Global messaging briefing kit

World malaria report 2023

30 November 2023

World Health Organization

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Briefing kit | Global messaging

1 Global state of malaria

The large disruptions to malaria services during the COVID-19 pandemic drove up malaria case incidence and mortality rates at a time when progress against the disease had already stalled. In terms of both malaria cases and deaths, the world is worse off now than before the pandemic.

2 Global state of malaria interventions

Despite progress in expanding access to WHO-recommended malaria interventions, too many people are still missing out on the services and quality care they need to prevent, detect and treat the disease.

3 Climate change and malaria

A changing climate can have both direct and indirect effects on malaria transmission and burden. Short-term extreme weather events can lead to large epidemics of diseases such as malaria. While data on the longer-term impacts of climate change on malaria is sparse, the direction and magnitude of transmission and burden are likely to vary across social and ecological systems.

4 Other drivers of malaria epidemics

In addition to extreme weather events, other drivers of malaria epidemics and spikes in malaria cases include humanitarian crises, biological threats such as drug and insecticide resistance, and socioeconomic constraints.

5 Progress despite challenges

There are grounds for optimism. Successes include, among others: the roll-out of the world's first malaria vaccine and the recommendation by WHO of a second safe and effective vaccine; the current availability of a new generation of dual-active ingredient insecticide-treated nets; the scale-up of seasonal malaria prevention for children at high risk of severe malaria; and progress towards or the achievement of malaria elimination in a widening circle of countries.

6 What is needed now

A substantial pivot is needed to get back on track with much greater financing, better tools, data-driven strategies and robust political commitment. Whole-of-society engagement will be crucial to build integrated and climate-resilient malaria responses.

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Goals and milestones of the *Global technical strategy for malaria 2016-2030*

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1 Global state of malaria

The large disruptions to malaria services during the COVID-19 pandemic drove up malaria incidence and mortality rates at a time when progress against the disease had already stalled. Malaria-endemic countries, with the support of global partners, have since managed to stabilize those rates, but at a very high level. In terms of both malaria cases and deaths, the world is worse off now than before the pandemic. Five countries bore the brunt of these increases, hindered by multiple challenges. The impacts of extreme weather events, conflict and humanitarian crisis, resource constraints, biological threats, and inequities have impeded recovery.

» **Number of global malaria cases in 2022 was significantly higher than before the pandemic in 2019.** From 2000 to 2019, the number of global malaria cases fell from 243 million to 233 million. There were an additional 11 million cases in 2020, no change in 2021, and then an increase of 5 million cases in 2022, for a total of about 249 million cases.

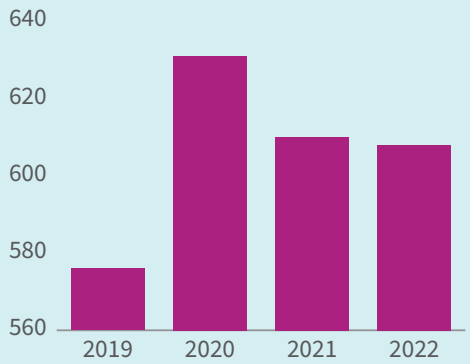
» **Number of global malaria deaths in 2022 was higher than in 2019.** Since 2000, malaria deaths declined steadily from 864 000 to 576 000 in 2019. With the onset of the pandemic, the number of deaths increased by 55 000 in 2020, to 631 000. Marginal decreases in the following two years resulted in an estimated 608 000 deaths in 2022 – 32 000 more deaths than before the pandemic.

» **Global malaria case incidence remains slightly higher than in 2019.** The case incidence rate (number of cases per 1000 population at risk) declined from 81 in 2000 to 56.8 per population at risk in 2019. By 2020, the rate had climbed to 58.7. A small decrease in 2021 was followed by a small increase in 2022, which ended with a rate of 58.4.

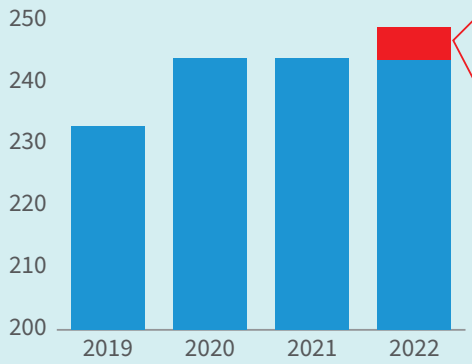
» **Global malaria mortality rate remains slightly higher than in 2019.** The malaria mortality rate (number of deaths per 100 000 population at risk) halved between 2000 and 2019, from 28.8 to 14.1. In 2020, this rate increased to 15.2 before decreasing slightly to end 2022 at 14.3.

» **Five countries bore the brunt of global case increases.** The 5 million additional cases observed between 2021 and 2022 were mainly concentrated across five countries. Pakistan saw the largest rise, with 2.1 million more cases, followed by Ethiopia and Nigeria (+ 1.3 million each), Uganda (+ 597 000), and Papua New Guinea (+ 423 000). In Pakistan, case incidence jumped five-fold, from 2.2 to 11.5 cases per 1000 population at risk. Meanwhile, case incidence increased by 32% in Ethiopia (from 46.3 to 60.9); by 32% in Papua New Guinea (from 124.3 to 163.7); and by 2% in Uganda (from 262.9 to 267.8). In Nigeria, the increase in cases was attributable to population growth as incidence remained unchanged.

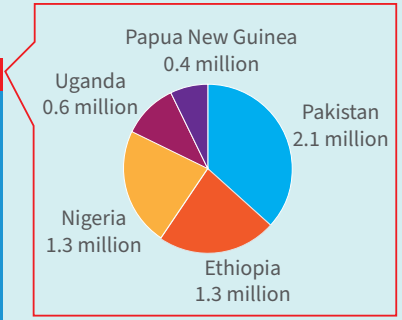
Number of malaria deaths (000), 2019–2022



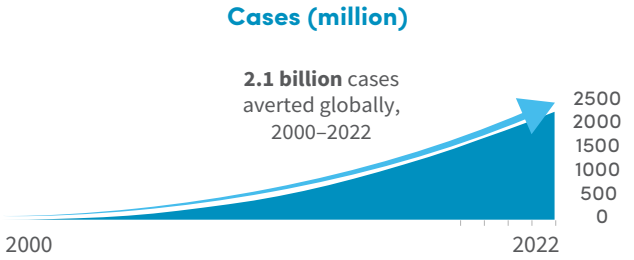
Number of malaria cases (million), 2019–2022

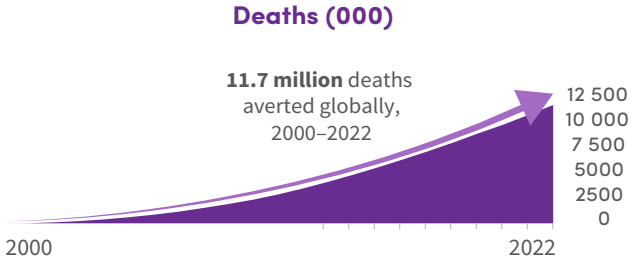


Distribution of the 5 million additional cases in 5 countries



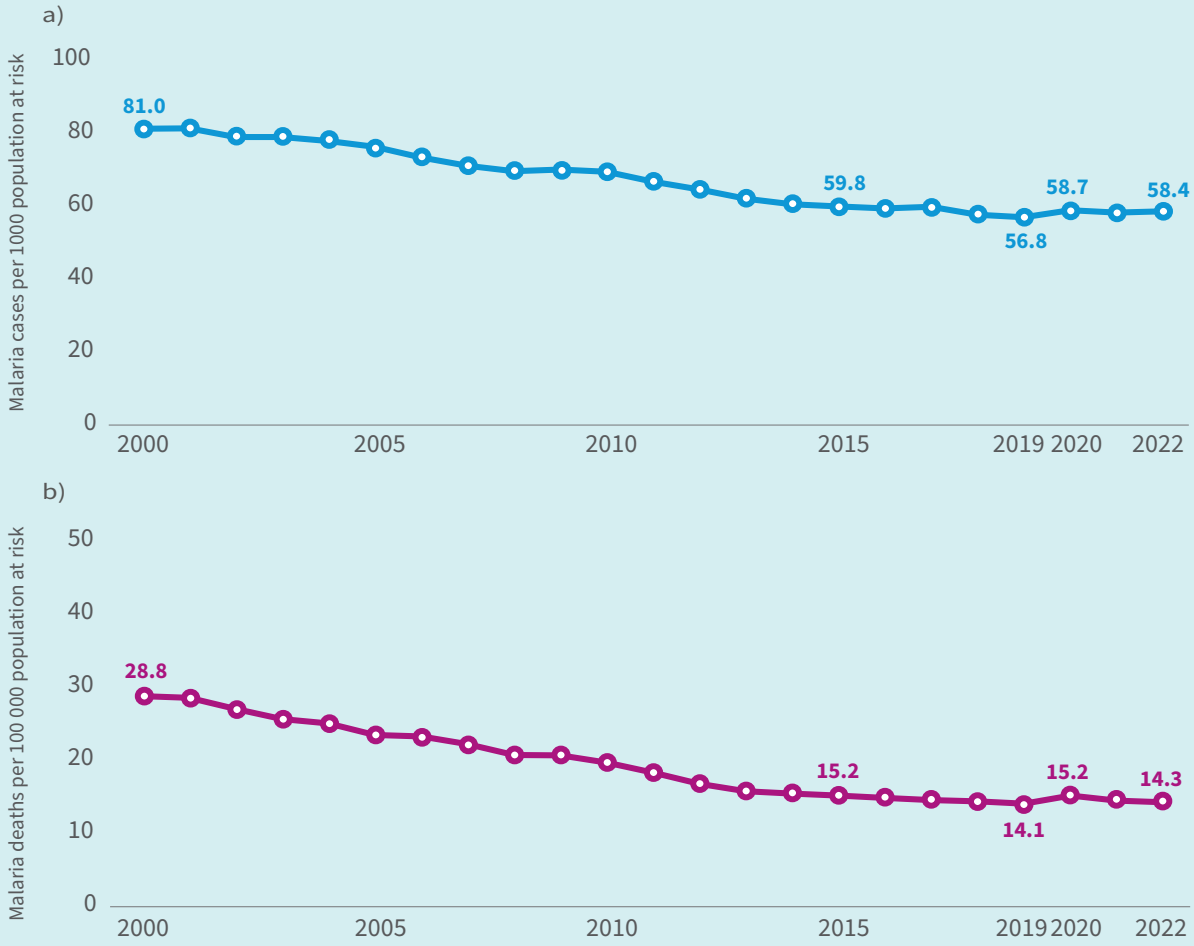
» **Cases and deaths averted over the period 2000–2022.** 2.1 billion malaria cases and 11.7 million malaria deaths were averted globally in the period 2000–2022. Most of the cases (82%) and deaths (94%) averted were in the WHO African Region, followed by the South-East Asia Region. The pace at which cases and deaths were averted slowed during the COVID-19 pandemic; nevertheless, an estimated 549 million cases and 2.82 million deaths were averted in the period 2020 through 2022.[1]





1 These malaria cases and deaths would not have been averted if the estimated burden of case incidence and mortality rates had remained at 2000 levels.

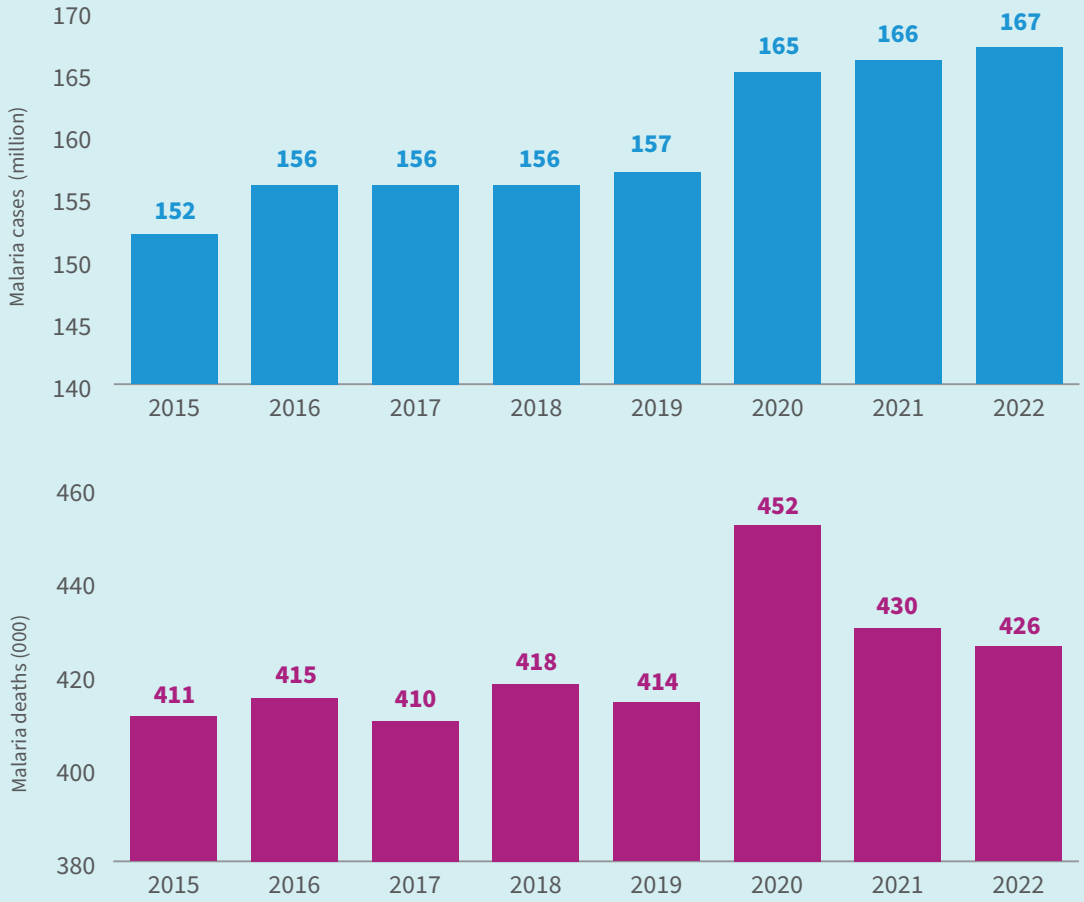
Global trends in a) malaria case incidence (cases per 1000 population at risk) and b) mortality rate (deaths per 100 000 population at risk), 2000–2022



» **Trends in malaria cases and deaths in 11 HBHI countries:** The "High Burden to High Impact" (HBHI) approach, spearheaded by WHO and the RBM Partnership to End Malaria in 2018, was designed to support the world's 11 highest burden countries (Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, India, Mali, Mozambique, Niger, Nigeria, Uganda and the United Republic of Tanzania, with Sudan joining as a 12th country in 2022).

- After an initial surge in cases and deaths in HBHI countries during the first year of the pandemic, case numbers have largely stabilized, and the number of deaths is returning to 2019 levels. In 2022, there were an estimated 167 million cases (67% of the global total) and 426 000 deaths (73% of the global total) in the original HBHI countries. Of these 11 countries, India had the largest relative reduction in cases (30%), while Nigeria accounted for the majority of malaria deaths (44%).
- Stagnation in incidence and mortality rates is largely due to limited healthcare access, ongoing conflicts and emergencies, lingering COVID-19 effects on service delivery until late 2022, inadequate funding, factors that are impacting the overall effectiveness of malaria interventions, such as insecticide resistance and quality of products, and uneven implementation of core interventions. For example, only seven of the 11 original HBHI countries had mass distribution campaigns of insecticide-treated nets (ITNs), with only five countries distributing at least 90% of their nets.

Trends in malaria case and deaths in 11 HBHI countries, 2015–2022

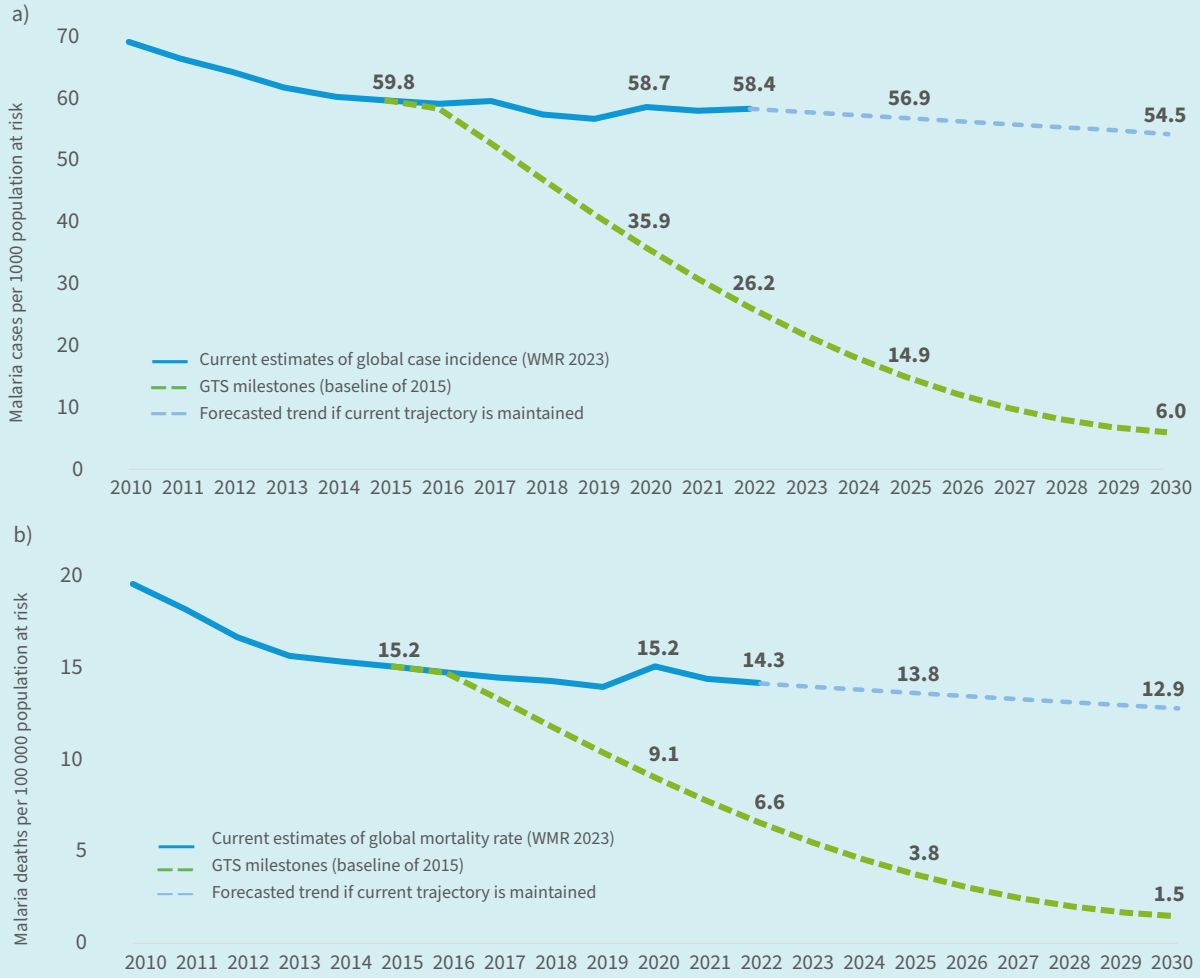


Cases and deaths reflected in these graphs are for the 11 original HBHI countries only.

» **Milestones missed:** WHO's *Global technical strategy for malaria 2016–2030* (GTS) is a comprehensive framework that aims to reduce malaria case incidence and mortality rates by at least 90% by 2030 (compared with a 2015 baseline), among other goals. Key milestones include a reduction in both measures of at least 40% by 2020 and 75% by 2025. Data from 2022 show that, despite the gains since 2000, the 2020 GTS milestones were missed by a wide margin.

- In 2022, global malaria case incidence was **58.4** against a target of **26.2** cases per 1000 population at risk. Progress towards the 2025 milestone for case incidence is now **55% off track** and, if this trajectory persists, the corresponding 2030 GTS target will be missed by a staggering 89%.
- The global malaria mortality rate in 2022 was **14.3** against a target of **6.6** deaths per 100 000 population at risk, **off the mark by 53%**. Without an acceleration in the pace of progress, the 2030 outlook indicates a potential 88% shortfall.

Comparison of global progress in a) malaria case incidence and b) mortality rate, considering two scenarios: current trajectory maintained (blue) and GTS targets achieved (green)



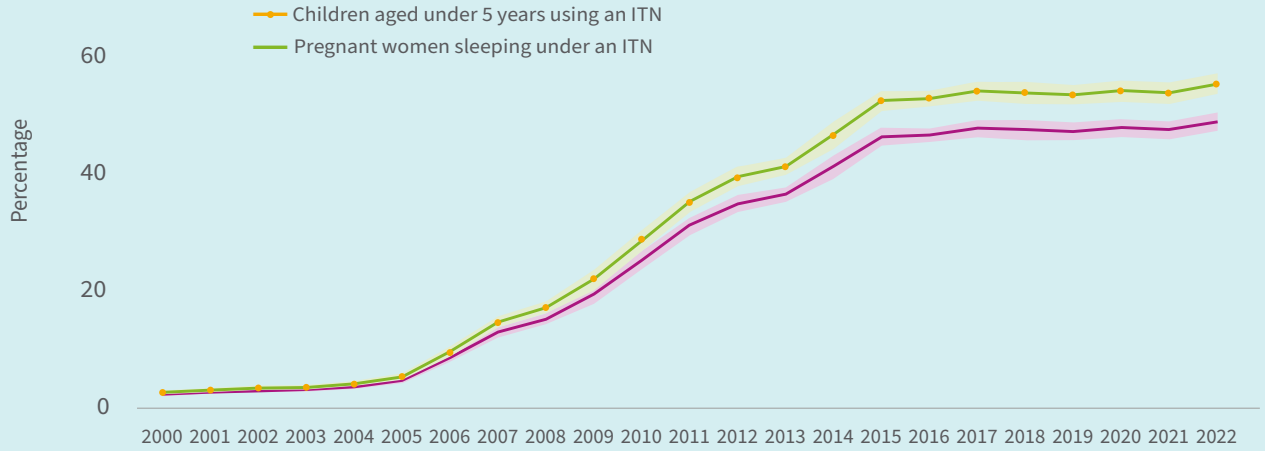
2 Global state of malaria interventions

Core interventions to control and eliminate malaria, such as insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS), antimalarial medicines, rapid diagnostic tests (RDTs) and, most recently, vaccines play a crucial role in reducing transmission and mortality rates. They not only support the goal of malaria elimination but also contribute to broader public health gains and economic stability in affected regions. Despite progress in expanding access to WHO-recommended malaria interventions, too many people are still missing out on the services and quality care they need to prevent, detect and treat the disease.

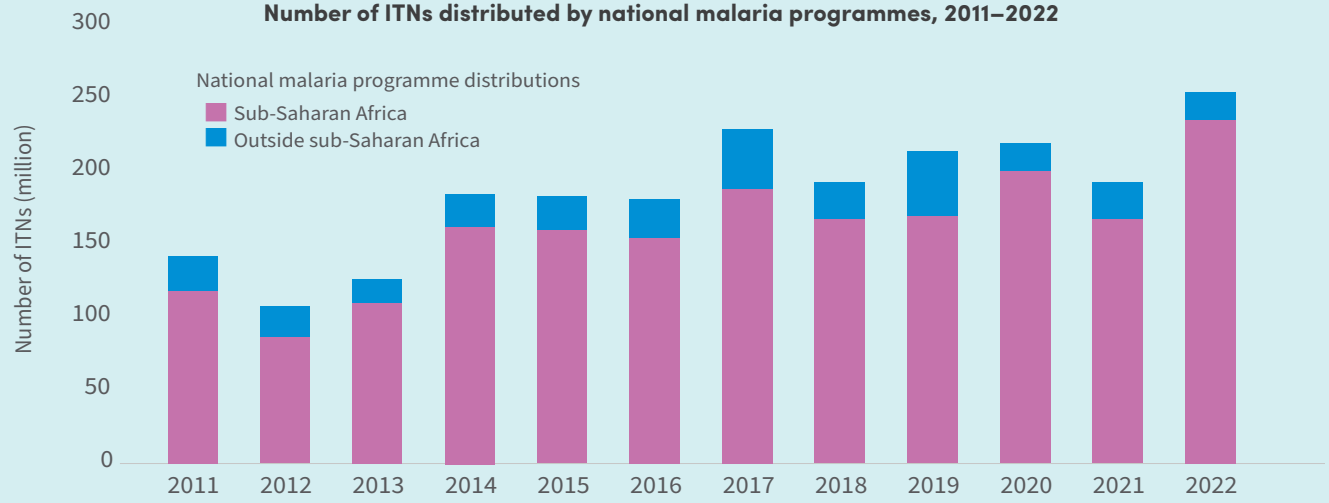
» **Insecticide-treated nets (ITNs)** are the primary vector control tool used in most malaria endemic countries. Between 2004 and 2022, manufacturers supplied more than 2.9 billion ITNs globally. In 2022, a total of 254 million ITNs were distributed through all channels by national malaria programmes in malaria-endemic countries (93% in sub-Saharan Africa). ITN use has remained largely unchanged since 2015: about 56% of young children and pregnant women were sleeping under a net in 2022.

» **Indoor residual spraying (IRS).** In 2022, 47 countries implemented IRS to prevent malaria. Globally, the percentage of the population at risk that is protected by IRS in malaria endemic countries declined from 5.5% in 2010 to 1.8% in 2022. In this same period, the number of people protected globally by IRS fell from 153 million to 62 million.

ITN use among young children, pregnant women and the population-at-large in sub-Saharan Africa, 2000–2022



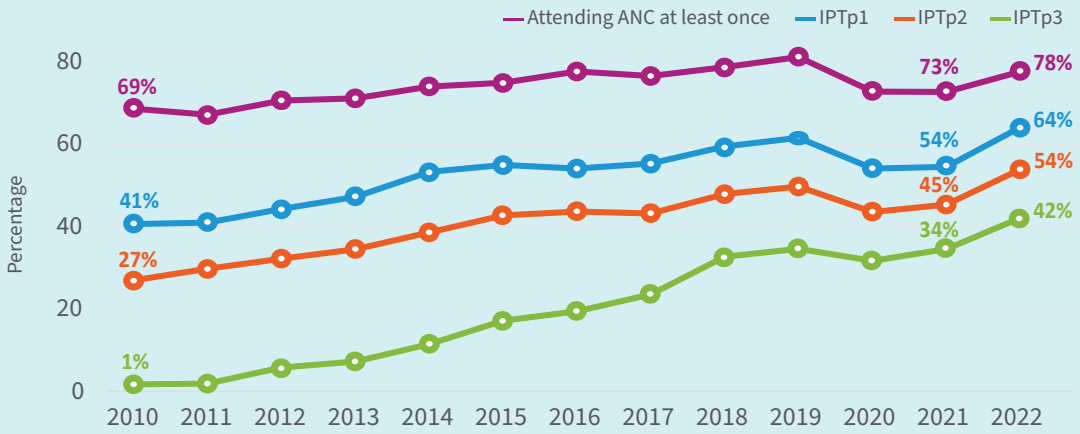
Number of ITNs distributed by national malaria programmes, 2011–2022



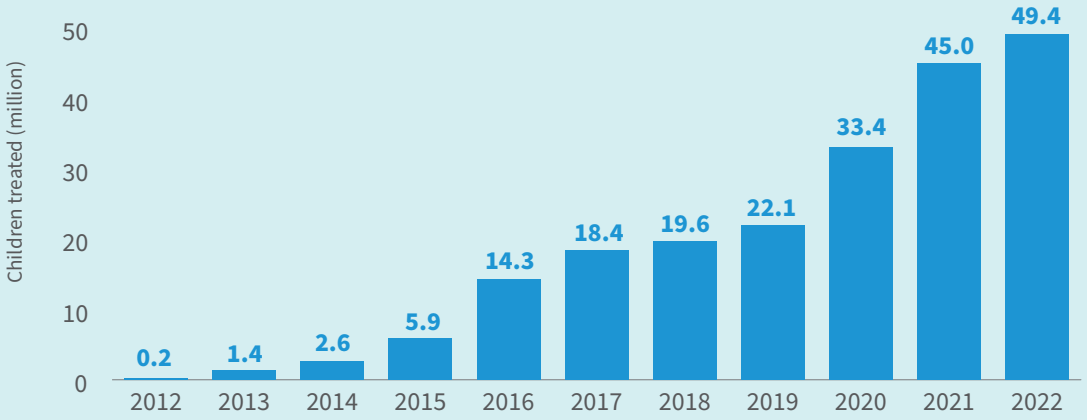
» **Seasonal malaria chemoprevention (SMC)** is a preventive therapy recommended for children at high risk of severe malaria living in areas with seasonal transmission. To date, 17 countries in sub-Saharan Africa have implemented SMC. The average number of children treated per cycle of SMC has steadily increased from about 0.2 million in 2012 to **49 million** in 2022. Nigeria alone treated an average of 25.5 million children per SMC cycle in 2022. In Mozambique, the number of children treated increased 12-fold between 2021 and 2022, from 0.1 million to 1.3 million, respectively. In 2022, Mauritania and South Sudan implemented SMC for the first time.

» **Intermittent preventive treatment of malaria in pregnancy (IPTp)** is used to prevent malaria among pregnant women living in areas of moderate-to-high malaria transmission in Africa. WHO recommends at least three doses of IPTp starting as early as possible in the second trimester; doses are administered at least one month apart and are typically delivered during antenatal care (ANC) visits. To date, 35 African countries have adopted IPTp. An estimated **42%** of pregnant women at risk of malaria benefited from three doses of the preventive therapy in 2022 compared to 34% in 2021 and 1% in 2010. Data also show that more pregnant women are seeking antenatal care: coverage of pregnant women visiting an ANC facility at least once increased from 73% in 2021 to 78% in 2022.

Percentage of pregnant women attending an antenatal care clinic at least once and receiving IPTp, by number of doses, in sub-Saharan Africa, 2010–2022



Average number of children treated with at least one dose of SMC, by year, in 17 African countries, 2012–2022

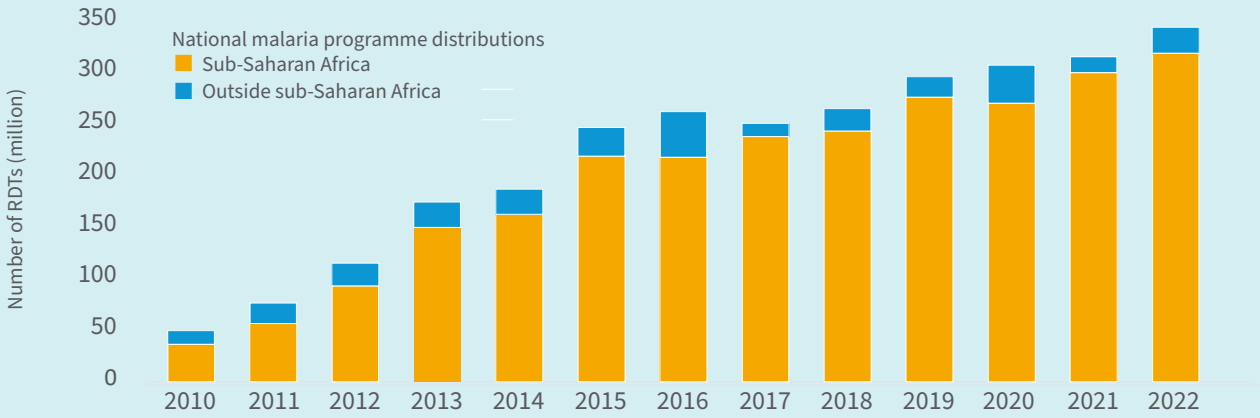


» **Rapid diagnostic tests (RDTs)** enable health providers to swiftly distinguish between malarial and non malarial fevers, facilitating appropriate treatment. Globally, 3.9 billion RDTs for malaria were delivered between 2010 and 2022, with more than 82% of sales in sub-Saharan African countries. National malaria programmes (NMPs) in sub-Saharan Africa distributed **345 million RDTs in 2022**, about 30 million more than in 2021.

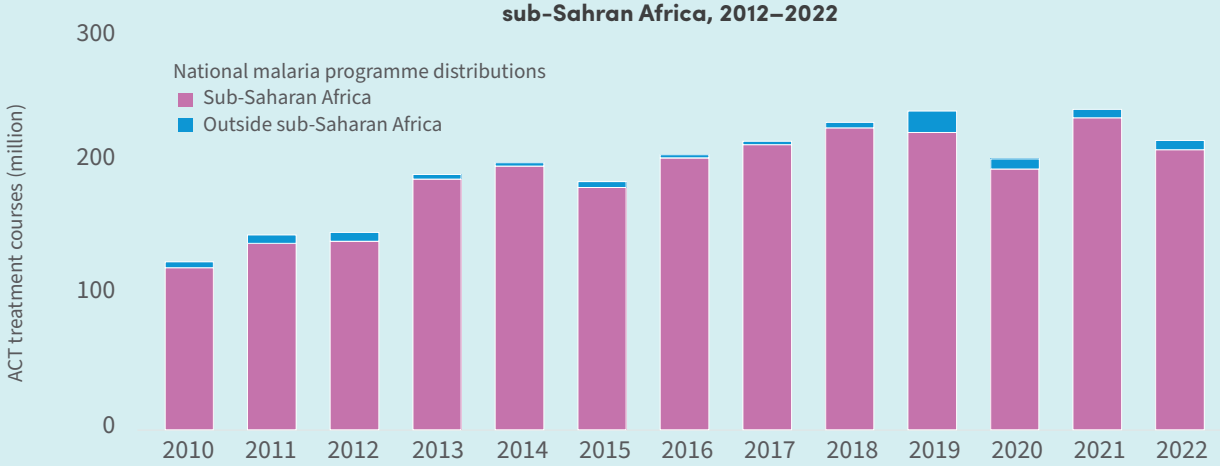
» **Artemisinin-based combination therapies (ACTs)** combine artemisinin with a partner drug, and they are the most effective treatment for *P. falciparum* malaria. Between 2010 and 2022, about 4 billion treatment courses of ACTs were delivered globally. National malaria programmes distributed **217 million ACTs in 2022**, 97% of which were in sub-Saharan Africa. Household surveys conducted in 22 countries in sub-Saharan Africa between 2005 and 2022 were used to analyse the coverage of treatment seeking, diagnosis and use of ACTs for children under the age of five. The surveys found that:

- Treatment seeking for febrile children changed very little between the baseline surveys in 2005–2011 and more recent surveys from 2015–2022 (65% vs. 66%).
- The proportion of children under five who sought care for a fever, and who received a diagnosis with a finger or heel prick, increased from about 30% at baseline to 54% in the latest surveys.
- The use of ACTs among those who sought care and were treated with an antimalarial increased from a median of 38% at baseline to 65% in the latest surveys.

Number of RDTs distributed by national malaria programmes for use in testing suspected malaria cases, sub-Saharan Africa, 2010–2022



Number of ACT treatment courses distributed by national malaria programmes, sub-Sahran Africa, 2012–2022



3 Climate change and malaria

Climate change is recognized as one of the biggest threats and challenges to human health and well-being, and vulnerable groups are particularly hard hit. A changing climate can have both direct and indirect effects on malaria transmission and burden. Short-term extreme weather events can lead not only to population displacement and socio-economic devastation but also to large epidemics of diseases such as malaria. While data on the longer-term impacts on malaria is sparse, the direction and magnitude of transmission and burden are likely to vary across social and ecological systems.

» **Climate change is recognized as one of the biggest threats and challenges to human health and well-being, and vulnerable groups are particularly hard hit.**

- Climate change threatens the complex relationship between natural and human systems and undermines many of the social determinants of good health – such as livelihoods, nutrition, security and access to quality health services. It is a both singular threat to health and a "threat multiplier".
- In many areas, extreme climate events are also having an impact on the health infrastructure and workforce. Without assistance to prepare and respond, countries with weak health systems will be least able to cope.
- According to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), "vulnerable communities who have historically contributed the least to current climate change are disproportionately affected". These groups include women, children, ethnic minorities, poor communities, migrants and displaced persons, older populations and people with underlying health conditions.
- An estimated 3.3 to 3.6 billion people already live in areas that are highly susceptible to climate change. Low-income and small island developing states endure the harshest impacts.
- Between 2010 and 2020, human mortality from floods, droughts and storms was 15 times higher in vulnerable regions than in less vulnerable regions.

» **A changing climate can have both *direct* and *indirect* effects on malaria transmission and burden.**

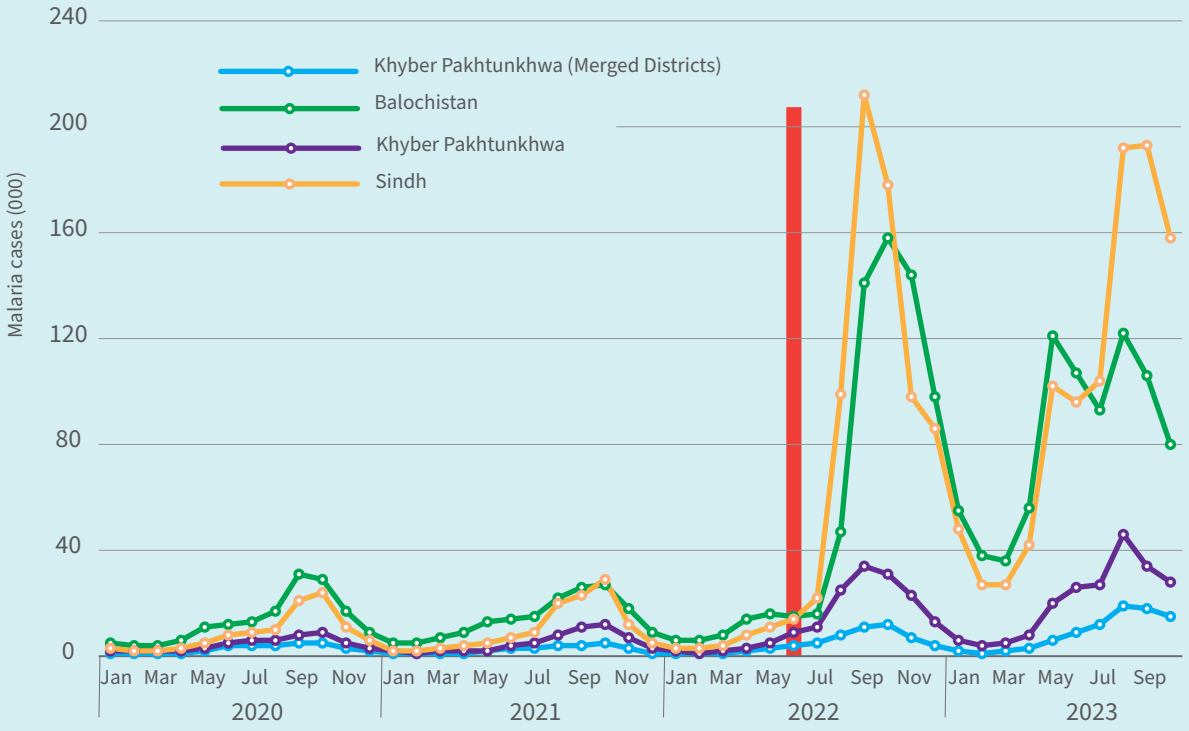
- It can directly affect malaria transmission due to the sensitivity of the malaria parasite and the mosquito to temperature, rainfall and humidity. For example, ideal mosquito breeding and survival occurs at temperatures ranging from 20–27 °C, with mortality increasing above 28 °C. Conversely, a slight warming in cooler, malaria-free zones could lead to new malaria cases.
- Indirect effects of climate change on malaria transmission can occur through reduced access to essential health services; disruptions to the

supply chain of critical malaria commodities, such as insecticide-treated nets and medicines; population displacement, as people without immunity move to malaria-endemic areas; and rising food insecurity and malnutrition, a risk factor for severe malaria among young children and pregnant women.

» **Short-term extreme weather events, such as the 2022 floods in Pakistan, can lead not only to population displacement and socioeconomic devastation but also to large epidemics of diseases such as malaria.**

- According to the IPCC, climate change has led to an increase in the frequency and/or intensity of extreme weather events. Although the specific contributions of climate change to any particular event is not known, there is a clear need to prepare for, and respond to, such events while also working to reduce the pace of climate change.
- Extreme weather in Pakistan in 2022 saw glaciers melt and rivers surge in the north, while heating of the Indian Ocean led to excessive rainfall and flooding in the south. Post-flood standing water became ideal breeding grounds for mosquitoes, and malaria cases increased five-fold compared to 2021 (just above **500 000 cases** reported in 2021 and **2.6 million cases** reported in 2022). The floods destroyed infrastructure and isolated millions, hindering medical access and increasing disease risk.

Malaria cases in the high burden provinces of Pakistan, 2020-2023



» **Data on the long-term impact of climate change on malaria transmission is sparse. The direction and magnitude of any impacts are likely to vary across social and ecological systems, both within and between countries.**

- Some of the strongest available data collected over several decades found that climate change has contributed to malaria transmission in African highland areas that were previously malaria free.
- WHO's Strategic Advisory Group for malaria eradication (SAGme) commissioned a study in 2017 to forecast malaria trends under different intervention, socioeconomic and climate change scenarios. Findings indicated that maintaining coverage of malaria interventions under a "middle of the road" climate mitigation scenario could lower cases by 2050, while increasing coverage of interventions to 80% under current levels of development and fossil fuel use could significantly reduce incidence, especially with the addition of new tools like highly efficacious vaccines. These findings demonstrate the importance of increasing coverage of malaria interventions.

» **This report offers a series of proposals to help countries and their development partners detect, prepare for, respond to, and recover from short-term climate-related threats to malaria while also adapting to and addressing the longer-term impacts of climate change.**

- See pages 21–22 for a list of proposed strategic, technical and operational actions.

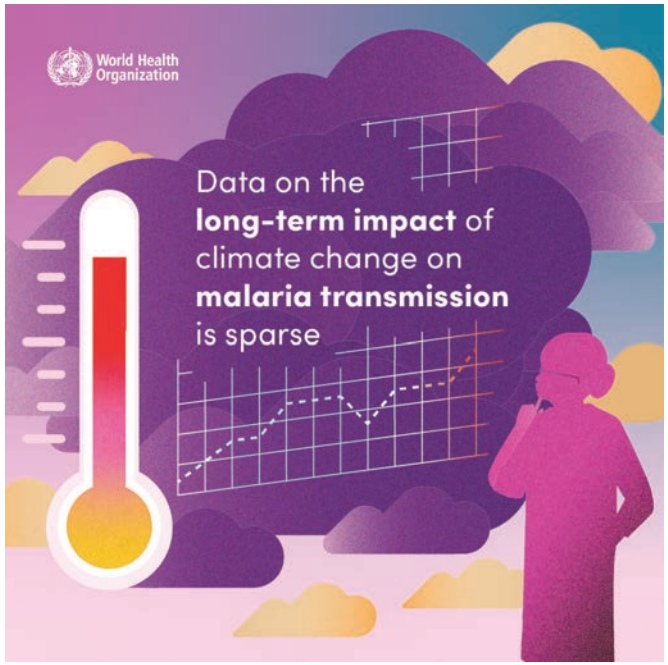
Weather vs climate – what's the difference?

- The terms "weather" and "climate" are often used interchangeably, but they refer to two different (but interrelated) systems.

  Weather is experienced as specific events – such as rainfall, floods, heat and cold – and is usually difficult to predict beyond a week or two.

  Climate is experienced over multiple timescales and measures the average weather conditions over a period of years or decades.

- Although **climate change** is measured in decades (usually 30 years or more), its effect can be felt as short- and medium-term climatic variations, such as changes in daily mean temperatures, timing of seasons, and intensity and frequency of extreme weather events.



4 Other drivers of malaria epidemics

In addition to extreme weather events, various forces have led to both epidemics and significant spikes in malaria cases and deaths. These drivers include biological threats; humanitarian crises; migration and population displacement; and funding and socio-economic constraints. Together with the impacts of extreme weather events, these challenges underscore the urgent need to adapt strategies and commit resources equal to the task of controlling and eliminating malaria.

» **Humanitarian crises.** Between 2019 and 2022, 41 malaria-endemic countries suffered humanitarian and health emergencies, not including the COVID-19 pandemic. Many of these countries saw significant increases in malaria cases and deaths, and a few experienced malaria epidemics.

- **Ethiopia:** in the grip of conflict, the country saw an increase of 1.3 million cases between 2021 and 2022.
- **Myanmar:** political and social instability led to a surge in malaria: from an estimated 78 000 cases in 2019 to 584 000 in 2022.
- **Thailand:** the surge of cases in Myanmar spilled over to neighbouring Thailand, as people sought health care across the border, and imported cases fuelled local spread. Cases more than doubled in Thailand between 2021 (2426 cases) and 2022 (6263 cases).

» **Biological threats.** Rising biological threats span parasite resistance to the frontline medicine for malaria; mosquito resistance to insecticides; genetic mutations in the malaria parasite that make it more difficult to detect; and the spread of new malarial parasites and mosquito vectors.

- **Parasite resistance to the front-line medicines:** partial resistance to artemisinin, the core compound of artemisinin-based combination therapies (ACTs), is a growing concern. In some areas, malaria parasites have also shown signs of resistance to the partner drugs within ACT drug therapies. The Greater Mekong Subregion (GMS) has historically been the epicentre of drug-resistant malaria, and high treatment failure rates have been detected over the years in several countries in the subregion. Even so, excellent progress has been made in reducing *P. falciparum* malaria cases, and elimination is within reach in the countries where antimalarial drug resistance has posed the greatest challenge in the past: Cambodia, Lao People's Democratic Republic, Thailand and Viet Nam.
  - A key area of concern is the emergence of artemisinin partial resistance in Africa. Such resistance is spreading in countries in Eastern Africa and the Horn of Africa. Nonetheless, nearly all patients infected with artemisinin-resistant parasites who are treated with an ACT are fully cured, provided the partner drug is efficacious. Should treatment with a particular ACT fail, other options are currently available.
  - In November 2022, WHO launched a new strategy to curb antimalarial drug resistance in the African continent. The strategy builds on lessons learned from past global plans and complements existing strategies, including broader efforts to respond to antimicrobial resistance. Vigorous measures are needed now to protect drug efficacy in the region: given the heavy reliance on ACTs in Africa, high treatment failure rates could have very serious consequences.

» **Mosquito resistance to insecticides.** Resistance to pyrethroids, the most common chemical used on insecticide-treated nets (ITNs) is rising globally. Recent data indicate that between 2010 and 2020, 78 countries confirmed mosquito resistance to at least one insecticide class, with 29 countries noting resistance to all four current classes (pyrethroids, organophosphates, carbamates and organochlorines). High-intensity pyrethroid resistance was particularly prevalent in Western Africa.

- To overcome insecticide resistance, WHO recommends the use of dual-active ingredient ITNs. WHO issued updated guidelines for their use in March 2023. WHO's global database and the Malaria Threats Map offer detailed resistance data and track its evolution, helping to inform strategies for managing resistance in malaria vectors.

» **Genetic mutations preventing diagnosis (*pf*HRP2/3 deletions).** Most rapid diagnostic tests (RDTs) for malaria work by detecting either one or two specific proteins produced by the *P. falciparum* malaria parasite. But parasites with genetic mutations that prohibit the expression of these proteins are spreading – and even, in some settings, becoming dominant among parasite populations.

- Since 2010, the mutations have been detected in Latin America, the Middle East, Africa and Asia. Their prevalence among symptomatic patients in Peru is as high as 80%. Because these parasites escape detection by commonly used RDTs, patients increasingly go undiagnosed. This poses challenges to malaria control and raises the risk of missed cases progressing to severe disease and death.
- WHO guidelines suggest that when the percentage of false negative RDT results exceeds 5%, alternative tests are needed. However, alternative options are limited and more research is needed to develop new diagnostic tests.

» **Spread of zoonotic malaria.** *P. knowlesi* is a significant concern for malaria control, especially in South-East Asia. This zoonotic parasite has a human fatality rate of 1–2% and is known for its severe and rapid onset.

- Since large infection clusters were discovered in Malaysia in 2004, *P. knowlesi* has spread across nearly all of South-East Asia (except Timor-Leste) and globally through travel and tourism. Although the number of *P. knowlesi* cases declined globally in 2022 by 24.4% (to a total of just 2768 cases), they increased significantly in Indonesia and Thailand and accounted for all malaria deaths in Malaysia and Thailand.
- The spread of *P. knowlesi* complicates malaria elimination efforts and could affect WHO's certification process for malaria-free status, which previously considered only four human malaria parasite species. WHO is now reassessing the certification criteria in light of *P. knowlesi*'s rise.

Malaria Threats Map

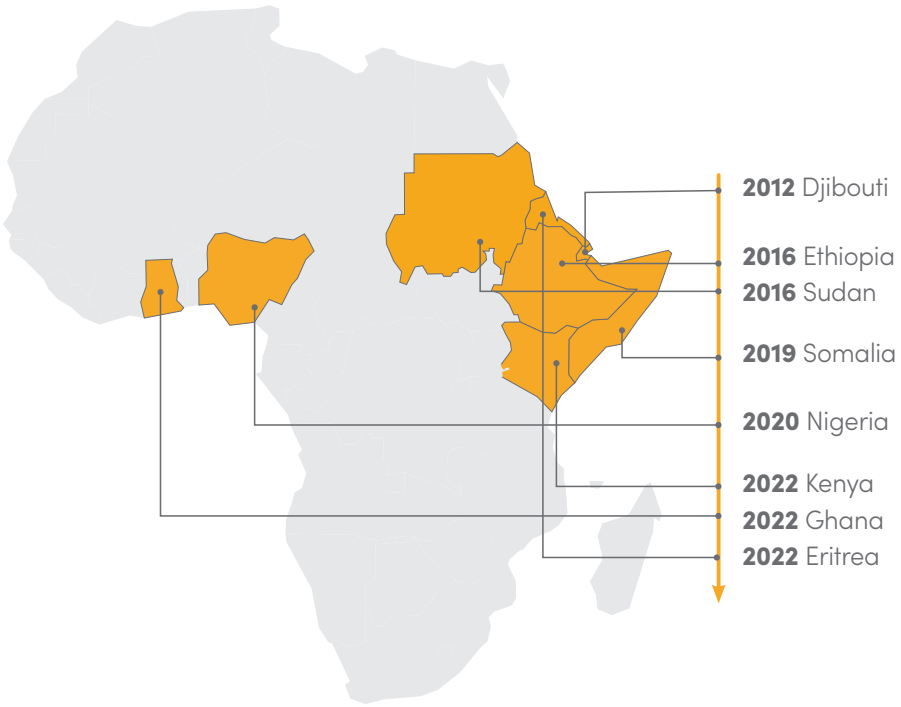
Countries heavily impacted by *P. knowlesi*

» **Invasive new mosquito vector.** *Anopheles stephensi*, a mosquito that transmits malaria, has spread beyond its native Asian and Arabian habitats to Africa. First identified in Djibouti in 2012, it has been linked to malaria outbreaks and is challenging to control because it thrives in urban settings, endures high temperatures and is resistant to many of the insecticides used in public health. Its spread, along with rapid urbanization, could heighten malaria risks in African cities.

- In September 2022, WHO launched a new initiative to stop the spread of the *An. stephensi* malaria vector in Africa. The initiative aims to support an effective regional response on the African continent through a five-pronged approach: increase collaboration across sectors and borders; strengthen surveillance to determine the extent of the spread of *An. stephensi* and its role in transmission; improve information exchange on the presence of *An. stephensi* and its control; develop guidance for national malaria programmes on appropriate responses; and prioritize research to evaluate the impact of interventions and tools against *An. stephensi*.

» **Socioeconomic threats.** Trends in real gross domestic product (GDP) following the COVID-19 pandemic further entrench malaria as a disease that predominantly impacts communities who face a vicious cycle of poverty and ill health. In 2020, 70% of malaria-endemic low- and middle-income countries saw their economies shrink, with a third experiencing a decline of GDP greater than 1%. Although fewer countries experienced such economic shocks in 2021 and 2022, wealth continues to be unevenly distributed in many areas. Additionally, many recovering economies carry the heaviest burden of climate change and of diseases such as malaria.

***Anopheles stephensi* mosquito vector detected in eight African countries to date**



5 Progress despite challenges

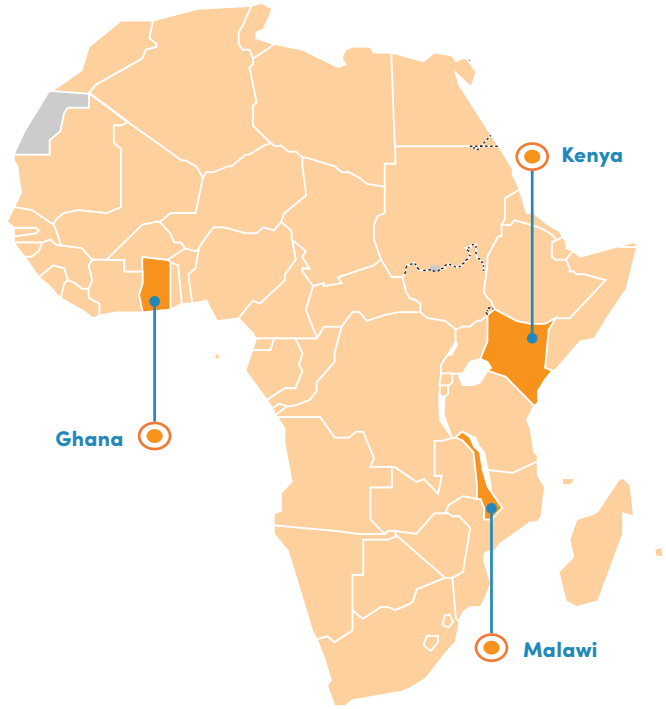
Despite the challenges, there have been important achievements in the fight against malaria. Countries made remarkable progress between 2000 and 2014 in lowering malaria cases and deaths, as well as incidence and mortality rates. Although a slow, concerning reversal has occurred, a majority of the gains have been retained to date. Other successes include: the roll-out of the world's first malaria vaccine, RTS,S/AS01 and the recommendation by WHO of a second safe and effective vaccine, R21/Matrix-M; the current availability of a new generation of dual-active ingredient insecticide-treated nets; the scale-up of seasonal malaria prevention for children at high risk of severe malaria (see page 8); and progress towards or the achievement of malaria elimination in a widening circle of countries. These and other advances are a testament to national commitment and global resolve to control and eliminate the disease.

» **Malaria vaccines.** In 2021, WHO recommended the RTS,S/AS01 (RTS,S) vaccine to prevent malaria among children living in regions with moderate-to-high *P. falciparum* malaria transmission. To date, more than 2 million children have been reached with at least one dose of the vaccine through the WHO-coordinated Malaria Vaccine Implementation Programme in Ghana, Kenya and Malawi. A rigorous evaluation has shown a substantial reduction in severe malaria and a 13% drop in early childhood deaths in the areas where RTS,S has been administered compared with areas where the vaccine was not introduced. In October 2023, WHO recommended a second safe and effective malaria vaccine, R21/Matrix-M. The availability of two malaria vaccines is expected to increase supply and make broad-scale deployment across Africa possible.

» **A new generation of dual-active ingredient ITNs is available.** WHO recommends dual-active ingredient ITNs to address resistance to pyrethroids, an insecticide class which, until recently, had been used almost exclusively to treat the nets.

- **Pyrethroid-piperonyl butoxide (PBO) nets** enhance the potency against resistant mosquitoes, with a significant portion of ITNs distributed in Africa now using this combination.
- **Pyrethroid-chlorfenapyr nets** combine a pyrethroid with a pyrrole insecticide and are strongly recommended by WHO in areas where mosquitoes have become resistant to pyrethroids.
- **Pyrethroid-pyriproxyfen nets** incorporate an insect growth regulator and are conditionally recommended due to concerns about cost-effectiveness compared to pyrethroid-only ITNs.

Countries that participated in the Malaria Vaccine Implementation Programme, 2019–2023

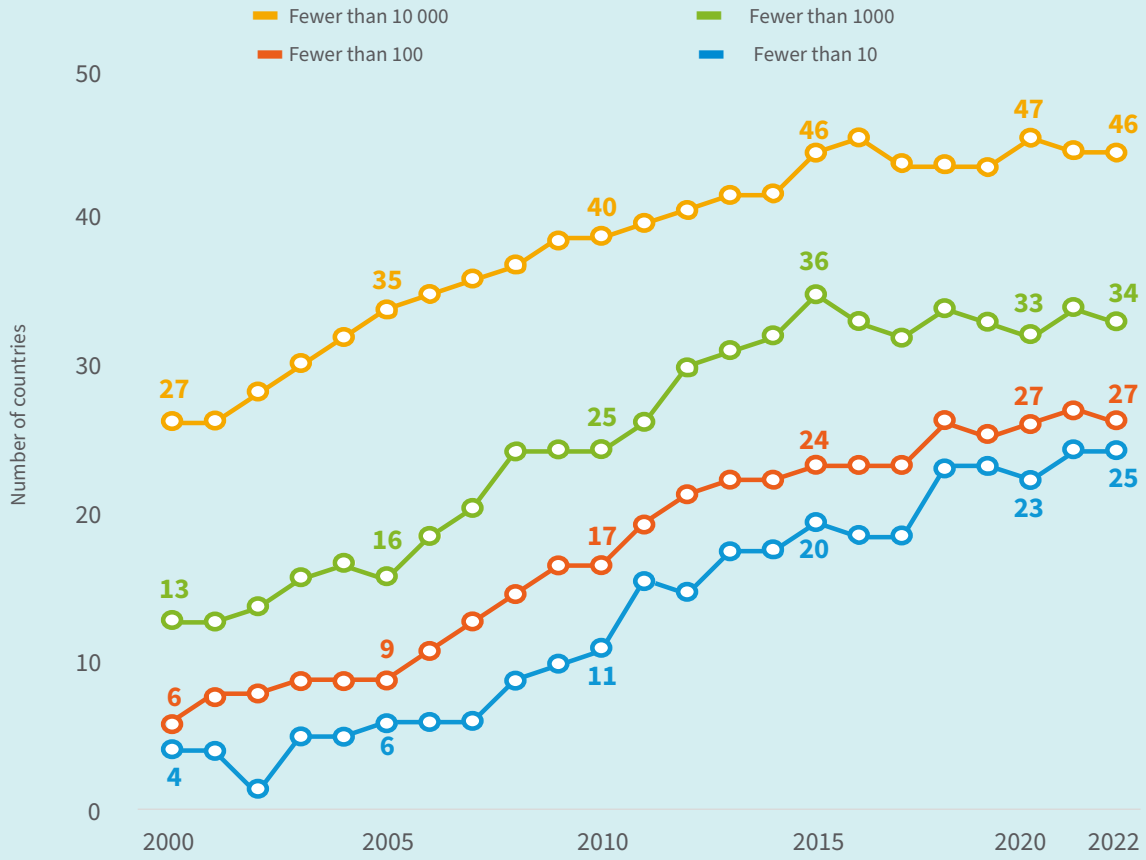


» **Progress towards malaria elimination.** Despite stalled progress in countries with a high burden of malaria, a growing number of low burden countries are moving steadily towards the goal of malaria elimination. In 2022, 34 countries reported fewer than 1000 cases of malaria compared to just 13 countries in 2000. Twenty-seven countries reported fewer than 100 cases of malaria in 2022, up from just six countries in 2000.

» **Certification of malaria elimination by WHO** requires the elimination of the four main human parasite species*: P. falciparum, P. vivax, P. ovale and P. malariae*. A country or territory is awarded the certification by WHO when it has been proven, beyond a reasonable doubt, that the chain of mosquito-borne transmission has been interrupted nationwide for at least the past three consecutive years. Additionally, there must be a programme in place to prevent re-establishment of transmission.

- Between 2000 and 2023, 25 countries that were malaria-endemic in 2000 achieved zero indigenous malaria cases for three consecutive years, and 15 of these countries were certified as malaria-free by WHO.
- Belize, Azerbaijan and Tajikistan were granted the certification in 2023. In 2021, China became the first country in the WHO Western Pacific Region to be certified malaria-free in over three decades.
- Cabo Verde reported zero malaria cases for the fourth consecutive year in 2022 and has requested an official certification of malaria elimination from WHO (decision expected in early 2024).

Number of countries that were malaria endemic in 2000 and had fewer than 10, 100, 1000 and 10 000 indigenous malaria cases between 2000 and 2022



- In 2022, Timor-Leste and Saudi Arabia reported zero indigenous cases for the second consecutive year. Also in 2022, Bhutan and Suriname reported zero indigenous cases for the first time.

» **Other malaria-eliminating countries reported substantial reductions in indigenous malaria cases in 2022:** Botswana (43.5%), the Democratic People's Republic of Korea (9.3%), Ecuador (38.0%), Eswatini (57.6%), French Guiana (71.6%), Mexico (32.6%) and South Africa (31.3%).

» **Uneven progress towards elimination in the Greater Mekong Subregion (GMS).** Countries of the GMS (Cambodia, China's Yunnan Province, Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam) saw a 55.5% decline in indigenous malaria cases and an 89.1% decline in cases caused by *P. falciparum* from 2000 to 2022. This is particularly important as, historically, the subregion has been the epicentre of antimalarial drug resistance. However, some GMS countries – notably Myanmar and Thailand – are now experiencing a concerning resurgence of malaria.

- The total number of indigenous cases in the GMS increased from 90 082 in 2021 to 170 527 in 2022, while the number of indigenous *P. falciparum* cases likewise nearly doubled, increasing from 16 490 in 2021 to 30 789 cases in 2022.
- Myanmar accounted for 92.4% of indigenous malaria cases and 95.0% of *P. falciparum* malaria cases in the GMS. Resources are limited in Myanmar due to internal political conflict, which is driving many people to seek medical care across the border into Thailand. This raises the need for increased investments and resources for diagnostics, treatment and prevention in Thailand.
- GMS countries, excluding Myanmar, are moving towards subnational verification and aiming for malaria elimination certification, following the example set by China's successful elimination of the disease.

Total indigenous malaria and *Plasmodium falciparum* indigenous cases in the GMS, 2000–2022

6 What is needed now

Amid extreme weather challenges, scarce resources, system inefficiencies and biological threats, the goal of a malaria-free world is still far from reach. A substantial pivot is needed to get back on track, with much greater financing, better tools, data-driven strategies and robust political commitment. Whole-of-society engagement will be crucial to build integrated and climate-resilient malaria responses. Key to alleviating the effects of climate change on malaria are efforts to rein in global warming, strengthen climate change adaptation and reduce vulnerabilities.

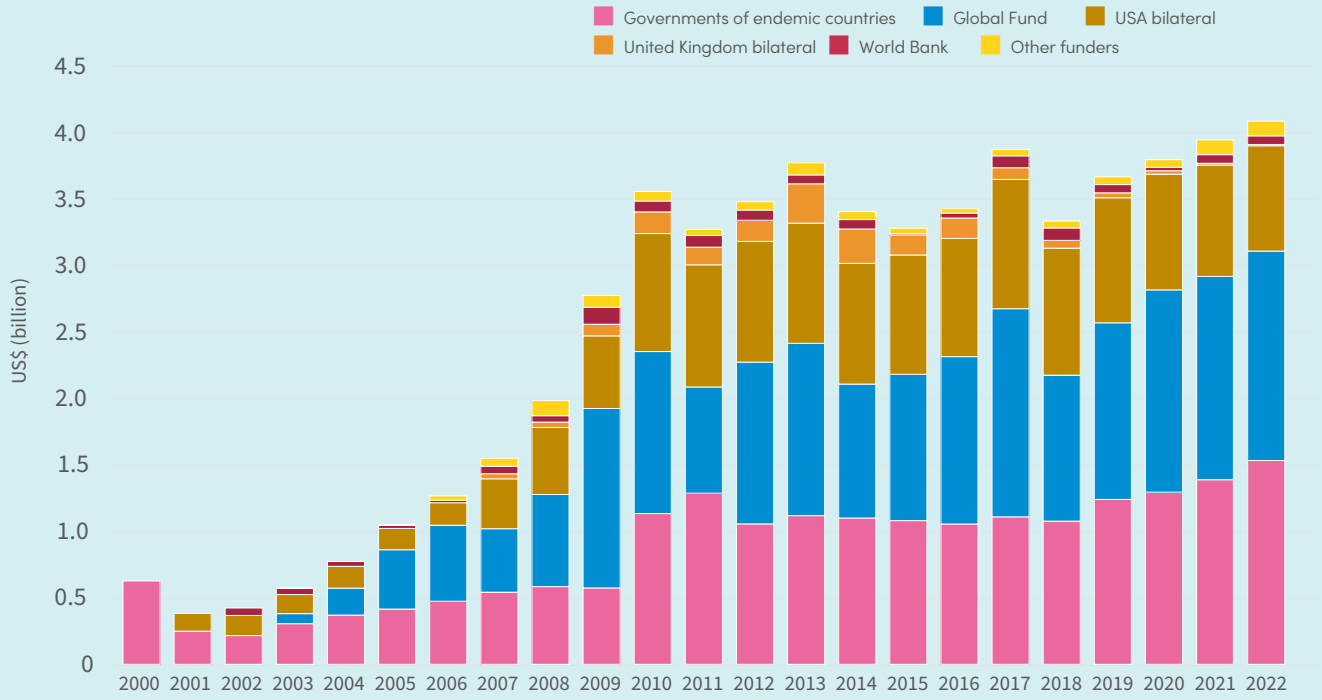
Step up malaria financing

» **Total funding gap for malaria.** The funding gap between the amount invested in malaria control and elimination and the resources needed continues to widen. It grew from US$ 2.3 billion in 2018 to US$ 3.7 billion globally in 2022. Malaria spending reached US$ 4.1 billion in 2022 – a leap from 2021 but well below the US$ 7.8 billion required to stay on track for the GTS milestones, and the US$ 9.3 billion needed by 2025.

» **Share of international and domestic funding.** Over the period 2010 to 2021, international sources consistently provided an average of 66% of malaria funding, with endemic countries contributing 34%. In 2022, there was a shift in funding distribution, with malaria-endemic countries increasing their share to 38%, while international funders contributed 62%.

» **Individuals and households carry much of the financial burden.** In 2020, catastrophic health expenditures – costs surpassing 40% of a family's income – impacted over 47% of households in low- and middle-income countries, including 1.9 billion people living in areas where the risk of contracting malaria is high. Exorbitant personal healthcare expenses can limit health care accessibility, deepen poverty, and widen social and economic inequalities, further intensifying the impact of diseases such as malaria. This situation underscores the urgency of implementing universal health coverage and establishing financial safeguards.

Funding for malaria control and elimination, by channel, 2000–2022 (constant 2022 US$)



» **Funding gaps for R&D.** In 2022, global investment in malaria research and product development dropped to US$ 603 million. This represented its steepest fall yet – down more than 10% (US$ 73 million) from 2021, leaving funding at its lowest recorded level in the past 15 years.

Use data strategically

» **Health surveillance systems and the strategic use of data and information are critical for estimating the burden of malaria and developing strategies for its control and elimination.** However, weak surveillance systems and data collection and analysis in many malaria-endemic countries limit the effective use of data. In some countries (including Afghanistan, Somalia, the Sudan and Yemen) there is not enough reliable data to estimate recent trends in the burden of malaria.

- Sub-national tailoring (SNT) of malaria interventions utilizes local data to guide the mix of interventions and achieve maximum impact. Use of data with an emphasis on SNT is one of four pillars of the High Impact High Burden approach. SNT was also used by China to accelerate the successful elimination of malaria.
- Between 2018 and 2023, WHO supported more than 30 countries in the strategic use of data for decision-making and subnational tailoring. Its application has sparked the integration of data as part of countries' regular decision-making processes and strengthened the collection, review and quality of data on a regular basis. It has also revealed the uneven capacity of countries to fully implement the SNT process, and insufficient investments in surveillance. This highlights the need for countries, their partners and donors to collectively address any gaps in capacity.
- WHO is in the process of finalizing guidance to aid countries in prioritizing malaria interventions, which will help optimize their impact under resource constraints.

Harness innovation

» **Investment in new tools.** Developing more efficacious tools will be essential to accelerate progress towards global malaria targets. Such tools include highly efficacious vaccines, longer-lasting insecticides (preferably non-pyrethroid), vector control tools that address outdoor biting, efficacious single-dose preventive therapies, such as monoclonal antibodies, diagnostic tools that can detect latent stages of *P. vivax* infections, new antimalarials to mitigate ACT resistance, and single-dose chemoprevention therapies.

- Innovation should focus on the development of more efficient and affordable products that are simple to produce and less susceptible to changes in temperature.
- Processes for bringing products to market need to be accelerated while maintaining safety, efficacy and quality. The global community has a role to play in increasing supply and reducing cost, which will facilitate the introduction and scaling of new tools.
- Capacities of national and regional regulatory authorities to review, approve and evaluate these products must be strengthened.

Strengthen political commitment

» **Countries must translate their stated political commitments into resources and tangible actions that will save more lives.**

- Ownership of the challenge lies in the hands of governments most affected by malaria. Grassroots initiatives that empower people to take action to protect themselves from malaria can help foster an environment of accountability and action.

Ensure malaria responses are sustainable and climate-resilient

» **Some of the proposed strategic, technical and operational actions needed include:**

- **Establish a common voice and build partnerships that integrate malaria reduction with climate action.** The threat to progress on malaria must be seen within the broader paradigm of climate and health. The Alliance for Transformative Action on Climate and Health, convened by WHO, provides a global platform for establishing political commitment by ministers of health to build climate-resilient and low-carbon sustainable health systems.
- **Decarbonize health systems; make them more climate-resilient and environmentally sustainable.** Health care is responsible for nearly 5% of global greenhouse gas emissions globally. There is great potential to reduce emissions without compromising quality of care. Health systems should share best practices to "level up," with services that provide high performance, low cost and low emissions – including in the supply chain, a major contributor of carbon emissions. A resilient health system can anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress. Countries with a higher level of per-capita emissions should start to build climate-resilience health systems now. In countries that have historically contributed little to the carbon footprint, the work towards minimizing emissions should be accompanied by a means of improving health sector performance and climate resilience.
  - WHO has developed an operational framework to guide countries in building health systems that are resilient to climate change. The framework has 10 key components to help health organizations and programmes in a country to better anticipate, prevent, prepare for and manage climate-related health risks, thereby ensuring health system resilience.
- **Shift the locus of decision making from global health institutions to country and community actors for action to address risks and opportunities at the climate-health nexus.** Robust, locally led decision-making will be key to mitigating the effects of climate change; for example, through improved tailoring of interventions, epidemic response, delivery of malaria interventions, health system strengthening and multisectoral action.

- **Increase knowledge of the climate change and health nexus.** A combination of low climate literacy among health experts and low health education among climate experts has hampered discussions on the appropriate ways to respond to interacting threats in climate change and health. Scaling up knowledge of the climate change-health nexus among policy-makers at all levels is urgently needed.
- **Improve guidance and tools for climate and health surveillance, monitoring and evaluation.** Practical guidance and tools in the surveillance, monitoring, evaluation and use of both climate and malaria indicators are essential to understand short and medium-term risks and adapt responses accordingly.
- **Use climate and disease information for decision-making.** Deliberate efforts will be needed to foster partnerships between climate and public health experts and stakeholders to develop subnationally tailored plans. Investment in appropriate digital solutions, including artificial intelligence, is key to making better use of health and climate information.
- **Strengthen epidemic detection, preparedness and response.** Climatic indicators are essential to malaria epidemic forecasting and early warning systems, and these indicators can improve national preparedness to respond to malaria epidemics. Building the WHO climate and health framework into current systems for epidemic preparedness and response is an immediately feasible goal in many countries.
- **Enhance national capacity in the analysis and use of climate and malaria information,** with coordinated training of both climate and health practitioners. The first step is to establish platforms for joint work and coordination among such practitioners. Engagement with relevant regional and global institutions will be essential for strengthening national capacity.

Graphs drawn from the *World malaria report 2023*. For more information on sources, please see the report.

Global messaging briefing kit: World malaria report 2023

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