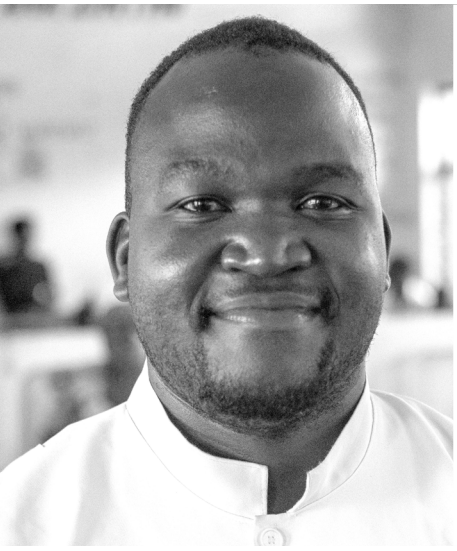
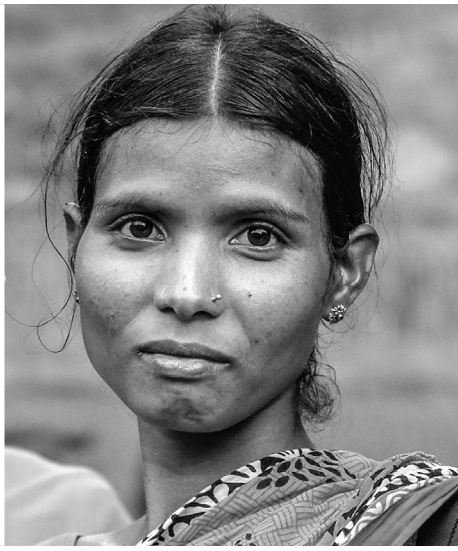
World Health Organization

# GLOBAL TECHNICAL STRATEGY FOR MALARIA 2016–2030





## 2021 UPDATE

World Health Organization

# GLOBAL TECHNICAL STRATEGY FOR MALARIA 2016–2030

## 2021 UPDATE

Global technical strategy for malaria 2016–2030, 2021 update

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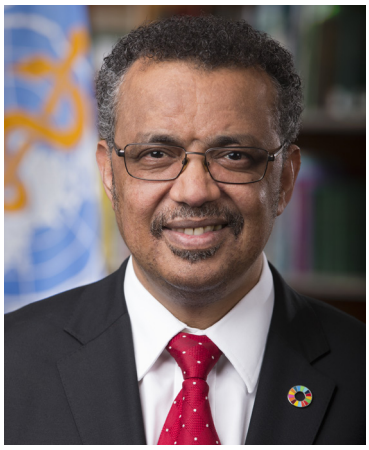
# FOREWORD



DR TEDROS ADHANOM GHEBREYESUS

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At the World Health Assembly in May 2015, Member States adopted WHO's *Global technical strategy for malaria 2016–2030*. The strategy is designed to guide and support all malaria-affected countries as they work to reduce the human suffering caused by the world's deadliest mosquito-borne disease.

By adopting this strategy, Member States endorsed the bold vision of a malaria-free world and set the ambitious target of a 90% reduction in the global malaria burden by 2030. They agreed on the need for health systems that reach all people at risk of malaria with the services they need to prevent, detect and treat the disease, regardless of citizenship or ability to pay.

The strategy called for high-quality surveillance data for decision-making and innovation in new malaria control tools and approaches. It highlighted the urgent need for robust investment across all intervention areas – including preventive measures, diagnostic testing, treatment and disease surveillance.

This updated version of the strategy, endorsed by the World Health Assembly in May 2021 through resolution WHA74.9, reflects lessons learned in the global malaria response over the last five years. While the milestones and targets remain the same, our approaches to tackling the disease, in some areas, have evolved to keep pace with the changing malaria landscape.

Since 2015, global funding for malaria control and elimination has levelled off. Progress in reducing cases and deaths has plateaued at unacceptably high levels, with more than 200 million cases and 400 000 deaths reported annually. This levelling off in funding and progress has compelled us to respond in new ways.

Through the "High burden to high impact" (HBHI) initiative, launched in 2018, countries hardest hit by malaria have been moving away from a "one-size-fits-all" strategy, choosing instead to apply mixes of interventions that are tailored to local settings. By adopting this more targeted approach, countries can maximize available resources while ensuring efficiency and equity in their malaria responses.

HBHI builds on the principle that no one should die from a disease that is preventable and treatable. It is an example of the type of approach we need to get malaria responses back on track – with a view to reaching the 2030 targets of this strategy.

Experience has shown that with adequate investments, robust political commitment and the right mix of strategies, we can make major strides against this complicated enemy. We should act with resolve and keep a laser focus on our shared goal: creating a world in which no one dies of malaria. I am confident that if we respond with urgency and determination, we can beat this disease once and for all.

# ACKNOWLEDGEMENTS

The *Global technical strategy for malaria 2016–2030* was developed through an extensive consultation process that began in June 2013 and culminated in the document's adoption by the World Health Assembly at its Sixty-eighth meeting in May 2015. The strategy was developed in close collaboration with numerous colleagues and partners worldwide and under the overall leadership of Robert Newman, John Reeder and Pedro Alonso, Directors of the Global Malaria Programme. The preparation of the original strategy was coordinated by a Steering Committee chaired by Pedro Alonso and including Kevin Baird, David Brandling-Bennett, Tom Burkot, Lesong Conteh, Azra Ghani, Margaret Gyapong, Corine Karema, Sandii Lwin, Fatoumata Nafo-Traore, Bernard Nahlen, Abdisalan Noor, Gao Qi, Ciro de Quadros, Ana Carolina Santelli and Wichai Satimai, with Secretariat support from Erin Shutes, Kristine Silvestri, Sunetra Ghosh and George Davis.

The Malaria Regional Advisors and their teams in WHO's Regional and Country Offices provided extensive input and support for the seven regional consultations that facilitated the engagement of over 400 technical experts representing more than 70 Member States in 2014. The Global Malaria Programme is grateful for all of their contributions and especially to Hoda Atta, Keith Carter, Eva Christophel, Elkhan Gasimov, Leonard Ortega and Issa Sanou.

The Global Malaria Programme launched a consultative process to review progress against the 2020 milestones and the corresponding update to the Strategy in 2020. The Department gratefully acknowledges the guidance of Member States that participated in two information sessions and the panellists and participants of the Webinar: Update of the WHO *Global technical strategy for malaria 2016–2030*. The updated Strategy was drafted by the Global Malaria Programme with input from the Regional Malaria Advisors. The document benefitted from contributions from other departments of WHO and a broad range of global stakeholders. The WHO Malaria Policy Advisory Group reviewed and provided key inputs: Samira Abdelrahman, Ahmed Adeel, Evelyn Ansah, Graham Brown, Tom Burkot, Gabriel Carrasquilla, Maureen Coetzee, Umberto d'Alessandro, Abdoulaye Djimde, Azra Ghani, Caroline Jones, Patrick Kachur, Nilima Kshirsagar, Fredros Okumu, Gao Qi, Arantxa Roca-Feltrer and Dyann Wirth.

All information concerning the preparation of the original strategy and the Steering Committee members as well as the process followed for the 2021 update is available at the following link: https://www.who.int/teams/global-malaria-programme/global-technical-strategy-for-malaria-2016-2030

# BACKGROUND

**Malaria has been a scourge of humanity since antiquity and remains so today.** Despite being preventable and treatable, malaria continues to have a devastating impact on people's health and livelihoods around the world. In 2019, about 4 billion people were at risk of the disease in 87 countries, territories and areas. An estimated 229 million cases occurred (range: 211 million–252 million), killing about 409 000 people (range: 387 000–460 000), mostly children under the age of 5 in sub-Saharan Africa *(1)*. In most countries where malaria is endemic, the disease disproportionately affects people experiencing disadvantage, poverty and exclusion, who have limited access to health facilities and can barely afford the recommended treatment. Malaria is both a consequence and a cause of poverty and inequality.

Between 2001 and 2015, a substantial expansion of malaria interventions contributed to a 30% reduction of the global incidence of malaria and a 47% decline in malaria mortality rates, averting an estimated 4.3 million deaths *(1)*. Target 6.C of the UN Millennium Development Goal (MDG) 6, namely "Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases", was reached. In the WHO African Region, the malaria mortality rate in children under 5 was reduced by 58%, and 55 of the 106 countries that had malaria transmission in 2000 were on track to reduce malaria incidence by 75% by 2015 – a goal set by the World Health Assembly in 2005 in resolution WHA58.2 on malaria control *(2)*. Against this background of unprecedented achievements, the *Global technical strategy for malaria 2016–2030* was developed and approved at the 2015 World Health Assembly in resolution WHA68.2. The Strategy set ambitious but achievable goals, with five-year milestones leading to the 2030 targets that aim to reduce malaria incidence and mortality rates by at least 90% compared to the 2015 baseline, interrupt malaria transmission in at least 35 countries, and prevent its re-establishment in all malaria-free countries. These targets are consistent with the Sustainable Development Goals (SDGs).

# VISION, GOALS AND PRINCIPLES

The vision of WHO and the global malaria community is a world free of malaria. As part of this vision, the Strategy set ambitious global targets for 2030, with milestones for measuring progress for 2020 and 2025. Countries will set their own national or subnational targets, which may differ from the global targets. The goals, milestones and targets are set out in Table 1.

### TABLE 1. GOALS, MILESTONES AND TARGETS FOR THE GLOBAL TECHNICAL STRATEGY FOR MALARIA 2016–2030

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

These goals apply to all types of human malaria and have been developed after reviewing (i) the targets of national malaria programmes, as stated in their national strategic plans, including detailed analysis to tailor interventions subnationally in the highest burden countries; (ii) the magnitude of decreases in the numbers of cases and deaths due to malaria between 2000 and 2019, as reported to WHO; and (iii) the results of updated mathematical modelling of malaria transmission in order to estimate the potential impact of applying different combinations of recommended interventions between 2016 and 2030. The modelling analysis assumes that the scale-up of new-generation insecticide-treated nets (ITNs) will mitigate the future impact of pyrethroid resistance. However, the analysis does not include variations in important megatrends known to have an impact on malaria, such as improvements to housing, rural electrification, and other land use and land cover changes related to socioeconomic development. Despite more emerging data indicating that progress has clearly stalled since 2015 and funding has plateaued, and despite disruptions due to the COVID-19 pandemic, the goals adopted by the Sixty-eighth World Health Assembly in 2015 remain unchanged and aligned with the SDGs.

Modelling suggests that if the coverage of malaria interventions remains at current levels, incidence could increase moderately. However, this rise and its consequences could be averted through a concerted effort to optimize the use of currently available interventions at levels above 80% coverage of at-risk populations and by improving the quality of services. Such efforts could significantly reduce the incidence of and deaths due to malaria. Given that reaching this level of coverage will be operationally difficult, further innovations in interventions are needed to reduce the burden of malaria in areas where transmission rates are high and in areas and for population groups that are presently hard to reach with current interventions; and to interrupt transmission in settings close to elimination.

Six principles, including one new principle, underlie the Strategy for malaria. Country ownership and leadership, with the involvement and meaningful participation[1] of communities, are essential to accelerating progress through a multisectoral approach. All countries can accelerate efforts towards elimination through combinations of interventions that are tailored to the local context. Improve impact through the use of data to stratify and tailor malaria interventions to the local context. Equity in access to quality health services is essential, especially for the populations who are experiencing disadvantage and are the most challenging to reach. Innovation in interventions will enable countries to maximize their progress along the path to elimination. Finally, the new principle is that a resilient health system underpins the overall success of the malaria response. Health systems must not only be adept at delivering quality malaria services, but must also effectively adapt to disruptive events, such as epidemics, pandemics and other natural disasters, while responding in a gender-responsive, equity-oriented and human-rights-based manner.

## NEED FOR AN UPDATED POST-2015 TECHNICAL STRATEGY

The world has reached a critical juncture in the fight against malaria. Over the first five years of implementation of the Strategy, the milestones for elimination and prevention of reestablishment of malaria were both achieved, with 10 countries achieving interruption of malaria transmission and none of those that were malaria-free in 2015 reporting re-establishment of transmission. However, during the first five years of implementation, progress in reducing malaria mortality and morbidity slowed, stalled

1 Definition: "Meaningful participation requires that individuals are entitled to participate in the decisions that directly affect them, including in the design, implementation, and monitoring of health interventions." (https://www.who.int/gender-equity-rights/understanding/participation-definition/en/)

or even reversed in many moderate- and high-transmission countries. Globally, the malaria mortality rate was estimated to have decreased by 22% in 2020 compared to the 2015 baseline. In the same period, however, malaria case incidence decreased by only 3%, with cases increasing from 218 million to 229 million. Therefore, the Strategy's 2020 milestones for morbidity and mortality reductions have not been met. In 2019, the WHO African Region accounted for 94% of the global malaria mortality and morbidity burden, and only nine out of 47 countries achieved the 2020 milestones. Two countries – the Democratic Republic of the Congo and Nigeria – still account for about 40% of the estimated morbidity and mortality due to malaria worldwide.

Different factors have contributed to the stalling of progress. While disease incidence has decreased, the population in sub-Saharan Africa continues to grow at a rapid rate. This population growth has led to the paradoxical result that the continent is facing approximately the same number of malaria cases today as it did 20 years ago. Given the projected growth in the size of the world's population by 2030, more people will be living in countries where malaria is a risk, putting further strain on health systems and national malaria programme budgets. As a consequence of population growth, investment per person at risk has decreased over the first five years of the Strategy.

Despite the incredible increase in access to services in the last two decades, too many people are still missing out on the malaria interventions they need, and more than half the world's population is still unable to access health services without incurring financial hardship *(3)*. The challenge is compounded by substandard quality of services. For example, 36% of households in moderate- and high-transmission settings had one net for every two persons, and only 46% of the population at risk of malaria uses an ITN. One third of those with fever did not seek care and only 38% of those who sought care were tested for parasites *(1)*. Many of those missing out are the poorest and most marginalized, which calls for a deliberate approach to reach the unreached.

Success has been threatened by high-impact health emergencies (epidemics, pandemics, conflicts, natural and technological disasters). Inevitably, the next decade will see further disruptions, including natural disasters, unnatural catastrophic events and violent conflicts that impact malaria by disrupting the ecology, displacing people from their homes, and compromising access to and quality of health services. In 2021, a record 235 million people are expected to need humanitarian assistance *(4)*.

The COVID-19 pandemic has highlighted the consequences of major disruptive events on population health and the immediate impact on the delivery of malaria services. It has also exposed the fragility of health systems across the globe. In malaria-endemic countries, the consequences of health service disruptions are likely to last for years, as the ability of countries to recover is impaired by economic devastation related to the pandemic. The global attention to health security will need to translate into investments in resilient health systems, and should not be at the expense of other priority public health challenges such as malaria. In terms of research and innovation, an abiding lesson from the response to the COVID-19 pandemic is the scale of investment and the speed of development of multiple vaccines, some using technologies not previously applied to vaccine development. Bringing such urgency and investment to the development of more efficacious malaria prevention tools is critical if we are to reach the goals for malaria in the coming decade.

Many of the threats to health are rooted in social, political, economic and gender inequalities and other determinants of health. There is a disproportionate risk of malaria among hard-to-reach populations, including high-risk occupational groups, migrants, people in humanitarian crises, and rural communities with poor access to health services. The world is gaining further insight into the impact of different megatrends on malaria. Increasing economic development, urbanization, deforestation and climate change are expected to contribute to changes in transmission dynamics, while projected population growth in areas where malaria poses a high risk has the potential to increase disease burden, further emphasizing the need to optimize coverage of interventions. A detailed analysis of the impact of these megatrends on the risk of malaria over time was recently undertaken and published by WHO in the report of the Strategic Advisory Group on malaria eradication *(5)*.

Progress can be hastened by reaching the unreached. This will require a significant expansion of existing interventions to all those in need. This expansion will rely on making malaria a higher technical, financial and political priority, and ensuring that the development and use of interventions are maximized, guided by the stratification of data by risk to optimize impact and the cost-effectiveness of interventions.

**Opportunities.** This Strategy is strongly aligned with the broader health and development agendas. The 2030 Agenda for Sustainable Development acknowledges the importance of the "interlinkages and integrated nature of the Sustainable Development Goals (SDGs)". Efforts to prevent and control malaria contribute to, and benefit from, sustainable development. Well-established linkages and factors include the contribution of malaria to the poverty cycle; the concentration of disease in populations experiencing disadvantage, discrimination and exclusion and those traditionally underserved with poor access to health services; and the detrimental impact of disease on education through missed school days and the cognitive effects of chronic anaemia. The WHO's Thirteenth General Programme of Work (2019–2023) is based on the SDGs and is structured around three interconnected strategic priorities to ensure healthy lives and well-being for all at all ages: achieving universal health coverage (UHC), addressing health emergencies and promoting healthier populations *(6)*. As such, this broad development framework provides an opportunity to shift to a more comprehensive health systems approach and multisectoral action that embraces all of society, leaving no one behind.

The progress made in countries that have eliminated malaria and those that have reduced transmission to low levels demonstrates what is possible, and provides useful lessons and best practices to guide progress elsewhere. There are good examples of the use of reliable, actionable data to improve health. The "High Burden to High Impact" (HBHI) approach is pioneering a move away from a one-size-fits-all approach to implementation and exploring the potential for more efficient and equitable outcomes from data-driven subnational targeting of interventions.

**Challenges.** The fight against malaria is being prolonged, and in some places slowed down, by several interconnected challenges. The first is the lack of robust, predictable and sustained international and domestic financing, which is compounded by the difficulties in sustaining political commitment and ensuring regional collaboration at the highest levels. Per capita population at risk funding for malaria has declined, making it even more imperative to optimize all available resources through the efficient and equitable delivery of locally tailored interventions. The lack of resources across the health sector has compromised the delivery of good-quality services. Delivery systems are still in need of a fit-for-purpose, well-performing and equitably distributed health and social workforce. Weak supply chains are failing to guarantee the availability of quality-assured products at the point of delivery. The private sector is often unregulated and poorly informed. Weak systems for surveillance, monitoring and evaluation are failing to adequately identify gaps in programme coverage and track changes in disease burden.

There are also biological challenges: The gains made in malaria could be eroded by the emergence or expansion of parasite resistance to antimalarial medicines and mosquito resistance to insecticides. Additional biological challenges include *pfhrp2/3* gene deletions, which are leading to false-negative rapid diagnostic test results, and new invading vector species (e.g., the urban vector, *A. stephensi*, which has expanded its distribution into the Horn of Africa). In some parts of the world, existing vector control interventions cannot effectively protect against the disease given the diversity of malaria vectors and differences in their behaviours. In countries where both *Plasmodium falciparum* and *P. vivax* are present, the burden of disease due to *P. vivax* is more difficult to reduce because the parasite forms a dormant stage in the liver. This hypnozoite state is currently undetectable and leads to relapses, thereby contributing to maintaining disease transmission. In addition, human infection with zoonotic plasmodia such as *P. knowlesi* presents new challenges to malaria control and elimination.

Although there are some promising new tools to fight malaria in the pipeline, no transformative products have reached the market, and thus the world continues to rely on moderately effective prevention tools, further threatened by the risk of parasite and insecticide resistance.

The update to the Strategy reflects the current context of uneven progress and acknowledges the impact of COVID-19, as well as the lessons learned on accelerated innovation in response to the pandemic. The Strategy has also been updated to align more closely with the United Nations priority of UHC and the integration of essential health services. The Strategy recognizes the value of a whole society and multisectoral response to malaria that creates a stronger alignment with the SDGs and UHC and leaves no one behind. The Strategy's guiding principles have been reordered to acknowledge the critical role of country ownership. A sixth principle has been added that places further emphasis on the need for more equitable and resilient health systems and the value of primary health care (PHC) to ensure access to needed services and the appropriate mix of interventions for all populations at risk across public and private health sectors. The update recognizes that not all interventions are necessary everywhere. Instead, the emphasis is on providing the appropriate interventions to the populations that need them. The wording changed from "Ensure universal access to malaria prevention, diagnosis and treatment" to "Ensure access to malaria prevention, diagnosis and treatment as part of universal health coverage". Another update is to move away from the term "core" interventions, with the implication of "one size fits all", to reflect the need for subnational data collection and participatory analyses that identify existing health barriers or disparities and determine the most effective mix of interventions according to the local context and needs. The consolidated *WHO Guidelines for malaria* contain evidence-based recommendations and promote a "problem-solving approach" *(7)*.

More attention is given to the strengthened capacity of countries to generate, analyse and use high-quality surveillance data for making decisions and tailoring responses to achieve national or subnational goals. Over the next 10 years, there needs to be a more deliberate approach that draws upon reliable and timely data to tackle the challenges that are impeding progress. These include the following actions:

- Reach the many people who have not been reached with the package of services they need. Data will be used to identify populations that are not being reached to help overcome the barriers they face in accessing the optimal package of services, suited to the context.
- Improve the effectiveness and quality of health services. Data will be used to assess service availability and quality and to identify and address the health system challenges that compromise delivery.
- Introduce additional highly effective interventions into the existing package of interventions. Evidence will be used to identify and recommend new and improved tools to reduce malaria and facilitate their timely and appropriate introduction and efficient delivery to stop transmission or disease progression.
- Use data to better understand and address the wider determinants that potentially disrupt or facilitate the reach and quality of services.

This framework should be the foundation of strategies for national and subnational malaria programmes. It defines a clear and ambitious path for the next 10 years for countries where malaria is endemic and their partners in malaria control and elimination. The Strategy identifies areas in which innovative solutions will be essential for attaining the milestones and targets and the importance of swiftly incorporating them into the national malaria response. It summarizes the estimated costs of implementing the Strategy and provides an updated estimate of the research and development costs for new interventions.

# STRATEGY DEVELOPMENT PROCESS

Following the support expressed by Member States at the Sixty-sixth World Health Assembly to develop a global malaria strategy for the post-2015 period, the Secretariat held seven regional consultations *(8)*. Input was gathered from more than 400 experts representing national malaria programmes, health ministries, research organizations and implementing partners. The process, led by the Secretariat, was supported by both the Malaria Policy Advisory Committee (now Malaria Policy Advisory Group) and a dedicated Steering Committee, consisting of leading malaria experts, scientists and representatives of countries where malaria is endemic, who provided extensive additional inputs to the initial draft document. Following these consultations, a revised draft was prepared by the Secretariat for an online consultation, which was open for comment between 11 July and 15 August 2014, and the final version was adopted by the Sixty-eighth World Health Assembly in May 2015 (WHA68.2).

In 2019, the Strategic Advisory Group on malaria eradication assessed progress and identified a number of areas where there was room for improvement in the current Strategy. Notable was the need for countries to be able to adapt the global strategy to their local context and to maximize the implementation of measures known to be effective – a difficult challenge where health systems are weak. Community engagement and national leadership were highlighted as critical, in addition to improved national surveillance and strengthened workforce capacity. In many cases, funding was the limiting factor to more widespread implementation. The Group also recommended five-yearly reviews of the Strategy so that gaps identified could be highlighted and addressed.

The Strategy update process was launched in 2020 to reflect on the progress against the 2020 milestones, incorporate lessons learned and highlight unforeseen new challenges like COVID-19 in order to achieve impact and accelerate towards the burden reduction milestones of 2025. WHO Regional Offices were engaged in the planning and provided the link to and feedback from the development of the five-year Regional Frameworks. An Information Session for Member States was held in September 2020 to discuss the planned updates, and impact and costing analyses were undertaken to inform the revisions. The proposed areas to update were presented and discussed in an open session at the Malaria Policy Advisory Group meeting in December 2020 and during an open virtual webinar attended by partners and country programmes in January 2021. The input from those sessions was incorporated into the revised Strategy, which was presented to Member States for comment at a WHO Information Session in April 2021. The updated Strategy was linked to the malaria progress report presented to the Seventy-fourth World Health Assembly and endorsed in May 2021 through resolution WHA74.9.

# PATH TO MALARIA ELIMINATION

Progress towards malaria-free status is a continuous process and not a set of independent stages. Countries, subnational areas and communities are situated at different points along the path towards malaria elimination, and their rate of progress will differ depending on the level of investment, biological determinants (related to the affected populations, the parasites and the vectors), environmental factors, strength of health systems, and social, demographic, political and economic realities.

At all levels of endemicity, the risk of malaria varies significantly within a country or area, and the same strategy is not necessarily appropriate for all settings within a country. Malaria transmission intensity and burden are often heterogeneous, depending on the natural variations in transmission suitability, urbanization, other changes in land cover and use, and the impact of increasing the coverage of interventions directed against

malaria. A key approach to optimizing malaria responses within a country will be tailoring intervention packages through a process of stratification by malaria burden and analysis of other characteristics, such as past malaria incidence data and risk determinants related to the human host, parasites, vectors and the environment; and ensuring equitable access to quality services.

The performance of national health systems and their adaptability to new opportunities are two of the key determinants of the rate of progress along the path. As malaria programmes reduce transmission to low or very low rates, they should shift the focus from preventing, detecting and treating clinical cases to preventing, detecting and treating every malaria infection. This change requires strengthened and sustained epidemiological and entomological surveillance systems – a requirement that can be satisfied only through substantial long-term financial and political commitment – as well as significant structural and organizational changes to malaria programmes.

The first priority for all countries where transmission rates of malaria are high or moderate is to ensure a maximum reduction of morbidity and mortality. Reductions will be achieved through the sustained and equitable provision of targeted, quality-assured and appropriate vector control measures, diagnostics and antimalarial medicines, together with the implementation of all WHO-recommended preventive therapies that are appropriate for the epidemiological and contextual setting. These activities must be backed up by efficient disease surveillance systems that include surveillance of major biological threats related to the vector, the parasite and its diagnosis, and strong public health communication and behaviour change programmes that are mindful of the needs of the recipients and take into account gender, human rights and equity considerations.

In countries where the potential for malaria transmission is high, optimal application of all appropriate interventions will result in marked falls in morbidity and mortality rates, but these may not be sufficient to eliminate malaria. In these settings, additional interventions will be needed to accelerate progress. Many new interventions are already in development and could be available within the coming years (see section on Harnessing innovation and expanding research).

Once programmes have reduced transmission to very low levels, countries should adapt their strategic plans and approaches to deliver enhanced elimination activities. Case-based surveillance systems, better tracking of population movements and improved understanding of the determinants of residual transmission will be important to enable a more focused tailoring of the malaria response. An increase in meaningful and equitable community participation in surveillance and response is needed.

As programmes approach elimination or work to prevent re-establishment of transmission, all cases of malaria infection need to be detected and managed by general health services, both public and private, and reported as a notifiable disease to a national malaria registry. Patients with suspected malaria must be diagnosed and treated promptly with effective antimalarials in order to avoid preventable deaths and to decrease the probability of onward transmission in the community. All cases must be investigated appropriately to determine the likely location where infection was acquired in order to direct the actions required to prevent onward transmission. Entomological surveillance systems should be maintained so that appropriate vector control interventions can be introduced or modified as necessary.

# STRATEGIC FRAMEWORK

In order to accelerate progress towards elimination, WHO urges affected countries and the global malaria community to maximize the impact of existing life-saving interventions. Until new and improved interventions become available, there is an urgent

need to adopt and expand implementation of WHO-recommended strategies to improve effectiveness and prevent malaria deaths. The Strategy is built on three pillars with two supporting elements that guide global efforts to move closer to malaria elimination. These are summarized below.

- **Pillar 1. Ensure access to malaria prevention, diagnosis and treatment as part of universal health coverage.** The WHO-recommended package of interventions – namely, vector control, chemoprevention, diagnostic testing and treatment – can dramatically reduce morbidity and mortality. The principal objective of national malaria programmes in areas of moderate to high transmission is to ensure that populations at risk have equitable access to the appropriate mix of interventions to prevent, diagnose and treat malaria, without financial hardship. The metrics of success are reductions in malaria case incidence and malaria mortality rates. WHO recommends implementing two sets of interventions in a complementary way: (i) prevention strategies based on vector control, and, in certain settings and in some population groups, administration of chemoprevention; and (ii) diagnosis and prompt, effective treatment of malaria in public and private health facilities and at the community level. Programmes should base their strategic response on the analysis of past and current malaria transmission intensity and incidence data, contextual vulnerability related to the human host, parasites, vectors and the environment, and access to services in order to tailor interventions to the local context and ensure efficient and equitable use of resources.

- **Pillar 2. Accelerate efforts towards elimination and attainment of malaria-free status.** Countries need to intensify efforts to interrupt onward transmission of new infections in defined geographical areas, particularly in settings where transmission is low. In addition to prevention, diagnosis and treatment as part of UHC, attaining this objective will entail the targeting of both parasites and vectors in transmission foci, guided by active case detection and case investigations as part of a malaria surveillance and response programme. In some settings, the achievement of elimination may require the use of medicines to reduce the infectious reservoir. The development and adoption of innovative solutions will be essential to respond to the spread of insecticide resistance and residual transmission, and to target the hypnozoite reservoirs of *P. vivax*.

- **Pillar 3. Transform malaria surveillance into a key intervention.** Strengthening malaria surveillance is fundamental to programme planning and implementation and is a crucial factor for accelerating progress. All countries where malaria is endemic and those susceptible to the re-establishment of malaria should have an effective health management information system in place for helping national malaria programmes direct resources to the most affected populations, identify gaps in programme coverage, detect outbreaks, and assess the impact of interventions in order to guide national strategic planning and delivery. At all levels of transmission, surveillance should trigger locally tailored packages of interventions and response at relevant units of operation such as districts or communities. At very low levels of transmission, response may be linked to every detected infection.

- **Supporting element 1. Harnessing innovation and expanding research.** In support of these three pillars, countries where malaria is endemic and the global malaria community should harness innovation and increasingly engage in basic, clinical and implementation research. Successful innovation in product development and service delivery will make a major contribution to accelerating progress. Basic research is essential for better understanding the parasites and vectors, and for developing more effective diagnostics and medicines,

improved and innovative vector control methods, and other interventions such as vaccines. Implementation research and research on the contextual vulnerability of the population will be fundamental to optimizing impact and cost-effectiveness and facilitating rapid uptake and high coverage in populations at risk. Working with countries and stakeholders to overcome market entry barriers for new tools will also be important to ensure an equitable distribution of resources.

- **Supporting element 2. Strengthening the enabling environment for more sustainable and equitable results.** Malaria interventions need to be embedded in, and supported through, a strong enabling environment that can ensure that efforts are expanded in an effective and sustainable manner. Central to success is accountable and trusted national leadership, committed to sustainable and equitable societies and well-functioning, resilient health systems supported by a gender-responsive, equity-oriented and human-rights-based approach, with a focus on leaving no one behind. Political commitment linked to resources and actions is needed to ensure that all those in need have access to the appropriate mix of interventions for malaria and other public health priorities without financial hardship. The services, both public and private, and medical products need to be safe and effective and delivered in a timely, equitable, efficient and integrated manner. High-quality and integrated delivery are important for reducing both the burden of malaria and the potential for onward transmission of parasites. Those at the front line, both the providers and users of services, should be the co-developers of health and social services, as self-carers and caregivers to others. The health sector alone cannot provide a durable solution. Truly making an impact on malaria and preventing re-establishment will require contributions from other sectors that are equipped to address the broader determinants of malaria. A holistic approach, anchored in the SDGs, is needed to optimally deliver malaria interventions and address the broader determinants of disease. To keep ahead of the disease will require a culture of learning and adapting with the capacity to effectively generate and use knowledge to identify gaps, health disparities and existing inequalities, monitor progress, and seek and adopt transformative approaches and new interventions that have the potential to accelerate progress.

# THE THREE PILLARS OF THE STRATEGY

## PILLAR 1. ENSURE ACCESS TO MALARIA PREVENTION, DIAGNOSIS AND TREATMENT AS PART OF UNIVERSAL HEALTH COVERAGE

UHC means that all individuals and communities receive the health services they *need* without suffering financial hardship. It includes the full spectrum of essential, quality health services – from health promotion to prevention, treatment, rehabilitation and palliative care. Quality of care is fundamental to UHC. It is essential to ensure that the care provided through public, private and community systems is timely, effective, safe and in keeping with the needs of all people being served.

For malaria, WHO has recommended a range of interventions – namely, vector control, chemoprevention, diagnostic testing and treatment – to reduce transmission and prevent morbidity and mortality. A UHC approach means ensuring that individuals and communities are covered by the appropriate mix of these interventions, based on local context, to control and ultimately eliminate malaria. These interventions are presented in the *WHO Guidelines for malaria*, with accompanying guidance to deploy mixes of interventions *(7, 9)*.

The principal objective of national malaria programmes is to combine a selection of these interventions into packages that are tailored to achieve sustainable, equitable and optimal impact in a given setting, while taking into account equity, gender and human rights considerations. To decide upon the appropriate intervention package and allocation of resources that will achieve this objective and contribute to UHC, programmes should use a process that combines the analysis of impact and value for money with extensive stakeholder engagement and discussion through meaningful participation during the entire undertaking. The process should be informed by past and current malaria transmission intensity and incidence data; contextual vulnerability related to the human host, parasites, vectors, and past and present intervention coverage; acceptability; and equity of access and use (including analysis of financial and geographic barriers and how to address them). When the objective is elimination, a similar process should be undertaken, although the types of interventions and value for money analysis will be different than in high-burden settings.

## Vector control

**Maximize the impact of vector control.** Vector control is an essential component of malaria control and elimination. The capacity of vectors to transmit parasites and their vulnerability to vector control measures vary by mosquito species and are influenced by local environmental factors. Vector control must be implemented on the basis of local epidemiological and entomological data. At present, WHO recommends deployment of one of two broadly applicable vector control interventions, namely, ITNs or indoor residual spraying (IRS). National malaria programmes need to ensure that all people at risk of malaria are protected through the provision of, use and timely replacement of ITNs or through the regular application of IRS. Depending on the country context, both ITNs and IRS may be deployed across different geographical areas. In addition to ITNs or IRS, the deployment of other vector control interventions may be appropriate in specific settings. Most commonly, this consists of the regular application of biological or chemical insecticides to water bodies (i.e., "larviciding").

**Build and maintain adequate entomological surveillance, monitoring and evaluation.** To enable an effective vector control response, entomological surveillance, monitoring of coverage and evaluation of the impact of vector control interventions must be included in national surveillance systems. Countries should collect data across all settings, including those areas that are malaria-free but at risk of re-establishment of malaria.

**Manage insecticide resistance and residual transmission.** Growing physiological resistance of *Anopheles* mosquitoes to insecticides is recognized as a major threat that requires an urgent and coordinated response. To monitor this threat and inform country-level responses to it, WHO launched the Malaria Threats Map in 2014. In addition, all countries where malaria is endemic need to develop and implement plans for monitoring and managing insecticide resistance *(10, 11)*.

Numerous situations exist where transmission of malaria parasites continues even when high coverage with ITNs or IRS has been achieved. This highlights the need for more in-depth monitoring of local transmission dynamics, including insecticide resistance and vector genomics, and new interventions to respond to resistance and to tackle existing intervention gaps, most importantly that of outdoor biting.

Many new vector control interventions are currently being evaluated in order to generate an evidence base to inform WHO recommendations and prequalification in the coming years. Many of these interventions will cost more than the currently available interventions, emphasizing the need for a comprehensive prioritization process at the national level that is informed by local data on the cost and effectiveness of the potential alternatives and takes into account equity, gender and human rights considerations for their implementation. Such prioritization needs to go beyond vector control and consider all available interventions to improve impact.

**Implement malaria vector control in the context of the *Global vector control response 2017–2030*.** To maximize the impact of malaria vector control, national malaria programmes should apply the principles of the *Global vector control response 2017–2030*. The Response provides a strategy to strengthen vector control worldwide through increased capacity, improved surveillance, better coordination and integrated action across sectors and diseases.

## Chemoprevention

**Expand preventive treatment to prevent disease in the most vulnerable groups.** Preventive treatment strategies are key, highly cost-effective elements of the multipronged strategy to reduce disease burden and transmission. Faltering progress in malaria control since 2015 has drawn attention to the need to substantially expand the use of chemoprevention in countries seeking to reduce their malaria burden. These interventions suppress existing infections and prevent the consequences of parasitaemia, including disease and death. A range of chemoprevention strategies are available and should be considered, depending on the intensity and seasonality of transmission, and the local level of parasite resistance to antimalarial medicines.

WHO-recommended preventive treatment strategies against malaria presently include intermittent preventive treatment of pregnant women (IPTp), intermittent preventive treatment of infants (IPTi), and seasonal malaria chemoprevention (SMC) for children under 6.[2] These interventions are recommended in areas of moderate to high malaria transmission in sub-Saharan Africa, with SMC recommended only in areas of highly seasonal transmission across the Sahel subregion. Chemoprevention strategies should be tailored to the local context; for example, the number of rounds of SMC should be sufficient to cover the transmission season, and alternative delivery strategies for IPTp, and potentially IPTi, should be considered to maximize coverage. Preventive treatment strategies currently target falciparum malaria, but merit consideration for other types of human malaria.

**Protect all non-immune travellers and migrants.** Chemoprophylaxis is the administration of subtherapeutic doses of antimalarial medicines at regular intervals sufficient to prevent malaria disease. Chemoprophylaxis has traditionally been recommended for non-immune travellers to areas with malaria transmission, in combination with advice on measures to reduce vector bites. Chemoprophylaxis has also been encouraged for individuals living in endemic settings who are at increased risk of severe malaria. As malaria control improves and individuals grow up with insufficient malaria exposure to develop naturally acquired immunity, it will be increasingly important to consider the most appropriate use of malaria medicines to protect such individuals when they visit areas with malaria risk.

## Diagnostic testing and treatment

Diagnosis and treatment of malaria should be available to all those who may be infected with malaria. With increasing population movement, these services should not be confined solely to areas of malaria transmission.

**Ensure diagnostic testing of all suspected malaria cases.** All patients who are suspected to have malaria should have the diagnosis confirmed by parasite detection methods, such as quality-assured microscopy or antigen-detecting rapid diagnostic tests. Both public and private sector health services should be equipped to confirm diagnosis before administering antimalarial treatment. Ensuring diagnostic testing of all suspected cases will reduce the overuse of artemisinin-based combination therapies – the first-line treatment for uncomplicated malaria – and reduce the drug pressure on parasites, and could contribute to the more effective treatment of other

2 Section 4.2: Preventive chemotherapies & Mass drug administration in the *WHO Guidelines for malaria (7)*.

conditions *(12)*. Additionally, it will lead to improved identification and management of the many non-malarial febrile illnesses that are often presumed to be malaria solely on the basis of fever or history of fever.

Every confirmed malaria case should be tracked and reported in the surveillance system in order to inform programme planning. Expansion of diagnostic testing will provide timely and accurate surveillance data based on confirmed rather than suspected cases. Expanding access to prompt diagnostic testing has lagged behind vector control prevention efforts, but strengthening diagnosis and treatment in all settings will help to reduce malaria morbidity and mortality. WHO recognizes that safe and effective radical treatment of vivax malaria currently requires two diagnoses: the presence of *P. vivax* parasites and glucose-6-phosphate dehydrogenase (G6PD) status. As point-of-care G6PD tests become available, these services will need to be implemented alongside malaria diagnostic testing to ensure the most safe and effective treatment to prevent *P. vivax* relapse.

**Provide treatment to all confirmed cases of malaria.** Ensuring universal access to WHO-recommended antimalarial medicines is crucial in all settings to prevent the progression of uncomplicated malaria to severe illness and death. After diagnostic confirmation, every patient with uncomplicated malaria should be treated with a recommended medicine. Severe malaria requires urgent medical attention and WHO's recommendations are available to countries *(7)*. The emergency care system relies on early recognition of danger signs and life-threatening conditions at the periphery and effective referral systems that ensure timely access to intensive care, management of the disease and its complications. Post-discharge care should include measures to reduce risk of re-admission and post-discharge deaths. Malaria programmes should develop and regularly update detailed national treatment guidelines that take into account the latest evidence on local antimalarial drug resistance patterns and health service capacities. Countries should select WHO-recommended artemisinin-based combination therapies with more than 95% efficacy demonstrated through therapeutic efficacy monitoring in local sites.

**Scale up community-based diagnostic testing and treatment.** Training and deployment of community health workers can substantially complement and extend the reach of public health services, particularly in rural and remote areas, where health infrastructures tend to be the weakest and malaria transmission the highest. The strategic use of community health workers in malaria prevention and care can not only bridge health system gaps, but also help to ensure a continuum of care for populations experiencing disadvantage, discrimination and exclusion. Ministries of health should expand integrated community delivery platforms, such as Integrated Community Case Management (iCCM) of malaria, pneumonia and diarrhoea, with a focus on children under 5 years of age.

**Monitor safety and efficacy of antimalarial medicines and manage antimalarial drug resistance.** Enhanced pharmacovigilance and surveillance of the efficacy of antimalarial medicines are essential to detect unexpected adverse events and reduced efficacy so that the most appropriate combinations can be selected for national treatment policies. Countries should monitor the efficacy of first- and second-line malaria therapies – against both falciparum and vivax malaria – using the standard WHO protocol for therapeutic efficacy studies every two years *(13)*. A treatment failure rate exceeding 10% should prompt a change in the national antimalarial treatment policy. For the time being, artemisinin-based combination therapies remain highly effective, provided that the partner medicines remain efficacious. Caution is required, however, as the emergence of artemisinin resistance increases the risk of resistance spreading to the partner medicines in the combination.

**Contain antimalarial drug resistance.** Protecting the efficacy of artemisinin-based combination therapies and developing new non-artemisinin-based combinations should be a top priority both for countries where malaria is endemic and for the global malaria community *(14)*. In countries and areas where artemisinin and artemisinin-based

combination therapies continue to be fully effective, there is a need to (i) promote recommended medicine use, with special attention on expanding diagnostic testing and quality-assured treatment, and (ii) extend all basic malaria interventions, including vector control, to reduce the potential emergence of resistance. Countries where artemisinin resistance is reported are urged to intensify malaria control in order to reduce the burden of disease and delay or prevent the spread of resistance. In areas of low transmission where resistance to artemisinin is present, countries should target rapid elimination of malaria. In the Greater Mekong Subregion, for example, *P. falciparum* resistance to artemisinin emerged independently in multiple geographical locations and the situation was worsened by resistance to several partner medicines. However, the successful implementation of an elimination strategy has prevented the spread of resistance outside the Subregion and minimized the public impact of resistance *(15)*.

**Remove and replace inappropriate or substandard antimalarial medicines.** All countries in which malaria is endemic should ensure that inappropriate and substandard antimalarial medicines are removed from both public and private sector markets. For instance, national regulatory authorities are urged to regulate against production, marketing authorization, export, import and use of oral artemisinin-based monotherapies. Countries should also take decisive steps to set up enforcement mechanisms to ensure that these recommendations are followed, including surveillance and regulatory action, as well as stringent follow-up, to remove inappropriate antimalarial medicines from health facilities and pharmacies, and stop their provision through informal providers. Recommended alternative medicines should be made widely available at quality-assessed standards, and public and private sector treatments should be harmonized and aligned with national guidance. The removal of inappropriate oral artemisinin-based monotherapies is crucial for preserving the efficacy of artemisinin-based combination therapies, the mainstay of antimalarial treatment to date, and will make a substantial contribution to accelerating progress on the path to burden reduction and elimination. Countries are likewise encouraged to phase out substandard medicines and replace them with more effective alternatives, e.g., injectable artesunate should be given preference over injectable quinine.

## PILLAR 2. ACCELERATE EFFORTS TOWARDS ELIMINATION AND ATTAINMENT OF MALARIA-FREE STATUS

**All countries should aim to eliminate malaria.** Attaining this objective will entail targeting both the vectors and the parasites. Preventing contact between people and vectors will reduce onward transmission of new infections, while clearing the parasites from the large number of people with undiagnosed infections will accelerate declines in transmission. Over the next decade, new interventions will become available that will help to target the infectious parasite reservoir in humans and transmission that occurs outdoors.

**Adapt national strategies for intensified response.** When there are few malaria cases in a given country or subnational area, the malaria programmes' strategies, priorities and activities should be adjusted to complete the final phase of elimination. Therefore, in addition to the interventions mentioned under Pillar 1, programmes should enhance surveillance (Pillar 3) to ensure that every infection is detected and investigated to determine the likely location of infection; implement targeted measures for attacking both parasites and vectors to interrupt local transmission; eliminate all parasites in the human reservoir; and manage the risk of re-establishment through imported malaria.

**Enact legislation.** New legislation is needed to support changes in programme prioritization, such as to ensure that the over-the-counter sale of antimalarial medicines is banned and that surveillance is further strengthened to include compulsory notification of all confirmed cases of infection detected in both public and private health care facilities using digital technology. In addition, health ministries – with the support of relevant authorities – need to assume direct oversight of supply management for

malaria medicines; build a centralized reporting system for epidemiological surveillance of malaria, vector control data, outbreak reporting, and preparedness and response; and intensify coordination among public, private and community-based agencies and services.

**Renew political commitment, increase multisectoral support and deepen regional collaboration.** The final phase of elimination needs strong political commitment, predictable long-term financing, multisectoral support and increased collaboration between neighbouring countries. Political commitment must be translated into budgets and financing for sufficient human resources at the national and subnational level and commodities. Independent national elimination committees that report to the Minister of Health or above can provide oversight, extra assistance and accountability. Sectors outside health (such as agriculture, environment, industry and tourism) must bring their resources and perspectives to bear in helping the country to eliminate and prevent re-establishment of malaria. Regional collaboration is important to facilitate cross-border communication and coordination efforts, to address transmission foci that cross international boundaries and to resolve common bottlenecks.

**Detect and treat all malaria infections for free to attain elimination and prevent re-establishment.** As countries reach very low transmission levels, the last cases of malaria may occur in populations facing discrimination and in traditionally marginalized groups with limited access to diagnosis and treatment. Solutions should be found for protecting itinerant population groups and migrant workers within and across countries by informing them of the potential dangers of the disease, and providing free access to prevention and treatment through accessible health clinics.

**Implement transmission-blocking chemotherapy.** Transmission-blocking chemotherapy is the use of effective antimalarial medicines to reduce the transmission of gametocytes, the sexual stage of *Plasmodium* that are infectious to mosquito vectors, thereby interrupting the malaria transmission cycle. WHO recommends transmission-blocking chemotherapy to reduce malaria transmission, particularly in areas threatened by resistance of *P. falciparum* to artemisinin and as part of strategies to eliminate *P. falciparum*.[3] This intervention is currently recommended in areas with low transmission and where treatment coverage is high. Transmission-blocking strategies are currently available for falciparum malaria but have not been developed for other malaria parasites.

**Intensify surveillance efforts.** As malaria programmes progress towards elimination, the aim of surveillance is to detect all malaria infections, whether symptomatic or not; to investigate each individual case of infection, identifying the likely location of infection to direct actions to interrupt transmission; and to ensure that each detected case is promptly treated and followed in order to prevent secondary infections. Although infections may occur sporadically or in distinct foci, surveillance systems must cover an entire country, with particular attention to areas with ongoing or recent history of transmission. Case investigations and detection of infections among people who share their living environment with someone diagnosed with malaria at a health facility will provide information on potential exposure to the same sources of infection, thereby elucidating whether local transmission is occurring or whether cases have been imported. Countries should monitor imported infections, which represent a significant proportion of all infections in the elimination phase and may pose a risk for re-establishment of transmission in areas where it had previously been interrupted *(16)*.

**Implement targeted malaria vector control.** As transmission decreases to low levels in countries or subnational areas, universal coverage of populations at risk of malaria with vector control interventions should be maintained in vulnerable settings to prevent resurgences. For a given area, the defined population at risk will likely change as programmes proceed along the path to elimination. A shift from universal

3 Section 5.2.5 Reducing the transmissibility of treated P. falciparum infection in areas of low-intensity transmission in the *WHO Guidelines for malaria (7).*

coverage to the targeting of vector control in specific areas or defined transmission foci may be justified in circumstances where the inherent transmission potential is low and surveillance systems are strong, and where there is a high level of preparedness and the ability to respond quickly in the event of a resurgence. Targeted IRS can play an important role in some settings as a response to outbreaks and resurgences, or to eliminate transmission foci. As transmission declines, there may be an increased need for other vector control measures such as larval source management.

**Use medicines to reduce the reservoir of infections.** Ensuring that malaria parasites are fully cleared from infected people through public health interventions will require new approaches that are not yet part of the WHO-recommended arsenal of interventions. Strategies such as mass drug administration (MDA) have been successfully used in the past and are currently being explored in a range of transmission settings. Targeted administration of medicines to groups at high risk of infection due to occupation or activities is also being evaluated as a strategy to interrupt transmission. Other research is evaluating the impact and longer term effect of administering effective antimalarials to either an entire population or targeted population groups, including treatment of infected individuals screened for malaria parasites with highly sensitive tests.

**Devise *P. vivax*-specific strategies.** For elimination to succeed, greater attention must be given to *P. vivax*, a parasite less well understood than *P. falciparum*. Vivax malaria presents multiple challenges and needs specific strategies. The challenges include the following:

- *P. vivax* tolerates a wider range of environmental conditions than *P. falciparum* and therefore has a wider geographical range.
- *P. vivax* can be transmitted from humans to mosquitoes before infected people develop symptoms.
- Dormant hypnozoites are more difficult to detect because the parasitaemia is typically low and because the dormant hypnozoites residing in the liver cannot be detected with existing diagnostic tests.
- Hypnozoites can give rise to multiple relapses and contribute to significant morbidity and onward transmission.
- *P. vivax* hypnozoites can only be eliminated through treatment with drugs belonging to the 8-aminoquinoline class, which can produce serious side effects (haemolytic anaemia) in patients who have G6PD deficiency, and such treatment is contraindicated in vulnerable population groups such as infants and pregnant or breastfeeding women.
- Testing for G6PD deficiency will become more accessible as point-of-care testing solutions are available, but human and financial resources will be required to appropriately support safe and effective implementation of G6PD testing services in a range of settings.
- Chloroquine-resistant vivax malaria is spreading.

**Prevent re-establishment of local malaria transmission.** Even after the disease has been eliminated from a country or subnational area, continued importation of malaria cases means that the quality of surveillance and sensitivity of case detection must remain high. Vigilance for possible renewed local transmission is a responsibility of the general health services as part of their normal function in communicable disease control, in collaboration with other relevant sectors (such as agriculture, environment, industry and tourism). Individuals who plan to travel to areas where malaria is endemic should be provided with health information, chemoprophylaxis and advice about measures to protect themselves against mosquito bites. These steps are aimed at protecting individuals from severe illness or death and reducing the importation of parasites. Visitors and migrants from endemic areas should be informed of the risks

of malaria and given easy access to free-of-charge diagnostic and treatment facilities. Vector control must continue to be used to contain local outbreaks and to protect areas that are known to be receptive to the resumption of transmission and exposed to frequent importation of malaria parasites. The patterns of vigilance that need to be applied to ensure the successful maintenance of malaria-free status depend on the risk of importation and receptivity of an area. Transmission foci that cross international boundaries are at heightened risk of introduced cases, and joint, cross-border analyses of the malaria situation in these foci should be undertaken to develop specific and actionable plans to maintain these areas free of local transmission. The programme for prevention of re-establishment of transmission has an unlimited duration. Therefore, surveillance should be maintained in countries that no longer have transmission.

## PILLAR 3. TRANSFORM MALARIA SURVEILLANCE INTO A KEY INTERVENTION

Irrespective of where countries are on the path to elimination, surveillance of malaria should be considered a central intervention in national and subnational malaria strategies. Surveillance as an intervention encompasses tracking the determinants and levels of transmission intensity and burden of malaria; the populations at risk and their geographic distribution; their access to, use and equity of malaria prevention and treatment interventions; and the effectiveness of these interventions. The surveillance system itself should be monitored to ensure that it is fit for purpose. All this information should be used to take appropriate action to improve impact. In recent years, there have been considerable improvements in surveillance systems in most high-burden countries. However, these are often unable to capture essential malaria data in a complete, accurate and timely manner, thereby making it difficult to optimize responses, assess disease trends, health disparities and gaps in interventions, and respond to outbreaks. Frequent stockouts of malaria commodities, delays in data aggregation and transmission, weak validation and feedback processes, limited use of data for decision-making, and the near absence of reporting from the private health sector remain important challenges. Surveillance may function most intensively as an intervention when programmes are closest to elimination. However, effective surveillance is required at all points on the path to elimination and should be anchored within national health information systems. To interpret data effectively for operational, strategic and policy purposes, all levels of the malaria programmes should strengthen their data analysis and use capacities. The benefits of effective surveillance and the actions needed to transform surveillance are described below.

Strong malaria surveillance enables programmes to optimize their operations by empowering programmes to:

- advocate for investment from domestic and international sources, commensurate with the malaria disease burden in a country or subnational area;
- identify populations experiencing disadvantage, including those left behind, determine the extent of the inequalities, barriers or disparities that they face, and allocate resources to the populations most in need and to the interventions that are most effective in order to achieve the greatest possible public health impact;
- assess regularly whether plans are progressing as expected or whether adjustments in the scale or combination of interventions are required;
- account for the impact of funding received and enable the public, their elected representatives and donors to determine if they are obtaining value for money;
- evaluate whether programme objectives have been met and learn what has worked and not worked so that higher quality and more efficient and effective programmes can be designed;

- identify and respond to biological threats to progress against malaria; and
- provide the necessary information to certify that a country has achieved malaria elimination and prevent its re-establishment.

**Surveillance in areas of high transmission.** Data analysis and programme monitoring are based on aggregate numbers, and actions are undertaken at the population level to ensure that all populations have access to necessary services and there are no adverse disease trends *(16)*. Accurate and timely information on the numbers of and trends in malaria-associated deaths is a key requirement for tracking the progress of malaria control. Concerted efforts should be made to ensure that all admissions for malaria to hospitals and health centres and deaths from malaria therein are confirmed by a parasitological test and reported through a national surveillance system. The representativeness of hospital data should be characterized in selected sites that have well-defined catchment populations and that continuously track the cause of death. Data on the efficacy of malaria interventions, entomological data from sentinel sites, climate data from meteorological and satellite sources, population-level information on the coverage of interventions and treatment-seeking patterns, and operational programmatic data (financial, human resources, logistics and supply chain) are critical to national strategy and the tailoring of interventions subnationally to optimize impact.

**Surveillance in areas of low transmission.** In areas where rates of transmission are low or moderate, there is appreciable heterogeneity in the distribution of malaria. It becomes increasingly important to identify the population groups most susceptible to disease, including groups traditionally marginalized or facing discrimination, and to target interventions appropriately. Malaria can be concentrated in marginalized populations, such as those living in remote or border areas, itinerant and migrant workers, and migrant and tribal populations with limited access to services. It may be necessary to take diagnostic testing and treatment services directly to populations without access to services (i.e., to undertake proactive case detection and treatment). As the immunity of populations at risk wanes as interventions take effect, it is important for programmes to be vigilant against potential outbreaks, with intensified reporting (e.g., weekly) of the incidence of infections and the monitoring of major determinants of transmission, such as meteorological data. Routine surveillance should transition from aggregate data to case-based reporting, with frequency of reporting determined by the anticipated programmatic response. At this point, countries may consider using electronic platforms at all points of care to improve the efficiency of the surveillance system. Population-wide surveys become less useful and increasingly countries will rely on granular programmatic data.

**Surveillance in areas targeted for elimination of malaria.** Malaria-specific reporting systems are increasingly needed to satisfy the additional information demands for targeting and monitoring interventions in particular risk groups and foci. As progress is made towards elimination, it becomes necessary to investigate individual cases of infection or clusters of cases in order to understand risk factors and eliminate foci of transmission. It also becomes increasingly important to ensure that surveillance systems capture data on cases detected by private sector care providers, both formal and informal. Increasing resources and capacity are required to run and maintain malaria surveillance systems that become more complex and resource-intensive in moving to the elimination phase. Additional skills, training and activities will have to be provided for the personnel involved. Strong surveillance systems need to be maintained to sustain the status of elimination once it is achieved. Countries also need to monitor the risk of importation (vulnerability) and the transmission potential in risk areas (receptivity) *(16)*. Over time, targeted genomic surveillance may provide additional information on importation, transmission chains and transmission intensity *(17)*.

**Invest in routine national information systems.** Routine information systems are crucial for UHC and the delivery of appropriate malaria interventions across the transmission continuum. Sufficient investments must be made in the recording, transmission, management and use of data from improved routine information systems in order to generate the information needed for programme planning, implementation and evaluation. Adequate financial and logistical support is needed for provision of office supplies and equipment, training and retraining of staff, supervision of health facilities, and communications. Data reporting requires management with quality controls in place and good follow-up, and digital solutions should be explored to improve efficiencies and overall data quality. Building the technical capacity of staff for data analysis and interpretation is the overriding need in order to enable programmes to use surveillance information most effectively. For countries to strengthen and sustain the practice of using data for decision-making, dynamic data repositories are necessary at national and subnational levels. These platforms should be linked to national routine systems and should integrate efficacy, household survey, programmatic, and social, behavioural and cultural data to enable routine operations, along with detailed annual subnational programmatic reviews and, where necessary, stratification to further tailor interventions and response, while taking into account gender, human rights and equity considerations.

**Collect necessary data for understanding disease trends and overall programme performance.** Necessary information includes data on the resources available for malaria control (programme financing, staff and commodities), existing levels of service provision (access to services and intervention coverage), and trends in health service utilization. It also covers data on the populations affected, including malaria parasite prevalence rates and factors associated with a higher risk of acquiring malaria. Multiple sources of data include routine information systems (to track finances, commodity flows, service delivery and disease trends), health facility surveys (to track implementation of services delivered by health facilities), household surveys (to track programme coverage and parasite prevalence in populations), and findings of implementation research. Entomological monitoring systems are required to periodically update information on vectors and their behaviour and susceptibility to insecticides. Therapeutic efficacy studies are essential for detecting resistance to antimalarial medicines. The weight given to different data sources will vary according to the level of malaria transmission and the maturity and capacities of the malaria programme.

**Develop national malaria strategic plans that take into account the epidemiology and heterogeneity of malaria in a country.** A key approach to optimizing malaria responses within a country or territory will be the subnational tailoring of interventions through the process of stratification, in which a country or area is divided into smaller units where different combinations of interventions may need to be delivered *(9)*. These analyses should be the basis for developing evidence-informed national malaria strategic plans that are owned and led by countries. The process relies on mapping operational units and their relevant stratification-based demographic, epidemiological, entomological, climatic, health system and other contextual information. This information, linked to the criteria for implementing WHO-recommended interventions, is expected to result in optimized subnationally tailored intervention mixes. Mathematical models may help countries to understand the impact on malaria of the scenarios with different combinations of interventions. National strategic plans should also take into account the readiness of health systems to expand malaria programmes and identify the resources required to achieve the intended levels of coverage and impact. They should define the roles of different stakeholders in the implementation of the plan and set targets for monitoring progress and ensuring accountability.

**Monitor the implementation of national malaria strategic plans at regular intervals.** In particular, annual reviews should be undertaken before budgets are prepared; mid-term reviews may be conducted to assess interim progress; and a

final programme review should be undertaken before developing the next strategic plan. Feedback showing the status of selected key indicators should be communicated to districts and health facilities on a monthly or quarterly basis and include private health facilities. It is important that data are summarized in ways that enable staff in health facilities and districts to readily assess the facilities' performance. Monitoring of community-level intervention delivery, such as ITNs and SMC, can be tracked at households and villages using digital solutions. Such solutions allow for timely identification of gaps in distribution and promote immediate course corrections. Programme monitoring and surveillance should not be confined to malaria programme managers and implementers. Other government departments, elected leaders, community members and donors have a stake in ensuring high-quality malaria programmes and need to be able to scrutinize the operations they are supporting. If involved in the review process, they can help to ensure that malaria programmes are responsive to populations' needs and that malaria control and elimination are promoted as a development priority.

**Ensure the surveillance system is monitored.** Routine health information systems and well-functioning disease surveillance enable programmes to monitor malaria financing, intervention coverage and disease trends. It is important that the performance of the surveillance system itself is also monitored through metrics such as the percentage of health facilities submitting monthly reports, the proportion of health facilities receiving quarterly feedback, and, in the advanced phase of malaria elimination, the proportion of cases and deaths investigated. Other important characteristics that should be evaluated periodically include data timeliness, accuracy, representativeness and validity. Monitoring the surveillance system itself will identify weaknesses and enable actions to be taken to improve surveillance, which in turn can improve the performance of the malaria programme and accelerate progress towards malaria elimination.

# SUPPORTING ELEMENTS

## SUPPORTING ELEMENT 1. HARNESSING INNOVATION AND EXPANDING RESEARCH

New interventions (tools, technologies and approaches) to enhance the fight against malaria are expected to become available within the lifetime of this Strategy. These may include new and more effective medicines, combinations of medicines, improved diagnostics, vaccines, new insecticides, other innovative vector control interventions, and genomic approaches. Programmes should undertake relevant implementation research to refine approaches and apply existing interventions as effectively and efficiently as possible in their local contexts. Implementation research will need to focus on equitable population coverage and intervention uptake in the short and long terms, as well as human resource issues supported by a human rights, gender-responsive and inclusive approach. As candidate interventions become available, WHO will review them, and recommend and prequalify them when applicable. Countries should continue to strengthen the national regulatory environment and facilitate appropriate uptake of validated interventions, coupled with robust post-marketing surveillance. Countries need to have the capacity to assure the quality of existing and new products and equipment. Implementation research can identify – and determine how best to overcome – many of the bottlenecks to the early and equitable introduction of new interventions. The priorities in five different areas are outlined below.

## Vector control

Timely and affordable access to effective vector control interventions by populations that need them, including those interventions needed to mitigate insecticide resistance and residual transmission, is a key component of malaria control and elimination efforts. Numerous interventions are in development, aiming to address these areas. These include new insecticides, formulations or methods of application, new attractants and repellents, new bioactive agents (e.g., fungi or endo-symbionts), new mosquito life-cycle targets (e.g., sugar feeding, mating or oviposition phases), genetically modified mosquitoes, and endectocides. Interventions are also needed to protect people when they are outdoors. New strategies are being explored to improve the delivery of interventions, such as the novel use of mobile phone technology and digital mapping.

The improvement of existing vector control interventions – ITNs and IRS – and rigorous evaluation of these improvements is a priority area that requires further attention given the continued large expenditures on these interventions. Besides assessing the impact of repurposed or new active ingredients when delivered via ITNs or IRS, the development and validation of nets with prolonged residual effect and physical integrity are important.

Countries and the global community must work with industry and research institutions to evaluate candidate interventions, and to develop new or improved methods to test for insecticide resistance, including the identification and validation of markers of insecticide resistance.

## Diagnostic testing and treatment

Research is required to assess the performance of new diagnostic technologies and to ascertain the effectiveness of different testing strategies to support surveillance and case management at higher transmission levels, in order to appropriately target interventions, and when countries enter the elimination phase. Better species-specific point-of-care rapid diagnostic tests are needed for all non-falciparum malaria parasites, and non-HRP2-based diagnostics are needed for *P. falciparum* to circumvent the problem of *pfhrp2/3* deletions. Tests to identify carriers of *P. vivax* hypnozoites would facilitate the targeting of anti-relapse therapy.

Simple, point-of-care rapid diagnostic tests are needed to establish the G6PD status of individuals in order to expand access to treatment of vivax malaria with 8-amino-quinoline antimalarials.

A robust pipeline of new candidate therapeutic and chemoprevention agents is required because the long-term usefulness of any medicine or combination is threatened by the emergence and spread of resistance. The ideal combination would be a safe, effective and affordable single-dose treatment that can produce radical cure, reduce the transmissibility of gametocytes, deliver prophylactic effects for both *P. falciparum* and *P. vivax* infections, and be used during pregnancy and in people with G6PD deficiency. New regimens of medicines that are safe, well-tolerated and affordable, avoid promoting resistance, and demonstrate a broad spectrum of activity need to be developed for the treatment of confirmed clinical cases and for potential mass use against the parasite reservoir, including the sexual stages of both *P. falciparum* and *P. vivax*. New regulatory pathways will need to be created to develop novel chemoprevention agents, as well as clear research strategies for developing antimalarial medicines for preventive treatment.

Reliable and easily applied and interpretable tests for molecular markers of drug resistance for all components of medicine combinations are urgently required. The identification and validation of molecular markers will improve our ability to monitor the emergence and spread of resistance to each component compound individually. In addition to molecular markers detecting resistance of *P. falciparum*, markers are

also needed to detect resistance of *P. vivax*. The monitoring of molecular markers for drug resistance, once they become available, will be particularly useful in areas of low transmission where therapeutic efficacy studies are increasingly difficult to perform.

Context-specific strategies are required to ensure optimal treatment-seeking behaviours, increased demand for recommended testing and treatment, and equitable access for people in regions with continuing transmission. Innovative evidence-based methods should be devised to ensure that both public and private providers, and those outside the formal health system, adhere to standard guidelines for detecting, treating and recording all malaria cases.

## Malaria vaccines

Malaria vaccines are expected to be an important addition to the arsenal of interventions in the future. Several vaccine candidates, with different modes of action, are in various stages of development to prevent *P. falciparum* and *P. vivax* infections. RTS,S/AS01 received a positive scientific opinion from the European Medicines Agency in 2015 and began pilot implementation through the routine health services in parts of Malawi, Ghana and Kenya in 2019. Systematic evaluation of the pilot will generate the evidence required to inform a potential WHO recommendation on the large-scale implementation of the vaccine. Malaria vaccines are currently envisaged as a complementary intervention that should not replace the package of existing interventions.

## Surveillance

As countries increasingly tailor their mixes of interventions subnationally, the complexity of the indicators needed to track progress and assess impact will increase. Innovation in the design of national surveillance, monitoring and evaluation systems will be required. Improvement in the measurement of the denominator population upon which operational and population intervention coverage levels are quantified is critical. Adaptable and less expensive approaches for the design and implementation of household surveys represent an important area of methodological innovation.

Advances in information technology and communications offer prospects for the increased timeliness of reporting, better sharing of data (between information systems and different levels of a health system), and enhanced data analyses and visualization. Information technology can be applied to optimize and improve procurement and supply management, early warning systems, and the mapping of disparities or gaps in service delivery. Moreover, adoption of new technologies should offer the chance to improve the management of systems and strengthen the capacities and human resources involved.

Efforts are needed to enable better sharing of results of interventions, drug-sensitivity testing, *pfhrp2/3* deletions, insecticide resistance, and information about advances in surveillance and research that are often generated and held by multiple institutions *(18)*. All agreements for research and service delivery should include a provision for data-sharing, possibly through open-access portals.

Research is needed to identify which strategies are most effective at detecting cases, and to assess the effectiveness of response packages once cases have been detected.

## Elimination

Research is required to define the range of transmission settings in which reducing transmission by targeting the parasite reservoir is an effective intervention. This research will also need to define optimal combinations of interventions and to optimize intervals between treatments and methods for monitoring the effectiveness of this intervention.

Relapses of infection with *P. vivax* contribute to a significant proportion of transmission of vivax malaria from its hypnozoites in the liver. Strategies aimed at this parasite reservoir need to be developed as part of vivax elimination strategies, including those for people not eligible for therapy with 8-aminoquinolines.

Basic research is needed to develop new interventions to prevent transmission, including vaccines that target different stages of the parasite life-cycle and may be effective in preventing all infections, interventions that directly target the sexual stages and prevent infection of and from mosquitoes, and interventions that prevent outdoor biting.

## SUPPORTING ELEMENT 2. STRENGTHENING THE ENABLING ENVIRONMENT FOR SUSTAINABLE AND EQUITABLE RESULTS

A holistic approach, anchored in the SDGs, is needed to optimally deliver malaria interventions and address the broader determinants of disease. Malaria interventions need to be embedded in, and supported through, a strong enabling environment that can ensure that efforts are expanded in an effective and sustainable manner through gender-sensitive, equity-oriented and human-rights-based approaches. It will require functional health systems, bolstered by political commitment, to reach the unreached and impact malaria and other health priorities. In addition, tackling malaria will contribute to health goals and sustainable development. The main activities to contribute to this enabling environment are as follows.

**Strengthen health systems.** Well-functioning, resilient health systems based on PHC are the foundation for global health security and UHC, including to tackle diseases such as malaria. Malaria should be integrated into health sector planning, budgeting and prioritization at local and national levels and included in relevant sector dialogue, supported by a human rights, diversity and inclusion approach with a focus on gender-responsive and equity-oriented initiatives. National programmes should ensure that all work on programme implementation and elimination is fully in line with and fully integrated into wider national health and development strategic priorities and draws upon WHO recommendations, adapted to suit their local context while avoiding a duplication of efforts. For durable results, national malaria programmes both depend on and should contribute to the strengthening of overall health systems. This includes basic health infrastructures, human resources, and vital registration systems to improve the environment in which national malaria programmes operate. Specific priorities include a stronger focus on improved supply chains for quality-assured diagnostics, medicines and vector control interventions, well-planned procurement, the harnessing of new technologies for data collection and management, and an appropriate regulatory framework to ensure safe use of quality-assured interventions by appropriately trained personnel in the public and private sector.

**Translate political commitments into action for UHC and a malaria-free world.** The progress made in reducing malaria in the context of the MDGs was a public health and political triumph. The SDG era provides further opportunity, as the world has committed to ensuring healthy lives and promoting well-being for all at all ages. Commitments, such as those made at the United Nations High-Level Meeting (UNHLM) "Universal Health Coverage: Moving Together to Build a Healthier World", will need to be translated into resources and actions to strengthen health systems and implement high-impact health interventions to combat diseases such as malaria, to protect women's and children's health, and to ensure that no one suffers financial hardship because they have to pay for health care out of their own pocket. There is a powerful opportunity for health and disease programmes and advocates to come together behind a shared vision of health for all. Strong national leadership is needed to define the direction and strategies, steward financial and technical resources for greater equity and efficiency, and ensure coherent action, trust and accountability through inclusive participation in health governance, while taking into account gender, equity and human rights perspectives to leave no one behind.

**Increase international and domestic financing.** Investments in health and malaria will contribute to more sustainable and equitable societies. If countries were to fall back on existing levels of intervention coverage because of lack of funding, some of the recent gains in global malaria efforts could be lost. High-level political commitment must translate into predictable and long-term financing for health, including malaria programmes. More public spending on health and better policies would reduce the likelihood of households facing financial hardship or forgoing life-saving health services. In addition to securing additional domestic funding, technical and allocative efficiency enhancements can generate additional resources for malaria and the health sector. International donors are encouraged to increase their commitments to malaria goals, aligning resources behind national targets, plans and programme priorities to leave no one behind. New financing solutions should be conceived of to tap into emerging development financing and private sector resources.

**Contribute to robust health delivery platforms and "PHC for UHC".** Many people living in countries where malaria remains a priority public health challenge still lack access to essential health services or are pushed into extreme poverty by paying for them. It is time to reach all those in need by investing in good-quality, integrated front-line primary and emergency care, equipped with essential medicines and commodities. Strong collaboration and linkages between malaria programmes and other health programmes – such as reproductive, maternal, neonatal child and adolescent health programmes, laboratory services and regulatory authorities (for diagnostic devices, medicines and insecticides) – is essential for the successful delivery, implementation and coordination of malaria interventions. Integrated, people-centred community services, such as iCCM, have an important role, particularly for populations living in remote or hard-to-reach areas with limited access to health facilities. Community care will need to be scaled up, not as isolated projects, but as an integrated element of the broader delivery system. In many countries where malaria is endemic, the private sector is the first point of care for a significant proportion of the population. Engaging the private sector in service delivery will require effective governance of the whole health system – both private and public – to ensure quality of care and financial protection for patients, irrespective of where they seek care. This will facilitate the appropriate reporting to the national surveillance systems of all malaria cases, treatment outcomes and deaths.

**Strengthen the health workforce and build skills for malaria.** The health workforce is an essential part of the health system that needs to be valued and respected. Yet, in most countries where malaria is endemic, there is a chronic shortage of skilled health professionals, clinical practices are outdated, surveillance systems are inadequate, and monitoring and evaluation are weak. The public health capacity in many countries remains inadequate to deal with existing health priorities, let alone emerging challenges. Robust expansion of malaria interventions requires capacity for data analysis, including data disaggregation by sex, age and other categories or inequity dimensions. This disaggregation enables the identification of gaps or health disparities that need to be addressed in order to respond to this dynamic environment and deliver targeted responses to populations experiencing disadvantage, discrimination or exclusion. Significantly augmented human resource capacities are needed at national, district and community levels, including the deployment of health workers to cater to populations that are traditionally marginalized, underserved or facing discrimination. Regulations on who can test and treat need to be aligned with policies for expansion of services. To meet the health needs of their people, governments will need to draw upon a broad range of expertise, including local capacity, knowledge and solutions, to ensure that the available resources are used wisely and that quality services are accessible to those who need them, taking into account gender, human rights and equity considerations and leaving no one behind. Training must include a focus on the management of the disease for at-risk populations, including women during pregnancy in all their diversity. Efforts also need to be made to recruit, train and retain human resources for health that are representative of the populations most affected by malaria and from groups facing

discrimination or who have been traditionally marginalized. The education, training and motivation of health workers, programme staff, entomologists and malaria researchers – including adequate mentoring, supervision and compensation – are key to solving problems and ensuring effectiveness. The maintenance of robust malaria programmes and capacities is paramount at every step along the path to elimination and preventing re-establishment of transmission.

**Empower individuals, families and communities as participants and beneficiaries of health systems.** The cornerstone of stronger health systems is PHC, and a critically important element is the provision of comprehensive health care as close as feasible to people's everyday environment. PHC includes systematically addressing the broader determinants of health and empowering individuals, families and communities to optimize their health, as advocates for policies that promote and protect their health and well-being; as co-developers of health and social services; and as self-carers and caregivers to others *(19)*. Involving people and communities in their own care and in the design of their health services is now recognized as a key determinant of better outcomes. Meaningful participation of community leaders, target populations and nongovernmental implementing partners is an essential factor for success. Malaria interventions cannot succeed unless communities are fully engaged and able to fully realize the benefits from the use of prevention tools and recommended therapies. Evidence-based and well-planned public health communication and behaviour change programmes are essential for educating, engaging and mobilizing affected communities around the benefits and correct use of malaria prevention, while increasing community ownership of the initiatives. People-centred care requires that people have the education and support they need to make decisions and to participate in their own care.

**Address the broader determinants of malaria.** The huge reductions in malaria made during the MDG period were augmented by a period of considerable economic growth and development, infrastructure and housing improvements, rapid urbanization, and general improvements in health systems and population health. Yet, the rapid urbanization and migration to cities at times led to disparities in housing that increased population density and overcrowding. Many social and environmental factors continue to increase people's risk of malaria and impede people's access to quality-assured prevention and care services. National malaria programmes will need to better engage with broader development processes to embed health and malaria in poverty-reduction strategies, national development plans and regional development cooperation strategies. The response should be elevated from a single-disease approach to a health-in-all-policies approach. Political and community action is needed to address factors such as the environment, climate, marginalization and discrimination, lack of education, inadequate income and poor housing. Other sectors have an important role to play as they can contribute to malaria vector breeding and malaria transmission (agricultural, irrigation, urban planning, water and sanitation, and mining sectors); serve as reservoirs of malaria parasites; and bear the socioeconomic brunt of malaria morbidity.

**Encourage private health sector participation.** The private health sector, including industry, health facilities and other actors, has a vital role in the delivery of commodities and services, and in the development of new interventions and bringing them to market. New and improved partnerships are needed to strengthen the supply chain for commodities. These partnerships can also play an important role in protecting workers who are recruited for major development projects and treating those who become infected. Additionally, the private sector can play an important role in mobilizing and contributing to domestic financing to support the programme.

**Improve government coordination and cross-border collaboration of malaria programmes.** Coordination within country and across borders is needed given the large number of interested stakeholders and partners, including development partners, private industry, research and academia, private sector health facilities, nongovernmental organizations, community health workers and national public health

systems. Effective cross-border collaboration between national programmes must be initiated and strengthened in order to ensure optimal coverage of interventions in these areas, avoid duplication of efforts and leave no one behind.

## COST OF IMPLEMENTING THE GLOBAL TECHNICAL STRATEGY

To reach over 80% coverage of currently available interventions, malaria investments, including both international and domestic contributions, need to increase substantially above the current annual spending of US$ 3.0 billion. The annual investment will need to increase to an estimated total of US$ 9.3 billion per year by 2025 and US$ 10.3 billion by 2030. The cost of implementation has been estimated from the quantities of goods required for expanding interventions, multiplied by the estimated unit cost for the provider to deliver each intervention, and an analysis of the surveillance and financing data available in national strategic plans and WHO's annual world malaria reports *(1)*. Additional funding of US$ 8,515 million is projected to be needed for research and development during the period 2021–2030, representing an average annual investment of US$ 851 million. This estimate stems from a risk-adjusted portfolio model of malaria research and innovation needs until 2030 *(20)*.

Analysis of the cost of the Strategy will be updated regularly as important variables, such as commodity costs, change over time.

## MEASURING GLOBAL PROGRESS AND IMPACT

Global progress in reducing mortality and morbidity and finally eliminating malaria will be dependent on countries' surveillance efforts. Progress will be measured using multiple data sources, including routine information systems, household and health facility surveys, and longitudinal studies. Progress should be monitored through a minimum set of 13 outcome and impact indicators (see Table 2) drawn from a larger set of indicators recommended by WHO and routinely tracked by malaria programmes. Certain indicators are applicable only to subsets of countries, which are defined by levels of malaria endemicity (e.g., IPTp in sub-Saharan Africa) or by the position on the path to elimination (e.g., investigation of cases and foci for programmes engaged in malaria elimination activities). For other indicators, such as those for vector control, the population at risk who may benefit from the intervention may be defined differently for programmes at different points along the path to elimination. Countries should ensure that a 2015 baseline for at least these 13 indicators, where appropriate, is available so that it is possible to monitor progress throughout the course of the Strategy.

As countries increasingly tailor their mixes of interventions subnationally, the measurement of indicators for tracking progress towards the Strategy's milestones will be more complex, and their interpretation will require great care. For example, for measuring the coverage of a given intervention, the population at risk will need to be quantified as the population that is considered 'eligible' for the intervention, not the whole administrative unit or country. Aggregation to national, regional and global levels must also account for this. This will require a different approach to design current population survey samples and potentially a consideration of other novel methods to measure intervention coverage. The 13 indicators selected to monitor the Strategy are not considered static; as new interventions are scaled up, the list will be updated accordingly.

### TABLE 2. INDICATORS FOR THE POST-2015 GLOBAL TECHNICAL STRATEGY FOR MALARIA 2016–2030

**OUTCOME**

- Proportion of population at risk who slept under an insecticide-treated net the previous night
- Proportion of population at risk protected by indoor residual spraying within the past 12 months
- Proportion of pregnant women who received at least three or more doses of intermittent preventive treatment of malaria while attending antenatal care during their previous pregnancy (sub-Saharan Africa only)
- Proportion of patients with suspected malaria who receive a parasitological test
- Proportion of patients with confirmed malaria who receive first-line antimalarial treatment according to national policy
- Proportion of expected health facility reports received at national level
- Proportion of malaria cases notified within 24 hours (programme engaged in elimination)
- Proportion of cases investigated (programmes engaged in elimination)
- Proportion of foci investigated (programmes engaged in elimination)

**IMPACT**

- Malaria case incidence: number of confirmed malaria cases per 1000 persons per year*
- Malaria mortality rate: number of malaria deaths per 100 000 persons per year*
- Number of countries that have newly eliminated malaria since 2015
- Number of countries that were malaria-free in 2015 in which malaria was re-established

* In some countries where routine surveillance systems have low coverage and completeness, parasite prevalence (i.e., the proportion of the population with evidence of infection with malaria parasites measured during community surveys) is used as a basis for quantifying morbidity or as a covariate in estimating the fraction of death due to malaria. In those countries, parasite prevalence, while not an impact indicator for the Strategy, is a critical input in measuring progress.

# ROLE OF THE SECRETARIAT

The Secretariat will continue to provide support to Member States and work closely with organizations in the United Nations system, donors, intergovernmental organizations, institutions of research and academia, and all other technical partners whose work is fundamental to the successful implementation of this Strategy. The Secretariat will undertake the following activities to help achieve the global, regional and national targets for malaria control and elimination.

The Secretariat will continue to recommend, communicate and disseminate normative guidance, policy advice and implementation guidance to support country action. It will ensure that its recommendation development process – which includes the Malaria Policy Advisory Group and area-specific Guideline Development Groups – is responsive to the rapidly changing malaria context and that its global technical guidance is regularly updated to incorporate innovative interventions that are proven effective. The Secretariat will continue to assess and prequalify vector control products, diagnostics and antimalarial medicines.

The Secretariat will provide guidance and technical support to Member States in reviewing and updating their national malaria strategies in line with the priority actions

outlined in this Strategy. It will ensure that its own capacities are strengthened at the global, regional and country level to enable it to lead a coordinated global effort to reduce the disease burden by at least 90% by 2030, and to support the implementation of all recommendations in this Strategy. It will work with Member States to develop regional implementation plans, where appropriate.

The Secretariat will support countries in strengthening their national malaria surveillance systems in order to improve the quality, availability and management of malaria data, and to optimize the use of such data for decision-making and programmatic responses. It will monitor implementation of the strategy and regularly evaluate progress towards the milestones and goals set for 2025 and 2030. It will also provide support to countries for developing nationally appropriate targets and indicators to facilitate the subregional monitoring of progress.

In line with its core roles, the Secretariat will continue to monitor regional and global malaria trends, and make these data available to countries and global malaria partners. It will support efforts to monitor the efficacy of medicines, diagnostics and vector control interventions, and – to this end – maintain global databases for efficacy of medicines, insecticide resistance and other biological threats to malaria control and elimination. It will regularly report to the regional and global governing bodies of the Organization, the United Nations General Assembly, and other United Nations bodies.

WHO will promote and encourage the research and knowledge generation that is required to accelerate progress towards a world free of malaria.

The Strategy will be updated at regular intervals in order to ensure linkage to the latest policy recommendations and complementary technical guidance.

# GLOBAL TECHNICAL STRATEGY AT A GLANCE

## VISION – A WORLD FREE OF MALARIA

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

## PRINCIPLES

- Country ownership and leadership, with involvement and meaningful participation of communities, are essential to accelerating progress through a multisectoral approach.
- All countries can accelerate efforts towards elimination through combinations of interventions tailored to local contexts.
- Improve impact through the use of data to stratify and tailor interventions to the local context
- Equity in access to quality health services, especially for populations experiencing disadvantage, discrimination and exclusion, is essential.
- Innovation in interventions will enable countries to maximize their progression along the path to elimination.
- A resilient health system underpins the overall success of the malaria response.

## STRATEGIC FRAMEWORK

– comprising three major pillars, with two supporting elements: (1) innovation and research, and (2) a strong enabling environment

**Maximize impact of today's life-saving interventions**

- **Pillar 1.** Ensure access to malaria prevention, diagnosis and treatment as part of universal health coverage
- **Pillar 2.** Accelerate efforts towards elimination and attainment of malaria-free status
- **Pillar 3.** Transform malaria surveillance into a key intervention

**Supporting element 1. Harnessing innovation and expanding research**

- Basic research to foster innovation and the development of new and improved interventions
- Implementation research to optimize impact and cost–effectiveness of existing interventions
- Action to facilitate rapid uptake of new interventions

**Supporting element 2. Strengthening the enabling environment**

- Strong political and financial commitments
- Multisectoral approaches, and cross-border and regional collaborations
- Stewardship of entire heath system including the private sector, with strong regulatory support
- Capacity development for both effective programme management and research

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