Malaria

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Key facts

To better understand public health terms included in this Disease Tool (e.g. What is a case definition? or What is an infectious agent?), consult our page on Key concepts on epidemiology.

Importance

Between 2000 and 2019, there was a marked reduction in global malaria case incidence and mortality rates:

- The malaria case incidence rate (cases per 1,000 population at risk) fell from 80 in 2000 to 57 in 2019, while total malaria cases declined from 238 million in 2000 to 229 million in 2019. In this same period, the population in sub-Saharan Africa, which accounts for more than 90 per cent of the global burden of malaria, increased from 665 million to over one billion.
- The mortality incidence rate (deaths per 100,000 population at risk) was reduced from 25 in 2000 to 10 in 2019, while the total number of deaths fell from 736,000 in 2000 to 409,000 in 2019.

Of the estimated 1.5 billion malaria cases and 7.6 million malaria deaths averted globally since 2000, most cases (82 per cent) and deaths (94 per cent) averted were in the African Region, followed by the South-East Asia Region (10 per cent cases and 3 per cent related deaths).

In spite of the decreases, malaria continues to take a heavy toll on pregnant women and children, particularly in Africa.

Coverage gaps are an important contributor to non-achievement of the WHO Global Technical Strategy targets, particularly in hard-to-reach, conflict-affected and marginalized communities. While expanded access to WHO-recommended malaria control interventions has played a critical role in reducing the global burden of the disease since 2000, a large proportion of the population at risk of malaria – particularly in the WHO African region – continues to lack access to prevention, diagnosis and treatment.

Case definition

A **case definition** is a set of uniform criteria used to define a disease for public health surveillance. It enables public health officials to classify and count cases consistently.

The following are standard case definitions to allow national health authorities to interpret data in an international context. However, during an outbreak case definitions may be adapted to the local context and the Red Cross Red Crescent should use those agreed/established by national health authorities. NB: Consider that during community-based surveillance, ***volunteers*** *should use broad (simplified) case definitions (referred to as community case definitions) to recognize most or all possible cases, provide relevant risk communication and appropriate actions and encourage them to seek care. Other actors such as* ***healthcare workers or investigators*** *studying the cause of a disease, on the other hand, can use more specific case definitions that may require laboratory confirmation.*

Case definitions for malaria control (different case definitions are used for malaria elimination):

Malaria case: Occurrence of malaria infection in a person in whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test.

Suspected malaria case: Illness is suspected by a health worker to be due to malaria, generally based on the presence of fever with or without other symptoms. These criteria vary according to local circumstances and are established by national malaria programmes. All suspected cases of malaria should be tested by either microscopy or a rapid diagnostic test (RDT).

Presumed (not tested) malaria case: Case suspected of being malaria and not confirmed by a diagnostic test. Such designation is reserved for situations in which a diagnostic test cannot be performed in a timely manner.

Confirmed malaria case: A suspected case of malaria in which the parasite called *Plasmodium* has been detected in a diagnostic test. WHO case definition source of information: https://apps.who.int/iris/bitstream/handle/10665/208815/WHO_HTM_GMP_2016.6_eng.pdf

Risk factors

- Malaria epidemics tend to occur where endemicity is relatively low, reflecting the infrequency of transmission.
- Partial immunity is developed over years of exposure, and while it never provides complete protection, it does reduce the risk that malaria infection will cause severe disease. For this reason, most malaria deaths in Africa occur in young children, whereas in areas with less transmission and low immunity, all age groups are at risk.
- Environmental factors such as altitude and tropical climate are optimal for the *Anopheles* mosquitoes to breed.
- Human related factors such as socio-economic status, health access, migration, gender, vector control activities and land use (irrigation, deforestation, swamp drainage and living near breeding sites).
- Health status of the population: malnutrition can weaken children's immunity and can increase the level of malaria morbidity and mortality; HIV has been associated with an increased level of malaria transmission.
- Emergence and spread of drug-resistant parasites and insecticide-resistant mosquito populations.
- Population migration, reduced health systems access and quality, socio-economic pressure as

population grows.
- Environments where mosquitoes breed such as tropical rainforests, humid, and semi-humid environments, as well as around bodies of stagnant water in and close to human habitations in urban settings.
- Epidemics can occur when people with low immunity move into areas with intense malaria transmission to find work or as refugees.

Attack rate (AR)

The **attack rate** is the risk of getting a disease during a specific time period (such as during an outbreak).

Attack rates will vary from one outbreak to another. In case of an outbreak, consult the latest information provided by health authorities.

It depends on the level of natural immunity of the population. Infections are often asymptomatic.

Groups at increased risk of severe illness (most vulnerable)

- In terms of age, children under five years of age are the most vulnerable group affected by malaria.
- Pregnant women.
- People living with HIV/AIDS or other immunosuppressed diseases
- Populations moving from non-endemic to endemic areas
- Populations living in previously non-endemic areas experiencing outbreaks due to climate, ecological or other factors.
- Non-immune migrants, mobile populations and travellers.

Infectious agent

Infectious agents are bacteria, viruses, fungi, prions and parasites. A disease caused by an infectious agent or its toxic products is defined as an infectious disease.

Malaria is caused by a parasite called *Plasmodium* of which there are five species.

P. falciparum and *P. vivax* pose the greatest threat to humans.

Vector-borne: The *Plasmodium* parasite is transmitted to humans through the bite of infected mosquitoes (vector) of the *Anopheles* genus.

Reservoir / host

A **reservoir of infection** is a living organism or material in or on which an infectious agent lives and/or usually multiplies. Reservoirs include humans, animals and the environment.

A **susceptible host** is a person at risk of being infected. The level of susceptibility depends on age, sex, ethnicity and genetic factors, specific immunity also depends on other factors that affect an individual's ability to resist infection or to limit its ability to cause infection.

A **zoonotic disease** or **zoonosis** is an infectious disease that has jumped from a non-human animal to humans.

Humans.

How disease is spread (modes of transmission)

Categorisation of **modes of transmission** varies from one agency to another. In addition, some infectious agents can be transmitted by more than one mode. A list of modes of transmission can be found in the key concepts to serve as guidance to better understand the diseases included in this website.

Vector-borne:

- *Anopheles* mosquitoes transmit malaria. The female *Anopheles* mosquito ingests malaria parasites (gametocytes) from an infected individual when taking a blood meal. These parasites grow and multiply in the mosquito for 10—18 days becoming a different form of the parasite (sporozoites), which are transmitted to an uninfected individual during blood feeding. Only female *Anopheles* mosquitoes can transmit malaria and they must have been infected through a previous blood meal taken from an infected person.
- The mosquitoes usually bite between sunset and sunrise (during the night).

Incubation period

This time from when infection occurs to the onset of symptoms is called the **incubation period**. It is a range of days and it can be different for each disease.

The incubation period in most cases varies from 7 to 30 days. The shorter periods are observed most frequently with *P. falciparum* and the longer ones with *P. malariae*.

Antimalarial drugs taken for prophylaxis by travellers can delay the appearance of malaria symptoms by weeks or months, long after the traveller has left the malaria-endemic area. Such long delays between exposure and development of symptoms can result in misdiagnosis or delayed diagnosis because of reduced clinical suspicion by the healthcare provider.

Period of infectiousness

Period of infectiousness is the time interval during which an infected person can transmit the infection to other susceptible persons.

With appropriate treatment, symptoms of malaria usually go away quickly, with a cure **within two weeks**. Without proper treatment, malaria episodes (fever, chills, sweating) can return periodically over a period of years and mean that the person is still carrying malaria parasites which can be transmitted to others through the *Anopheles* vector as described above.

Clinical signs and symptoms

Malaria disease is typically classified into “uncomplicated” and “severe”:

“Uncomplicated” malaria typically presents with the following signs and symptoms:

- Fever
- Chills
- Sweats
- Headaches
- Nausea and vomiting
- Body aches
- General malaise

In countries where cases of malaria are infrequent, these symptoms may be attributed to influenza, a cold or other common infections, especially if malaria is not suspected. Conversely, in countries where malaria is frequent, residents often recognize the symptoms as malaria and treat themselves without seeking diagnostic confirmation (“presumptive treatment”).

- “Severe” cases present with weakness, loss of consciousness, severe anaemia, acute respiratory and renal failure.
- Children with “severe” malaria frequently develop one or more of the following symptoms: severe anaemia, respiratory distress in relation to metabolic acidosis, or cerebral malaria. In adults, multi-organ involvement is also frequent.

Other diseases with similar clinical signs and symptoms

Dengue fever, Zika virus infection, chikungunya, pneumonia, influenza, Ebola virus infection, trypanosomiasis and other haemorrhagic infections.

Diagnosis

- Microscopy.
- In areas where microscopy is not available, rapid diagnostic tests (RDTs) are useful to aid diagnosis and guide public health action.

Vaccine or treatment

Please refer to the appropriate local or international guidelines for clinical management. All clinical management including the administration of any treatment or vaccine should be conducted by health professionals.

- A list of medicines maintained by the World Health Organization includes first-line treatments in endemic countries for uncomplicated and severe malaria, as well as for prevention and treatment during pregnancy.
- A vaccine has been available since October 2021 for people at risk. The World Health Organization (WHO) is recommending widespread use of the RTS,S/AS01 (RTS,S) malaria vaccine among children in sub-Saharan Africa and in other regions with moderate to high *P. falciparum* malaria transmission.

Immunity

There are two types of immunity:
- **Active immunity** results when exposure to an agent triggers the immune system to produce antibodies to that disease.
- **Passive immunity** is provided when a person is given antibodies to a disease rather than producing them through his or her own immune system.

- An immune response occurs following natural infection. However complete protective immunity does not develop, because repeated infections occur in individuals living in endemic areas.
- The vaccine demonstrates high-level efficacy of 77 per cent over 12 months of follow-up.

Which interventions are most effective for prevention and control?

The following is a list of activities considered for Red Cross Red Crescent volunteers to take part in. It is not an exhaustive list of all prevention and control activities for the specific disease.

The most effective interventions to prevent malaria ensure that mosquitoes cannot bite individuals and

transmit the disease. These interventions are:

- Use of insecticide-treated nets (ITNs) every night, throughout the year, by the whole family; other options may include insecticide-treated curtains or durable wall linings treated with insecticides
  - WHO recommends that countries do not only do mass free net distribution, but also that nets are provided through other mechanisms such as antenatal consultations or the Expanded Programme on Immunization (EPI) to achieve optimal coverage.
  - Nets have an expected three-year lifespan, but recipients should be encouraged to continue using the net beyond that period of time until a replacement net is available.
  - Community members should be advised that nets should not be put into any water body because the insecticide they are impregnated with can be toxic to fish and other organisms.
- Spraying of walls with insecticides (Indoor Residual Spraying [IRS]).
- Community education for pregnant women to ensure the adoption of key actions such as the use of ITNs and prompt healthcare seeking if developing symptoms. In some areas with moderate to high malaria transmission, Intermittent Preventive Treatment (with a drug called sulfadoxine-pyrimethamine (IPTp-SP) is provided to all pregnant women in their first or second pregnancy. Check if this is the case in the area where you work and coordinate with authorities if this is a message to disseminate in the community.
- Community education for caregivers about seasonal malaria chemoprevention (SMC) primarily for children under five, which involves the intermittent (typically monthly) administration of full treatment courses of an antimalarial medicine during the malaria season (three to four months/cycles) to prevent malarial illness with the objective of maintaining therapeutic antimalarial drug concentrations in the blood throughout the period of greatest malarial risk.
- Reducing mosquito entry to households at night when *Anopheles* are most active, particularly through screening of windows, doors and eaves.

Additional malaria prevention methods include:

- Wearing clothes that minimize skin exposure.
- Application of “DEET” mosquito repellent to exposed skin or clothing (in accordance with product label instructions). It is important to assess whether this is culturally accepted, accessible and affordable in the context of intervention. That said, the impact of this intervention on malaria is not significant when deployed at a community-level because to be effective a very high level of individual compliance is needed.

Targeting males and females separately and being sensitive to their specific gender roles is essential when enlisting their support for vector control.

- Covering water containers
- Environmental management and clean-up campaigns
- Larviciding, which is the application of insecticides to water bodies reducing vector density. Note that it is most effective in areas where aquatic habitats (where larvae lie) are easy to identify and are fixed. Larviciding will be costly and less effective in areas where water habitats are predominant, scattered and where their location may vary. Additionally, larviciding is a “supplementary” prevention strategy in that it should not be used to replace distribution of ITNs or IRS in areas of high malaria risk.
- Social and behaviour change communication is also important to encourage community members to access early diagnosis and effective treatment in case of signs or symptoms of illness.
- Use of insecticide-treated clothing may be appropriate for certain groups of the population such as the military or refugee populations that may be more exposed. There is however limited evidence as to the effectiveness of this strategy for the general population.
- Communicate risks about the disease or epidemic, not only to share information on prevention and

mitigation measures, but also to encourage informed decision-making, positive behaviour change and maintenance of trust in the Red Cross Red Crescent response. This includes the identification of rumours and misinformation around disease—frequent during health emergencies—to manage them appropriately. Volunteers should use the most context-appropriate communication techniques (ranging from social media to face-to-face interactions).

Which interventions have NO evidence and therefore are NOT recommended?

- Spatial or airborne repellents have no sufficient evidence.
- Space spraying should not be implemented. IRS or ITNs should be prioritized.

Epidemic characteristics and RCRC indicators and targets

The first table below includes data that should be gathered from health authorities and relevant non-governmental actors to understand the progress and characteristics of the epidemic in the specific country and area of intervention. The second table includes a list of suggested indicators that can be used for monitoring and evaluating Red Cross Red Crescent activities; wording of indicators may be adapted to specific contexts. Target values for a specific indicator can vary widely from one context to another and therefore managers should define them based on the specific population, area of intervention and programmatic capacity. Exceptionally, some indicators in this website may include target values when these are globally agreed as a standard; e.g. 80 per cent of individuals who slept under an insecticide-treated net (ITN) the previous night—the normative World Health Organization benchmark for universal coverage with ITNs.

Epidemic characteristics and progression (epidemiological indicators)
Number of malaria cases (presumed and confirmed)
Confirmed malaria cases (microscopy or RDT): rate per 1,000 persons per year
Malaria-specific deaths per 1,000 persons per year
Indicators for Red Cross/Crescent activities
Number of volunteers trained in ECV ***Numerator**:* Number of volunteers trained in ECV *Source of information:* Training attendance records

Indicators for Red Cross/Crescent activities
Percentage of individuals with access to insecticide-treated mosquito nets (ITN) in the target area ***Numerator****:* Individuals in a given setting that have the opportunity to use an ITN (have access) ***Denominator****:* Total number of individuals surveyed *Source of information:* Survey
Percentage of individuals who slept under an insecticide-treated net (ITN) the previous night ***Numerator***: Number of individuals who slept under an ITN the previous night ***Denominator***: Number of individuals who spent the previous night in surveyed households *Source of information:* Survey
Percentage of individuals that slept under an ITN the previous night in households with access to ITNs ***Numerator***: Number of individuals who slept under an ITN the previous night ***Denominator***: Number of individuals who spent the previous night in surveyed households with access to ITNs *Source of information:* Survey
Percentage of households sprayed by indoor residual spraying in the last 12 months ***Numerator***: Number of households that have been sprayed by indoor residual spraying in the last 12 months (but months should be adjusted based on context) ***Denominator***: Number of households surveyed *Source of information:*
Percentage of children under age five detected by volunteers with fever for whom advice or treatment was sought *(NB. This indicator requires the implementation of a system in collaboration with the health facility, whereby health workers specifically asked the patient how they heard about the service)* ***Numerator***: Number of children under age five with fever in the last two weeks for whom advice or treatment was sought from a health facility or provider ***Denominator***: Total number of children under age five with fever in the last two weeks *Source of information:* Survey; volunteer activity records
Percentage of people who know the cause, symptoms, treatment or preventive measures (this indicator can be split into three or four separate indicators) ***Numerator***: Number of people who cite the cause, symptoms, treatment or preventive measures for malaria ***Denominator***: Number of people surveyed *Source of information:* Survey

See also:

- For Community Engagement and Accountability (CEA) indicators for activities accompanying ECV actions, please refer to: IFRC *CEA toolkit (Tool 7.1: Template CEA logframe, activities and indicators).* Available at:

https://www.ifrc.org/document/cea-toolkit

Impact on other sectors

Sector	Link to the disease
WASH	Inadequate water supply and waste management allow mosquitoes to breed easily. Stagnant water in and around the household such as in flowerpots, vehicle tyres or rock pools contribute to the increase of mosquito breeding sites.
Nutrition	Malnutrition increases the risk for severe malaria infection.
Shelter and settlements (including household items)	People in rural areas and sleeping outdoors are at increased risk of mosquito bites in epidemic regions. Mosquito nets and different household actions like screening in homes and covering water containers are a good prevention strategy to decrease the transmission of *Plasmodium* from mosquitoes to humans.
Psychosocial support and mental health	Studies show that malaria, as a debilitating physical illness, may predispose to depression, while depression may predispose to malaria as it affects immunity. Additionally, depression may affect treatment and recovery from malaria, and vice versa.
Education	Children are the most vulnerable group for a severe malaria disease because they have not developed a partial immunity yet. They are at risk of losing out on education if staying at home or in hospital because of illness. Long distances to walk to school increase the risk of being outside before sunrise and after sunset, the period of the day where the *Anopheles* mosquitoes are the most active and can transmit malaria. If kindergartens and schools do not have the appropriate equipment, such as window and door screens or covered water containers, the risk of infection is greater. Children may then be at risk of getting the disease if attending classes. Schools and other facilities dedicated to children and youth can offer an important space for them to engage, mobilize and raise awareness around health education issues. With support, trust and appropriate capacity-building, young people can be effective advocates for the adoption of preventive measures during an epidemic and are those best placed to mobilize their peers.
Livelihoods	Loss of days of productivity could result from a person's challenges caused by complications of severe malaria as people may not be able to work. This can lead to a loss of income due to the reduction in work activity and to the diversion of resources to seek medical treatment.

Sector	Link to the disease
Sex and gender	Pregnant women have a lower immunity to malaria and are therefore at higher risk of contracting the disease, of anaemia, of developing severe disease and of death. Malaria during pregnancy increases the risk of stillbirth, premature delivery, spontaneous abortion and low birth weight. In 2019, an estimated 11.6 million pregnant women living in 33 African countries with moderate-to-high transmission were infected with malaria (35 per cent of all pregnancies). As a result, an estimated 822,000 children in these 33 countries were born with a low birth weight.

References:

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