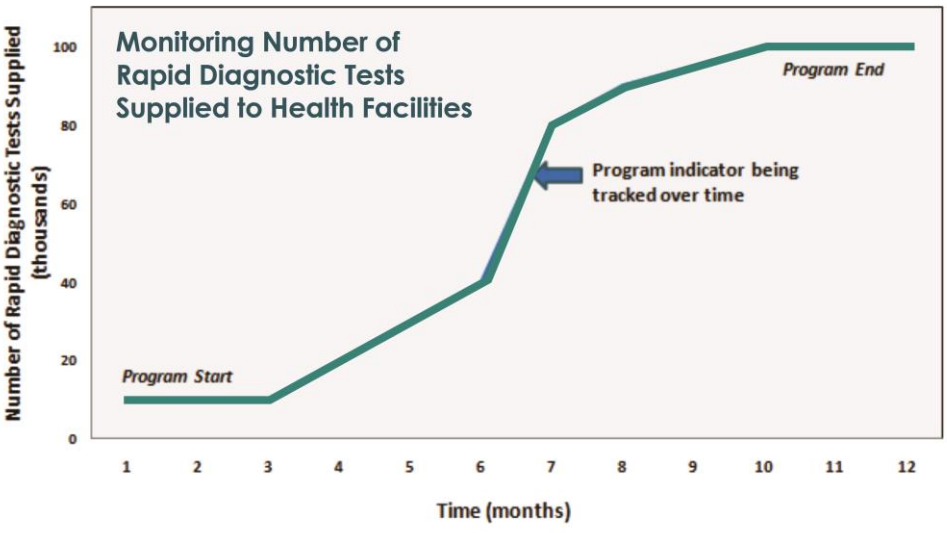
Monitoring can help answer questions such as:

- Was the program implemented according to how it was planned?
- Are the program's activities being implemented similarly across the different sites?
- Is the program making efficient use of its resources?

Monitoring of Malaria Programs

The graphic that follows is an illustration of what monitoring looks like over the lifetime of a program. It shows how a program indicator—for example, number of rapid diagnostic tests supplied to health facilities—is tracked over time—from the start of a program to the end.

Figure 5. An example of an indicator monitored throughout a program



Many components of malaria programs can be monitored. Some examples of common malaria program monitoring activities are as follows:

- Tracking the number of ITNs that have been distributed by the national malaria control program (NMCP)
- Collecting data from health facilities on the number of children under five with malaria who received prompt and correct treatment for malaria
- Reviewing health facility records to track the number of pregnant women who received at least two doses of intermittent preventive treatment during their pregnancy

Evaluation

Evaluation is a process that aims to determine as systematically and objectively as possible the relevance of objectives, the efficiency of resources used, the effectiveness of the program design and implementation, the value added of a program, the sustainability of results, and the impact of a program or intervention. Evaluation aims to provide valuable management information to judge the value of an intervention and provide lessons for future programs or policies.

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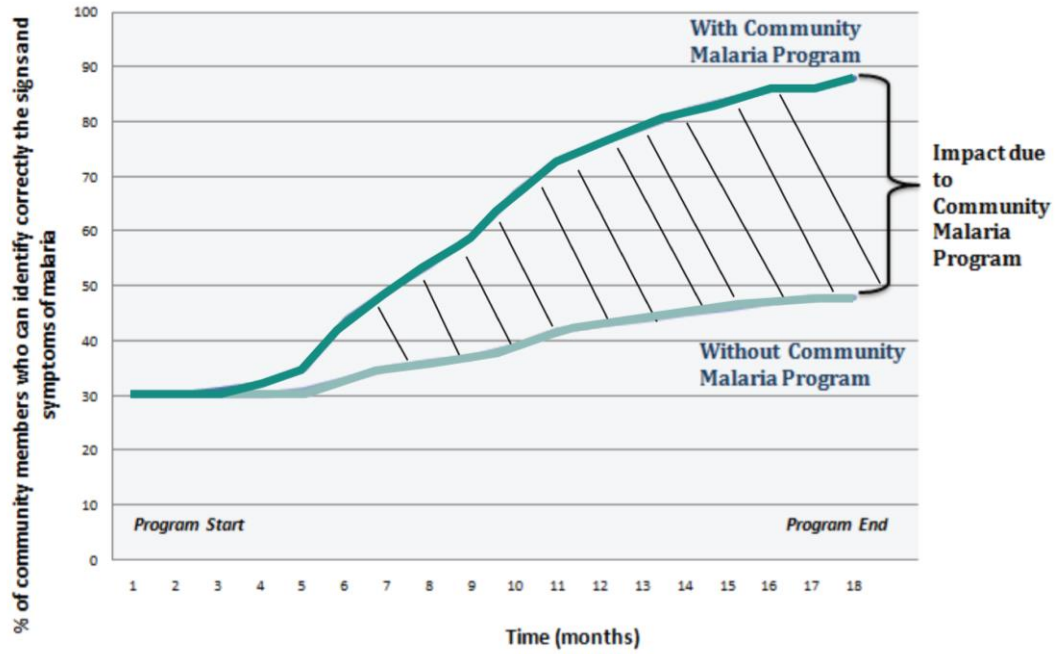
Evaluation can help answer questions such as:

- Did the implementation of the program lead to an improvement in health status among the targeted population?
- Did the program improve access to health services for the targeted population?
- Was the program cost-effective?

Evaluation of Malaria Programs

This graphic illustrates the impact of a program on a specific program outcome.

Figure 6. Illustration of evaluation



For example, if a program achieved its aim to increase the community's knowledge of the signs and symptoms of malaria, then we would observe a positive change in the program outcome (community knowledge of signs and symptoms) that would otherwise not have been observed if the program was not implemented.

The shaded area on the graphic demonstrates the impact the program had on changing the community's knowledge of the signs and symptoms of malaria.

Sample evaluation questions for malaria programs:

- Did the ITN national distribution program in Country X reduce inequity in household ownership of ITNs?
- Was the program effective in increasing the population's knowledge of the proper use of ITNs?
- Did the program's activities to increase access to artemisinin-based combination therapy (ACT) treatment for children under five lead to a decrease in malaria-specific mortality among children under five?

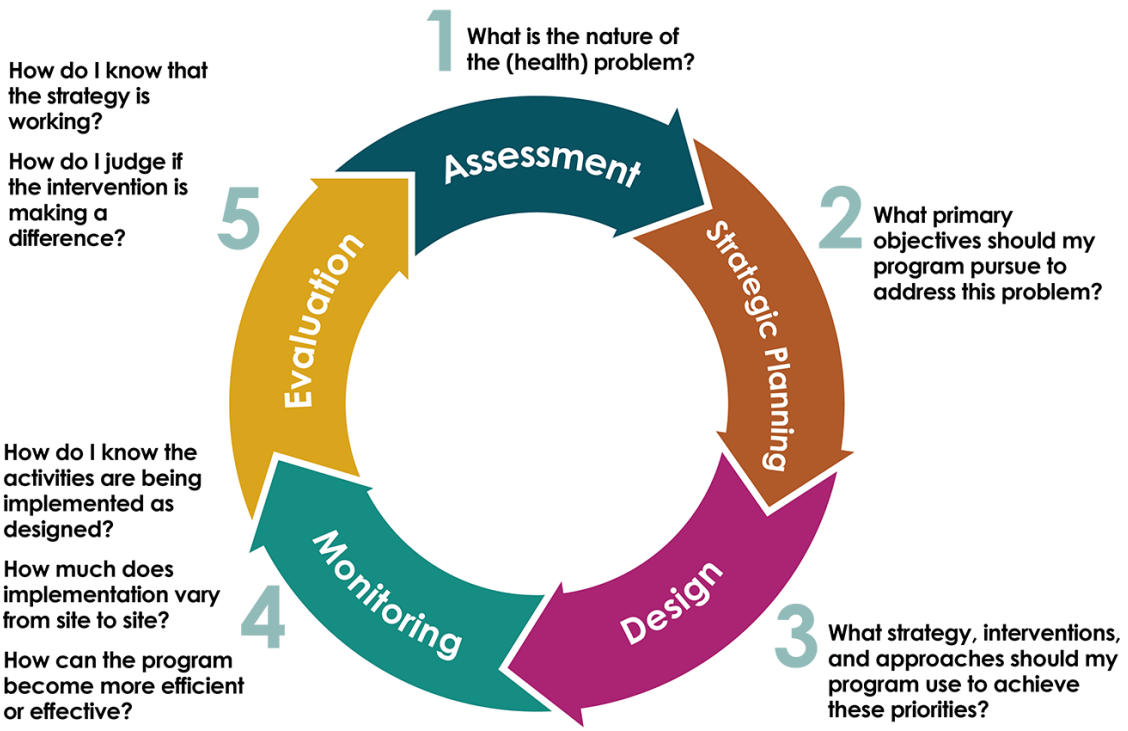
Role of SME in the Program Lifecycle

SME is a continuous process that occurs throughout the lifecycle of a program. An SME plan should be developed at the beginning of a program and should include input from all the relevant stakeholders. If there are any changes in the program over time, the SME plan must be modified accordingly. It is important to remember that an SME plan is a living document and can be changed over time based on the program's needs.

Unlike monitoring, which involves the routine collection of data, evaluation takes place during specified periods of a program. It might take place annually, midway through a program, or at the end. It is important to remember that for an evaluation to be successful, it MUST be planned from the beginning of a program to ensure that the appropriate data are collected to carry out the evaluation. Surveillance can

take place at any time and consists of a continuous analysis and interpretation of data on health issues for decision making.

Figure 7. Program lifecycle



Source: MEASURE Evaluation

Assessment

Prior to designing a program, it is vital to understand the nature of the (health) problem you want to address. Conducting an assessment of the problem in the specific population you want to engage with your program can help you identify the nature and severity of the problem. The assessment will provide you with the information and data you will need to begin strategically planning and designing your program.

Strategic Planning

The second phase in the program lifecycle is to begin planning your program, specifically what the program would like to achieve. The data and information that you collected during the initial assessment will help you understand the nature of the problem in the community as well as what is feasible in terms of addressing the problem. At this stage, you will determine the goal and primary objectives of your program.

Design

The third phase in the program lifecycle is designing your program. The data and information gathered during the assessment will also inform the design of the program. At this stage, you will decide on the different strategies, activities and interventions, and approaches that the program will implement to achieve its goal and primary objectives.

Monitoring

Monitoring occurs throughout the program, from the beginning to the end. It involves the regular collection and analysis of data to assist in timely decision making, aid in program planning and management, and provide a basis for evaluation and learning. Monitoring helps you determine whether your program's activities and interventions are being implemented as designed, whether implementation is consistent throughout different implementation sites, and whether the program can be more effective or efficient.

Evaluation

Evaluation typically occurs during certain periods of a program's lifecycle, for example annually, midway through the program, and at the end of the program. Evaluation should be planned at the beginning of a program. It will help you determine whether your program's strategy is working effectively and if it is making an impact. It allows you to assess whether the program has achieved its objectives and overall goal, and, if not, it helps you understand why.

Uses of Data

Data have many important uses. Primarily data should be used to inform decision making, which occurs at multiple levels—from the programmatic level to the policy level. Some examples of how data collected from a program or an intervention can be used are as follows:

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- To help to inform policies, planning, or program decisions
- To raise additional resources for scale-up of programs or for future programs
- To assess whether a policy, plan, or program has produced the desired or intended impacts
- To strengthen programs by improving their results, their efficiency, and the quality of services provided
- To identify factors or interventions that influence health outcomes
- To ensure accountability and for reporting purposes
- To contribute to global lessons learned that can aid other malaria control and prevention programs in implementing effective programs

"…without information, things are done arbitrarily and one becomes unsure of whether a policy or program will fail or succeed. If we allow our policies to be guided by empirical facts and data, there will be a noticeable change in the impact of what we do."
—National-level policymaker, Nigeria

Data for Decision Making

Decision making occurs at all levels of a program and among all of a program's stakeholders. Because of this, each stakeholder requires different information and data to be able to make informed decisions. It is important to engage stakeholders in discussions from the beginning of your program to fully understand all the decisions they make and what the information they will need to make those decisions.

Even though each program will vary, the following table presents an example of all the different stakeholders (and thus decision makers) in a malaria control and prevention program and the types of information they may need to make informed decisions.

Table 2. Malaria program stakeholders and their information needs

Decision Maker	Information Needs
Beneficiaries	Effectiveness of program or intervention, quality of services provided
Community Leaders/Local Government Officials	Effectiveness of program or intervention; quality, equity, and coverage of services provided; who are the clientele
Program Managers/Implementation Partners	Effectiveness of program or intervention; who are the clientele; quality, equity, and coverage of services provided
Policymakers	Quality and equity of services, cost-efficiency and effectiveness of program or intervention, information relevant for correcting and improving policy
Partner Agencies	Effectiveness of program or intervention, policy implications, sustainability of program, cost-efficiency and effectiveness

Stakeholder Decision Making

A common misconception is that data are collected only to be used at the top management levels; however, stakeholders at all levels need and use information. Stakeholders at each level make decisions that require different types of information. This section provides examples of decisions made by all the different stakeholders.

Beneficiary level: A family decides whether to take their child with a fever to the clinic based on their impression of the quality of care received during past visits.

Community level: A health facility director decides how many drugs and supplies to order based on health facility use data on average number of monthly malaria cases.

Program management level: A program manager decides where to focus LLIN distribution campaigns based on malaria endemicity levels.

Policy level: The Ministry of Health decides on new antimalarial policy based on evidence demonstrating which antimalarial drugs have the highest efficacy.

Global level: Global partners decide whether to allocate funding to a specific grant based on the effectiveness of the intervention and past program performance.

Common Barriers to Data Use

There are a number of common barriers to data use within organizations. It is important to recognize the barriers that your organization faces regarding data use to help identify solutions and create an environment that promotes and facilitates data use within your organization.

Common barriers that organizations can face include the following:

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- Organizational structures within a program can be a constraint to efficient data management processes.
- Decision makers may not be accustomed to using data to inform their decisions.
- Staff may have low motivation.
- Staff may have limited capacity in SME and technology use.
- Training on SME is often ad hoc and does not provide refresher courses or coaching to keep skills current.
- Structural constraints may exist within the country, such as poor roads or telecommunication.
- Staff roles may not be clearly defined.
- Poor information flow may exist within the organization.
- Funding for SME may be limited or insufficient.
- Politics may influence decisions on what data can or should be collected.
- The program may have limited access to computer technology for tracking and analyzing data.

Case Study: Common Barriers to Data Use

Read the following short vignette on a local malaria program in Western Kenya. While reading the vignette, consider what constraints or barriers the local nongovernmental organization (NGO) faces regarding data use and what could be done to improve data use in this situation. After you have read the vignette, go to the next page to answer a few questions regarding the barriers to data use described in the scenario.

Over the past few years, a local NGO in Western Kenya has been working in partnership with the NMCP to implement a vector control program in its community. The NGO helps coordinate and carry out ITN distribution campaigns in the community and provides education and assistance to families in the surrounding villages to hang ITNs appropriately, in addition to carrying out social and behavior change communication (SBCC) activities to help promote the use of ITNs and seeking of prompt treatment for malaria. The program has been running smoothly for the past three years, has distributed more than 150,000 ITNs, and has carried out a number of great SBCC activities in the community. The program has been well-received in the community, receiving praise from the local community leaders.

The NGO's SME officer, Thomas, is responsible for collecting various data for the malaria program, including data on the number of ITNs distributed, the number of families assisted, the number of households that have ITNs, and the number of people reached with SBCC activities, among others. On a quarterly basis, Thomas aggregates the program's data from the previous quarters and prepares a summary report that he sends to the program manager, Florence. Thomas never receives any feedback on his reports from Florence, so he assumes he is doing a good job and continues to carry out his work in the same fashion. Florence looks over the quarterly reports for any clear mistakes before sending them to the NGO's central office in Nairobi. Florence never receives any feedback from the central office after submitting the reports, and therefore she assumes her program is on the right track and progressing well. If there is a way her program could improve its daily operations, she expects that this would be communicated to her from her supervisor at the central office in Nairobi.

At the NGO's headquarters in Nairobi, the SME manager aggregates the data from all the community-level reports and writes a summary report that is submitted to the NMCP in the Ministry of Health. After the NMCP receives the report, data are extracted from the report and aggregated across all malaria prevention and control programs in the country. A final report is created on the progress of all malaria control and prevention activities in Kenya and sent to the respective donor agencies. Based on the findings of the report, donor agencies engage in discussions with the NMCP to decide which programs to continue funding in the future. At this quarter's meeting, the donors note to the NMCP that although a lot of funding has been provided to the local NGO in Western Kenya for malaria prevention activities for the past three years, the number of malaria cases and deaths has not fallen. Based on this information, the donors and the NMCP decide that the program must not be performing well.

Case Study Questions

Answer the following questions about the case study on the previous page.

- What are the main barriers to data use that you see in this scenario?
- Do you think the decision of the donors and the NMCP that the program was performing poorly was accurate?
- What recommendations would you provide to improve the use of data in this situation?

Case Study Answers

What are the main barriers to data use that you see in this scenario?

The main barrier in this scenario is that the local NGO program staff view data collection as more of a reporting requirement, rather than viewing the process as useful for informing how to improve their program or to track whether their program is achieving its set goal and objectives. It is common for data to be collected and sent to higher levels in the health system, and not considered or used at the local or district levels to make decisions about future program or service delivery. This barrier could be due to a lack of culture of data use in general across the multiple levels.

Another barrier is the lack of a feedback mechanism at all levels. After the information has been submitted to the next level, there is limited or no feedback to the lower levels in the system. In this scenario, we can see that this lack of feedback causes the program staff to wrongly assume that their program is on track and performing well.

Although not elaborated on in the scenario, it is possible that program staff in the NGO have limited SME skills. Staff might be trained in data collection only, and not necessarily in how to analyze data or how to effectively present and use data for decision making.

Do you think the decision of the donors and the NMCP that the program was performing poorly was accurate?

It is hard to tell whether the decision of the donors and the NMCP was accurate in this instance, because we are not given any specific information on which data they used to inform their decision. We are only told that the data are aggregated at the various levels, and we are not sure what information is actually available and being used to inform the decision. Thus, it could be that there is poor interpretation of the data or insufficient data to make an informed decision at this high level. Or the program may not be not performing well, as the donors and the NMCP assume. This highlights another issue around data use—that data can be used inappropriately to make decisions.

What recommendations would you provide to improve the use of data in this situation?

To improve data use in this situation, it might be important to first take time to build the capacity of the NGO in SME, specifically in effective data presentation and data use. This can help build a culture of data use in the organization by ensuring that data are shared within the organization among staff and in an effective way that facilitates data use. This will ensure that the program is not reliant on receiving feedback from other levels for input on the program's progress.

Although it is important to improve the culture of data use within the organization, it is also important to create a culture of data use among all program stakeholders. This can be done by regularly sharing program findings with all program stakeholders and asking for input and feedback on how to improve the program based on the findings. This ensures that all stakeholders are aware of the progress of the program and are able to quickly identify whether the program is not performing according to expectations.

Increasing Data Use

A good SME system allows for timely and effective use of data. Collecting data is a worthwhile effort only when the data collected are used for decision making. Although organizations face a number of common barriers in using data, there are many actions they can take to help increase the demand and use for data. Some examples of these actions include the following:

Monitoring progress in Kenya
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- Involving program staff in monitoring and evaluation activities, such as in data collection and data review
- Building organization capacity in data management and use
- Being sure to package information in user-friendly formats that facilitate use of the information
- Sharing findings and recommendations with all relevant stakeholders and providing them with timely and regular reports
- Ensuring good data quality, consistency in the indicators used, and that data are available at all the relevant levels
- Developing realistic recommendations from data gathered on ways to improve the program
- Developing an action plan that details how to implement the recommendations from the data
- Linking the allocation of resources to performance monitoring

Can you think of any other effective ways to increase data demand and use in your own program?

Success Stories

Since the 1980s, resistance to chloroquine for treatment of malaria caused by *P. falciparum* in malaria endemic areas has risen dramatically, with increasingly higher treatment failure rates found across many countries throughout Africa, Asia, and Latin America. The emerging amount of evidence of widespread resistance to chloroquine, in addition to documented increases in morbidity and mortality due to malaria, led many NMCPs to decide to take action to change their current national drug policy for malaria treatment. By gathering and sharing evidence with stakeholders, many NMCPs were able to start a process in their countries to change and implement new national drug policies. In Africa, Zambia was the first country to use the evidence to push for the change.

Zambia: Malaria Drug Policy Change

In 2002, Zambia implemented a national drug policy change to ACTs for first-line treatment of malaria. Based on evidence of increasing malaria morbidity and mortality in Zambia over the previous two decades and from multiple studies carried out from 1995 to 2000 in sentinel sites across Zambia that demonstrated the decline in efficacy of chloroquine, Zambia initiated the process to develop and implement a new national drug policy. Due to the recognized challenge of implementing a national policy change, the country formed a Drug Technical Advisory Group to develop a technical framework and advocacy strategy for implementing the drug policy change. Upon review of the evidence, the Advisory Group concluded that immediate action was required to change the first-line therapy, as well as to ensure access to the treatment. After the decision was made, efforts focused on developing new treatment guidelines, training materials, and plans detailing how the new policy would be implemented. Although not without its challenges, the successful implementation of the policy change and additional increased vector control activities resulted in a dramatic decrease in malaria cases and deaths in Zambia by 2008.

Example of ACTs and RDTs

Many other countries across Africa, Asia, and Latin America also used the same strategy, leading to the successful use of evidence to advocate and inform the development of a new drug policy. As of 2016, ACTs have been adopted as a national policy for first-line treatment for malaria in 80 countries where *P. falciparum* is endemic.

Senegal: Progress toward Elimination

Senegal's focus on malaria elimination has historically been one of Senegal's major health challenges. Less than two decades ago, malaria accounted for one-third of outpatient visits nationwide. Today, Senegal has one of the lowest malaria incidence rates in West Africa, a rate which continues to fall. There was a 30 percent reduction in cases between 2015 and 2016 due to scale-up of key interventions by the National Malaria Control Program and its partners.

In fact, Senegal's progress has been so pronounced that there are now several northern districts where local transmission has been interrupted and where elimination appears to be achievable soon. The country is now conducting malaria case notification and investigation in these areas, which is the next step to reach elimination. Senegal's substantial and sustained progress in controlling malaria is an inspiring public health success story and a source of potential lessons for other countries on the path to elimination.

Module 2 Assessment

Questions

Correct answers are provided on the next page.

1. Which of the following questions would be best answered by an evaluation?

    a. How many pregnant women attending the health facility during the last month received a dose of intermittent preventive treatment during their routine antenatal care visit?
    b. What percentage of households did the program cover with indoor residual spraying during the past year of program implementation?
    c. Did the program's distribution of long-lasting insecticide-treated nets (LLINs) reach the poorest quintile in Community X?
    d. How many LLINs were distributed each month by the National Malaria Control Program?

2. *True or False:* Surveillance, Monitoring and evaluation is a continuous process that occurs throughout the lifecycle of a program.

    a. True
    b. False

3. The Ministry of Health in Uganda would like to know whether the malaria programs being carried out in the Northern region of the country are increasing insecticide-treated net use among pregnant women and children under five in that region. This question could be answered by which of the following?

    a. Monitoring
    b. Evaluation

4. At what level are data needed for decision making? *(Select all that apply.)*

    a. Beneficiary level
    b. Program level
    c. Policy level
    d. Partner agency level

Correct Answers

Correct answers are noted in bold.

1. Which of the following questions would be best answered by an evaluation?

   c. Did the program's distribution of long-lasting insecticide-treated nets (LLINs) reach the poorest quintile in Community X?

   This question deals with understanding how effective the program was in targeting the distribution of LLINs to those that have the greatest need; therefore, it would be answered through conducting an evaluation. Routine program monitoring data do not typically collect more detailed information, like socio-economic status, on the beneficiaries of the program that would be necessary to answer this question.

2. *True or False:* Surveillance, monitoring and evaluation is a continuous process that occurs throughout the lifecycle of a program.

   a. True

   Surveillance, monitoring and evaluation occurs throughout the lifecycle of a program; not just at the beginning or end of a program, or at specified times.

3. The Ministry of Health in Uganda would like to know whether the malaria programs being carried out in the northern region of the country are increasing insecticide-treated net use among pregnant women and children under five in that region. This question could be answered by which of the following?

   a. Evaluation

   This question deals with understanding the impact of the Ministry of Health's malaria programs on insecticide-treated net use among the targeted population, pregnant women, and children under five in the northern region. Monitoring data will not be able to provide an answer to this question; an evaluation will be required.

4. At what level are data needed for decision making? *(Select all that apply.)*

   a. Beneficiary level

   b. Program level

   c. Policy level

   d. Partner agency level

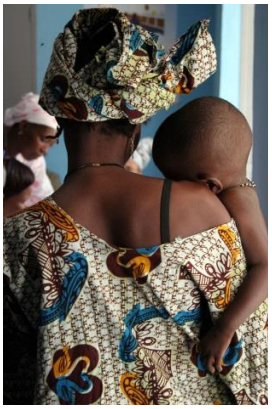
   Data are needed at all levels: beneficiary, program, policy, and partner levels.

MODULE 3:

INTRODUCTION TO SURVEILLANCE, MONITORING, AND EVALUATION FOR MALARIA PROGRAMS

MODULE 3: INTRODUCTION TO SURVEILLANCE, MONITORING, AND EVALUATION FOR MALARIA PROGRAMS

This module describes the key players in surveillance, monitoring, and evaluation (SME) for malaria programs, common indicators for monitoring coverage of malaria control and prevention interventions, and challenges for SME for malaria programs.



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Module Objectives

By the end of this module, you will be able to:

- Identify the key players in SME for malaria programs
- Identify the key goals and targets of the Roll Back Malaria (RBM) Partnership
- Identify common indicators for SME for malaria programs
- State common SME challenges for malaria programs

Key Players in the SME of Malaria Programs

Surveillance, monitoring, and evaluation plays a vital role in all malaria control and prevention programs. A number of key players in SME of malaria provide valuable guidance and support for SME within country programs. The following are some of the key players in SME.

National Malaria Control Program

The national malaria control program (NMCP) is the main institution within a country that is responsible for formulating policies and strategies to reduce the malaria burden in the near and mid-term, as well as the global eradication in the long-term. National malaria programs may focus on control or elimination, which is reflected in their identity as NMCPs or national malaria elimination programs. Regardless of the name, the institution is in charge of coordinating, supervising, monitoring, and evaluating the implementation of these interventions.

Roll Back Malaria Partnership and Surveillance, Monitoring and Evaluation Reference Group

The purpose of the RBM Partnership to End Malaria's Surveillance, Monitoring and Evaluation Reference Group (MERG) is to facilitate alignment of partners on strategies and "best practices" in SME for malaria control and elimination programs. It also identifies emerging questions and needs related to the implementation of SME initiatives, communicates these to appropriate partners, and brainstorms solutions. The RBM MERG also advises on SME of international, regional, and national initiatives. It provides technical advice on state-of-the-art approaches to SME for malaria programs, including providing guidance on appropriate indicators, data collection methods, analytic strategies, and dissemination of recommendation for SME for malaria programs. The RBM MERG welcomes participation from all partners working on SME for malaria and actively pursues engagement with professionals in malaria endemic countries.

For more information, visit the RBM MERG website at https://endmalaria.org/our-work-working-groups/monitoring-and-evaluation.

U.S. President's Malaria Initiative

The U.S. President's Malaria Initiative (PMI) is an interagency initiative led by USAID and implemented together with the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Department of Health and Human Services. Its strategy goal for 2015–2020 is to work with countries and partners to further reduce malaria deaths and significantly reduce malaria morbidity, until reaching elimination. It works in 25 countries that have a high burden of malaria in sub-Saharan Africa as well as in Burma and Thailand. The agency works closely with country NMCPs, providing technical support, building capacity, and helping coordinate SME efforts within the country.

For more information, visit the PMI website at PMI.gov.

Global Fund to Fight AIDS, Tuberculosis and Malaria

The Global Fund is a global public/private partnership that attracts and disburses resources to prevent and treat HIV/AIDS, tuberculosis, and malaria. The Global Fund provides nearly 60 percent of all international funding for malaria and has invested more than $10.5 billion in malaria control programs in more than 100 countries from 2002–2017, using a comprehensive approach combining malaria education, diagnosis, prevention, and treatment.

For more information, visit the Global Fund website at https://www.theglobalfund.org/en/.

SME Goals and Targets for Malaria Control and Prevention

The WHO Global Technical Strategy for Malaria, 2016–2030 (GTS), is a technical framework intended to guide and support malaria endemic countries to achieve malaria control and elimination. The strategy contains three pillars:

1. Ensure universal access to malaria prevention, diagnosis, and treatment
2. Accelerate efforts toward elimination of malaria and attainment of malaria-free status
3. Transform malaria surveillance into a core intervention

The Global Technical Strategy targets are as follows:

- Reduce malaria mortality rates globally compared with 2015 by at least 40 percent by 2020, at least 75 percent by 2025, and at least 90 percent by 2030
- Reduce malaria case incidence globally compared with 2015 by at least 40 percent by 2020, at least 75 percent by 2025, and at least 90 percent by 2023
- Eliminate malaria from countries in which malaria was transmitted in 2015 in at least 10 countries by 2020, at least 20 countries by 2025, and at least 35 countries by 2030
- Prevent re-establishment of malaria in all countries that are malaria-free

Common Indicators for SME for Malaria Programs

There are a number of common household-level indicators for SME of malaria programs based on the four main malaria control and prevention strategies:

- Vector control, including insecticide-treated nets (ITNs)/long-lasting insecticide-treated nets (LLINs) and indoor residual spraying (IRS)
- Chemoprevention, including intermittent preventive treatment for pregnant women and seasonal malaria chemoprevention
- Case management
- Malaria surveillance

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Indicators monitor the coverage of each of these interventions. Coverage indicators help us understand how effective a program is, determine whether one strategy reached its goal more effectively than another, and identify underserved areas or regions. More information on indicators for malaria programs is found in Module 6.

Malaria SME Challenges

SME of malaria programs is not always straightforward. In many cases, it can be quite complex. As you gain more experience in SME for malaria programs, you will most likely face many of these challenges and grow to appreciate and understand all of the complexities.

Challenges in archiving SME data

For this course, we will begin to shed light on some of the main challenges that are faced in SME, specifically for malaria programs. At this point, the aim is to make you aware of these challenges so you can take them into consideration when you are developing SME plans, designing your programs and interventions, and analyzing and interpreting your data.

Challenges for SME for Malaria Programs: NMCPs

A key challenge that NMCPs face is being able to measure the impact of the malaria control and prevention interventions they implement. Measuring the impact of country programs has not always been routinely required. This is now changing with an initiative to evaluate the impact of these programs by the RBM Partnership and PMI.

In order to measure impact of interventions, such as the impact on malaria-specific mortality or morbidity, often a rigorous experimental evaluation design is required. Such an evaluation design can be complex and costly to undertake, and can thus potentially pose a challenge to country NMCPs.

Another common difficulty faced by NMCPs is developing a case definition for malaria that is practical in the field. Currently, most countries have policies in place to diagnose a malaria case using a blood test, such as microscopy or a rapid diagnostic test; however, sometimes those diagnostic tests are not available, there is a stockout, or there is a lack of confidence in the diagnostic tool. In situations in which diagnostic

tools for measuring malaria are not available, malaria is measured by onset of fever. In doing so, the precision for measuring malaria incidence and burden decreases.

Other common challenges faced by NMCPs are the variation in completeness of reporting over time and location and the low coverage and quality of vital registration systems in developing countries.

These are a few of the main challenges the field of SME faces for malaria programs. Can you think of others that you have faced in your work?

Challenges for SME for Malaria Programs: Complexity of Malaria Epidemiology

The complexity of malaria epidemiology also poses challenges to SME for malaria programs by adding a layer of complexity to the interpretation of the data collected.

The relationship between transmission and mortality is not a perfect linear relationship. For example, a high level of malaria transmission does not necessarily result in a higher level of malaria-specific mortality. A population that experiences a high level of malaria transmission builds immunity over time with repeated infection with malaria. This immunity helps lessen the severity of the disease, resulting in fewer deaths. Meanwhile, people who live in areas with less malaria transmission do not build the same level of immunity and therefore are more vulnerable when they get infected with malaria.

Another important aspect of the disease to take into consideration is the complex relationship between transmission and immunity and how this can affect the severity and symptoms of malaria morbidity. For example, if there is high malaria transmission, it presents in the population in the form of chronic infections and severe anemia. If there is low malaria transmission, often it presents as higher life-threatening severe malaria. This is because with high transmission, the overall population's immunity rises, and with low transmission, the overall population has a lower immunity.

These are a few of the main complexities we must be aware of and take into consideration when we interpret the data we have collected.

Module 3 Assessment

Questions

Correct answers are provided on the next page.

1. Which key malaria SME player advises on SME of international, regional, and national initiatives, providing technical advice on state-of-the art approaches to SME for malaria programs?

    a. National malaria control programs
    b. Roll Back Malaria Surveillance, Monitoring and Evaluation Reference Group
    c. President's Malaria Initiative
    d. The Global Fund

2. Which statement about the WHO Global Technical Strategy is INCORRECT?

    a. Reduce malaria case incidence by at least 90 percent by 2030 is one of the GTS targets.
    b. Reduce malaria mortality rates globally by at least 75 percent by 2030 is one of the GTS targets.
    c. A pillar of the GTS transforms malaria surveillance into a core intervention
    d. The GTS is a technical framework intended to guide and support malaria endemic countries in achieving malaria control and elimination

3. Which program at the national level is in charge of elaborating and implementing malaria control strategies?

    a. National malaria control program
    b. The Global Fund
    c. Roll Back Malaria Partnership and Surveillance, Monitoring, and Evaluation Reference Group
    d. President's Malaria Initiative

Correct Answers

Correct answers are noted in bold.

1. Which key malaria SME player advises on SME of international, regional, and national initiatives, providing technical advice on state-of-the art approaches to SME for malaria programs?

   b. Roll Back Malaria Surveillance, Monitoring and Evaluation Reference Group

   The RBM MERG's role is to advise on SME of international, regional, and national initiatives. It provides technical advice on state-of-the-art approaches to SME for malaria programs, including providing guidance on appropriate indicators, data collection methods, analytic strategies, and dissemination of recommendation for SME for malaria programs.

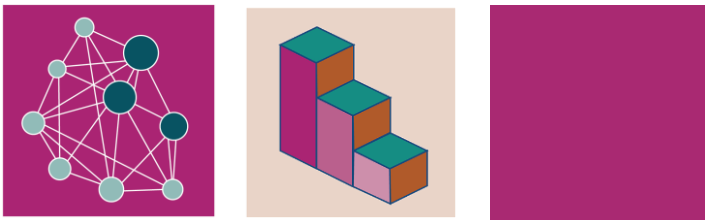
2. Which statement about the WHO Global Technical Strategy is INCORRECT?

   b. Reduce malaria mortality rates globally by at least 75 percent by 2030 is one of the GTS targets.

   Reducing malaria incidence by at least 90 percent by 2030 is one of the GTS targets.

3. Which program at the national level is in charge of elaborating and implementing malaria control strategies?

   a. National malaria control program



MODULE 4:

DESIGNING AND IMPLEMENTING A SURVEILLANCE, MONITORING, AND EVALUATION PLAN FOR MALARIA PROGRAMS

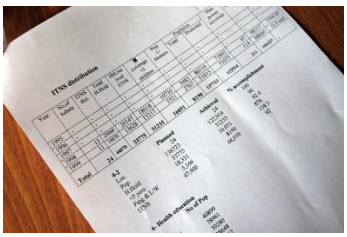
MODULE 4: DESIGNING AND IMPLEMENTING A SURVEILLANCE, MONITORING, AND EVALUATION PLAN FOR MALARIA PROGRAMS

This module describes the main functions and essential elements of an surveillance, monitoring, and evaluation (SME) plan for malaria programs and the process for developing and implementing an SME plan. It will also review Specific, Measurable, Appropriate, Realistic, and Time-bound (SMART) goals and objectives.

Module Objectives

By the end of this module, you will be able to:

- Describe the functions of an SME plan for malaria programs
- Identify the main elements of an SME plan
- Describe the process of developing an SME plan
- Understand how to implement an SME plan
- Make a distinction between goals and objectives for malaria programs



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What Is an SME Plan?

An SME plan is a comprehensive document that describes all SME activities in an SME system, including:

- Program objectives and interventions developed to achieve the stated objectives and procedures to be implemented to determine whether or not the objectives are met
- Expected program results and how they relate to goals and objectives
- Data needed and how it will be collected and analyzed
- Information use including resources needed to do so
- Program procedures for how the program will be accountable to stakeholders

Ideally, the SME plan should be developed when your program is being developed. In practice, however, this is often not the case and SME plans are often developed after the program is already in place. If feasible, aim to develop the two simultaneously.

Functions of an SME Plan

An SME plan serves a number of functions. First, the plan states how the program will measure achievements, providing accountability for the program. Second, it serves to document the consensus reached from all stakeholders. This provides greater transparency and holds stakeholders responsible for the achievements of the program. Third, the plan helps guide the SME implementation over the life of the program, thus standardizing and coordinating all SME efforts throughout the program. Lastly, the plan helps to preserve institutional memory.

It is important to remember that an SME plan is a living document. Often programs are modified based on lessons learned during implementation. If your program is modified at any time during the life of the program, it is important to also adjust the SME plan accordingly.

An SME plan should strive to be:

- Useful, by serving the practical information needs of its intended users
- Feasible, as well as realistic, diplomatic, and frugal
- Conducted in a legal and ethical manner with regard to those involved in and affected by the evaluations
- Accurate, by conveying technically sound information

Components of an SME Plan

An SME plan consists of eight main elements:

1. Introduction
2. Program description
3. Indicators
4. Data sources and reporting systems
5. Strategies for demonstrating program outcome and impact
6. Plans for dissemination and use of information
7. Analysis of data quality constraints and potential solutions
8. Implementation plan

It is important to note that not every plan will conform to this exact outline. Some plans will include other elements or a different arrangement of elements. These elements represent the essential components in an SME plan that should be thought out and discussed in detail.

1. Introduction

The introduction of the SME plan includes:

- The purpose of the SME plan. For example, "To detail how the program will monitor its progress and evaluate its achievements"
- A description of how the plan was developed, which describes who the stakeholders are and the process that was undertaken to reach consensus among all the stakeholders
- A review of the SME system, including a Strengths, weaknesses, opportunities, and threats (SWOT) analysis

A SWOT analysis is a tool used for strategic planning during the review of an SME system. It generates information that is helpful in matching a malaria program's goals, activities, and capacities. A SWOT analysis identifies a malaria program's internal factors, such as strengths and weaknesses, and external factors, such as opportunities and threats.

Internal factors:

- Strengths are positive attributes that are internal to the malaria program and can be controlled by the program.
- Weaknesses are factors within the control of the program that lesson the program's ability to attain its goals.

External factors:

- Opportunities are external factors that may improve a program.
- Threats are factors, beyond the program's control, which could place program activities at risk.

A matrix is often used during a SWOT analysis to assess each system within a malaria program. Here is an example of a matrix used during a SWOT analysis.

Figure 8. Example of a SWOT analysis matrix

System	Strengths	Weaknesses	Opportunities	Threats
Routine Health Information System (RHIS)				
Integrated Disease Surveillance and Response System (IDSR)				
Demographic and Health Survey (DHS)				
Entomological sentinel sites				
Other reporting systems				

2. Program Description

The program description includes:

- *A problem statement* that describes the nature of the malaria-related issue being addressed by the program
- *The conceptual framework for the program*
- *Goals and objectives that* describe the ultimate outcome of the program (goal) and the shorter-term aims (objectives)
- *Program description which provides a description of the interventions that will be implemented,* describes the geographic scope of the program and the target population for the interventions, and discusses the expected duration of the program
- *A logical framework/results framework*

3. Indicators

This section details which indicators will be measured to track the program's progress and achievements. When selecting the indicators for the program, a number of important considerations should be taken into account.

Indicators should be based on the following:

- The program's conceptual and logic framework
- The strategic information that will be needed for decision making at all relevant levels (global, policy, community, programmatic, beneficiary)
- The specific requirements of the country and health partners
- What existing data are already available or will be feasible to collect
- The amount of funding the program has allocated for SME activities

Figure 9. Example of an indicator matrix

Indicator	Data Source	Frequency	Level	Responsible persons
Number of health personnel and community health care agents trained in case management	Program Records	Quarterly	Output	LGA SME personnel
Proportion of children <5 years who slept under an ITN the previous night	Representative household survey (ex. DHS, MICS, MIS)	Periodic (Every 1-5 years)	Outcome	Survey Personnel

Here are a few suggested ways in which you can present the indicators in your SME plan:

- Indicator matrix: Table that presents the indicators and information on data source, frequency, and who is responsible
- Indicator reference sheets: Detailed sheets describing each indicator, how to measure it, underlying assumptions, and interpretation considerations.

Figure 10. Example of an indicator reference sheet

Name of Indicator
DESCRIPTION
Rationale
Definition of the Indicator: • **Numerator:** • **Denominator:**
Measurement:
Frequency:
Interpretation:
Data Source(s):
Strengths:
Limitations:
THIS SHEET LAST UPDATED ON: 02/04/2020

4. Data Sources and Reporting Systems

The data sources and reporting systems section of the SME plan describes the source of the information for each indicator, how that information will be reported, and how the SME team will collect the information.

It typically includes a description of each of the following:

- The specific sources of the data for each of the indicators
- A framework that details the data collection, processing, analysis, and reporting system
- The data collection tools will be; for example, patient records or registers, survey instruments, commodity management forms
- The management of the SME activities, including the roles and responsibilities of each group or member of the reporting system

5. Plans for Demonstrating Program Performance, Outcome, and Impact

It is important to include in your SME plan a detailed account of how you will demonstrate the outcomes and impact of your program. This entails building an evaluation into your program from the start to measure the outcomes and impact over the life of the program. Typically, it is best to build in an evaluation that would take measures at baseline (at the start of the program) and compare them to the same measures either at the end of the program or ongoing throughout the life of the program. Other

special studies that take place during or after the program can be included in the SME plan. These special studies are less ideal than a baseline and end line evaluation, but in some cases they will be the most feasible option.

This section of the SME plan includes the following:

- A methodology for measuring program outcome or impact
- Protocols for any other special study planned for the program

6. Plans for Dissemination and Use of Information

It is critical to include a section in the SME plan that discusses how the data and information collected will be disseminated, to what audiences and stakeholders they will be disseminated, and how they will be used for decision making. Clarifying from the start of the program how the data will be used at all levels and across all stakeholders for decision making will help to create a "culture" for using data for decision making.

This section of the SME plan includes the following:

- How the data and other information collected will be stored to ensure confidentiality and who the users of the data will be
- How the information and results from the evaluations and special studies will be disseminated and used
- The different methods envisioned for disseminating the information; for example, through reports, media, conferences, and publications

7. Analysis of Data Quality Constraints and Potential Solutions

The SME plan should include a description of any constraints you expect to encounter throughout the implementation of the program and potential solutions and actions that will be undertaken by the program to avoid these constraints. It is important to show that you have considered and planned for possible constraints in the quality of the data collected by the program or in the system's overall performance.

8. Implementation Plan

This section of the plan describes the capacity needed to implement functions of the SME unit and how this will be addressed. It also includes a detailed work plan for how the SME plan will be implemented, a calendar with a timeframe to complete the activities, who will be responsible for each activity, and a budget.

Preparing an SME Plan

There are a number of steps involved in developing and preparing an SME plan, in addition to drafting the actual document. These steps are outlined as follows:

1. Identify your program's stakeholders and involve them in the development and implementation of the SME plan.
2. Assess your program's strategic information needs.

3. Assess the existing systems' capabilities to address your strategic information needs. If the current systems are unable to gather the information you need, decide on what mechanisms or systems will need to be put in place to collect that information.
4. Gather baseline data for the indicators chosen in the SME plan.
5. Develop a mechanism for SME plan development and review it among the stakeholders.
6. Prepare a budget for the implementation of the SME plan.
7. Achieve consensus and commitment among stakeholders on all of the following:
    a. Resources for implementation of the SME plan
    b. Indicators and their definitions
    c. Data collection, data analysis, processing systems and mechanisms
    d. A reporting structure, timeline, and formats
    e. The roles and responsibilities of all stakeholders for the implementation of the SME plan
8. Prepare a draft of the SME plan.
9. Review and achieve consensus from stakeholders.
10. Finalize the SME plan.

Tips for Implementing the SME Plan

Here is a list of important tips to remember for effective implementation of your SME plan:

- It is important to continually engage and involve your program's stakeholders in the implementation of the SME plan.
- It is essential at the beginning of the process to clarify the roles and responsibilities of each stakeholder for carrying out the SME plan.
- The program should regularly organize and interpret program results to ensure that it is being implemented as planned and achieving the expected results.
- The program should regularly prepare and disseminate reports and presentations for stakeholders on the results of the program.
- When possible, the program should facilitate and support stakeholders to use the information for decision making.
- Remember to update the SME plan whenever there are changes to your program and share these changes with program stakeholders.

Role of the SME Unit

There are a number of important roles that the SME unit of a program or of an organization plays in the development and implementation of an SME plan.

The main roles include:

- Building consensus among all of the stakeholders in the program, including beneficiaries, program managers, policymakers, and donors, around the proposed SME plan

SME Plan Development: Tips for Building Consensus

- Make sure that stakeholders understand what you are trying to achieve consensus on in the SME plan
- Ensure that all stakeholders are involved early in the process of developing the SME plan. This will ensure that they will have ample opportunity to provide input into the development of the plan.
- Provide stakeholders with the opportunity to provide input and receive feedback on the plan.
- Consistently promote the message that SME provides the means to demonstrate the extent to which a program is achieving its objectives and provides valuable information for improving your program.

- Coordinating SME efforts with the implementation of program activities
- Managing and manipulating the data, which includes all data entry, analysis, and interpretation
- Reporting the results and disseminating the information to all stakeholders in a user-friendly and easily accessible format
- Taking appropriate steps to ensure data quality, including auditing data to assess their quality
- Training staff and building their capacity in SME

Important Tips

Table 3 offers a few tips to keep in mind while you are preparing your SME plan.

Table 3. Tips for preparing an SME plan

Do	Don't
• Start early. • Involve stakeholders at all stages in the process. • Assess current capacity and use what is already available. • Avoid duplication of data collection and reporting. • Budget appropriately for the SME plan. • Report results in an easily accessible format and in a timely manner.	• Collect information that will not be used. • Underestimate the importance of stakeholder buy-in and ownership at each step of the process.

Developing a Problem Statement

A problem statement must be developed in the program description of an SME plan. A good problem statement concisely states a situation related to the programs needs or purpose that needs to be changed. It states who or what is affected, how many people, and what links the problem to the program's purpose. Another way to look at a problem statement is to ask:

- What is the ideal (expected) situation?
- What is the current situation?
- Where do we stand now or where is the gap?

Understanding the causes of the problem contributes to developing an effective plan. Two common tools used in developing a problem statement are problem tree analysis or fishbone diagram.

Goals and Objectives

A program description also includes goals and objectives that describe the outcome of the program and the shorter-term aims. A **goal** is a broad statement of a desired, long-term outcome of a program, and an **objective** is a statement of a desired, specific, realistic, and measurable program result.

Read each statement in the quiz and decide whether it represents a goal or whether it is an example of an objective. Your responses will not be graded. *Correct answers are provided on the next page.*

1. To reduce malaria morbidity and mortality among children under five
   a. Goal
   b. Objective

2. At least 85 percent of pregnant women have access to intermittent preventive treatment in Community X by January 2020.

    a. Goal
    b. Objective

3. Eighty percent of children who present with fever in the health clinic in Community Y receive the appropriate antimalarial treatment according to the current drug policy each month.

    a. Goal
    b. Objective

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Now think of your own malaria project; what are your program's overarching goal and objectives? Can you think of other effective ways for increasing data demand and use in your own program?

Correct Answers for Goals and Objectives

1. To reduce malaria morbidity and mortality among children under five

    a. Goal

2. At least 85 percent of pregnant women have access to intermittent preventive treatment in Community X by January 2016.

    b. Objective

3. Eighty percent of children who present with fever in the health clinic in Community Y receive the appropriate antimalarial treatment according to the current drug policy each month.

    b. Objective

SMART Objectives

Your program's stated goal and objectives should be written SMART. In other words, they should meet the SMART—Specific, Measurable, Appropriate, Realistic, and Time-based—criteria.

Your program goal and objectives should aim to be:

- **Specific:** Identify concrete events or actions that will take place.
- **Measurable:** Quantify the amount of resources, activity, or change.
- **Appropriate:** Logically relate to the overall problem statement and desired effects of the program.
- **Realistic:** Provide a realistic dimension that can be achieved with the available resources and plans for implementation.
- **Time-based:** Specify a time within which the objective will be achieved.

Putting SMART Objectives into Action

Test your knowledge of SMART objectives by determining whether the following statements meet the SMART criteria. Your responses will not be graded. *Correct answers are provided on the next page.*

1. *True or False:* The following statement meets the SMART criteria: "To ensure that at least 80 percent of people sleep under insecticide-treated nets in every district."
2. *True or False:* The following statement meets the SMART criteria: "At least 80 percent of pregnant women have access to the package of interventions to reduce the burden of malaria in pregnancy by December 2020."
3. *True or False:* The following statement meets the SMART criteria: "At least 85 percent of people sleep in insecticide-sprayed structures in eligible areas of the 36 selected districts by December 2019, an upward revision from the 15 initially planned districts in the 2015-2020 National Malaria Strategic Plan."

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4. *True or False:* The following statement meets the SMART criteria: "One hundred percent of malaria patients in all districts are receiving treatment according to the national policy within 24 hours of onset of symptoms by the end of next month."

Correct Answers for SMART Objectives

1. *True or False:* The following statement meets the SMART criteria: "To ensure that at least 80 percent of people sleep under insecticide-treated nets in every district."

   False: This objective statement does not meet all of the SMART criteria. It does not include a time frame for when the objective should be met.

2. *True or False:* The following statement meets the SMART criteria: "At least 80 percent of pregnant women have access to the package of interventions to reduce the burden of malaria in pregnancy by December 2020."

   False: This objective statement does not meet all of the SMART criteria. It is not specific; it should include a definition of what is meant by the "package of interventions" for reducing the malaria burden. When an indicator is not specific, it is very difficult to measure.

3. *True or False:* The following statement meets the SMART criteria: "At least 85 percent of people sleep in insecticide-sprayed structures in eligible areas of the 36 selected districts by December 2019, an upward revision from the 15 initially planned districts in the 2015-2020 National Malaria Strategic Plan."

   True: This objective is SMART. It meets all of the five criteria—it is specific, measurable, appropriate, realistic, and time-bound.

4. *True or False:* The following statement meets the SMART criteria: "One hundred percent of malaria patients in all districts are receiving treatment according to the national policy within 24 hours of onset of symptoms by the end of next month."

   False: This objective does not meet all of the SMART criteria. It is not a realistic objective, because ensuring that all malaria patients receive prompt and effective treatment within 24 hours according to the current drug policy most likely will take a very long time to accomplish and will not realistically be achieved within one month.

Module 4 Assessment

Questions

Correct answers are provided on the next page.

1. Which of the following is NOT an essential element of an SME plan?

    a. A detailed description of the program's activities or interventions, including a timeline and implementation plan
    b. The different data sources that will be used for collecting all the indicators
    c. A plan for how to implement the SME plan
    d. An analysis of potential data quality constraints

2. *True or False:* After an SME plan is developed, it is important to stick to the plan throughout the life of the program, even if there are small modifications to your program.

    a. True
    b. False

3. Which of the following is NOT one of the main functions of an SME plan?

    a. To state how a program will measure achievements
    b. To show stakeholders how the program plans to carry out its SME activities
    c. To guide SME implementation over the life of the program
    d. To document exactly how SME activities will be carried out to avoid having to make any changes later

4. *True or False:* Typically, it is best to include all stakeholders in the process of developing a program's SME plan.

    a. True
    b. False

5. Which of the following statements represents a SMART objective?

    a. To reduce malaria mortality in children under five by 50 percent
    b. At least 90 percent of all health workers in Districts X and Y receive training on how to properly diagnose and provide the correct antimalarial treatment for children who present with fever in the clinic by the end of the year.
    c. To increase use of insecticide-treated nets among pregnant women and children under five by 50 percent
    d. All pregnant women in Community Y receive two doses of intermittent preventative treatment during their pregnancy.

6. Which of the following statements represents a SMART objective?

    a. At least 80 percent of children under five who present with fever at the health clinics in District X receive the appropriate antimalarial treatment by December 2019.
    b. Health providers receive training on correct diagnosis and treatment of malaria in children under five.
    c. All pregnant women have access to intermittent preventive treatment.
    d. At least 75 percent of households are sprayed with insecticides in Community Y.

Correct Answers

Correct answers are noted in bold.

1. Which of the following is NOT an essential element of an SME plan?

   a. A detailed description of the program's activities and interventions, including a timeline and implementation plan

   A brief description of the program's activities, goals, and objectives is an essential element, but it is not necessary to include a long and detailed description of the program's activities and interventions, how and by whom they will be implemented, and a timeline. This information can be found in the program's work plans and other related documents.

2. *True or False:* Once an SME plan is developed, it is important to stick to the plan throughout the life of the program, even if there are small modifications to your program.

   b. False

   If there are any changes or small modifications to your program over time, then the SME plan will need to be modified accordingly to reflect those changes.

3. Which of the following is NOT one of the main functions of an SME Plan?

   d. To document exactly how SME activities will be carried to avoid having to make any changes later

   It is important to document how SME activities will be carried out, but if your program changes over time (as often happens), the SME plan will need to be modified accordingly. The point is **not** to document it from the beginning so that no changes have to be made later on.

4. *True or False:* Typically, it is best to include all stakeholders in the process of developing a program's SME plan.

   a. True

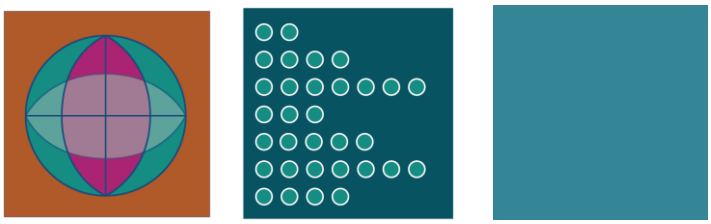
   It is important for all stakeholders to be part of the process of developing a program's SME plan because different stakeholders will need different information for decision making, thus their input is essential. Furthermore, it is important that there is consensus from stakeholders on how the program will track progress and its measure its achievements.

5. Which of the following statements represents a SMART objective?

   b**. At least 90 percent of all health workers in Districts X and Y receive training on how to properly diagnose and provide the correct antimalarial treatment for children who present with fever in the clinic by the end of the year**

6. Which of the following statements represents a SMART objective?

   a. **At least 80 percent of children under five who present with fever at the health clinics in District X receive the appropriate antimalarial treatment by December 2019.**



MODULE 5:

FRAMEWORKS

MODULE 5: FRAMEWORKS

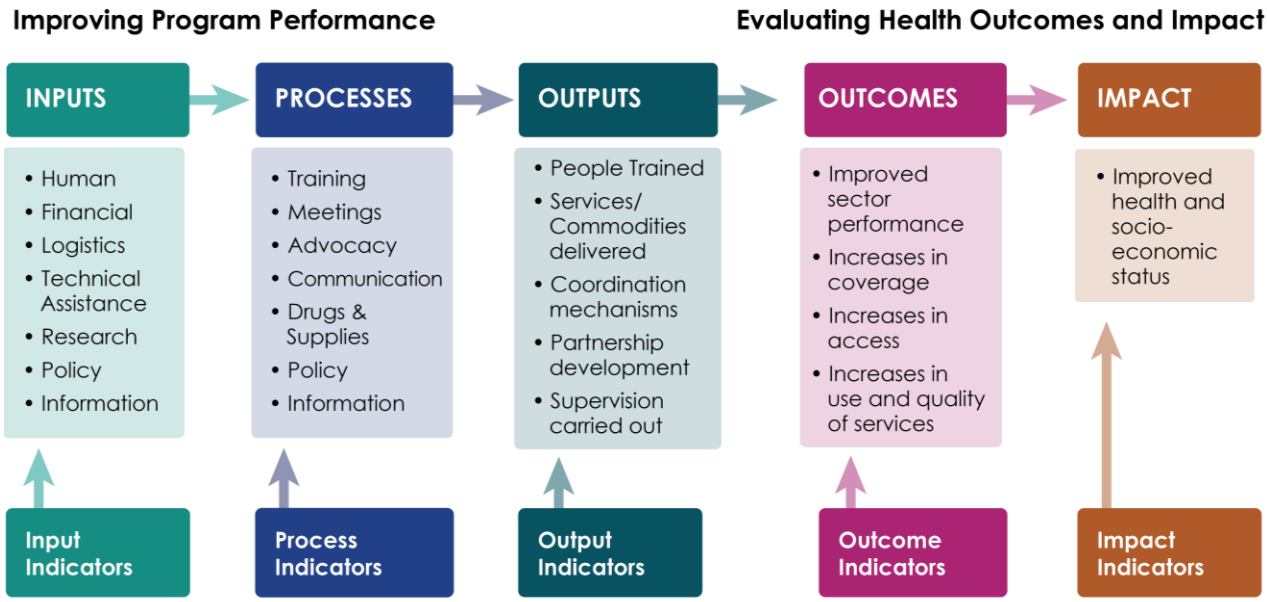
This module provides an overview of four popular frameworks used in malaria surveillance, monitoring, and evaluation (SME). It explains the design and purpose of each framework and how it is used for malaria SME planning.

Module Objectives

By the end of this module, you will be able to:

- Identify the different types of frameworks (conceptual, results, logical) and logic models.
- Design frameworks for specific intervention programs
- Understand how frameworks are used for malaria SME planning.

Figure 11. Basic M&E framework



Source: Roll Back Malaria Monitoring and Evaluation Reference Group

What Is an SME Framework?

Frameworks provide a detailed depiction of the components of a program and the sequence of the steps and processes needed to achieve the desired outcomes of a program. Designing a framework assists in developing clear program goals and measurable objectives. It also helps define the relationships between each of the components or factors of a program, as well as other internal and external factors that could potentially influence the program's desired outcomes.

In summary, frameworks allow you to understand how a program is supposed to work. Another important function of frameworks is to help guide program implementation and SME plans.

There are four common types of frameworks that vary by function or type of program. There is not one perfect framework that will fit the needs of every program. Each of the different frameworks will allow you to think about how to monitor and evaluate your program in a different way. It is good to have an understanding of all four frameworks, because different partner organizations use and require different types of frameworks.

The four main types of frameworks are as follows:

- Conceptual framework
- Results framework
- Logical framework
- Logic model

Conceptual Framework

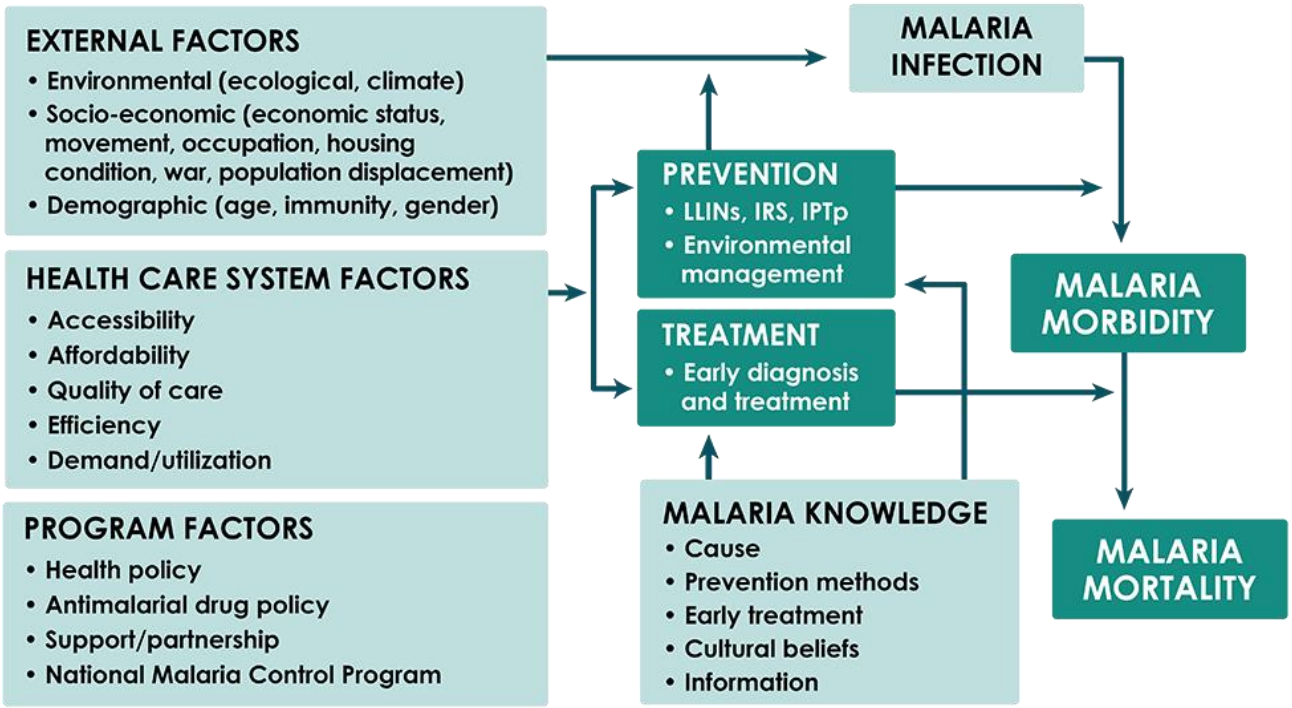
A **conceptual framework** is a diagram that identifies and illustrates the relationships between all relevant systemic, organizational, individual, or other relevant factors that may influence program operation and the successful achievement of the program's goals. A conceptual framework serves the following purposes:

- To show where the program fits within the wider context and environment
- To clarify the assumptions about causal relationships upon which the program is based
- To show how the different program components will operate to influence outcomes
- To guide the identification of indicators that the program will use to monitor and evaluate its progress, outcomes, and impact
- To guide impact evaluation based on the defined relationships among the different program factors and components

Conceptual Framework: Malaria Burden

This is an example of a conceptual framework to reduce malaria burden. Observe the external factors that contribute to malaria infection. Observe also how program factors influence the health care system, which affects malaria prevention and treatment interventions. Knowledge of malaria also contributes to treatment intervention. Ultimately, these factors influence malaria infection, which impact malaria morbidity and mortality within the targeted population.

Figure 12. Conceptual framework: malaria burden



Results Framework

A **results framework** is a diagram that maps the direct causal relationships between incremental steps or results of key activities all the way up to the overall **objective** and **goal** of the program or intervention. It includes an overall goal, **strategic objectives,** and **intermediate results.** A strategic objective is an outcome that is the most ambitious result that can be achieved and for which the organization is willing to be held responsible. An intermediate result is a discrete result or outcome that is necessary to achieve a strategic objective. The goal and strategic objectives are at the top of the framework, signifying that to achieve the broader strategic objectives, the intermediate results must be reached first.

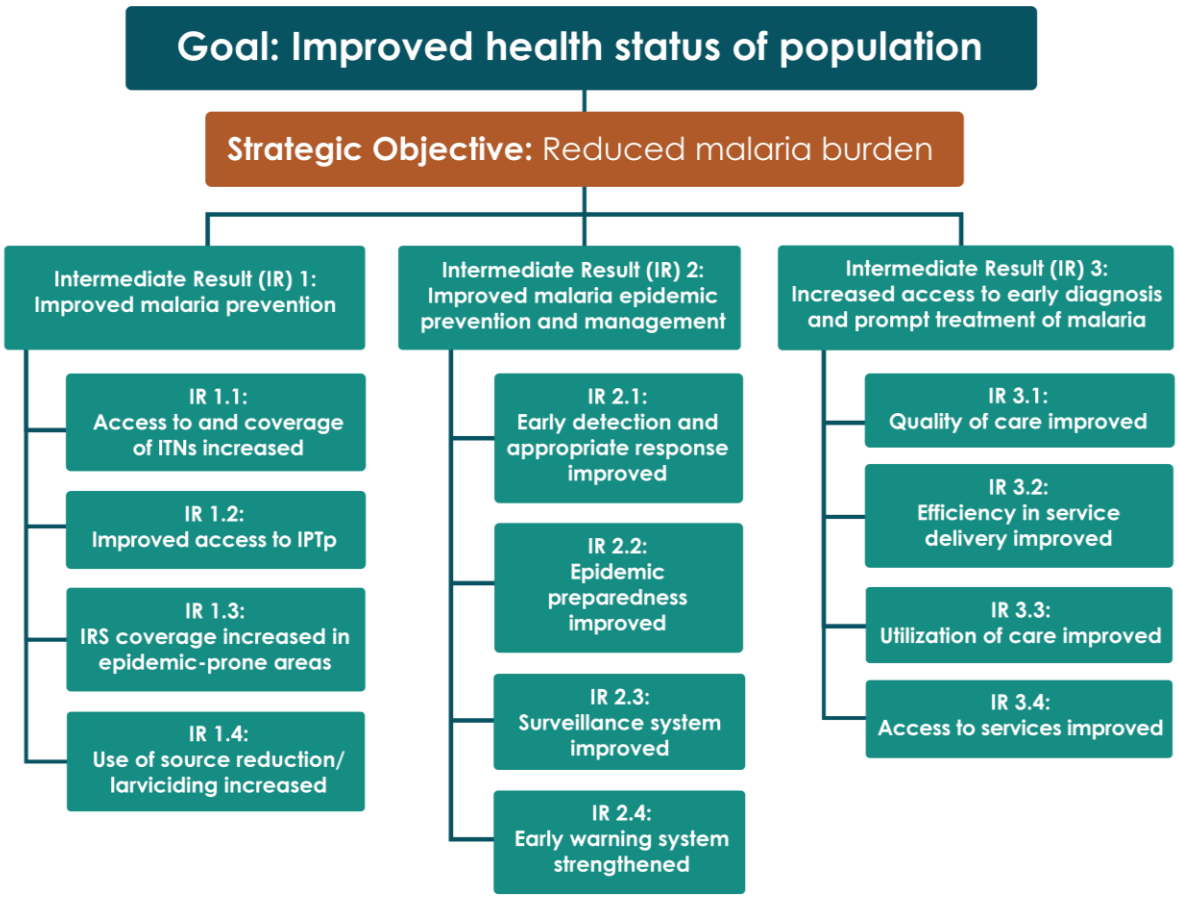
A results framework serves the following purposes:

- To show the causal relationships that connect the incremental achievement of intermediate results to the comprehensive program impact
- To clarify the relationships between different program factors and to provide a basis for objectively measuring the desired outcomes of the program or intervention

Results Framework: Malaria Burden

As illustrated in Figure 13, all of the intermediate results must be achieved first to achieve the strategic objective of reducing the malaria burden and the overall goal of improving the population's health status.

Figure 13. Example of a results framework for a malaria prevention and control program



Logical Framework

A **logical framework** is a table that presents a standardized summary of the program and its logic.

A logical framework serves the following purposes:

- To summarize what the project intends to do and how
- To clarify the key assumptions that went into the design of the program and how the program is intended to work
- To describe the key outputs and outcomes that will be monitored and evaluated

Logical Framework: Malaria Control

In the malaria program example shown in Figure 14, the logical framework states the goal, purpose, and objectives of the program, along with performance indicators, data sources, and assumptions for each.

Figure 14. Example of a logical framework

Logical Framework: National Malaria Control Program			
	Performance indicators	**Means of verification**	**Assumptions**
Goal: Reduced malaria morbidity and mortality	• Malaria incidence and prevalence rates • Malaria-specific death rates	•Annual reports •Surveys •Health & Demographic Surveillance System •Demographic & Health Surveys	• Political stability • Environmental stability (no natural disasters)
Purpose: To reduce malaria morbidity and mortality by 50% by 2015.	• Coverage of control interventions	• Annual reports • Surveys • Record reviews	• Problem of drug resistance will be reduced through effective and affordable drugs
Objectives: 1. To increase the proportion of children under 5 and pregnant women who are sleeping under a treated net by 10% every two years.	1.1 % of children under-5 who slept under LLIN the previous night 1.2 % of pregnant women who slept under LLIN the previous night Outcome: Increase in proper LLIN use by pregnant women and children under 5.	• Community surveys	• Availability of LLINs • Subsidies for LLINs • High community awareness and acceptance of LLIN

Logic Model

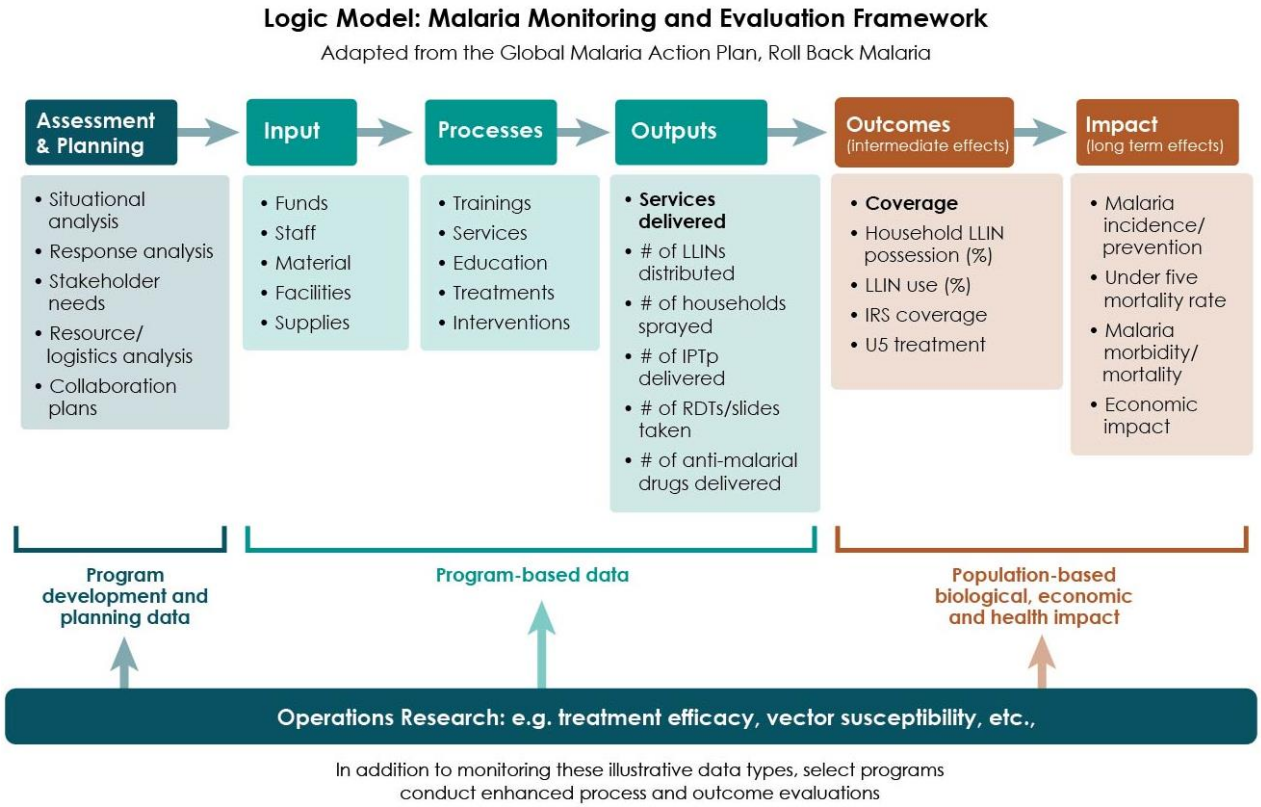
A **logic model** is a diagram that identifies and illustrates the linear relationships from program inputs, processes, outputs, and outcomes to the impact. The diagram shows how the inputs affect processes, which work to produce immediate results or outputs that ultimately lead to longer-term or broader impact. In the example on the next page, we can see that the inputs and processes are linked to achieving the broader outcome of increasing coverage of malaria prevention interventions, which is linked to reducing malaria incidence and malaria morbidity and mortality.

A logic model serves the following purposes:

- To provide a streamlined interpretation of planned use of resources and desired ends
- To clarify the program's assumptions about linear relationships between key factors relevant to desired outcomes

Logic Model: Malaria SME

Figure 15. Example of a logic model



Summary of Different SME Frameworks

Test your knowledge of frameworks by answering the questions in the quiz below. Your responses will not be graded.

Framework Summary

Correct answers are provided on the next page.

1. Match each framework to its description.

Conceptual framework	Logically links program objectives to outputs and activities
Results framework	Logically links a program's inputs, processes, and outputs to the outcomes and impact
Logical framework	Logically links the program objectives
Logic model	Describes the interaction of various factors on the outcome

2. Match the type of framework to each program management description.

Conceptual framework	Shows the casual relationship between inputs and objectives
Results framework	Determines which factors the program will influence
Logical framework	Shows the casual relationship between program objectives
Logic model	Shows the casual relationship between activities and objectives

3. Match the type of framework to its SME function.

Conceptual framework	Basis for SME at the objective level
Results framework	Basis for SME at the output and objective levels
Logical framework	Basis for SME at all stages of the program
Logic model	Not a basis for SME; however, it can help explain results

Framework Summary Answers

1. Match each framework to its description.

Conceptual framework	Describes the interaction of various factors on the outcome
Results framework	Logically links the program objectives
Logical framework	Logically links program objectives to outputs and activities
Logic model	Logically links a program's inputs, processes, and outputs to the outcomes and impact

2. Match the type of framework to each program management description.

Conceptual framework	Determines which factors the program will influence
Results framework	Shows the casual relationship between program objectives
Logical framework	Shows the casual relationship between activities and objectives
Logic model	Shows the casual relationship between inputs and objectives

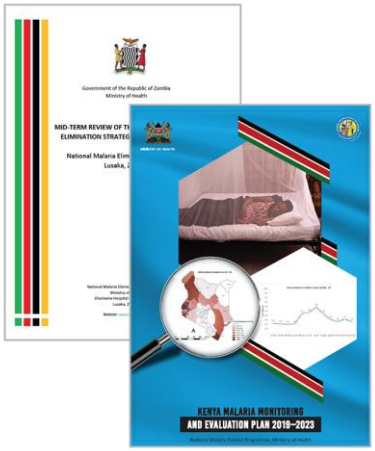
3. Match the type of framework to its SME function

Conceptual framework	Not a basis for SME; however, it can help explain results
Results framework	Basis for SME at the objective level
Logical framework	Basis for SME at the output and objective levels
Logic model	Basis for SME at all stages of the program

Using Frameworks for SME Planning

Frameworks guide the SME planning process, clarify the program's assumptions, goals and relationships between factors. They also help define a program's objectives. A framework can be used to select and plan activities, as well as to define the different levels of performance and desired results of the planned activities.

SME plans are based off of a program's framework. The plans incorporate the program's assumptions, objectives and a description of how the program is intended to work. Furthermore, a framework assists in identifying and selecting appropriate indicators to measure progress and impact of a program.



Monitoring and evaluation plans from different countries

Framework Summary

The table that follows provides a good summary of the four main SME frameworks, illustrating their main purposes and how they each differ slightly in their focus and function.

Table 4. The four SME frameworks

Type of Framework	Brief Description	Program Management	Basis for Monitoring and Evaluation
Conceptual	Interaction of various factors on the outcome	Determines which factors the program will influence	No—however, it can help explain results
Results	Logically linked program objectives	Shows the casual relationship between program objectives	Yes—at the objective level
Logical	Logically linked program objectives, outputs, and activities	Shows the casual relationship between activities and objectives	Yes—at the output and objective levels
Logic model	Logically linked inputs, processes, outputs, outcomes, and impact	Shows the casual relationship between inputs and objectives	Yes—at all stages of the program, from inputs to process to outputs to outcomes and objectives

Module 5 Assessment

Questions

Correct answers are provided on the next page.

1. *True or False:* A framework serves to provide a detailed depiction of the components of a program and the sequence of steps and processes that go into achieving the desired outcomes of a program.

   a. True
   b. False

2. The following is a description of which type of framework:

   "A diagram that illustrates the causal relationships linking all levels of a program's objectives, from the intermediate results to the broader strategic objectives"

   a. Conceptual framework
   b. Results framework
   c. Logical framework
   d. Logic model

3. *True or False:* A logical framework guides the monitoring and evaluation process by helping clarify the program's assumptions, objectives, and desired levels of performance or desired outcomes.
   a. True
   b. False

Correct Answers

Correct answers are noted in bold.

1. *True or False:* A framework serves to provide a detailed depiction of the components of a program and the sequence of steps and processes that go into achieving the desired outcomes of a program.

   a. True

   Frameworks provide a detailed depiction of the components of a program and the sequence of steps and processes that go into achieving the desired outcomes of a program.

2. The following is a description of which type of framework:

   "A diagram that illustrates the causal relationships linking all levels of a program's objectives, from the intermediate results to the broader strategic objectives"

   b. A results framework

   A results framework is a diagram that illustrates the causal relationships linking all levels of a program's objectives, from the intermediate results to the broader strategic objectives.

3. *True or False:* A logical framework guides the monitoring and evaluation process by helping clarify the program's assumptions, objectives, and desired levels of performance or desired outcomes.

   a. True

   A logical framework helps guide the monitoring and evaluation process by helping clarify the program's logic (and assumptions), objectives, and desired levels of performance or desired outcomes.

MODULE 6:

INDICATORS FOR MALARIA PROGRAMS

MODULE 6: INDICATORS FOR MALARIA PROGRAMS

This module describes how to identify and develop good indicators for malaria programs. Specifically, it will cover the criteria for selecting good indicators, how to critique indicators, how indicators are linked to frameworks, and different sources for the main indicators for malaria programs.

Module Objectives

By the end of this module, you will be able to:

- Identify the strengths and weaknesses of indicators for malaria programs
- Identify criteria for the selection of sound indicators
- State how indicators are linked to the frameworks (logic models, conceptual frameworks, results frameworks, and logical frameworks)
- Identify sources for predefined malaria-related indicators that are in line with global standards

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What Is an Indicator?

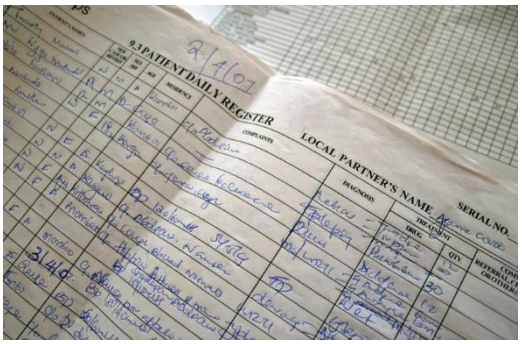
An **indicator** is a variable that measures one aspect of a program, project, or health outcome. It serves to measure the value of change over time in meaningful units, allowing comparison between a baseline value and a future value. Indicators are most commonly expressed in a quantitative form, as either a percentage or number.

Because indicators measure only one aspect of a program, project, or health outcome, an appropriate set of indicators will include at least one indicator for each significant aspect of the program or project. In many cases, there will be two or three indicators for each aspect of the program or project to obtain the necessary information for decision making.

Common Indicator Metrics
Counts *Examples:* number of providers trained, number of insecticide-treated nets distributed
Calculations Percentages, rates, and ratios *Example:* proportion of children under five who slept under a bed net the previous night
Index Composite measures *Example:* wealth index
Threshold Presence or absence, a cutoff point, a predetermined level or standard *Example:* epidemic threshold for early detection

Function of Indicators

Indicators are central to surveillance, monitoring, and evaluation (SME) efforts because they allow you to reduce a large amount of data down to their simplest form. They provide vital information for a program or project, by signaling the need for corrective management action, evaluating the effectiveness of various management actions, and providing evidence as to whether the objectives of the program or project are being achieved.



Clinic logbook for monitoring patient care

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Characteristics of a Good Indicator

A good indicator includes the following characteristics:

- **Valid:** A valid indicator is an accurate measure of a behavior, practice, or task. In other words, it measures what it is intended to measure.
- **Reliable:** The indicator can be consistently measured in the same way by different observers.
- **Measurable:** The indicator is quantifiable using available tools and methods.
- **Precise:** A precise indicator is operationally defined in clear, well-specified terms.
- **Timely:** The indicator provides a measurement at time intervals that are relevant and appropriate in terms of program goals and activities.
- **Programmatically important:** The indicator is linked to a public health impact or to achieving the objectives that are needed for impact.

Examples of Indicators

It is important to check that the indicators that you have selected for your program or project meet each of these criteria. Using these characteristics as your guide and considering the objective trying to be met, identify the potential strengths and weaknesses of the indicators listed in this section. Can you think of any other potential limitations of these indicators?

Example 1:

Objective: To reduce malaria-related morbidity in Community Z

Indicator: Prevalence rate of parasitemia in Community Z

Limitations: This indicator is not necessarily a valid measure of malaria-related morbidity in a community. It is possible that you could test positive for malaria parasites but have no symptoms in an area that has stable malaria transmission. It is important to take into account these nuances, because malaria is a complex disease, making monitoring and evaluation of malaria prevention and control programs challenging.

Example 2:

Objective: To increase the knowledge of prevention and treatment of malaria among adults ages 15 and older in Community X

Indicator: Number of people reached by behavior change communication campaigns

Limitations: In this example, measuring the proportion of adults ages 15 and older exposed to malaria prevention and treatment-related messages (target population) would be a more valid and precise measure of this objective. The indicator is not measuring the outlined objective, making it an invalid measure. It is measuring how many people were reached by the campaign, not the knowledge of malaria prevention and treatment in the community. Furthermore, the indicator is not precise. The objective is to increase knowledge among adults ages 15 and above. The indicator only states "number of people" and is not specific to the age group targeted.

Example 3:

Objective: To increase insecticide-treated net (ITN) ownership in Community Y

Indicator: Number of ITNs that were distributed by the health clinic in community Y

Limitations: In this example, measuring the proportion of households with at least one ITN would be a more valid and precise measure of this objective. The indicator is not valid or precise. First, the indicator does not measure what it is intended to measure, which is actual household ownership of ITNs. Second, the indicator is vague and not precise, in that it is determining how many ITNs were distributed by the health clinic only and does not take into account whether there were other programs distributing ITNs that could have also increased ITN ownership in the community.

Example 4:

Objective: At least 80 percent of pregnant women who have an antenatal care visit at clinic Y each month receive intermittent preventive treatment

Indicator: Number of pregnant women who received intermittent preventive treatment at their last antenatal care visit

Limitations: In this example, measuring the proportion of pregnant women who received intermittent preventive treatment at their last antenatal care visit during the last month would be a better way to measure this objective. The indicator does not state how frequently the measurement is to take place, thus the timing of data collection might not allow the indicator to capture whether the program is achieving its objective.

Selecting Indicators for Your Malaria Program

There are a number of factors that are important to consider when you are selecting indicators for your malaria program:

- Is the indicator linked to your program or project framework?
- Does it match your programmatic needs and provide valuable information for decision making?
- Do you have the resources necessary to be able to collect the data? Be sure to consider whether you have the necessary human resources.
- What are the external requirements of the program or project? For example, does the government or donor have other specific reporting requirements?
- Are the data available and accessible?
- Are there standardized indicators that you could use that would facilitate sharing and comparing data across other programs?

Common Pitfalls in Selecting Indicators

- Indicators are not linked to the program activities.
- Indicators selected do not currently exist and cannot be realistically collected.
- Process indicators are used to measure outcomes or impact of a program.
- Indicator is not very sensitive to change.
- Too many indicators selected.
- Indicator does not accurately represent the program's desired outcome.
- Indicator is difficult to interpret or too vague and poorly defined.
- The data needed for the indicator are not available.

Levels of Indicators

There are a number of different levels of indicators. The main levels of indicators for malaria programs are global, national, subnational, district, and health facility levels. Indicators at different levels are used for distinct purposes. Most often, the number and type of indicators at each level varies because stakeholders at each of these levels have different information needs. For example, at the national and global levels, typically the indicators focus on measuring program outputs, outcomes, and impact. Overall, fewer indicators are reported at these levels. At the district and facility levels, more indicators are typically collected to capture the necessary information for program management purposes.

Figure 16. Levels of malaria program indicators

In most cases, indicators at the high levels are linked to those at the lower levels. In many cases, data will be collected at lower levels (district or facility) and then passed up to the national level and then up to the global level.

Global

The global level refers to international agencies, such as the World Health Organization (WHO) or the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund). These agencies typically collect

information on coverage and impact of malaria prevention and control interventions to assess the progress of countries and regions over time as well as to be able to compare progress across countries. They also collect information to be able to assess their investments in malaria programs.

National or Subnational

The national or subnational level refers to agencies or organizations that are responsible for supporting malaria efforts at the national or regional and provincial levels in a country. An example of a national-level agency would be a national malaria control program housed in the Ministry of Health. At this level, an agency might require information regarding assessments of coverage to justify further investments in its program and to assess which areas in the country have the greatest need for specific malaria interventions.

District or Health Facility

At the district and health facility levels, the information requirements are much greater than at the higher levels. At this level, more information is typically collected on inputs into programs (e.g., human resources, drugs and supplies), different program processes (e.g., trainings for staff), and outputs of programs (e.g., number of staff trained in malaria diagnostics). This information is useful for programmatic decision making as well as for informing managers on how they can improve their programs. For example, hospital managers may collect information to assess the quality and costs of their services to decide what needs to be done to improve those services. District managers may need information on provision and use of health services in their district for future planning and budgeting of services.

Operationalizing Indicators

After selecting the indicators for your program, the next step is to establish exactly how each indicator will be measured. In other words, once you have selected your indicators, you must operationalize them. This is done by first defining each indicator in precise terms and establishing the metric that will be used for calculating the indicator. The second step is to define specifically how the indicator will be calculated. For proportions or percentages, this means that you will need to define both the numerator and the denominator. For example, if our indicator was the proportion of the population that slept under an ITN the previous night, the numerator and denominator would be defined as follows:

Numerator: Number of individuals who slept under an ITN the previous night

Denominator: Total number of individuals who spent the previous night in surveyed households

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For more information on ITN indicators see this video. Defining an indicator and how to calculate it as precisely as possible will help ensure that anyone using the same data will arrive at the same indicator value. After you have defined the indicator and how it should be calculated, the next step is to clearly write out detailed instructions for how to collect, analyze, and report on your indicators. Often programs develop an indicator reference sheet for each indicator they are responsible for measuring. Indicator reference sheets provide detailed information on the indicator definition; how the indicator will be

measured; plans for data collection; plans for data analysis, reporting, and review; and potential data quality issues to consider. They also include a performance data table with the baseline and program targets for that specific indicator. An example is available in Module 5.

Linking Indicators to Frameworks

The indicators that you select should be linked directly to the framework that you use for designing your program, project, or intervention. If the indicators are not linked to the framework, then it will not be possible to assess the progress of your program or intervention or whether it met its stated objectives.

Example 1: Logic model

In the example logic model that follows, you would want to select at least one indicator for each of the elements of the framework. In some cases, you may need multiple indicators per element if you are unable to measure the element completely with only one indicator. The number of indicators per program will vary and will be based on what is needed, the resources available, and what is feasible.

This table shows which indicators are linked to the different elements in the logic model.

Table 5. Linkages between a malaria logic model and program indicators

Logic Model →	Indicators
Input	
Human resources	Number of community health workers (CHWs) in program catchment area
Financial resources	Annual program funding
ITNs	Number of ITNs purchased for distribution
Process	
Training for CHWs on ITN delivery	Number of trainings for CHWs
Establish distribution points for selling ITNs	Number of distribution points of ITNs established
Develop educational communication campaigns on proper use of ITNs	Number of educational communication campaigns developed
Output	
Trained CHWs on ITN delivery	Number of CHWs trained on ITN delivery
ITNs sold at distribution sites	Number of ITNs sold at distribution sites
ITNs delivered by CHWs	Number of ITNs delivered by CHWs
Educational communication campaigns implemented	Number of educational communication campaigns implemented
Outcome	
Household ownership of ITNs	Proportion of households with at least one ITN
Household use of ITNs	Proportion of children under five who slept under an ITN the previous night
Impact	
Malaria mortality	Reported annual number of malaria cases
Malaria morbidity	Reported annual number of malaria deaths

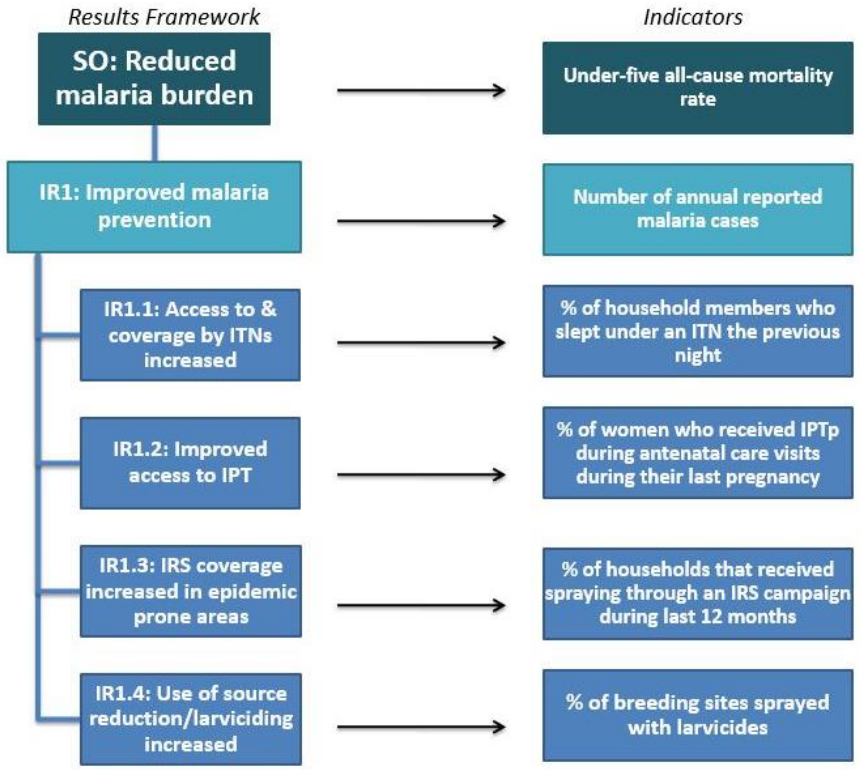
Table 6. Another way to show linkages between a logic model and indicators

Elements of the Logic Model	Indicators
Input	1. Number of CHWs in program catchment area 2. Annual program funding 3. Number of ITNs purchased for distribution
Process	1. Number of trainings for CHWs 2. Number of distribution points of ITNs established 3. Number of educational communication campaigns developed
Output	1. Number of CHWs trained on ITN delivery 2. Number of ITNs sold at distribution sites 3. Number of ITNs delivered by CHWs 4. Number of educational campaigns implemented
Outcome	1. Proportion of households with at least one ITN 2. Proportion of children under five who slept under an ITN the previous night
Impact	1. Reported annual number of malaria cases 2. Reported annual number of malaria deaths

Example 2: Results framework

Here is another example of how indicators are linked with a results framework. In this example, you can see that an indicator is developed for the intermediate result (IR) as well as for each of the intermediate results that are linked to reach the final result.

Figure 17. Linking a results framework with indicators



Tips to Link Indicators to Frameworks

As a general rule of thumb for selecting indicators for your program:

- Select at least one to two indicators per key activity or result area within your framework. Ideally, the data for your selected indicators will come from different data sources and not from just one source.
- Select at least one indicator for every core activity of your program.
- There should be no more than 8–10 indicators per area of significant program focus.
- When possible, use a mix of data collection strategies and sources to strengthen data quality.

Selecting too many indicators to monitor your program can be a huge burden and will likely result in the data not being used.

It is important to remember not to select too many indicators for your program, but be sure to select enough to be able to monitor and evaluate the key activities and results areas as defined in your program's framework. If you have too many indicators, collecting data to monitor them can be a burden on time and program resources. If you select indicators that follow your program's framework, then they will provide the necessary information for program improvement and programmatic decision making.

Sources for Malaria-Related Indicators

Indicators do not need to be newly developed for every new program or project. If possible, it is helpful to use indicators that have already been predefined. A few good sources to keep in mind when you are in the process of selecting indicators are as follows:

- Indicators that were used during previous years of the program. Using the same indicators over time allows data to be compared over many years.
- Indicators from related or similar programs. This allows for comparison between programs that provide similar services or conduct similar activities.
- Global or other recommended indicators from the Roll Back Malaria Monitoring and Evaluation Reference Group, WHO, Global Fund, the U.S. President's Malaria Initiative (PMI), and other key partners. The following links provide resources on these indicators:
  - Household Survey Indicators for Malaria Control
  - Global Fund Indicator Guide
  - Malaria Behavior Change Communication Indicator Reference Guide

Indicator Strengths and Limitations

Although some indicators are more useful and appropriate than others, it is important to remember that all indicators have limitations. Even the indicators that we commonly use in malaria programs have their own limitations. Being aware of and understanding those limitations is essential.

For example, the commonly used indicator for measuring coverage of indoor residual spraying is subject to recall bias that can end up resulting in what is referred to as "heaping" of dates. This occurs when subjects are not able to recall exactly the correct date when something happened in the past and they round up to a more common date. For example, instead of stating that their house was sprayed 11 months ago, they round up and say one year ago.

Another example is for the indicator used to measure ITN/LLIN use among children under five and pregnant women. This indicator is subject to two main types of bias. Because the indicator is based on self-reported data, it can be subject to social desirability bias, which can happen, for example, when the subject being interviewed reports what he or she feels the interviewer would like to hear, rather than reporting accurately. The second is the bias that occurs due to the timing of survey implementation relative to the malaria transmission season. Malaria transmission is higher during the rainy season than during the dry season, and therefore this may affect ITN/long-lasting insecticide-treated net usage levels. Thus, the season during which the survey is implemented must be taken into account when analyzing your data.

It is important to note that the following two issues can affect the results obtained from household surveys.

Malaria Endemicity

The first issue that may affect the interpretation of indicator values involves the definition of the target population. As stated previously, the Roll Back Malaria targets stipulate that coverage indicators are intended to be measured among the target population defined as those at risk for malaria. For countries in which malaria is endemic or are epidemic-prone throughout, this issue should not be of particular concern as long as stratification by urban and rural residence is undertaken, which is typically the case with the Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), and Malaria Indicator Surveys (MIS). In countries with large populations in areas absent of malaria, such as those with mountainous areas or deserts, national-level estimates, such as those obtained from the DHS and MICS surveys, will likely result in an underestimate of coverage for those at risk for malaria. In such a situation, it may be advisable to collect additional information that can establish whether an enumeration area is within or outside a malaria risk area; then during data analysis, the analysis can be limited to survey domains that are deemed to be malarious.

Seasonality

A second consideration that affects the interpretation of the survey findings is the timing of survey implementation relative to the high malaria transmission season (rainy and early post-rainy seasons). MIS surveys are typically conducted during and immediately after the rainy season and should conclude no later than four to six weeks after the rains end, because this timeframe is associated with peak transmission. For operational reasons, however, both DHS and MICS surveys may be conducted during the dry season and therefore outside the peak malaria transmission period. Intervention coverage or usage levels may differ significantly between seasons, and malaria morbidity and mortality will differ by season, so interpretation of the data obtained must take into account the seasonality of the survey period. It is also important to note that parasite prevalence data from surveys conducted outside peak transmission periods are not a reliable indicator of peak transmission; therefore, biomarker measurement is recommended during the malaria transmission season only. Further analysis of these data is needed to better understand the extent of the relationship between survey timing and intervention coverage.

Module 6 Assessment

Questions

Correct answers are provided on the next page.

1. If an indicator measures exactly what it was intended to measure, which of the following characteristics would it represent?

    a. Reliable—You did not select the correct response. An indicator that is reliable means that the indicator can be consistently measured in the same way by different observers. If an indicator measures exactly what it is intended measure, then it would be **valid.**
    b. Precise—You did not select the correct response. An indicator that is precise means that the indicator is operationally defined in clear and well-specified terms. If an indicator measures exactly what it is intended measure, then it would be **valid.**
    c. Programmatically important—You did not select the correct response. An indicator that is programmatically important refers to an indicator being linked to a public health impact or to achieving the objectives that are needed for impact. If an indicator measures exactly what it is intended measure, then it would be **valid.**
    d. If an indicator measures exactly what it is intended to measure, then it is **valid**.

2. *True or False:* It is important to have at least one indicator for each significant aspect, component, or activity of your program.

    a. True
    b. False

3. Which of the following actions is not involved in operationalizing indicators?

    a. Establishing how a given concept or behavior will be measured
    b. Developing a precise definition and metric for the indicator
    c. Defining how the value will be reliably calculated
    d. Training SME staff to collect the indicators

4. *True or False:* It is not necessary to link your indicators to the framework that you designed for your program or project.

    a. True
    b. False

Correct Answers

Correct answers are noted in bold.

1. If an indicator measures exactly what it was intended to measure, which of the following characteristics would it represent?

   d. If an indicator measures exactly what it is intended to measure, then it is valid.

2. *True or False:* It is important to have at least one indicator for each significant aspect, component, or activity of your program.

   a. True

   An appropriate set of indicators for a program will include at least one indicator for each significant aspect of the program. In many cases, there will be two to three indicators for each aspect of the program to obtain the necessary information for decision making.

3. Which of the following actions is not involved in operationalizing indicators?

   d. Training SME staff to collect the indicators

   Operationalizing indicators refers to establishing exactly how a given concept or behavior will be measured, then developing a precise definition and metric for the indicator and defining how the value will be reliably calculated.

4. *True or False:* It is not necessary to link your indicators to the framework that you designed for your program or project.

   b. False

   The indicators that are chosen to monitor and evaluate your program should be directly linked to your program's framework. Because your framework lays out the program's logic and how and what will be achieved, it is essential that the indicators you choose link directly to your program's framework.

MODULE 7:

DATA SOURCES FOR MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

MODULE 7: DATA SOURCES FOR MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

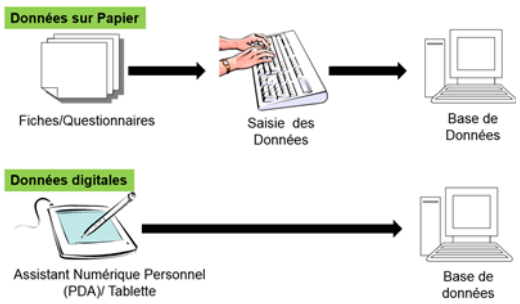
This module introduces the common data sources and systems for malaria programs and specifically discusses the different types and sources of data, the strengths and weaknesses of these data sources, and different issues affecting data quality for malaria programs.

Module Objectives

By the end of this module, you will be able to:

- Identify different data sources and systems for surveillance, monitoring, and evaluation (SME).
- Differentiate between routine and nonroutine data sources
- Identify strengths and weaknesses of common malaria data sources
- Identify different issues affecting data quality for malaria programs
- Identify strategies for linking malaria-related data sources

Figure 18. An example of data flow



Source: MEASURE Evaluation's anglophone SME regional course, Ghana, 2017

Introduction to Malaria-Related Data Sources

A program needs data to keep track of activities, follow the program's progress over time, make program management decisions, and use for program improvement. To collect these data, a program first requires a framework that outlines how the program is to work. Indicators should then be selected based on the framework, while also taking into account the different data sources that are available.

A number of different malaria-related data sources are available for use, as shown in the graphic on the next page. A few of the most common data sources for malaria programs include health information systems, health facility and population-based surveys, and surveillance systems. It is important to remember that for data sources to be useful, they must be complete, accurate, relevant or representative, and timely.

Potential Data Sources

Figure 19 presents the potential data sources for malaria programs, which are described in more detail in this section.

Figure 19. Potential data sources for malaria programs

Health management and information system: A system that collects and aggregates all health-related information and data at the multiple administrative levels in a country

Operational/special research: The systematic and objective assessment of the availability, accessibility, quality, or sustainability of services designed to improve service delivery

National household survey: A large-scale, nationally representative survey carried out at the household level

Geographic information system (GIS), satellite data: A system that captures, stores, analyzes, manages, and presents data that are linked to a specific location

Surveillance system: A systematic ongoing process of assessing the health status of a population by using these four main activities:

- Collection of relevant data
- Aggregation and tabulation of data
- Analysis and interpretation of data
- Dissemination and use of data and results for a decision

Sentinel surveillance: Conducted in a small number of health facilities called sentinel sites, which are selected on the basis of well-defined criteria for the collection of routine data and malaria-specific data with varying frequency

Health and demographic surveillance system (HDSS): A set of field and computing operations to handle the longitudinal follow-up of well-defined entities or primary subjects (individuals, households, etc.) and all related demographic and health outcomes within a clearly circumscribed geographic area

Routine collection at community level: In the case of malaria routine data collection, community surveillance consists of malaria detection, reporting, providing adequate response, and ensuring SME at the community level.

Activity monitoring system: A system that collects data related to the progression or implementation of a program's activities

National census: A procedure for systematically acquiring and recording information about the members of a population at a national level

Rapid assessment: A smaller-scale survey that uses a small, reliable sample and is carried out over a short duration and typically examines only a small select set of variables

Meteorological data: Data related to weather conditions; for example, information on air temperature, winds, humidity, and precipitation

Focus group discussion or key informant interviews: A qualitative data collection method for obtaining in-depth information on concepts and perceptions about a certain topic through group discussion that is guided by a facilitator

Health facility survey: Survey of a representative sample of facilities. The aim of a facility survey is usually to assess the provision and quality of services provided within the health facility.

Vital registration system: A national system for registering all births and deaths of citizens and residents of a country, including the cause of death

Basic Data Types

Data are most frequently classified as either routine or nonroutine.

Routine and Nonroutine Data

Routine data are data that are continuously or regularly collected. These include data that are collected daily, weekly, or monthly. For example, routine data could include weekly reports on how many insecticide-treated nets (ITNs) were distributed in health facilities in a community, or how many children under five came into the health center and were diagnosed with malaria.

Here are some examples of routine data sources:

- Health information systems (HIS)
- Surveillance
- Routine service reporting
- Administrative systems
- Vital registration systems

Nonroutine data are only collected periodically. For example, these data are collected quarterly, annually, or every few years. A good example of a nonroutine data source is a population-based survey that is conducted every three to five years. Because these types of surveys are large scale, they require a lot of resources and time, and therefore it is only possible to conduct them every few years.

Here are some examples of nonroutine data sources:

- Special program reporting systems
- Facility surveys
- Household surveys
- Censuses
- Interviews
- Focus groups
- Direct observations
- Research and special studies
- Rapid assessments

Qualitative and Quantitative Data

Qualitative data are descriptive and deal with aspects that cannot be measured numerically. They are most often used to help understand why something is happening. For example, to understand why ITN use is not common in a community, a researcher might conduct qualitative interviews with members of the community to better understand why they do not use ITNs.

Examples of qualitative data sources are as follows:

- In-depth interviews
- Key informant interviews
- Focus group discussions
- Direct observations

Quantitative data measure characteristics numerically; for example, by using a count or a scale. These data allow for statistical analysis that helps us understand different trends or the relationships between different factors.

Examples of quantitative data sources are as follows:

- HIS
- Surveillance
- Facility surveys
- Household surveys
- Censuses
- Routine service reporting
- Vital registration systems
- GIS
- Remote sensing

Data Source Types Quiz

Think back to the examples of data source types on the previous pages and answer the questions in the quiz. Your responses will not be graded.

Data Source Types Questions

1. Select all of the following data sources that are classified as **routine.**

    a. Surveillance
    b. Facility surveys
    c. Administrative systems
    d. Focus groups

2. Select all of the following data sources that are classified as **nonroutine.**

    a. Censuses
    b. Routine services reporting
    c. Direct observations
    d. Vital registration systems

3. The following is an example of which two data types?

    "Interviews conducted with household head members to understand why ITNs are not used in Community Y"

    a. Quantitative
    b. Routine
    c. Nonroutine
    d. Qualitative

4. The following is an example of which two data types?

    "Carrying out a nationally representative household survey to gather information on the country's population, health, and nutrition"

    a. Qualitative
    b. Quantitative
    c. Routine
    d. Nonroutine

5. The following is an example of which data type?

    "Monthly reports from health facilities on the total number of deaths from malaria are sent to the district health office where they are compiled and aggregated before being sent to the national level."

    a. Qualitative
    b. Quantitative

6. The following is an example of which data type?

   "Monthly reports from health facilities on the total number of deaths from malaria are sent to the district health office where they are compiled and aggregated before being sent to the national level."

   a. Routine
   b. Nonroutine

7. *True or False:* The following statement is an example of a **quantitative** data source.

   "Focus group discussions with caregivers about their perceptions of the quality of care at the local health facility are conducted to understand why use of health services in the community is so low."

   a. True
   b. False

8. *True or False:* The following statement is an example of a **nonroutine** data source:

   "Focus group discussions with caregivers about their perceptions of the quality of care at the local health facility are conducted to understand why use of health services in the community is so low."

   a. True
   b. False

Data Source Types Answers

1. Select all of the following data sources that are classified as **routine.**

   a. Surveillance
   c. Administrative systems

   In addition to surveillance and administrative systems, other examples of routine data sources include HIS, routine service reporting, and vital registration systems.

2. Select all of the following data sources that are classified as **nonroutine.**

   a. Censuses
   c. Direct observations

   In addition to censuses and direct observations, other examples of nonroutine data sources include special program reporting systems, facility surveys, household surveys, interviews, focus groups, research and special studies, and rapid assessments.

3. The following is an example of which two data types?

   "Interviews conducted with household head members to understand why ITNs are not used in Community Y"

   c. Nonroutine
   d. Qualitative

   The information collected is regarding perceptions and beliefs about malaria transmission and prevention; it is not information that can be numerically measured. This type of information would also not be collected on a regular basis, given that attitudes and beliefs do not change quickly or frequently. Therefore, this type of data source is considered a qualitative, nonroutine data source.

4. The following is an example of which two data types?

   "Carrying out a nationally representative household survey to gather information on the country's population, health, and nutrition"

   b. Quantitative
   d. Nonroutine

   The information collected is on characteristics (population, health, and nutrition) that can be measured numerically, and it is only collected every three to five years due to the amount of effort and resources needed to conduct the survey. Therefore, this type of data source is considered a quantitative and nonroutine data source.

5. The following is an example of which data type?

   "Monthly reports from health facilities on the total number of deaths from malaria are sent to the district health office where they are compiled and aggregated before being sent to the national level."

   b. Quantitative

   Reported deaths from malaria can be measured numerically; therefore, this is considered to be a quantitative data source.

6. The following is an example of which data type?

   "Monthly reports from health facilities on the total number of deaths from malaria are sent to the district health office where they are compiled and aggregated before being sent to the national level."

   a. Routine

   In this case, because the reports are sent on a regular basis from the health facility to the district health office, the data are considered to be a routine data source.

7. *True or False:* The following statement is an example of a **quantitative** data source.

   "Focus group discussions with caregivers about their perceptions of the quality of care at the local health facility are conducted to understand why use of health services in the community is so low."

   b. False

   The information gathered during the focus group discussions is on caregivers' perceptions, attitudes, and beliefs about the quality of care, and thus is considered descriptive and cannot be measured numerically. Therefore, this would be considered a qualitative data source.

8. *True or False:* The following statement is an example of a **nonroutine** data source.

   "Focus group discussions with caregivers about their perceptions of the quality of care at the local health facility are conducted in order to understand why use of health services in the community is so low."

   a. True

   These discussions most likely would occur once and not on a regular basis; thus, this would be considered a nonroutine data source.

Choosing an Appropriate Data Source

When you are developing your SME plan and deciding on the appropriate data sources for your program, the following questions can help you determine whether a data source is an appropriate or feasible source to use:

- Do the data exist for the specified or required time period?
- Do the data exist for the specified population? For example, are data available for most-at-risk or special populations or disaggregated by gender or specific age groups?
- Do the data exist for the specified geographic area? For example, are data available at the subnational or program area levels?
- Do the data exist for the appropriate administrative or functional level? For example, are there data available at the following levels:
    - Policy and program
    - Service environment
    - Client
    - Population
    - Spatial/geographic
- If the data do not currently exist, will it be feasible and do you have the resources to set up the necessary structures to collect the data?

Data Sources: Health Information Systems

An **HIS** is a data system that collects and aggregates all health-related information and data at the multiple administrative levels in a country from a number of different sources. The information varies by country, but it generally includes information about the delivery, cost, and use of health services, patient demographics, and health status.

Table 7. Main strengths and weaknesses of HIS in developing countries

Strengths	Weaknesses

• Ideally reflective of and integrated within health systems activities
• Collected continuously and suitable for frequent reporting
• System already exists:
  • Need fewer resources for new infrastructure or systems
  • Helps build local capacity and is sustainable
• Typically available at lowest administrative levels
	• Data not representative of population
	• Difficult to determine population at risk or denominators for coverage estimates
	• Indicators determined centrally by Ministry of Health and may not be easily altered to answer new questions
	• Quality and completeness of reporting frequently varies
	• May only cover government facilities
	• Potential for double counting, both within and between facilities

Data Sources: Heath Facility Surveys

Health facility surveys collect data specifically on the type and quality of services, as well as on outcomes and impact of services provided at health facilities. They are typically conducted on a nonroutine basis and can be conducted in both public and private health facilities.

Table 8. Main strengths and weaknesses of health facility surveys in developing countries

Strengths	Weaknesses

• Can be nationally or regionally representative
• Can be tailored to specific program needs
• Quality control may be easier than in routine systems
• Provide more detailed data than is typically available in routine systems
• Timing can coincide with program implementation
• Can cover both public and private health facilities
• Can combine with a population survey for outcome monitoring and impact evaluation
	• Overall less sustainable and not carried out routinely:
	  • Data collection is periodic and less connected to ongoing program decision making
	  • Information can become rapidly outdated
	  • Requires devoted personnel, resources, and time
	• Survey sampling design and analysis can be complex
	• Coverage and sample size constraints exist:
	  • National vs. subnational coverage
	  • May not have enough of a specific type of facility to be completely representative
	• May have small client sample sizes for some services

Data Sources: Population-Based Surveys

Population-based surveys are large, nationally representative surveys conducted typically every three to five years. They provide important population and health data at the outcome and impact levels. Examples of common population-based surveys include the DHS, the MIS, and the MICS.

Table 9. Main strengths and weaknesses of population-based surveys

Strengths	Weaknesses
• Representative of the general population, which helps eliminate selection bias if the sample is truly random • Can collect a wide range of outcome-level indicators, such as program coverage • Questionnaires can be adapted to cover specific issues and topics • Involve well-tested instruments with good quality control	• Very expensive and time-consuming to conduct; thus, are typically carried out only every three to five years • Not suitable for some types of data; for example, if collecting retrospective data, the data will be subject to recall bias • Do not provide input/process-level data • May not be adequately powered for subnational or district-level estimates • Cannot detect small changes or changes over short periods of time without large sample sizes

Data Sources: Surveillance

Surveillance refers to the ongoing, systematic collection, analysis, and interpretation of health data. It aims to provide accurate and timely information for decision-making purposes to facilitate rapid medical and programmatic response. It also serves to track outbreaks, monitor progress toward malaria elimination, and evaluate control and prevention activities.

Table 10. Main strengths and weaknesses of a surveillance system

Strengths	Weaknesses

• Very flexible and can be adapted to cover specific topics to collect data that are otherwise hard to obtain
• Can collect a wide range of data, from input data to impact data
• Especially useful and necessary when the events being monitored are rare and when a rapid response is required
	• Expensive and resource-intensive because the following are necessary:
	  • Identifying sites and providing adequate resources for them
	  • Training staff at sites
	  • Creating a system to monitor and transfer data to central authorities
	• Active surveillance even more resource-intensive

Data Sources: Sentinel Surveillance

Sentinel surveillance is the ongoing, systematic collection, analysis, and interpretation of health data carried out in a limited number of health facilities. Sentinel surveillance is useful for when:

- The routine information system is inadequate.
- There is a need for high-quality data to monitor trends.
- Disease outbreaks need to be rapidly identified.
- Geographical distribution of malaria varies greatly.

There are a number of limitations of sentinel surveillance to consider:

- It can be very costly to equip and operate.
- It requires frequent supervision.
- The limited number of sites is not representative of all health facilities, and patients are not necessarily representative of the community; thus, the data are not generalizable.
- Record keeping can be burdensome to facility staff.
- Changes in use of health services can bias trend data.

Data Sources: Health and Demographic Surveillance Systems

An **HDSS** is a longitudinal follow-up of individuals or households and all related demographic and health outcomes within a clearly defined geographic area. It allows you to assess demographic dynamics with the defined geographic region and provides risk sets and outcome measures for evaluating interventions as well as up-to-date sampling frames for identifying target populations for appraisal, intervention, and monitoring. The International Network for the Demographic Evaluation of Populations and Their Health is an example of a network of HDSS, and it currently has 56 HDSS field sites in 20 countries (map of HDSS sites).

An HDSS offers the following features:

- Conduct a baseline or initial census
- Regularly update data on households and individuals on the following events: marriages, pregnancies, births, deaths, in- and out-migration, and education and vaccination records
- Carry out verbal autopsies on all deaths to determine cause of death profiles
- Conduct morbidity surveys involving biomarkers

Table 11. Main strengths and weaknesses of health and demographic surveillance surveys

Strengths	Weaknesses
• Can monitor vital events in the demographic surveillance area: births, deaths, migrations, morbidity, socioeconomic development (poverty) • Can assess progress and impact of intervention • Can define population denominator • Could be linked with the health management information system • Could serve as sentinel sites • Could serve as operational research sites • Most field sites include malaria in their research agenda • Multidisciplinary team • Provides an ideal environment for training	• High maintenance cost • Community fatigue • Covers only a small area; thus, is unrepresentative of the national population • Has either a weak link or no link at all to the health management information system • Potential bias from over-study of the population • Data not easily accessible • Set up to address specific research questions, not necessarily set up for malaria SME

Putting It into Practice: Scenario 1

Read the following scenario and decide which data source would be the most appropriate. Remember to consider the type of data, the timing, and the level or scale at which the information is needed when trying to determine the most appropriate data source.

A donor would like to determine whether its program has been able to improve coverage of prompt and effective treatment for children under five with malaria. Thus, the donor wants to know how many children under five in the program's intervention areas received antimalarial treatment within 24 hours of the onset of malaria. What would be the most appropriate data source to use to provide the answer? *Correct answer is provided on the next page.*

1. HIS
2. Health facility surveys
3. Population-based surveys
4. National census

Correct answer in bold:

1. **HIS: The HIS is the most appropriate data source because the donor wants to know how many children received antimalarial treatment only (rather than a percentage, which would require data on all children who had malaria). The HIS also has information on confirmed cases, and these data are accessible for the specific intervened areas in the HIS. Lastly, HIS will not require extra resources to obtain the data.**

2. Health facility surveys: A health facility survey could answer the donor's question; however, it is very resource-intensive to carry out. In this scenario, the HIS is the most appropriate data source because the donor wants to know how many children received antimalarial treatment only (rather than a percentage, which would require data on all children who had malaria). Further, it would be specific to the intervened areas.

3. Population-based surveys: A population-based survey would not be an appropriate data source in this scenario for many reasons. First, these types of surveys are conducted every three to five years; it would be difficult in terms of timing. Second, these surveys provide nationally representative data and percentages, not the absolute number of children who had received antimalarial treatment. Further, it would be specific to the intervened areas. In this scenario, the HIS is the most appropriate data source because the donor wants to know how many children received antimalarial treatment only.

4. National census: A national census would not provide information on the number of children who had received prompt and effective treatment with antimalarial drugs. In this scenario, the HIS is the most appropriate data source because the donor wants to know how many children received antimalarial treatment only (rather than a percentage, which would require data on all children who had malaria). Further, it would be specific to the intervened areas.

Putting It into Practice: Scenario 2

Read the following scenario and decide which data source would be the most appropriate. Remember to consider the type of data, the timing, and the level or scale at which the information is needed when trying to determine the most appropriate data source.

The National Malaria Control Programme wants information on the percentage of homes that own at least one ITN. What would be the most appropriate data source to use to provide the answer? *Correct answer is provided on the next page.*

1. HIS
2. Health facility surveys
3. Population-based surveys
4. National census

Correct answer in bold:

1. HIS: An HIS generally includes information about the delivery, cost, and use of health services and patient demographics and health status. It would not provide information regarding household ownership of ITNs. In this scenario, population-based surveys, like the DHS and MIS, would be the most appropriate source for providing the answer. In most cases, these surveys will provide a national and regional estimate of the percentage of household ITN ownership.

2. Health facility surveys: A health facility survey would not be an appropriate data source, because it does not capture information on household ITN ownership. In addition, it would not provide an accurate reflection of all households, because it collects data only on those who attend health facilities. In this scenario, population-based surveys, like the DHS and MIS, would be the most appropriate source for providing the answer. In most cases, these surveys will provide a national and regional estimate of the percentage of household ITN ownership.

3. **Population-based surveys: In this scenario, population-based surveys, like the DHS and MIS, would be the most appropriate source for providing the answer. In most cases, these surveys will provide a national and regional estimate of the percentage of household ITN ownership.**

4. National census: A national census gathers data on the members of a population, and thus would not provide information regarding household ownership of ITNs. In this scenario, population-based surveys, like the DHS and MIS, would be the most appropriate source for providing the answer. In most cases, these surveys will provide a national and regional estimate of the percentage of household ITN ownership.

Data Quality: Why Is It Important?

Data quality refers to the worth and accuracy of the data collected. The quality of the data determines how useful the data are. Ensuring that data quality is maintained throughout the data collection, analysis, interpretation, and dissemination process is critically important. When data quality is high, the data reflect true performance and can provide vital information for decision making and program improvement. If data quality is poor, it can cause the following:

- Erroneous program management decisions and the use of additional program resources to take corrective actions
- Missed opportunities for identifying program strengths and weaknesses
- Reduced stakeholder confidence and support

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Dimensions of Data Quality

There are six main data quality criteria that we need to consider and ensure that we are meeting throughout the entire data collection process:

- **Validity:** Data clearly, directly, and adequately represent what was intended to be measured.
- **Reliability:** Data are collected regularly using the same methodology, and if we repeat the same procedure over and over, we end up with the same results or findings.
- **Integrity:** Data are truthful. In other words, they are free from willful or unconscious error due to manipulation or through the use of technology.
- **Precision:** Data can be used to reproduce measurements consistently and to minimize random error.
- **Timeliness:** Data are regularly collected, and up-to-date data are available when needed.
- **Completeness:** Data collected and reported are complete.

Data Quality Assurance

Data quality assurance mechanisms should be implemented at every stage of the data management process. This includes during data collection, management, analysis, interpretation, and dissemination. For more information on data quality assurance methods and different data quality assessment tools, visit the MEASURE Evaluation website.

Here are some steps your program can follow to improve the quality of the data that you collect:

- Provide written instructions for how to use data collection instruments and tools. Include these instructions on each of the instruments and tools. This will help ensure that no matter who is collecting the data, they will be collected in the same way.
- Document processes for data entry, cleaning, and management.
- Provide continuous monitoring of data collection activities and perform routine checks to ensure that instructions are being followed properly.
- Randomly sample data and verify that they are accurate.
- Take proactive steps to report, document, correct, and communicate problems that compromise the quality of the data.
- Be transparent in the data analysis techniques used and the assumptions upon which the data are based.

Linking Data Sources

Linking data refers to connecting two or more data types or sources. Linking data offers the following benefits:

- Provides context by increasing understanding and informing analyses
- Helps corroborate data quality, trends, and associations within your data. In essence, linking data helps provide further evidence on a specific program or project output, outcome, or impact. This is also often referred to as triangulating data.
- Attributes causality by linking process-level data with impact and outcome-level data to establish causality

Data can be linked from different sources, across different levels, over time, across geography, and across different sectors. Examples include the following:

- **Sources:** Linking health facility survey or HIS data with household survey data to establish change in impact or outcome
- **Levels:** Linking HIS data from district, regional, and national levels to check data quality
- **Time:** Linking data on service provision for antenatal care with birth outcomes
- **Geography:** Linking malaria cases with GIS data to assess foci of transmission
- **Sectors:** Linking malaria cases from HIS with agricultural data on rainfall levels

It is important to remember that linking data appropriately requires advanced planning, preferably prior to data collection. It should be done when sufficient, good-quality data that are plausibly connected exist. It should NOT be done if there is no logical connection between the data.

Module 7 Assessment

Questions

Correct answers are provided on the next page.

1. Data and information serve which main purpose for programs? *(Select all that apply.)*

    a. To keep track of program activities
    b. To make program management decisions
    c. To provide evidence to improve programs
    d. To demonstrate a program's progress and achievements

2. The ongoing, systematic collection, analysis, and interpretation of health data carried out in a limited number of health facilities refers to which common malaria-related data source?

    a. Health information systems
    b. Surveillance
    c. Sentinel surveillance
    d. Population-based surveys

3. A routine data source refers to data that are continuously or regularly collected. Which of the following data sources is NOT an example of a routine data source?

    a. Health information systems
    b. Facility surveys
    c. Surveillance
    d. Vital registration systems

4. Linking different data sources serves all of the following purposes, except:

    a. Helps determine whether your data are of poor quality
    b. Provides context by increasing understanding and informing analyses
    c. Helps attribute causality by linking process-level data with impact and outcome-level data to establish causality
    d. Helps corroborate data quality, trends, and associations observed within your data

Correct Answers

Correct answers are noted in bold.

1. Data and information serve which main purpose for programs? *(Select all that apply.)*

   a. To keep track of program activities
   b. To make program management decisions
   c. To provide evidence to improve programs
   d. To demonstrate a program's progress and achievements

2. The ongoing, systematic collection, analysis, and interpretation of health data carried out in a limited number of health facilities refers to which common malaria-related data source?

   c. Sentinel surveillance

   Sentinel surveillance refers to the ongoing, systematic collection, analysis, and interpretation of health data within a limited number of health facilities.

3. A routine data source refers to data that are continuously or regularly collected. Which of the following data sources is not an example of a routine data source?

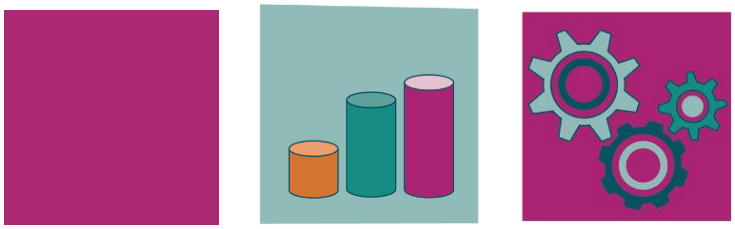
   b. Facility surveys

   Facility surveys are not carried out continuously or on a regular basis; therefore, they are considered a nonroutine data source.

4. Linking different data sources serves all of the following purposes, except:

   a. Helps determine whether your data are of poor quality

   Linking data sources does not help you necessarily to determine whether your data are of poor quality. Data quality checks and audits can help you to determine whether your data are of poor quality. Linking different data sources serves the following purposes: provides context by increasing understanding and informing analyses; helps attribute causality; and helps corroborate data quality, trends, and associations observed within your data.



MODULE 8:

ANALYSIS, INTERPRETATION, AND PRESENTATION OF MALARIA DATA

MODULE 8: ANALYSIS, INTERPRETATION, AND PRESENTATION OF MALARIA DATA

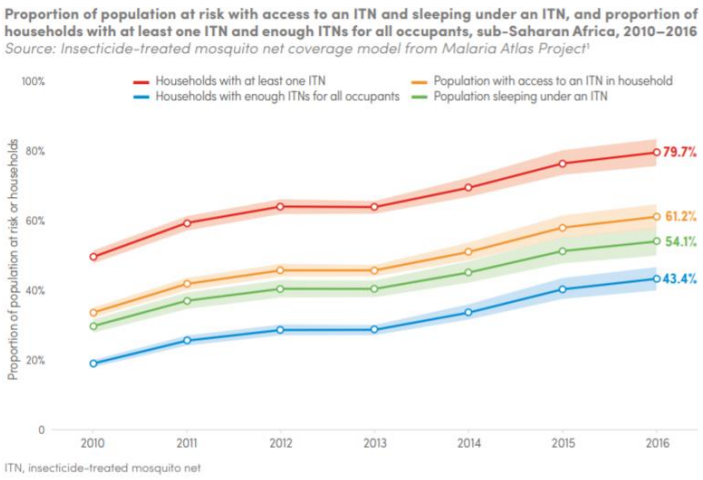
This module provides an introduction to the functions of and common concepts for data analysis and interpretation. It also covers how to present data effectively, walking learners through how to select an appropriate graphic for presenting data and providing tips for good data presentation.

Module Objectives

By the end of this module, you will be able to:

- Identify the functions of data analysis and interpretation.
- State common concepts for data analysis and interpretation.
- Identify appropriate graphics for presenting various types of data.
- Differentiate between the characteristics of a good data presentation and a poor data presentation.

Figure 20. Example of a graphic display of malaria data



Source: World Malaria Report, 2017

What Is Data Analysis and Interpretation?

Data analysis refers to the process of inspecting, cleaning, transforming, and modeling data for the purpose of highlighting useful information. In other words, data analysis is taking the raw ***data*** that you have collected for your program and transforming them into ***information*** that can be used for decision making.

Data analysis helps provide answers to questions being asked about your program or other research studies. It means taking the data that you collect and looking at them in comparison to the questions you would like to answer. For example, if you want to know whether your program is meeting its objectives—or if it is on track—you would look at your program targets and compare them to the actual program performance.

Data interpretation goes a step beyond data analysis. Interpretation is using the analysis to further understand your findings and the implications for your program. It is the process of adding meaning to information by making connections and comparisons, by exploring causes and consequences, and by explaining patterns or trends observed within the data.

Quiz Question

Which question can be answered through data analysis?

a. In which site did the malaria program achieve greater coverage of insecticide-treated nets?
b. Why did the malaria program fail to achieve its target of 80 percent coverage of insecticide-treated nets in Community A?

Correct answer:

a. This question can be answered through data analysis, comparing the coverage of insecticide-treated nets in each of the different program sites.

Analysis of Malaria Data

You can perform a number of different types of analyses at the program level. The type of analysis will depend on the information you need to manage your program effectively and track its progress. Here are three examples of common types of analyses that will help you to track your program's progress:

- **Actual performance compared to program target:** In this example, we are comparing our program's actual performance in terms of the number of persons trained on malaria case management to the target that was set for the program by June 1, 2016. In this case, we see that our progress over the first year of the program (from January 2015 to December 2015) is not progressing at the pace we would expect to meet the program target of 100 persons trained on malaria case management by June 2016. For the program to meet the target, an additional 85 people need to be trained in the next six months of the program.
- **Current performance compared to previous performance:** In this example, we are comparing our program's current performance (2015) in terms of the number of insecticide-treated nets (ITNs) that were distributed during the previous three years (2012–2014). As we can see for 2015, the program is outperforming all previous three years by a substantial number. It is clear that the current performance is better than previous performance for this program.
- **Comparison of performance between different sites or groups:** In this example, we are comparing the performance of the program in District A to the performance of the program in District B in terms of the number of fever cases tested for malaria in the health clinics. We can see that District B has tested 8,000 fever cases for malaria, compared to only 3,500 in District A. It appears that District B is performing better than District A, but it is hard to interpret these results without further information about the two districts. For example, we would also want to know the different target populations in each of the districts, as well as more information on the malaria endemicity in each district to see whether they are comparable.

Common Measures for Analysis

Some basic statistical measures that are important to understand, calculate, and interpret include the following:

- Measures of central tendency
    - Mean
    - Median
    - Mode
- Measures of variation
    - Range
    - Variance and standard deviation
    - Interquartile range (IQR)
- Ratio, rate

The following sections provide explanations and examples for each of the measures.

Measures of Central Tendency

These are some basic statistical measures that are important to understand, calculate, and interpret.

Mean

The most commonly investigated characteristic of a data set is its center, or the point around which the observations tend to cluster. The mean is the most frequently used measure to look at the central values of a data set.

Definition: The sum of the values divided by the number of cases or observations. It is also referred to as the average.

Calculation: Mean = sum of values / number of observations

Example: What was the mean number of malaria cases per month during the past year?

- Sum of malaria cases (January–December): 1,110
- Number of observations: 12
- Mean: 1,110 / 12 = 92.5 average number of malaria cases per month in the past year

Median

Definition: The median is the middle value in an ordered set of values.

Calculation: The first step is to sort the data from the lowest value to the highest value. The second step is to choose the middle observation within the data set. For data sets with an even number of values, the median is the average (mean) of the two middle values.

Example 1: What is the median number of malaria cases per month during 2013?

1. Sort the observations.
2. Select the two middle numbers because there are an even number of observations in the data set.
   Middle numbers: 45 and 45
3. Add the two numbers and divide by two: (45+45)/2=45.

Example 2: What is the median number of malaria cases per month during 2014?

1. Sort the observations.
2. Select the middle number, because there are an odd number of observations in the data set. This number represents the median, which in this case is 49.

Mode

Definition: The mode is the value that occurs most frequently in your data set.

Calculation: Select the value in your data set that occurs most frequently.

Example: What is the mode for the number of malaria cases in 2013 and 2014?

- Mode for number of malaria cases in 2013: 45
- Mode for number of malaria cases in 2014: 40

Of the three measures of central tendency—mean, median, and mode—the mean is the most frequently used measure to look at the central values of a data set. The mode is the least useful and thus, the least used measure of the three.

Measures of Variation

These are some basic statistical measures of variation that are important to understand, calculate, and interpret.

Range

Definition: The range represents the difference between the highest and lowest values within your distribution (data set).

Example: What is the range for the number of malaria cases in 2013 and 2014?

- Range for number of malaria cases in 2013: 36–69
- Range for number of malaria cases in 2014: 35–64

Variance and Standard Deviation

Definition of variance: Variance is a measure of how far a set of numbers are spread out from each other. It helps describe how far the numbers lie from the mean.

Calculation of variance: Variance (s2) is the sum of the squared deviations from the mean divided by the number of observations minus 1.

Definition of standard deviation: Standard deviation is a measure that shows how much variation there is from the mean. A low standard deviation indicates that the data points tend to be very close to the mean, and a large standard deviation indicates the opposite—that the data are spread out over a large range of values.

Calculation of standard deviation: The standard deviation (s) is the square root of the variance.

Interquartile Range

Definition: The IQR is a measure of statistical dispersion. It is equal to the difference between the third and first quartiles, and thus represents the middle 50 percent of the data. Quartiles divide data into four equal groups, with the lower quartile (Q1) being the 25th percentile, the middle quartile being the 50th percentile, and the upper quartile being the 75th percentile (Q3). Since the IQR uses the middle 50 percent of the data, it is not affected by outliers or extreme values.

Calculation: IQR=Q3-Q1

Example:

- Q3=42
- Q1=18
- IQR=42-18=24

Ratio

Definition: A ratio is a comparison of two numbers, expressed in one of the following ways: "a to b," "a per b," or "a:b."

Examples:

- Two household members per (one) mosquito net
- Women are slightly more likely to sleep under an ITN than men, with a ratio of 1.2:1.

Rate

Definition: A rate is a ratio between two measures. In public health, rate is a measure of the number of cases that occur in a given period, divided by the population at risk during that time period.

The comparison is often expressed as the number of occurrences per 1,000, 10,000 or 100,000 population. Rate is a probability statement, most often used in public health to describe infrequently occurring events, such as maternal mortality, because it is easier to express "8 per 100,000" rather than ".00008 percent." The under-five mortality rate is the probability, expressed as a rate per 1,000 live births, of a child born in a specified year dying before reaching age five at the current age specific mortality rates.

Examples of rates used in malaria:

- **Annual parasite incidence (API)**

$$\frac{\text{\# of confirmed malaria cases in 1 year}}{\text{Population under surveillance}} \times 1{,}000$$

Proportion

Definition: A ratio in which all individuals in the numerator are also in the denominator.

Example:

- Three staff members per clinic is a ratio expressed numerically as 3:1. It is not the same as saying 1 to 3 or 1:3. The order of the numbers matters.
- A clinic has 12 female clients and 8 male clients, the denominator is total clients, 20, and the ratio of male clients is 8 to 20, or 8:20.

Percentage

Definition: A proportion of the nominator, or part of the whole, multiplied by the denominator, or 100, used to compare data across facilities, regions, and countries.

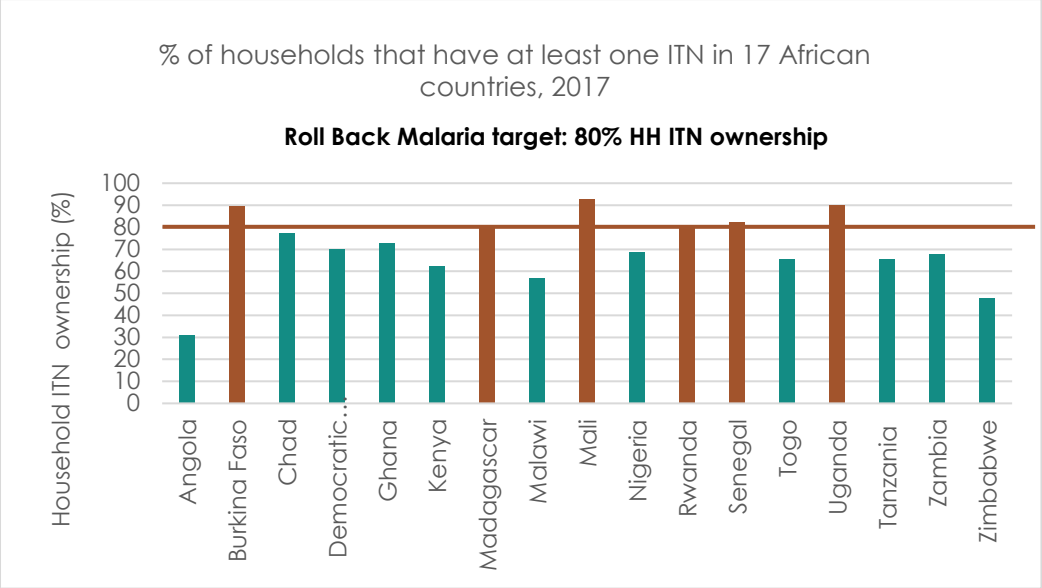
Example:

A clinic has 12 female clients and 8 male clients, which are the numerators, the denominator is 20, the total number of clients. The proportion of male clients is eight-twentieths or two-fifths. To state this as a percentage, convert the fraction to a decimal, 0.4, and then multiply by 100, which equals 40 percent. In this example, the denominator includes all clients, both male and female.

Data Interpretation

After data have been analyzed, the next step is interpreting the information. Interpretation is making sense of your information and understanding the implications for your program. In many cases, additional information is needed for people to be able to understand your findings. In Figure 21, showing ITN ownership for children under five, the target is to have more than 80 percent of children under five sleep under an ITN every night. From the graphic, we observe that this goal was achieved by five countries: Burkina Faso, Mali, Rwanda, Senegal, and Uganda.

Figure 21. Example of a graphic showing the implications of a malaria data set



Interpreting Graphs

In interpreting the graph, there are a few questions we might want to understand. For example:

- Why have some countries not met the target goal of greater than 80 percent ITN usage among children under five?
- What are the reasons behind countries not meeting the target goal? Is it because the program is not distributing enough ITNs? Is it because the health education and behavior change communication interventions are not effective?

We might also want to know why some countries are doing better than others in terms of progress toward the goal. For example, what is different about Country 2 compared to Country 1?

To understand the findings, we need to look at other relevant data that can help us answer our questions. In this case, we could look at household ownership of ITNs or at the coverage and effectiveness of health education and behavior change communication interventions in the countries. Sometimes conducting further analyses is needed to interpret the findings.

Challenges with Interpretation of Common Malaria Indicators

A number of issues need to be taken into consideration when you are interpreting findings for common malaria indicators. These issues can pose a challenge in understanding what your program findings mean, and, in many cases, other data may need to be collected to better understand your findings. Two of the main issues to consider when interpreting malaria-related data are seasonality and malaria endemicity.

Seasonality

In many places, malaria transmission is seasonal, meaning that transmission occurs or occurs more frequently during certain times during the year and not necessarily year-round due to changing climatic conditions. Given that transmission can fluctuate dramatically within a location within the year or across different years, it is important to take into account the season in which your data were collected.

Intervention coverage and usage levels for the four main malaria prevention interventions (ITN/long-lasting insecticide-treated net [LLIN], indoor residual spraying, intermittent preventive treatment in pregnancy [IPTp], and receiving prompt and effective treatment) may differ slightly between seasons. For example, during the rainy season, more people will likely sleep under an ITN/LLIN because they perceive the threat of getting malaria to be higher because there are more mosquitoes.

Seasonality will also affect malaria morbidity and mortality. We expect malaria morbidity and mortality to be higher during and for several weeks after the rainy season because there is higher malaria transmission. Thus, interpretation of your data must take into account the season in which the data were collected.

Malaria Endemicity

Malaria endemicity can affect the interpretation of the core malaria indicators, because each involves the definition of the target population. In other words, each indicator is intended to be measured only among the target population, which is defined as those who are at risk for malaria.

In countries where malaria is endemic or epidemic-prone throughout the country, this issue should not be a particular concern when interpreting the findings. In countries where malaria endemicity varies within the country and thus not all of the population is at risk for malaria, it is important to take this into consideration when you are collecting data and interpreting your findings.

Populations that are not at risk for malaria should not be included in your target population. In these situations, it may be necessary to collect additional information to establish which areas are within or outside of a malaria risk area. This is not always possible, however, and it needs to be taken into consideration when you interpret your findings.

For example, if you collect data at the national level on household ownership of ITNs/LLINs, you need to consider whether you are including data from non-malarious areas. If you do include data from non-malarious areas, then it is likely that your data will underestimate the national coverage level of ITNs/LLINs. This is because you have overestimated your target population (those actually at risk for malaria).

Effective Data Presentation

Regardless of the type of communication format you are using, whether it is an annual progress report or a presentation, the information should be presented in a clear and concise way with key findings and recommendations that are actionable. Presenting data in this way helps facilitate their use for decision making. When data are presented in an unclear manner, or when too much information or irrelevant information is provided, then there is less likelihood that the information will be used for programmatic decision making. It is also important to always remember who your audience is when you are thinking of how to present information. This means that you should tailor the information presented to your audience, so that it is useful, clear, and actionable to them.

Summarizing Data: Table

There are two main ways to summarize and present data: tables and graphs. Both of these forms are useful for conveying a message and for portraying trends, relationships, and comparisons.

A table is the simplest way of summarizing a set of observations. It has rows and columns containing data, which can be in the form of absolute numbers or percentages, or both. In the example table, the number of deaths is listed for years 2010–2016, for countries that are considered to have a low burden of malaria transmission. This table allows you to see the trend in the number of malaria deaths over seven years within regions and worldwide.

Figure 22. Example of presenting malaria data in a table

Estimated number of malaria deaths by WHO region, 2010–2016 *Source: WHO estimates*

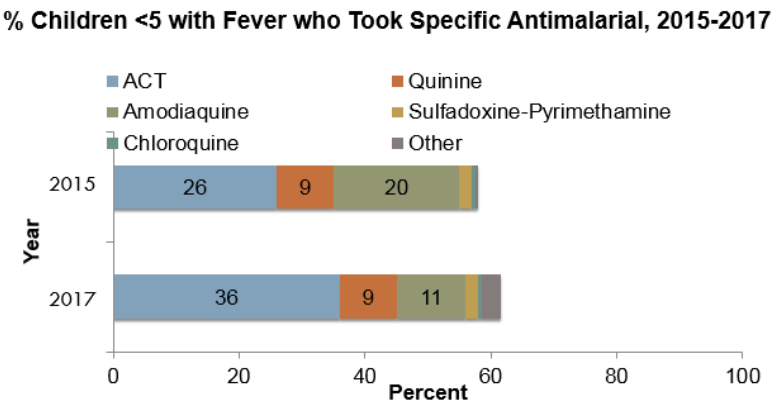
	Number of deaths						
	2010	2011	2012	2013	2014	2015	2016
African	538 000	484 000	445 000	430 000	423 000	409 000	407 000
Eastern Mediterranean	7 200	7 100	7 700	7 800	7 800	7 600	8 200
European	0	0	0	0	0	0	0
Americas	830	790	630	620	420	450	650
South-East Asia	41 700	34 000	29 000	22 000	25 000	26 000	27 000
Western Pacific	3 800	3 300	4 000	4 300	2 900	2 600	3 300
World	**591 000**	**529 000**	**487 000**	**465 000**	**459 000**	**446 000**	**445 000**

Source: World Malaria Report, 2017

Summarizing Data: Chart

Graphs are pictorial representations of numerical data and should be designed to convey a pattern or trend of the data. For example, in Figure 23—a stacked bar chart—we are able to compare the use rates of different antimalarial treatments among children under five with a fever within Country X over two years to see the changes in uptake of treatment, as well as changes in the type of treatment.

Figure 23. Example of a bar chart showing malaria treatment trends over time

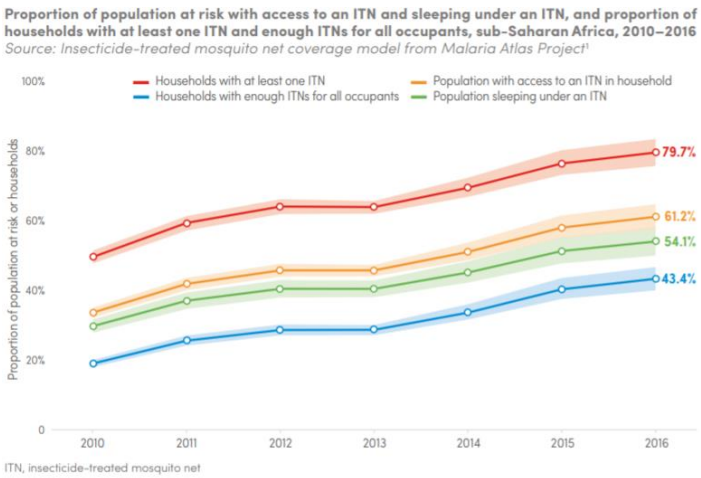


Source: World Malaria Report, 2017

Summarizing Data: Graph

In this line graph, there are two main messages being conveyed. First, we are able to see a trend in the number of people with access to ITNs over the past seven years globally. Overall, the number of people with access to ITNs has increased over the years.

Figure 24. Example of a line graph showing trends in access to ITNs



Source: World Malaria Report, 2017

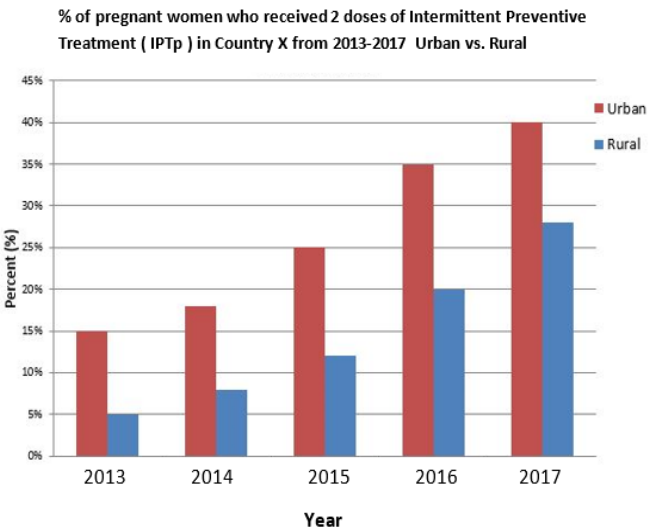
Presenting Data

There are four main charts and graphs used to present data. Each chart and graph has a specific use or function, which is important to keep in mind when you are deciding the best way to present your data.

Bar Chart

A bar chart is used to compare data across categories. The chart has rectangular bars with lengths that are proportional to the values they represent. They are used to plot data that have discrete values and are not continuous. In the example, we are able to compare the percentage of women who received two doses of IPTp in Country X across the five year time span as well as compare the differences between pregnant women in the rural areas versus the urban areas in terms of access to IPTp.

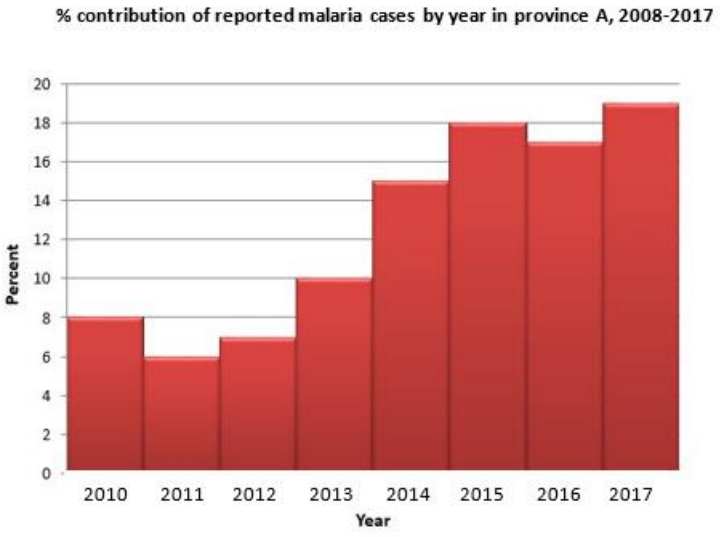
Figure 25. Example of a bar chart for comparison of malaria data by category



Histogram

A histogram represents the relative frequency of continuous data. In other words, it is a graph that shows a visual representation of the distribution of data. It consists of tabular frequencies, shown as adjacent rectangles, that are positioned over discrete intervals, whose area is equal to the frequency of the observations in the interval. The total area of the histogram is equal to the number of data. In the example here, we see the distribution of malaria cases by year from 2010 to 2017 in Province A.

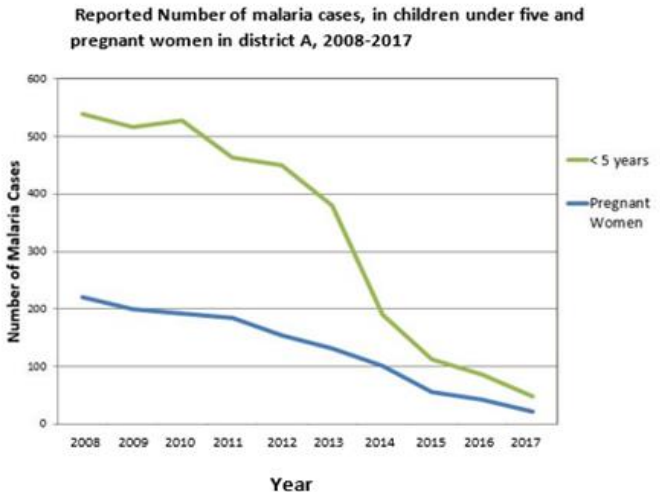
Figure 26. Example of a histogram showing the distribution of malria cases by year



Line Graph

A line graph is a graph that displays a trend or trends over time for continuous data. In the example, we are able to observe the decreasing trend in the number of malaria cases over the past 10 years for both children under five and pregnant women in District A.

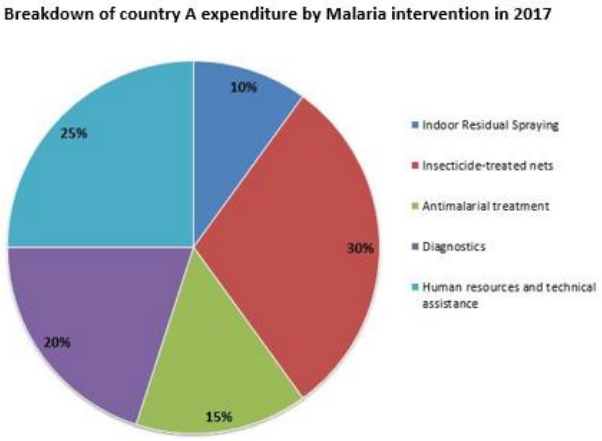
Figure 27. Example of a line graph showing decreasing trends in the number of malaria cases



Pie Chart

A pie chart is a circular chart that is divided into sections that represent the proportion or contribution of each value to a total. The size of the section is proportional to the quantity it represents. In this example, we are able to observe the relative proportion of Country A expenditure by the type of malaria intervention. Thus, we can see that the greatest proportion of the budget in the country is spent on ITNs (30%), and only 10 percent of the country's budget is spent on indoor residual spraying.

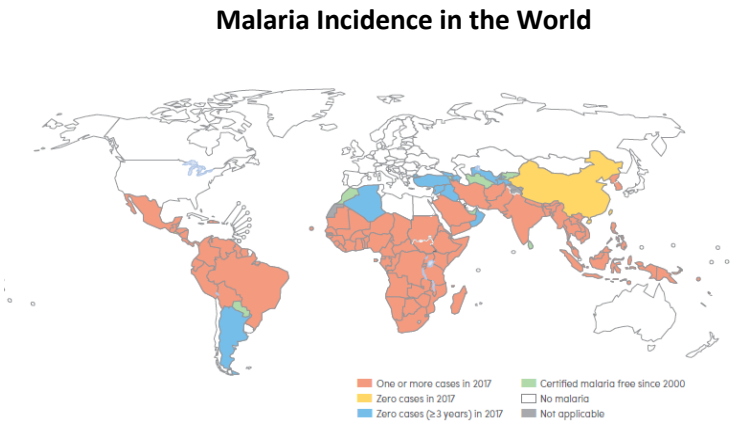
Figure 28. Example of a pie chart showing a breakdown of a country's malaria spending



Maps

On a map, the data can be represented according to their geographical distribution. For example, we can create a map showing the type of malaria by zone (endemic or epidemic) or a distribution in percentages of vaccination coverage in a region or a country.

Figure 29. Example of a map showing geographic distribution of malaria worldwide



World Malaria Report, 2018

Presenting Data Quiz

To complete the quiz, select an answer for each statement. *Correct answers are provided on the next page.*

It is important to remember that each of the four main charts and graphs have specific uses for presenting data. To check your understanding of their uses, read each statement and decide which chart or graph would be the most appropriate to use to convey the information. Select from these options: bar chart, histogram, line graph, pie chart.

a. The prevalence of malaria in Ghana over the past 30 years

b. Data that are comparing the prevalence of malaria in 10 different countries during one year in sub-Saharan Africa

c. Data on the reported reasons why individuals do not use insecticide-treated nets (ITNs) among the individuals surveyed who were not currently using ITNs

d. The distribution of patients tested for malaria by parasite density

Correct answers:

a. The prevalence of malaria in Ghana over the past 30 years**—Line graph**

   A line graph is the most appropriate way to show the prevalence of malaria in Ghana over the past 30 years, because it can visually convey the trend for the 30-year time span in the country.

b. Data that are comparing the prevalence of malaria in 10 different countries during one year in sub-Saharan Africa**—Bar chart**

   A bar chart is the most appropriate chart to use to be able to make the comparisons in prevalence of malaria across the 10 different countries.

c. Data on the reported reasons why individuals do not use insecticide-treated nets (ITNs) among the individuals surveyed that were not currently using ITNs**—Pie chart**

   A pie chart is the most appropriate chart to visually show the reported reasons why individuals do not use ITNs, in relative proportion to one another.

d. The distribution of patients tested for malaria by parasite density**—Histogram**

   A histogram is the most appropriate graph to show the distribution of patients tested for malaria by parasite density.

Key Tips for Good Data Presentation

Here are some key tips to remember to ensure good data presentation:

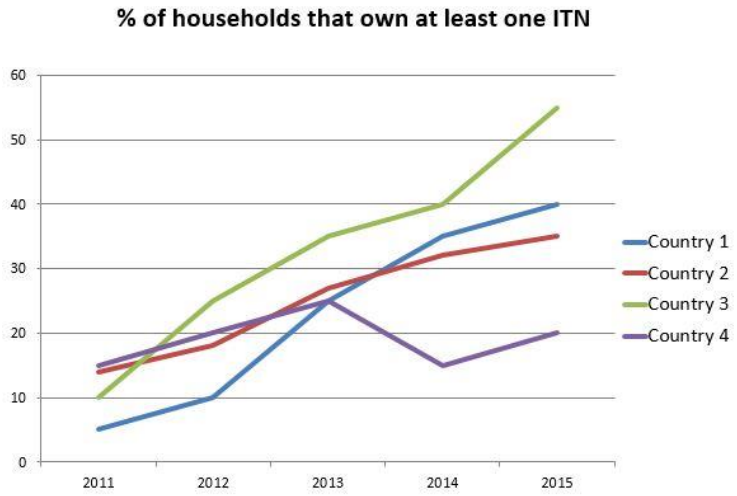
- ***Use the appropriate graphic***—Make sure to use the right graphic (table, chart, or graph) for your data, which will be based on the message you want to convey.
- ***Know your audience***—Present your information in a way that is clear, concise, practical, and actionable.
- ***Label all the components of your graphic***—All graphs and tables should have a title. The title should express the who, what, when, and where. Graphs and charts should have clearly labeled axes, and when appropriate, should include legends.
- ***Provide all relevant information***—Your graphic should be self-explanatory. This means that you should include the source and date for the data presented in your graphic. If something needs clarification or further explanation, include a footnote that helps bring clarity to the graphic. For good data presentation, it is essential that your audience has all the information needed to understand the message being conveyed in the graphic.

Data Presentation Examples

Keeping in mind the four tips for good data presentation, take a look at the following graphics. Are they presented well? If not, what is wrong with the way in which they are presented?

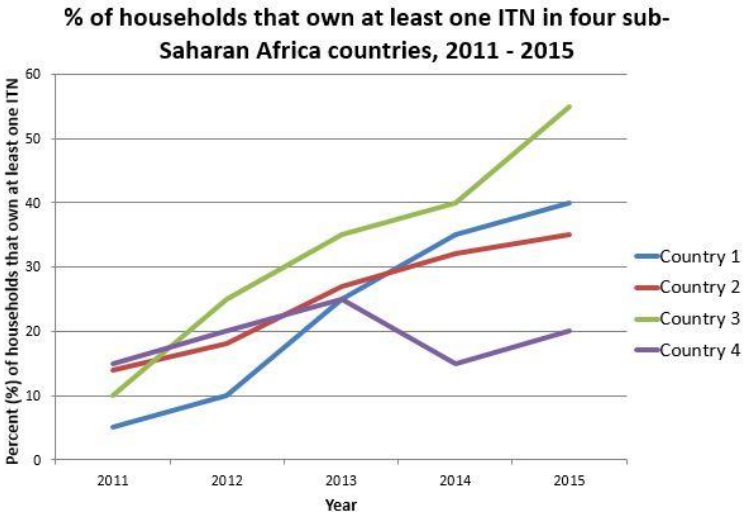
Example 1

What are the ways in which the data on this line graph could be presented more effectively?



A better way to represent the data includes the following elements:

- The title of the graph includes information on "when" and "where."
- The axes are properly labeled.



Source: World Malaria Report 2015

Example 2

What are the ways in which the data in this table could be presented more effectively?

Table 1

Year	(n)	Relative frequency (%)
2008	4,216,531	8
2009	3,262,931	6
2010	3,319,339	7
2011	5,338,008	10
2012	7,545,541	15
2013	9,181,224	18
2014	8,926,058	17
2015	9,610,691	19
Total	51,400,323	100.0

A better way to represent the data includes the following elements:

- The title explains the data contained in the table.
- The columns are clearly labeled.
- The data source is included.

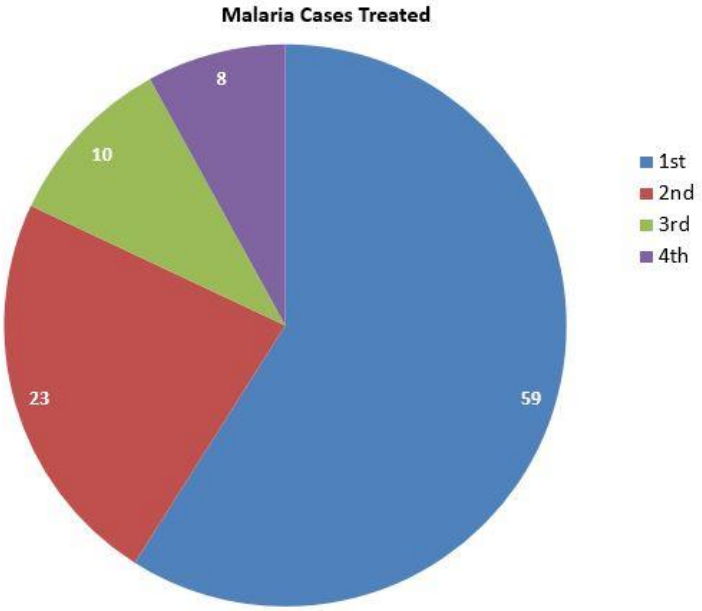
Table 1: Percent contribution of reported malaria cases by year in Country A, 2008 – 2015

Year	Number of malaria cases (n)	Relative frequency (%)
2008	4,216,531	8
2009	3,262,931	6
2010	3,319,339	7
2011	5,338,008	10
2012	7,545,541	15
2013	9,181,224	18
2014	8,926,058	17
2015	9,610,691	19
Total	51,400,323	100.0

Source: World Health Organization

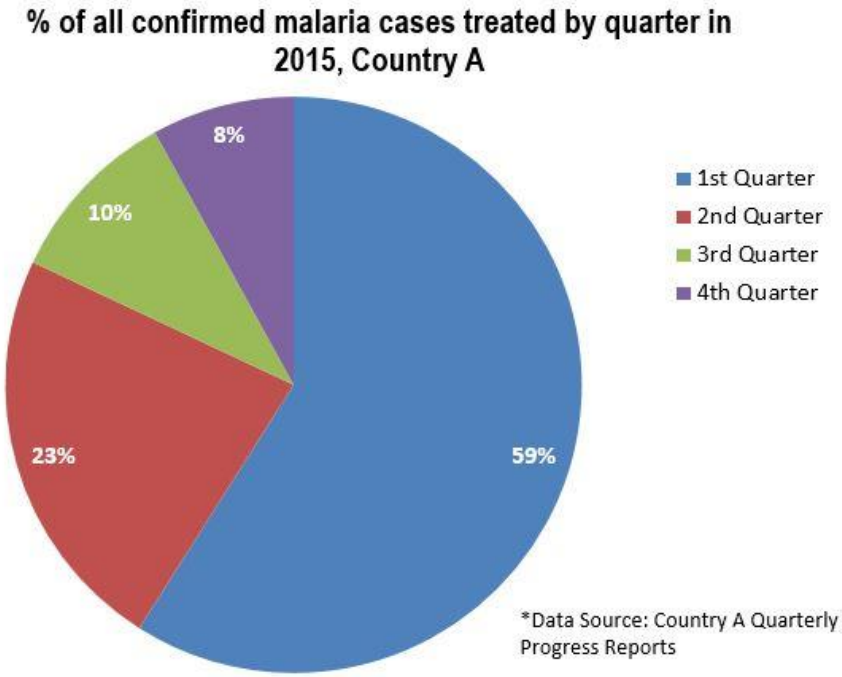
Example 3

What are the ways in which the data in the pie chart could be presented more effectively?



A better way to represent the data includes the following elements:

- The title of the chart is clear and specific.
- The numbers on the chart are clearly labeled.
- The chart legend is descriptive.
- The data source is included.



Module 8 Assessment

Questions

Correct answers are provided on the next page.

1. Which of the following questions cannot be answered through simple data analysis, but would need further information and interpretation to be able to answer?

   a. What was the annual number of malaria admissions in District A health facilities in 2015?
   b. Which country has the highest coverage (proportion) of households that own at least one insecticide-treated net?
   c. Why did the proportion of people sleeping under insecticide-treated nets decrease dramatically from last year?
   d. Which health facility in District B provided greater coverage of intermittent preventive treatment for pregnant women?

2. Based on the data presented in the table for annual number of insecticide-treated nets distributed by the National Malaria Control Program in Country X from 2002 to 2010, what is the mean, the median, and mode for the data set (in that order)?

   a. Mean: 140, Median: 174.67, Mode: 135
   b. Mean: 174.67, Median: 140, Mode: 135
   c. Mean: 135, Median: 140, Mode: 174.67
   d. Mean: 175, Median: 135, Mode: 140

Annual number of insecticide-treated nets distributed by the national malaria control program in Country X, 2007–2015

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
# of ITNs Distributed (thousands)	125	135	140	132	135	150	155	250	350

3. If you wanted to present a graphic comparing the proportion of households that have been sprayed with insecticides within the past 12 months across 15 high-burden countries, which would you use?

   a. Table
   b. Pie chart
   c. Histogram
   d. Bar chart

4. Annual parasite incidence, which is defined as the total number of confirmed malaria cases during one year (X 1,000) divided by the total population under surveillance, represents which common statistical measure?

   a. Rate
   b. Proportion
   c. Mode
   d. Percentage

Correct Answers

Correct answers are noted in bold.

1. Which of the following questions cannot be answered through simple data analysis, but would need further information and interpretation to be able to answer?

   c. Why did the proportion of people sleeping under insecticide-treated nets decrease dramatically from last year?

   A simple data analysis will only tell you that the proportion of people sleeping under insecticide-treated nets decreased this year compared to last year. To understand why, further information would need to be collected in order to determine why the proportion decreased.

2. Based on the data presented in the table for annual number of insecticide-treated nets distributed by the national malaria control program in Country X from 2002 to 2010, what is the mean, the median, and mode for the data set (in that order)?

   b. Mean: 174.67, Median: 140, Mode: 135

   Mean: 1,572/9 (observation)=174.67; Median: 125, 132, 135, 135, 140, 150, 155, 250, 350 = 140; Mode: 135

3. If you wanted to present a graphic comparing the proportion of households that have been sprayed with insecticides within the past 12 months across 15 high-burden countries, which would you use?

   d. Bar chart

   A bar chart is used for comparing data across different categories. In this case, you are comparing the difference in proportion of households that have sprayed insecticides across the 15 high-burden countries.

4. Annual parasite incidence, which is defined as the total number of confirmed malaria cases during one year (X 1,000) divided by the total population under surveillance, represents which common statistical measure?

   a. Rate

   Annual parasite incidence represents a rate, because a rate is ratio between two measurements. In this case, it is a ratio of the total number of confirmed malaria cases during one year (X 1,000) divided by the total population under surveillance.

MODULE 9:

ETHICS OF MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

MODULE 9: ETHICS OF MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

This module describes the ethical principles in research and their applications. It also highlights the historical events that affect ethics in research today.

Module Objectives

By the end of this module, you will be able to:

- Understand the importance of ethics in health research
- Describe key ethical principles in health research
- Apply health research principles to malaria surveillance, monitoring, and evaluation
- Describe the ethical approval process

Defining Ethics

Ethics can be defined as the set of moral principles that govern a person's behavior while conducting a program activity or research. Ethics includes the theoretical study of values and principles and the correct rules of conduct necessary when carrying out research involving human participants.

Importance of Ethics in Research

Ethical considerations in research promote values that are essential to collaborative work, such as trust, accountability, mutual respect, and fairness. They promote the truth by avoiding falsification or distortion of research data to avoid errors. Applying ethical principles to health research also means that no harm should be done to study participants. Participants must voluntarily agree to participate and must know what they are engaging in or what it is about. They must be able to withdraw at any time from the study, and the confidentiality of data collected must be respected.

Historical Events That Informed Research Ethics

Health research did not always apply good ethical practices, as you can see in the following historical events.

Historical Events: The Nazi Medical Experiments 1933–1945

© World History Archive / Alamy Banque D'Images

During the Second World War, Nazi doctors conducted experiments on thousands of concentration camp detainees to help the German military. Inmates were forced to participate without their consent. These Nazi doctors conducted painful and often fatal experiments in defiance of any medical ethics. These experiments included the following:

- Freezing prisoners to find an effective treatment against hypothermia
- Vaccine trials in which scientists tested immunization compounds and serums for the prevention and treatment of contagious diseases on prisoners without any safety precautions
- Bone transplant experiments in which sections of bones and muscles were removed from prisoners without the use of anesthesia and transplanted into different prisoners

Prisoners were forced to participate without their consent, and the experiments often resulted in death or permanent disabilities.

Historical Events: The Tuskegee Syphilis Study 1932–1972


© National Archives

The Tuskegee syphilis study was a clinical study conducted in Tuskegee, Alabama by American physicians to better understand the natural progression of syphilis. The study enrolled 600 registered African-American men, 399 with syphilis and 201 without syphilis. The participants were informed that the study would last six months, but it actually lasted for 40 years. Researchers did not inform participants that they had syphilis and withheld treatment with penicillin, an effective cure for the disease.

Historical Events: Ethical Code

Unethical health research led to the development of several prominent documents that provide ethical guidance worldwide.

The Nuremberg Code of Medical Ethics was established in 1949, after a series of trials held against German doctors in the Nazi party responsible for experimental and medical atrocities carried out on human beings in concentration camps during World War II. For the first time, this code outlined 10 rules to strictly control experiments and protect human beings. Subsequently, the World Medical Association strengthened these rules by adopting the Helsinki Declaration in 1964. The 1978 Belmont Report, developed by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, prescribed respect for individual rights, beneficence, and justice as fundamental principles of the ethical conduct of research involving human beings.

Applying Ethical Principles

The Belmont Report informed the basic principles used in health research today (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978), as shown in Figure 30.

Figure 30. The Belmont Report's ethical principles of health research

Respect for persons (Autonomy)	• Protecting the autonomy of all people and treating them with courtesy and respect and allowing for informed consent
Non-maleficence	• "Do no harm" while maximizing benefits for the research project and minimizing risks to the research subjects
Beneficence	• Moral obligation to act for the benefit of others: maximize benefits, minimize harms
Justice	• Ensuring that reasonable, non-exploitative, and well-considered procedures are administered fairly

Informed Consent

Respect for persons, or autonomy, protects individuals and treats them with courtesy and respect in health research. This requires that program participants be given truthful and complete information about the research and opportunities to ask questions and choose whether to participate. Standards for informed consent should be established ahead of time and explained to the participant. Consent information generally includes research procedures, purpose, potential risks and benefits, treatment and alternative procedures, and a statement offering the participant an opportunity to ask questions. An option to withdraw from the research study should be available at any time. Additional information sometimes includes how subjects are selected and the identity of the organization or researcher.

> "The respect for persons requires that subjects, to the degree that they are capable, be given the opportunity to choose what shall or shall not happen to them. This opportunity is provided when adequate standards for informed consent are satisfied."
>
> Belmont Report, 1978

The manner and context in which information is conveyed to the participant is as important as the information itself. For example, presenting information too fast or in a disorganized way does not provide the participant with enough time for consideration and questioning, which may affect a subject's ability to make an informed choice. Language and literacy must also be considered. Consent forms must be in a language understood by the participant, or a translator must clearly explain the study objectives and expectations so that the participant fully understands.

Voluntariness requires that the participant be given the opportunity to decline to participate or to withdraw later. This is done free of coercion and undue influence. Coercion is an overt threat of harm to obtain compliance. Undue influence occurs if an excessive reward is offered, or a reward is inappropriate or unwarranted. Inducements, such as monetary or food incentives that would ordinarily be acceptable, may become undue influences if the subject is especially vulnerable.

Risks and Benefits Assessment

This assessment relates to the principle of beneficence. All aspects of research must be justified based on a favorable risk to benefit assessment. Risks and benefits must be communicated to all researchers and participants, with alternatives considered if necessary.

> "The assessment of risks and benefits requires a careful arrayal of relevant data, including, in some cases, alternative ways of obtaining the benefits sought in the research. Thus, the assessment presents both an opportunity and a responsibility to gather systematic and comprehensive information about proposed research."
>
> Belmont Report, 1978

Selection of Subjects

Justice in the selection of subjects requires that researchers exhibit fairness. Potentially beneficial treatment should be offered to all participants equally. Social justice requires distinguishing candidate participants who should or should not participate based on their appropriateness and ability to bear burdens imposed by the research. An example of social justice is establishing an order of preference in the selection of participants, such as adults before children. Excluding participants, such as those who are institutionalized, mentally infirm, or prisoners, may also be a form of social justice.

> "The principle of justice gives rise to moral requirements that there be fair procedures and outcomes in the selection of research subjects. Justice is relevant to the selection of subjects of research at two levels: the social and the individual."
>
> Belmont Report, 1978

Ethical Principles in Research Writing

Writing for health research requires an ethical approach. Writing should follow laws and regulations on copyright and ownership and guard confidentiality of individuals. Writing should protect and promote the public good through scientific research, seek truth, and communicate it accurately.

Ethical writing also requires authors to know the harm and consequences that result from plagiarism and misleading authorship, fabrication, and falsification. These include avoiding inappropriate publication practices, such as withholding important data.

In presenting results, writers should be careful not to plagiarize, which is using the published ideas or words of others without giving credit. Writers can avoid plagiarism by using direct quotes in quotation marks or summarizing the idea in a paraphrase. A citation is used to indicate a source after a quotation or paraphrased summary of the idea. A reference is the information that guides a reader to the source, usually in a reference list or footnote.

Ethical Approval Process

Determining whether ethics in research are being or will be upheld in the conduct of a study cannot be left to the individual researcher; therefore, ethical review bodies are established to exercise that moral responsibility. Ethics committees should include at least five people from different backgrounds, including those with scientific, research, and non-scientific qualifications. Diversity in gender, age, ethnicity, and culture must be respected.

An ethics review board considers six fundamental questions when looking at a health research proposal:

- **Scientific approach, methodology, and implementation of the study.** The ethics committee must consider the impact of the methodology on participant safety.
- **Recruitment of participants.** The ethics committee must review the terms and conditions for recruiting research participants.
- **Community considerations.** The study must fit and address a local need or problem and be designed by people who understand the local community. Suggestions from community representatives can be helpful.
- **Care and protection of participants.** The ethics committee should consider the positive and negative consequences of the study on participants and their communities.
- **Informed consent.** The ethics committee must decide whether the procedure for obtaining informed consent and the accompanying forms are adequate. Community representatives can offer a relevant perspective on this topic.
- **Confidentiality issues.** The ethics committee should review the actions taken by the research team to protect the personal data of the participants. In some studies, the greatest risk for participants is the violation of the principle of confidentiality.

Only after these points have been addressed favorably by the researcher will an ethical review board approve the research study and the researchers can begin.

Summary

Ethics are important to protect human rights and quality of life. Health researchers have a moral responsibility to protect program participants from harm. Ethics standards establish values that are essential to collaborative work, such as trust, accountability, mutual respect, and fairness.

Ethics standards are important in health information systems to establish guidance on obtaining informed consent; collecting, aggregating, reporting, processing, and analyzing data; managing data systems and security; and presenting results without fabricating, falsifying, or misrepresenting results. Ethics standards promote accurate data collection, dissemination of truthful results, and avoidance of errors of omission or commission.

Module 9 Assessment

Questions

Correct answers are provided on the next page.

1. Which statement is false? To respect ethics means:

    a. No harm should come to research participants.
    b. Participants should agree to participate and know what the research is about.
    c. Participants must voluntarily agree to participate.
    d. Once agreed, participants can no longer withdraw from the study.
    e. Participant confidentiality must be respected.

2. The consent process contains three elements. They are as follows:

    a. Information, comprehension, voluntariness
    b. Information, obligation, benefit
    c. Explanation, agreement, voluntariness
    d. Comprehension, benefit, accountability

3. What steps must be considered for ethical approval?

    a. Confidentiality and voluntariness
    b. Protecting the autonomy of all people and treating them with courtesy and respect
    c. Beneficence and justice
    d. Scientific approach of the methodology and the implementation of the study, participant recruitment, community considerations, care and protection of participants, informed consent, confidentiality issues

4. *True or false:* In ethics, individual justice allows researchers to offer potentially beneficial research to favorable patients or select undesirable people for risky research.

    a. True
    b. False

Correct Answers

Correct answers are noted in bold.

1. Which statement is false? To respect ethics means:

    d. Once agreed, participants can no longer withdraw from the study.

2. The consent process contains three elements. They are as follows:

    a. Information, comprehension, voluntariness

3. What steps must be considered for ethical approval?

    d. Scientific approach of the methodology and the implementation of the study, participant's recruitment, community considerations, care and protection of participants, informed consent, confidentiality issues

4. **True or false:** In ethics, individual justice allows researchers to offer potentially beneficial research to favorable patients or select undesirable people for risky research.

    b. False

    Individual justice requires fairness in the participant selection process.

MODULE 10:

LEADERSHIP FOR MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

MODULE 10: LEADERSHIP FOR MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

This module describes the role of leadership in surveillance, monitoring, and evaluation (SME) of malaria control programs.

Module Objectives

By the end of this module, you will be able to:

- Identify leadership challenges for various program roles
- Carry out strong leadership at various levels of the health information system (HIS)
- Understand how routine and survey data are governed

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Leadership for Malaria SME

Effective leadership is essential for a health system to provide high-quality care and succeed. All managers at all levels of an organization, who depend on others for efficient and effective work performance, require strong leadership skills.

Who Is a Leader?

You are a leader no matter what position you hold. If you are not leading a company, a department, or a family, you are leading yourself. You have to determine in which direction you intend to go and who affects your input and output in whatever you are doing. However, leadership should not be confused with management. Leadership refers to the ability to develop a vision that motivates others to work passionately toward a common goal. Management focuses on the ability to organize resources and coordinate the execution of tasks necessary to reach a goal in a timely and cost-effective manner.

Approaches to Effective Leadership

A leader may be proactive or reactive:

- Proactive: A leader takes responsible initiatives to change situations and attitudes through people.
- Reactive: A leader responds to events and instructions.

Regardless of which approach a leader takes, effective leadership must achieve the following:

- Provide a vision that influences those who work in the organization
- Ensure confidence in one's vision and oneself
- Project and communicate the vision
- Initiate and guide change
- Mobilize commitment to and support for change
- Resolve conflicts
- Build trust
- Build sustainability
- Develop and promote others

There are different styles to leadership for decision making. Autocratic leaders use their authority to make decisions and announce them without giving subordinates freedom to share their ideas or provide input into the decision. Consultative leadership means that the leader presents an idea and allows questions only from the subordinates. Participative leadership means that the leader presents the problem to subordinates to get their suggestions, and the leader also consults the subordinates before making any decisions. In a democratic leadership, the leader defines the limits before asking the subordinates for their inputs. In laissez-faire leadership, the subordinates have greater freedom to function within the limits set by their supervisor.

Figure 31. Continuum of leader decision-making authority

Role of Leadership in Malaria SME

The role of a leader in malaria SME is to develop and communicate a clear and convincing vision of SME and to encourage the involvement and commitment of the team and all key actors. Specific leadership skills are to:

- Manage the development of evidence-based, strategic, and operational plans for the malaria program (including long- and short-term goals and objectives, risk assessments, and resource implications)
- Develop, regularly update, harmonize, and communicate SME plans that include identified data needs, standardized indicators, and data collection procedures and tools
- Adopt SME planning and implementation processes into national process
- Support a unified and effective SME system through planning and implementation of activities and SME capacity building at individual, organizational, and system levels
- Build and maintain partnerships among in-country and international stakeholders who have key roles in SME system operations

Role of Leadership in Health Data Governance

Good leadership in data governance starts with a good health data legal and regulatory framework and legislation. A good leader promotes accountability and transparency for health data by increasing

transparency and accountability of health system units, departments, managers, and staff for proper routine health information system operations, management, and use. A good leader also works to foster partnership and coordination for health data by maintaining good coordination and collaborative partnerships for the development of HIS and for the effective operation and sustainability of important HIS functions.

Example of Leadership in Governance of Health Data at the Country Level

At the country level, good governance of health data starts with a defined health data policy and strategic plan. A health data policy is a document that refers to decisions, plans, and actions undertaken to achieve specific development objectives, strategies, and results for health data. HIS strategic plans usually cover five to 10 years and can take three to six months to develop. These two documents are combined into a health data policy and strategic planning document.

Characteristics, Steps, and Products of HIS and Routine HIS Strategic Planning

An HIS strategic planning process is typically undertaken by ministries of health that want to identify and enhance the more important HIS functions and subsystems. The product of the planning process is usually a document that lays out the priority needs for HIS development, agreed-on strategic interventions and development efforts planned for a five-year period, along with estimated development and operational costs, and the definition of program responsibilities for plan implementation. The HIS strategic planning process is usually sponsored by the health ministry or by a higher-level office if more than one ministry is participating.

Sponsorship, Management, and Organization

The management and organization of the process is often structured similar to the following, with participation as indicated:

An **HIS development steering committee** oversees the progress and products of the planning process and provides policy guidance. It comprises 12–20 senior policy makers from all ministries involved; bureaus and institutes external to and from the health ministry with important information management functions (census bureau, civil registration and vital statistics); and directors-general of relevant departments. Senior representatives of international and donor agencies supporting the information system are also useful on this committee.

An **HIS core team** provides the technical management of the process and all of its steps. It usually comprises six to eight managers and senior technical staff of the departments that will be implementing system improvements, such as the following:

- The health ministry's health information department
- The census planning and analysis department
- The department of civil registration of the ministry of interior
- Other departments and institutes heavily engaged in social and health measurement
- Technical advisors engaged by the health ministry

The **HIS stakeholder working group** carries out the technical discussions for each step of the process and related products. It has 40–60 members from offices and programs that are in a position to contribute to the design of information system improvements, and who will eventually take responsibility

for implementing the strategies and activities that fall in their functional areas of work. These include offices such as policy and planning, budgeting and financial management, human resources management, monitoring and evaluation, disease surveillance, major health programs and service areas, other ministries and departments as appropriate, important health nongovernmental organizations and representatives of the private sector, and external technical and donor agencies interested in the subject.

The following guiding principles should be taken into account:

- Ensuring country leadership and ownership of the process
- Defining and addressing country needs and demands
- Building on existing initiatives and systems
- Striving for broad-based consensus through extensive stakeholder involvement
- Pursuing gradual and incremental developmental progress toward the achievement of a long-term vision

Module 10 Assessment

Questions

Correct answers are provided on the next page.

1. What is the role of leadership in the surveillance, monitoring, and evaluation (SME) of malaria programs?

    a. Develop and communicate a clear and compelling vision and mission for SME
    b. Manage the development of evidence-based, strategic and operational plans for the program (including long- and short-term goals and objectives, risk assessments, and resource implications)
    c. Build and maintain partnerships among partners who have key roles in SME system operations
    d. a and c
    e. a, b, and c

2. Management is defined as:

    a. Providing a vision that influences those who work in the organization
    b. Organizing resources and coordinating tasks to reach a goal
    c. Ensuring confidence in one's vision and oneself
    d. Resolving conflicts
    e. Building trust
    f. Developing others

3. *True or false:* Proactive leaders respond to events and instructions.

    a. True
    b. False

4. *True or false:* Reactive leaders take responsible initiatives to change situations and attitudes through people.

    a. True
    b. False

Correct Answers

Correct answers are noted in bold.

1. What is the leadership role in the surveillance, monitoring, and evaluation (SME) of malaria programs?

   e. a, b, and c

2. Management is defined as:

   b. Organizing resources and coordinating tasks to reach a goal

3. *True or false:* Proactive leaders respond to events and instructions.

   b. False

   Proactive leaders take responsible initiatives to change situations and attitudes through people.

4. *True or false:* Reactive leaders take responsible initiatives to change situations and attitudes through people.

   b. False

   Reactive leaders respond to events and instructions.

MODULE 11:

MALARIA SURVEILLANCE

MODULE 11: MALARIA SURVEILLANCE

This module describes malaria surveillance in the global context and defines basic concepts. It describes how malaria surveillance is conducted in various transmission settings, high and moderate, low, very low, and elimination, according to WHO guidelines. It takes into account risk factors that affect malaria surveillance. Finally, it discusses the importance of assessing the performance of a malaria surveillance system. Note that this module is not intended to duplicate the guidance provided in WHO's *Malaria Surveillance, Monitoring & Evaluation: A Reference Manual* (2018). Please refer to that document for more detail at https://www.who.int/malaria/publications/atoz/9789241565578/en/.

Module Objectives

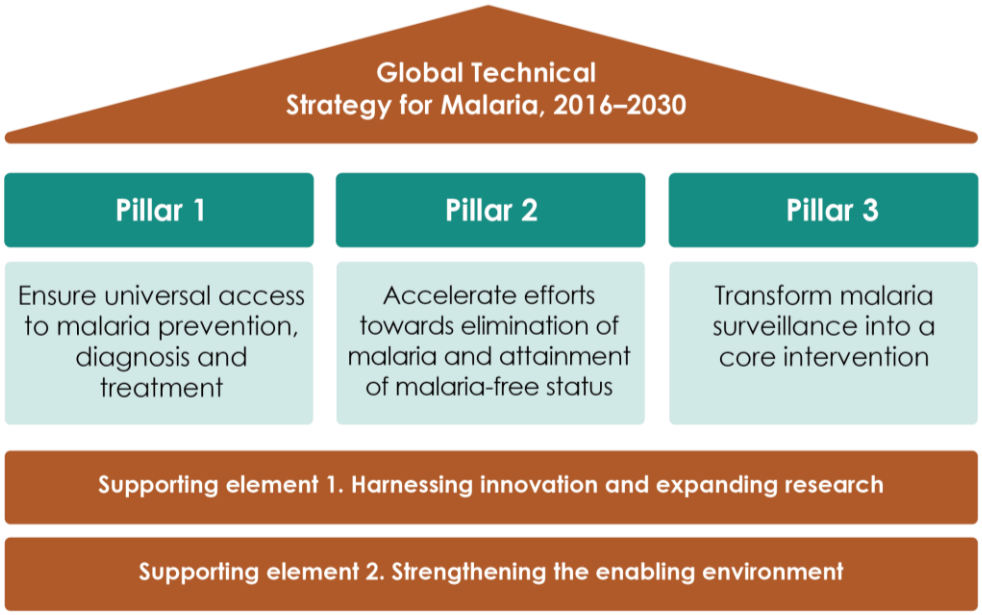
By the end of this module, you will be able to:

- Appreciate the global context of malaria surveillance
- Define basic concepts of malaria surveillance
- Understand malaria surveillance in various transmission settings
- Recognize risk factors
- Assess the performance of a malaria surveillance system

The Global Context

In 2015, WHO's Global Technical Strategy (GTS) transformed malaria surveillance into a core intervention under Pillar 3. This method of surveillance is to be used as a form of aggressive monitoring to guide malaria programs for action. More details on the GTS can be found at http://www.who.int/malaria/publications/atoz/9789241564991/en/.

Figure 32. WHO's Global Technical Strategy for Malaria, 2016–2030



Source: Framework for the WHO GTS

Basic Concepts

Definition of Malaria Surveillance

Malaria surveillance systematically collects relevant data, consolidates information, and delivers it quickly to guide decisions toward action to control or prevent malaria. It provides timely, malaria-specific data and information at a national scale or for specific geographical areas.

> "Surveillance as an intervention encompasses tracking of disease [malaria] and programmatic responses and taking action in response to data received."
>
> *—WHO GTS–Malaria*

Malaria surveillance must be adapted to the transmission context to account for different data and action requirements. Figure 33 shows the WHO Malaria SME operational guidance for malaria surveillance across various transmission settings.

Figure 33. WHO/GTS SME operational guidance for malaria surveillance by transmission setting

		High	Moderate	Low	Very low	Zero	Maintaining zero
		≥ 35% PfPR or ~450 per 1,000 API	10–35% PfPR or 250–450 per 1,000 API	1–10% PfPR or 100–250 per 1,000 API	> 0 but <1% PfPR or 100 per 1,000 API	No transmission	
Pillar 3 of the GTS 2016–2030 Transform malaria surveillance into a core intervention	Case detection	Passive case detection			Passive and active case detection		
	Recording	Outpatient and inpatient registers			Individual patient forms		
	Reporting frequency	Monthly		Weekly		Immediate case notification	
	Resolution of reported data	Aggregate cases by sex and age category			Case report, age, sex, residence, travel history, and case classification		
	Data use: health facilities	Data analyzed monthly		Weekly		Data analyzed in real time	
	Data use: intermediate levels	Data analyzed monthly		Weekly		Data analyzed weekly	
	Data use: national	Data analyzed monthly or quarterly		Weekly		Data analyzed weekly	
	Response time	Monthly or quarterly		Weekly		Case investigation within 24–48 hrs, focus investigation with 1 week	
	Feedback frequency to upper and lower levels	Annually or quarterly		Monthly		Every two weeks	
	Surveillance system monitoring	Every two years		Annually		Annually or more frequently	

Source: WHO Malaria SME Reference Manual, 2018, p. 13

Objectives of Malaria Surveillance

The GTS recommends that information from malaria surveillance be used for policy and program evidence-based decision making and to inform program implementation. Objectives include the following:

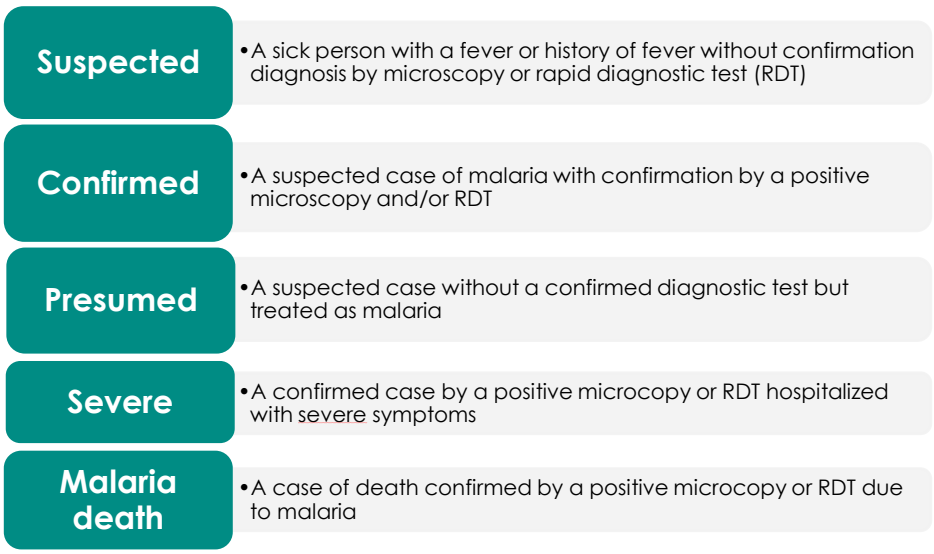
- **Plan:** To provide an evidence-based framework that organizes actions and tracks progress
- **Contribute:** To use early detection and fast response to improve health outcomes and allow the healthcare community to move resources to places where they are needed most
- **Alert:** To detect abnormal trends that can indicate epidemics and use this evidence to take preventive action
- **Describe:** To describe the possible magnitude of increase in cases by analyzing trends and patterns in diseases and reporting the evidence to stakeholders who can use the information to take action

- **Evaluate:** To measure the effectiveness of interventions and pinpoint areas that need strengthening
- **Hypothesize:** To analyze available information and interpret it to form a working hypothesis that can be tested through research and refined during actions
- **Research:** To identify disease elements that need answers through scientific research

Case Definition

Malaria surveillance detection follows established criteria—a standard case definition to ensure that every case is diagnosed in the same way. Malaria cases are defined as shown in Figure 34.

Figure 34. Standard malaria case definitions



Case Detection

Malaria surveillance can be passive or active, as shown in Figure 35.

Figure 35. Comparison of passive and active malaria surveillance

Passive surveillance	Active surveillance
•Data are collected from existing routine systems with in-place systematic notifications. •Cases are captured when patients seek care in health facilities or from a community health worker.	•Data are collected regularly from selected health facilities or households. •New cases are closely monitored and reported through routine systems.

Passive surveillance is less burdensome on the health system and costs less because it uses the existing routine health information system. It provides useful data that show trends over time; however, it may not be representative because not all cases are captured in the routine health information system. It may also fail to identify outbreaks and is limited by variability and incompleteness of reporting.

Active surveillance often validates passive reports, ensures more complete reporting, identifies outbreaks, and can be used with specific investigations for brief periods of time. There are two types of active

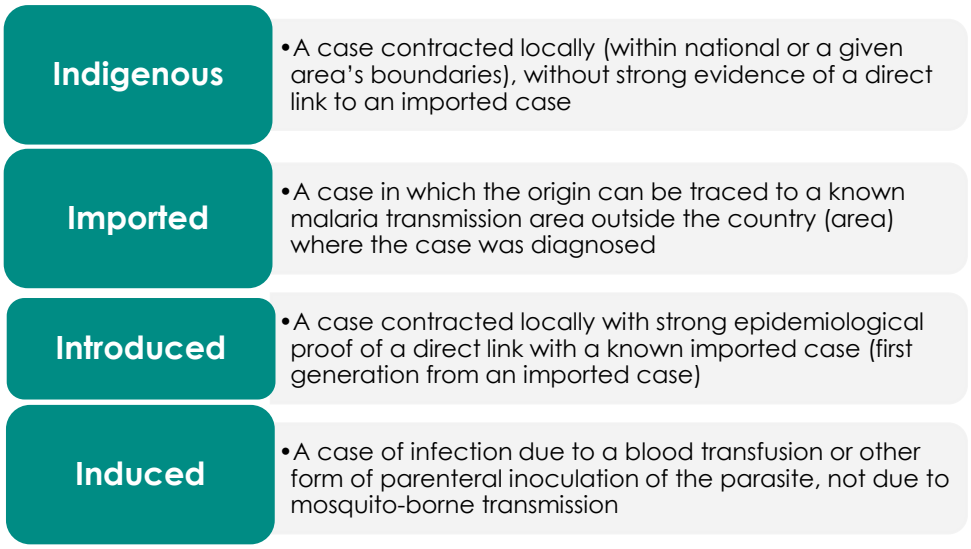
surveillance, proactive and reactive. During a proactive approach, a health worker tests an entire population in a given area for malaria. During a reactive approach, a health worker goes household to household to test a population for malaria. Both approaches are burdensome on health staff and expensive to maintain.

Case Investigation and Classification

Case investigation is performed to determine the origin of the infection (local or imported) and document related factors. Detailed information on the history of the index case is collected from the service delivery point where it was reported to initiate the investigation. Case investigation is conducted most often in very low transmission settings, as part of reactive case detection. Information collected will help classify the case as indigenous, imported, introduced, or induced.

After a case has been investigated, it is classified into one of the categories shown in Figure 36.

Figure 36. Classifications of malaria cases



Response

Every epidemic investigation and case investigation must end with a response. Programs often set levels of thresholds for actions. An alert threshold suggests the need for further investigation, and an epidemic threshold triggers a specific response through lab confirmation or the implementation of an urgent investigation. Thresholds are set according to transmission settings and the human and financial resources available for response. Malaria control programs set response activities, such as resource mobilization, multisector communications, and other interventions. Programs are also responsible for maintaining adequate stocks of case definition forms, equipment, medicines, and RDT kits to be used for immediate response.

Malaria Surveillance in High- and Moderate-Burden Settings

High-burden settings are defined as having a *Plasmodium falciparum* parasite rate (*Pf*PR) of more than 35 percent or an annual parasitic incidence (API) of 450 per 1,000. Moderate-burden settings are defined as having a *Pf*PR of 10–35 percent or an API of 250–450 per 1,000. The priority for malaria surveillance in these settings is to reduce malaria burden, cases, and deaths.

Table 12. Characteristics of a malaria burden reduction setting

Profile of malaria control in a burden reduction setting	
Parasite prevalence/API	• High: *Pf*PR>=35%, API=450 per 1,000 • Moderate: *Pf*PR=10–35%, API=250–450 per 1,000
Incidence	• Most cases occur in children under five • Limited temporal variation • Limited geographical variation
Deaths	• Most malaria deaths occur in children under five
Fevers	• High proportion due to malaria
Health facility attendance	• High proportion due to malaria
Parasite	• Most cases due to *P. falciparum*
Vectors	• Efficient and stable anopheline activities
Health systems	• Weak, poor accessibility of services • Low ratios of staff to patients • Frequent stockouts of supplies (RDT, microscopy)

A malaria surveillance system in a burden reduction setting collects data on malaria epidemiology to provide information for planning, implementing, and monitoring and evaluating malaria control interventions. Data on individual cases and deaths are recorded on outpatient department and inpatient registers, then aggregated into a monthly report for analysis. Data are collected through routine health information systems, integrated disease surveillance and response systems, program parallel surveillance systems, and sentinel sites. Household surveys, such as the Demographic and Health Surveys, Multiple Indicator Cluster Surveys, and Malaria Indicator Surveys, can also provide supplementary data on the prevalence of parasitemia and intervention coverage at the population level.

Data analysis in this setting requires observing trends in aggregated data. Health facilities graph cases and deaths monthly and monitor trends. Subnational and national levels use aggregated data on cases and deaths to identify trends over time, assess the efficacy of malaria control interventions, and make programmatic adjustments.

Examples of key indicators collected in high- and moderate-burden settings include the following:

- Number of confirmed malaria cases per 1,000 population per month/year
- Number of inpatient malaria cases per 10,000 population per month/year
- Number of inpatient malaria deaths per 100,000 per month/year
- Malaria test positivity rate (RDT and/or slide positivity rate)
- Percentage of cases due to *P. falciparum*
- Percentage of inpatients cases due to malaria
- Percentage of inpatient deaths due to malaria

- Annual blood examination rate
- Percentage of suspected malaria cases receiving a diagnostic test
- Completeness of reporting

Additional indicators for burden reduction are available in the WHO malaria SME manual (WHO, 2018, Table 14 and Annex 17).

Malaria Surveillance in a Low-Burden Setting

Low-burden settings are defined as having a *Pf*PR of 1–10 percent or an API of 100–250 per 1,000. These settings are classified into two groups: (1) areas that are transitioning moderate transmission to low transmission and (2) areas that show seasonal environmental changes that cause vectors to be inefficient. The priority in this setting is to collect information to monitor for changes that may indicate an irregular increase in malaria cases and prepare a response. The national malaria program goal in this setting is to reduce malaria incidence to very low, using passive case detection and reactive case detection when needed.

Table 13. Characteristics of a low malaria burden setting

Profile of malaria control in a low-burden setting	
Parasite prevalence/API	• *Pf*PR=1–10% (children ages 2–9) • API=100–250 per 1,000
Incidence	• Uniform in age groups • Most cases occur in marginalized populations with higher exposure • Significant proportion of imported cases
Case distribution	• Seasonal malaria, high risk of epidemics • More focal within districts
Deaths	• Few (most cases in populations with higher exposure)
Fevers	• Small proportion due to malaria
Health facility attendance	• Low proportion due to malaria
Parasite	• Higher proportion of *P. vivax*
Vectors	• Unstable seasonal anopheline activities
Health systems	• Usually stronger than high and moderate burden settings • Better availability of supplies (RDT, microscopy)

Programs use SME data collected on incidence, mortality, and patient attendance; diagnostic results; and the quality of health facility reporting to inform planning, monitoring, and evaluation of control interventions in focal areas.

Data collected at the health facility level identify trends, indicate population groups with the highest incidence, and pinpoint the source of infection. Health facility information is plotted weekly to identify trends, pinpoint population groups with the highest incidence, seek the source of the infection, and report to the subnational level. Any irregular changes are investigated immediately. The subnational level conducts a monthly data review and further analysis. The national level analyzes the impact of malaria control interventions in the area affected.

Surveillance in a low-burden setting considers country heterogeneity. Analysis is disaggregated accordingly based on a clearly defined threshold that can trigger an alert for further investigation. Surveillance data are compared to the thresholds over time. If the number of cases reaches or goes beyond the threshold, a further investigation is conducted to confirm the epidemic and prepare an adequate response. There are many different approaches for calculating alert and epidemic thresholds, including constant malaria case count, percentiles over the median or third quartile, the mean number of malaria cases +2 standard deviations (mean+2SD), the cumulative sum (C-SUM), and the weekly slope or doubling of cases during three consecutive weeks (7–9). Countries can choose the best approach based on their settings.

Malaria Surveillance in Very Low-Burden Settings

Very low-burden settings are defined as having a *Pf*PR more than 0 but below 1 percent or an API of less than 100 per 1,000. In this setting, the priority is to interrupt local transmission of malaria. The malaria surveillance system detects all malaria infections, with or without symptoms, to ensure an immediate response with prompt treatment to prevent secondary cases. The system captures an entire country or region with focused attention on areas with ongoing or recent transmission.

Table 14. Characteristics of a very low malaria burden setting

Profile of malaria control in a very low-burden setting	
Parasite prevalence/API	• *Pf*PR=>0 but <1% • API=<100 per 1,000
Incidence	• Cases sporadic • Imported cases common
Case distribution	• Focal distribution • High risk of epidemics
Deaths	• Very few (in populations with higher exposure)
Fevers	• Small proportion due to malaria (except in specific populations)
Health facility attendance	• Very low proportion due to malaria
Parasite	• Mostly *P. vivax* but not always
Vectors	• Vector activities controlled and inefficient (most cases are imported)
Health systems	• Strong • Availability of supplies (RDT, microscopy) and resources to investigate every case

High-quality data are required on all individuals with a suspected case of malaria, confirmed through a parasitological test. Every case and focus area is investigated fully, and results are reported immediately and completely. Records are kept for all tests and investigations to guide program implementation. Every malaria case reported through a passive surveillance system is important and requires the following immediate actions:

1. Confirm all malaria cases in public- and private-sector health facilities.
2. Investigate individual cases to determine whether the infection was acquired locally or imported.
3. Identify the foci, investigate to document the characteristics of transmitted cases, and intensify response and surveillance activities in the focus area.

More information on key indicators for very low transmission settings can be found in the WHO malaria SME manual (WHO, 2018, Table 14 and Annex 17).

Malaria Surveillance for Elimination

Elimination status is achieved when there is zero incidence of locally acquired malaria in an area due to deliberate efforts to prevent reestablishment of transmission. Malaria surveillance is essential to successful elimination of malaria through diligent data collection and recording. In this setting, the malaria surveillance system must confirm all malaria cases from public and private facilities and investigate each case to determine whether it is locally acquired or imported. An investigation of the focus area, or foci, is done to document characteristics and intensify response and surveillance activities. National support for policy legislation is needed as well as resources for additional staff, up-to-date laboratories for diagnostics, and treatment centers. Staff need to be properly trained on recognition of malaria symptoms, diagnostic testing procedures, appropriate treatments, and accurate data recording. The private sector must also be involved to ensure that the surveillance system is capturing cases from all facilities, public and private.

Key indicators for elimination focus on process, output, and impact. Table 15 lists selected common indicators.

Table 15. Common indicators for malaria elimination

Process and output Indicators	Impact indicators
• Annual blood examination rate by district and focus • Percentage of expected monthly reports received from health facilities and labs • Percentage of confirmed cases fully investigated • Percentage of foci fully investigated and registered • Time from first symptom (fever) to first contact with health system • Time from first contact to testing • Time from positive test result to start of treatment • Time from positive test result to notification of the national malaria program • Percentage of malaria testing labs participating in a quality management system • Percentage of past five years with national annual malaria program report	• Number and incidence rate of confirmed malaria cases by classification, sex, age group, risk group, etc. • Number of foci by classification (Incidence) • Number of imported cases (Incidence)

More information on key indicators for elimination is available in the WHO malaria SME manual (WHO, 2018, Table 14 and Annex 17).

Monitoring Risk Factors

A strong malaria surveillance system requires monitoring risk factors that affect vector breeding, transmission risk, and effective diagnostics and treatment. These risk factors can be environmental or anthropogenic.

Environmental Factors

Environmental factors that influence the vector life cycle include temperature, rainfall, humidity, wind, and topography.

Ambient temperature, the measure of heat in a volume of air, is registered at 2 p.m. for maximum temperature and at 6 a.m. for minimum temperature. Maximum and minimum temperatures affect the vector survival in larvae and adult stages, the parasite development in the vector, and the frequency of blood meals. The ideal mean temperature for malaria transmission is between 20 and 30 degrees Celsius.

Rainfall creates vector breeding sites by increasing water surface. Relative humidity, the ratio of air to water vapor, affects surface water dissipation and adult vector survival. Higher humidity increases mosquito survival. For example, an adult anopheles needs more than 60 percent humidity to survive.

Wind direction and speed distribute the vector. The topography, slopes, valleys, and wetlands affect water source formation and can affect vegetation coverage, which affects the vector habitat. The following table shows common environmental factors, the measurement tools used, and the effect that the factor has on malaria transmission.

Table 16. Effects and measurement of common environmental factors on malaria transmission

Environmental factors	Measurement tools	Effects on malaria transmission
Temperature (min, max, mean)	Thermometer	• Vector survival (larval and adult) • Development of the parasite in the vector • Frequency of blood meals
Relative humidity (%)	Hygrometer	• Vector survival (adult) • Creates surface water
Pluviometry	Pluviometer	• Creates habitat for the vector • Can flash off vector larval
Wind (direction and speed-m/s, km/h)	Anemometer and wind vane	• Facilitates spatial distribution of the vector
Vegetation coverage (NDVI, vegetation map)	SPOT/VG, field validation	• Vector habitat
Water surface (%)	Cartography	• Vector survival • Breeding sites
Topography (slope, valley, wallows, wetlands)	Contour map	• Affects the formation of water sources—potential breeding sites
Type of soil	Soil map	• Affects the availability of surface water for mosquito breeding sites

Anthropogenic Factors

Anthropogenic factors are factors influenced by human activity, which affect vector and parasite breeding. Land use, such as irrigation schemes, farming, and mining, can create or increase the surface water for breeding sites. Water sources, such as wells and boreholes, can provide breeding sites, even during the dry season. Urbanization affects vector survival by creating breeding sites in trash and puddles on pavement; however, it also reduces transmission by making treatment more accessible. Finally, the type of habitat, such as crowded housing or open villages, affects vector contact with humans.

Additional factors that influence malaria transmission include uncertainty of the health system, failure of health interventions, socio-political and economic instability, individual susceptibility (age, occupation), and housing conditions. Understanding the relationship between factors can build successful surveillance.

Assessing the Performance of a Malaria Surveillance System

An assessment of the surveillance system should be conducted periodically to ensure that the system is following program priorities. An assessment documents system effectiveness and linkages between the surveillance system and other existing health information systems. Outcomes from the assessment provide opportunities to introduce new surveillance methods to strengthen the system. An assessment of the performance of a surveillance system comprises four components: structure, core functions, support functions, and quality outputs. More details on what should be assessed in each component are found in the WHO malaria SME manual.

Module 11 Assessment

Questions

Correct answers are provided on page 137.

1. Malaria surveillance involves which of the following:

   a. A systematic and continuous process
   b. Collecting relevant data
   c. Analyzing and interpreting data
   d. All of the above
   e. None of the above

2. *True or False:* Presumed is a sick person with a fever or history of fever without confirmation of diagnosis by microscopy or RDT.

   a. True
   b. False

3. Match the following classification categories used in case investigation.

a. Imported	• A case contracted locally with strong epidemiological proof of a direct link with a known imported case (first generation from an imported case)
b. Indigenous	• A case in which the origin can be traced to a known malaria transmission area outside the country (area) where the case was diagnosed
c. Induced	• A case contracted locally (within national or a given area's boundaries), without strong evidence of a direct link to an imported case
d. Introduced	• A case of infection due to a blood transfusion or other form of parenteral inoculation of the parasite, not due to mosquito-borne transmission

4. What triggers a precise response for urgent implementation of interventions for epidemic management/control?

   a. Alert threshold
   b. Epidemic threshold
   c. Red light threshold
   d. All the above

5. Malaria surveillance in high and moderate burden settings focuses on which of the following:

   a. Confirming every case from public and private health facilities and determining whether each case is locally acquired or imported through a case investigation
   b. Collecting information to monitor for changes that indicate an irregular increase in malaria cases and preparing a response
   c. Reducing malaria burden, including cases and deaths
   d. Detecting all malaria cases, with or without infections, and ensuring an immediate response with prompt treatment to prevent secondary cases

6. Which is NOT true of passive case detection:

    a. Health worker tests an entire population in a given area for malaria.
    b. Data are collected from existing routine systems.
    c. Cases are captured when patients seek care in health facilities or from a community health worker.
    d. Passive case detection may be limited by incompleteness of reporting.

7. There are two forms of active surveillance. These are:

    a. Proactive and retroactive
    b. Proactive and reactive
    c. Reactive and retroactive
    d. None of the above

8. *True or false:* Malaria transmission anthropogenic-related factors are factors influenced by human activity, which affect vector and parasite breeding.

    a. True
    b. False

9. With which periodicity should malaria surveillance be conducted?

    a. Never
    b. Once every 20 years
    c. Every 10 years
    d. Periodically

Correct Answers

Correct answers are noted in bold.

1. Malaria surveillance involves which of the following:

   d. All of the above
   Malaria surveillance systematically collects relevant data and includes analyses and interpretation to inform decisions for action.

2. *True or False:* Presumed is a sick person with a fever or history of fever without confirmation of diagnosis by microscopy or RDT.

   False: Presumed is a suspected case without a confirmed diagnostic test but treated as malaria.

3. Match the following classification categories used in case investigation.

   Correct answers:

a. Imported	• A case in which the origin can be traced to a known malaria transmission area outside the country (area) where the case was diagnosed
b. Indigenous	• A case contracted locally (within national or a given area's boundaries), without strong evidence of a direct link to an imported case
c. Induced	• A case of infection due to a blood transfusion or other form of parenteral inoculation of the parasite, not due to mosquito-borne transmission
d. Introduced	• A case contracted locally with strong epidemiological proof of a direct link with a known imported case (first generation from an imported case)

4. What triggers a precise response for urgent implementation of interventions for epidemic management/control?

   b. Epidemic threshold
   An epidemic threshold triggers a specific response through lab confirmation or implementation of an urgent investigation.

5. Malaria surveillance in high and moderate burden settings focuses on which of the following:

   c. Reducing malaria burden, including cases and deaths

6. Which is NOT true of passive case detection:

   a. A health worker tests an entire population in a given area for malaria.

7. There are two forms of active surveillance. These are:

   b. Proactive and Reactive

8. *True or false:* Malaria transmission anthropogenic-related factors are factors influenced by human activity, which affect vector and parasite breeding.

   True: Anthropogenic factors are factors influenced by human activity, which affect vector and parasite breeding).

9. With which periodicity should malaria surveillance be conducted?

   d. Periodically
   Surveillance should be conducted periodically to ensure that the system is following program priorities.

MODULE 12:

GENDER IN MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

MODULE 12: GENDER IN MALARIA SURVEILLANCE, MONITORING, AND EVALUATION

This module provides an introduction to gender and malaria, describing how gender influences malaria transmission, prevention, and treatment, and how gender data can help malaria programs better target populations and intervention approaches.

Module Objectives

By the end of this module, you will be able to:

- Explain gender influences on malaria transmission, prevention, care-seeking, and treatment
- Identify sources of gender data for malaria programs
- Identify gender analyses that can be used to make decisions for malaria programs

Gender and Health

According to the World Health Organization (WHO), gender refers to a culturally defined set of economic, social, and political roles, responsibilities, rights, entitlements, and obligations, associated with being female and male, as well as the power relations between and among women and men, boys and girls. The definition and expectations of what it means to be a woman or girl and a man or boy, and sanctions for not adhering to those expectations, vary across cultures and over time, and often intersect with other factors such as race, class, age, and sexual orientation. Transgender individuals, whether they identify as men or women, are subject to the same set of expectations and sanctions.

> "Gender is a culturally defined set of economic, social, and political roles, responsibilities, rights, entitlements, and obligations associated with being female and male, as well as the power relations between and among women and men, and boys and girls."
> World Health Organization, 2009

Gender norms influence household decision making and access to resources, which in turn influence the following:

- Access to and uptake of preventive behaviors and interventions
- If, when, and how individuals seek care and treatment for themselves and their children

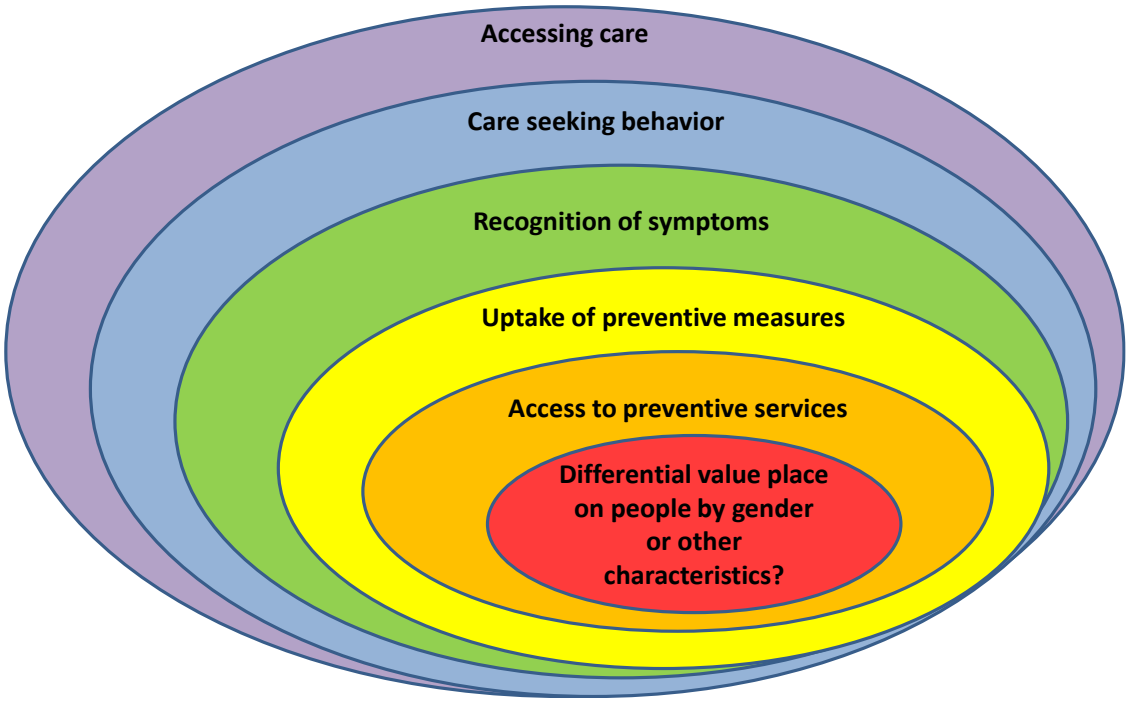
For example, travel requires resources and is often controlled by men who control household resources. Therefore, travel is a gendered barrier to accessing care and treatment outside of the home or community.

There are also gendered dimensions to consequences of illness. We will not discuss these issues in depth in this course, but it is important to note that these consequences can have long-term effects on individual, family, and community well-being and contribute to continued or deepened poverty. These consequences include attrition from school and inability to do work in or outside of the home.

Common Gender Influences on Malaria

Figure 37 illustrates the gendered dimensions of health. This graphic should be read from the center out, to see how different gender dynamics contribute to vulnerability to (risk of) disease infection, and how gender dynamics affect prevention, care-seeking, and access to quality care.

Figure 37. The gendered dimensions of health



Starting in the center, a basic question helps frame the context for how gender may influence the continuum of care: Is there a differential value placed on people by gender or other characteristics?

The term "differential value" refers to whether there is a difference in how people are valued in a society, community, or household, or whether there is a different social "worth" ascribed to different people.

For example, are male children more desired? This can extend to different expectations. For example, men may be thought to be physically stronger than women, so a different value or judgement is placed on men according to that characteristic.

Transmission Patterns

Populations may have different susceptibilities to malaria based on gendered norms, such as division of labor, which drives different transmission patterns.

Specific populations may spend the dawn and dusk hours outdoors—prime biting time for malaria-transmitting mosquitos. Some populations may even sleep outdoors, prolonging their exposure. These populations may include migrant communities and other marginalized groups, such as sex workers and LGBT individuals, who are more likely to be homeless or sleeping outside.

Other populations may have increased exposure at certain times of year. Farming season in some places may mean that certain household or community members, oftentimes men, spend a period of time sleeping away from home and outside.

Uptake of Prevention Behaviors

Now that you have examined how different populations may have differential exposure to malaria infection, consider whether these different populations have equitable access to preventive services.

Do different characteristics (e.g., sex), and the different value placed on these people based on those characteristics, affect their access to preventive services?

For example, women may lack financial or decision-making power to acquire insecticide-treated nets (ITNs) or to attend antenatal care (ANC) visits to receive intermittent preventive treatment in pregnancy (IPTp).

If you are identifying barriers that are surprising or new to you, and which may result in gaps in coverage of preventive interventions, this indicates that you may need more data about these barriers and the populations facing them. This can inform thinking about ITN distribution strategies and points of care other than ANC to ensure universal ITN coverage.

Next, consider how gender or other differentials may affect uptake and use of available and accessible preventive services. In a household, gender norms may affect who sleeps under an ITN, particularly if households do not have enough ITNs for each person or bed.

Some specific groups may be left out of routine ITN distribution campaigns. New or additional strategies for ITN distribution may be necessary to ensure that all populations are able to access and use ITNs for malaria prevention.

Care-Seeking and Treatment

Answer the following questions. If you do not have data or information to answer these questions, this identifies some data needs.

Consider how symptoms are recognized and whether there is different importance ascribed to symptoms based on the person experiencing them. If a pregnant woman has a fever, is this recognized more quickly or considered more serious than if an adult man has a fever? Do men "ignore" symptoms of malaria based on gender norms and expectations that men are "tough" or cannot take time away from work to be sick or seek care?

Consider factors that affect whether care is sought for a person with symptoms of malaria. How might gendered expectations around loss of economic productivity or income affect decisions to seek care? Are women able to make decisions independently about whether and when to take a sick child to a health facility? Do they need permission from a husband or male family member?

Globally, gender factors that impact care-seeking and treatment for sick children are those faced by mothers.[1] Evidence shows that, with few exceptions, there are no differences in care-seeking or treatment for children under five years of age in most settings. If women, typically primary caregivers of children, require permission from others to take children for care, this could delay care-seeking and treatment beyond the 48-hour period of fever onset in which appropriate malaria treatment should be given.

Differentials in care-seeking may manifest in differences in timely treatment. If all children are getting appropriate treatment, do we know whether it is timely treatment? Consider whether there are delays in seeking care for male children or female children.

Once a decision is made to seek care, barriers and facilitators to accessing quality care need to be considered. Are there gendered barriers or facilitators to accessing quality care? Travel, as discussed above, may be a gendered barrier, because travel requires resources, which may be controlled by a male head of the household.

Are women able to go to a health facility unaccompanied with a sick child? Is a pregnant woman able to go to a health facility unaccompanied? Or visit a pharmacy that sells artemisinin-based combination therapies? Or meet a community health worker (CHW) unaccompanied? Bringing care for children with malaria directly to communities through integrated community case management could reduce gender-related barriers—mothers may not need permission to access the care from female CHWs. However, male CHWs may pose a barrier if female caregivers are not permitted to access care unaccompanied.

What are the treatment policies in your country? How might these affect the ability of different groups of people to access timely treatment for malaria?

Lastly, consider the quality of care provided. Could the quality of care that an individual provider gives vary based on the person seeking care? For example, can you think of a context in which a woman accompanied by a male relative may get care faster, or get better care, than if she were alone or with a female relative? Does this differ by source of care (facility, pharmacy, CHW)? What barriers are there to completing treatment?

Gender Data

There are multiple sources of gender data. These include the following:

- **Sex-disaggregated data.** Examples of sex-disaggregated malaria indicators include:
    - Percentage of people reporting sleeping under an ITN, by sex and age
    - Number of people treated for malaria, by sex and age
- **Age-disaggregated data.** Examples of age-disaggregated malaria indicators include:
    - Percentage of women, by age group, that took more than three doses of sulfadoxine-pyrimethamine for IPTp
- **Gender data.** Examples of malaria gender indicators include:
    - Percentage of people who perceive they are at risk from malaria, by sex
    - Percentage of people who are confident in their ability to perform a specific malaria-related behavior (e.g., sleep under an ITN for the entire night), by sex
    - Percentage of married women who make decisions about their own health care
- **Data on key populations and vulnerable groups.** Examples of malaria indicators specific to key populations include:
    - Percentage of nomadic population that owns at least one ITN
- **Qualitative data.** Examples of qualitative malaria indicators include:
    - Perceptions of malaria risk among young adult males

Data Sources

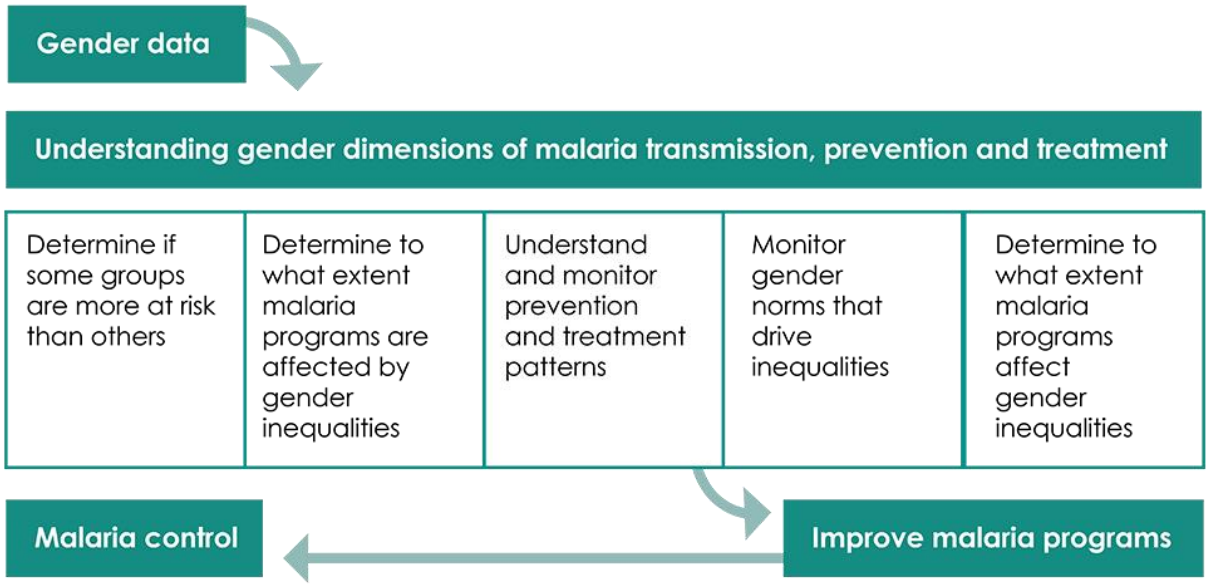
You learned about data sources for malaria SME in previous. Here are examples of gender data collected from multiple data sources.

Figure 38. Sources and types of gender data

Use of Data for Decision Making

You now have an idea of how gender influences risk of malaria transmission and access to and uptake of malaria prevention and treatment. To better control malaria and continue moving toward eradication, gender must be taken into account when designing and implementing malaria prevention and treatment interventions. Gender data can help malaria programs target populations and intervention approaches.

Figure 39. How gender data support malaria programs



Like all data, gender data should be used to make decisions and guide programming. Here are some examples of questions that can be generated and answered by gender data:

- Are the "right" populations being targeted for prevention and treatment services? Who is being missed?
- Might there be malaria transmission occurring among populations that are not targeted?
- Are the "right" populations accessing malaria prevention and treatment services?
- Do different characteristics (sex, age, etc.) necessitate different prevention intervention approaches?
- Do different characteristics (sex, age, etc.) necessitate different treatment intervention approaches?

If you have malaria gender data, use these data along with your work in the tables in the previous sections to help you answer these questions for your context.

If you do not have adequate data, make a list of the gender data you need to help you answer these key questions.

Module 12 Assessment

Questions

Correct answers are provided on the next page.

1. Gender is best defined as:

    a. The biological difference between females and males
    b. A culturally defined set of roles, responsibilities, rights, entitlement, and obligations associated with being female and male
    c. Power differences between men and women
    d. The characteristics of women and girls vis-à-vis men and boys

2. Gender influences which aspects of malaria control:

    a. Risk of malaria transmission
    b. Quality of diagnostics
    c. Use of ITNs
    d. a and c
    e. a, b, and c

3. Which of the following is an example of a gender indicator?

    a. Proportion of children under five with fever treated with artemisinin-based combination therapy within 48 hours
    b. Proportion of mothers of children under five who make decisions independently about when to seek care for a sick child
    c. Percentage of mothers of children under two who received at least two doses of IPTp at antenatal care
    d. Percentage of households with at least two ITNs

4. *True or false:* Women in village X must get permission from their husband or head of household to travel outside of the village. This is a gender-related barrier to access to malaria treatment.

    a. True
    b. False

Correct Answers

Correct answers are noted in bold.

1. Gender is best defined as:

   b. A culturally defined set of roles, responsibilities, rights, entitlement, and obligations associated with being female and male

2. Gender influences which aspects of malaria control:

   d. a and c

3. Which of the following is an example of a gender indicator?

   b. Proportion of mothers of children under five who make decisions independently about when to seek care for a sick child

4. *True or false:* Women in village X must get permission from their husband or head of household to travel outside of the village. This is a gender-related barrier to access to malaria treatment.

   a. True

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MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, North Carolina 27516 USA
Phone: +1-919-445-9359
measure@unc.edu
www.measureevaluation.org

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