



The Lancet Commission on malaria eradication

Fifty years after a noble but flawed attempt to eradicate malaria in the mid-20th century, the global malaria community is once again seriously considering eradication. Momentum toward eradication has been building for decades and more than half of the world's countries are now malaria-free.

Since 2000, there has been a surge of global progress, facilitated by the rollout of new technologies and the substantial growth in political and financial commitment by countries, regions, and their global partners. Between 2000 and 2017, the rate of malaria cases and deaths worldwide declined by an estimated 36% and 60%, respectively.

The Lancet Commission on malaria eradication was convened in October 2017 to consider the feasibility, affordability, and merit of malaria eradication, to inform global opinion, and to identify priority actions for the achievement of eradication. Countries and regions face many pressing development challenges, of which malaria is just one. Thus, a 21st century commitment to malaria eradication must be justified based on solid evidence that it is achievable within a defined time period; that it is worthwhile, in relation to societal benefits and the return on investment; and that the alternative to eradication is untenable.

The Commission's report, published in September 2019, synthesizes existing evidence with new epidemiological and financial analyses to demonstrate that malaria eradication by 2050 is a bold but attainable and necessary goal. In the report—the first peer-reviewed academic document of its kind—the Commission examines the major operational, biological, and financial challenges on the path to eradication and identifies solutions that will enable the global malaria community to bend the curve and achieve a world free of malaria within a generation. The Commission also emphasizes the substantial social and economic benefits of malaria eradication, together with its mutually reinforcing relationship with universal health coverage and global health security.

"This report by The Lancet Commission on malaria eradication addresses a bold proposition: malaria, one of the most ancient and deadly diseases of humankind, can and should be eradicated before the middle of the 21st century."

Malaria eradication is possible

In 1900, nearly all of the roughly 200 countries in the world had endemic malaria.

In 2017, there were 86 such countries (Figure 1) and the pace of malaria elimination has accelerated in recent years: between 2000 and 2017, 20 countries achieved elimination and several others are on track to eliminate by 2020. Building off these successes, an increasing number of countries and regions are setting malaria elimination goals and developing strategies and roadmaps to guide and monitor progress. Global malaria organizations and donors are revising their policies in recognition and support of the growing momentum towards elimination at the country and regional levels.

Global social, economic, and environmental trends are, in most places, helping to reduce malaria. The Commission's models show that these trends alone will lead to greatly reduced but still widespread malaria by 2050. When the impact of enhanced access to high quality diagnosis, treatment, and vector control is factored in, the 2050 projections show a world largely malaria-free, but with low-level transmission persisting in pockets across roughly ten countries in equatorial Africa (Figure 2). Eradication requires that we bend the curve to transform this modeled future into an engineered future of a world free of malaria by 2050. The Commission argues that this can be

achieved by 1) improving malaria program management and implementation and making better use of existing tools – what we call the software of eradication, 2) rolling out new tools – the hardware of eradication, and 3) increasing financial investment in malaria elimination and eradication efforts. Success in these three areas will depend on strong leadership and the establishment of accountability mechanisms at subnational, national, regional, and global levels.

Improving eradication software

Successful national and regional elimination – and eventual global eradication – depends on effective program management and quality implementation of malaria interventions. Operational obstacles limit the success of malaria programs in many countries, however, and managers often lack access to the training and tools needed to address them. The Commission emphasizes the overwhelming importance of strengthening management capacity through rigorous training programs at the subnational and national levels, as well as the need for improved staff incentivization, the use of timely and high-quality data to inform decision-making, and active and sustained community participation in local elimination efforts.

"The quality and effectiveness of program implementation will continue to be stronger predictors of success than epidemiological trends or how much money is being spent."

Figure 1: Malaria cases per 1000 total population in 2017, by country

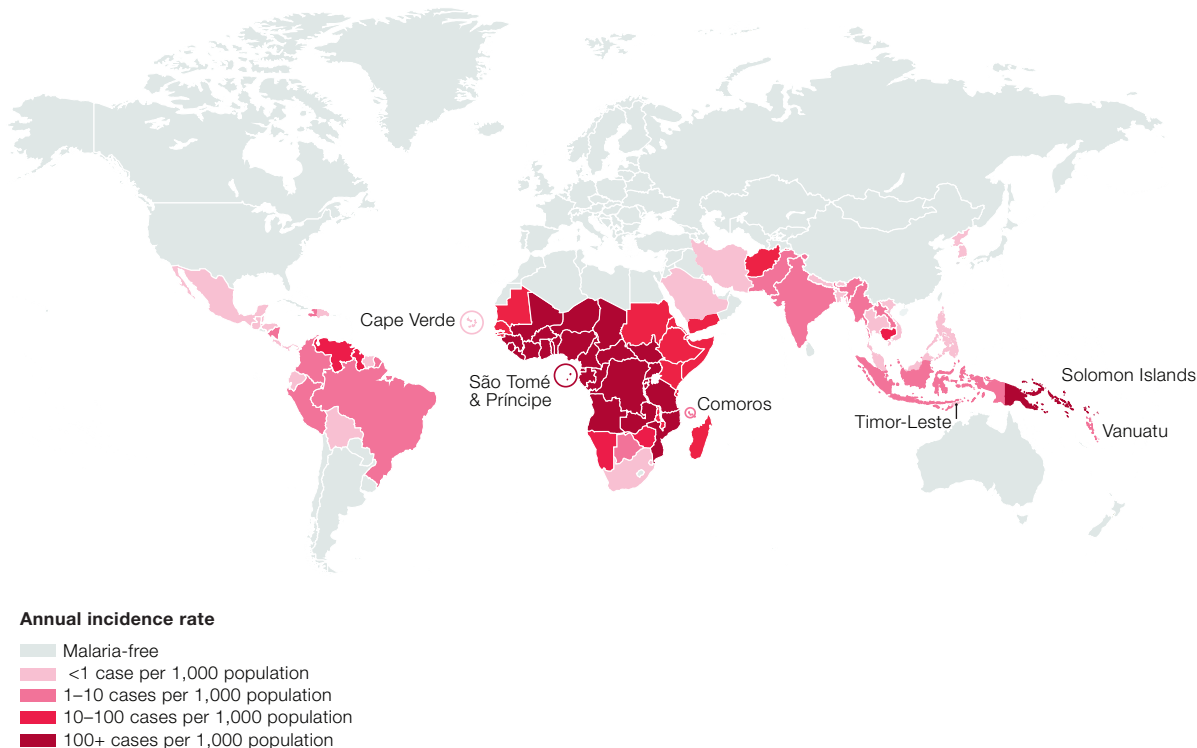
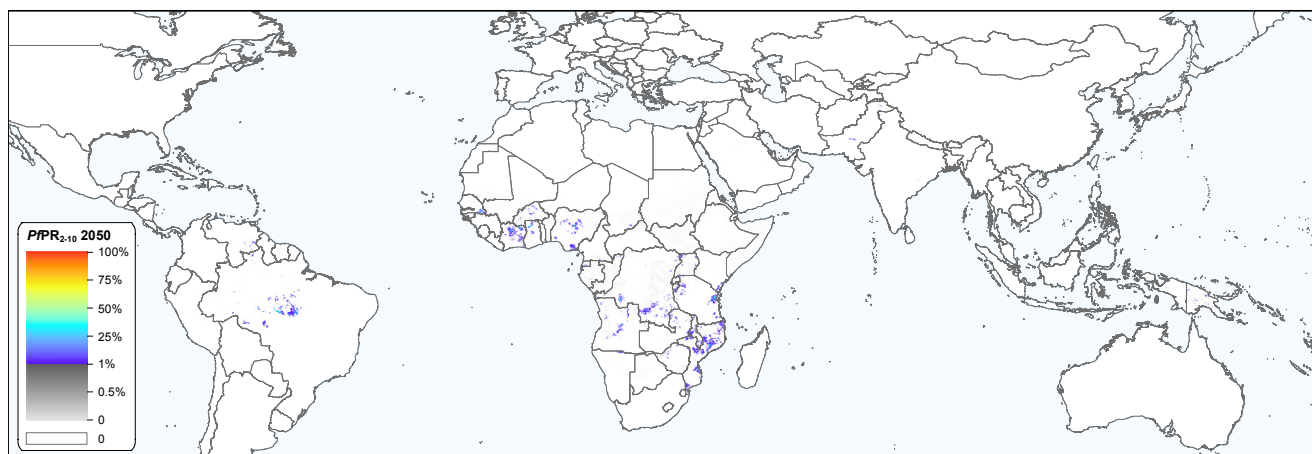


Figure 2: Projected future effect of global trends and enhanced malaria control on malaria endemicity



The map shows *Plasmodium falciparum* infection prevalence (children aged 2–10 years) projected for the year 2050. In this projection, malaria intervention coverage was enhanced above 2017 levels to reach 80% effective coverage of insecticide-treated nets, indoor residual spraying, and artemisinin-based combination therapies.

Other essential actions that will further strengthen program performance include:

- » *Leveraging the expertise and comparative advantages of the private sector, through outsourcing and stimulation of private markets for some commodities.*
- » *Forming close partnerships with private healthcare providers, to ensure that all malaria cases are correctly diagnosed, treated, and reported.*

- » *Deploying information technology solutions that facilitate faster and smarter collection, analysis, use, and sharing of data to inform the choice and targeting of interventions and improve the impact of existing tools.*

Rolling out new eradication hardware

The most pressing biological challenges to eradication include the development of drug and insecticide resistance, insufficiently sensitive parasite detection methods, limited

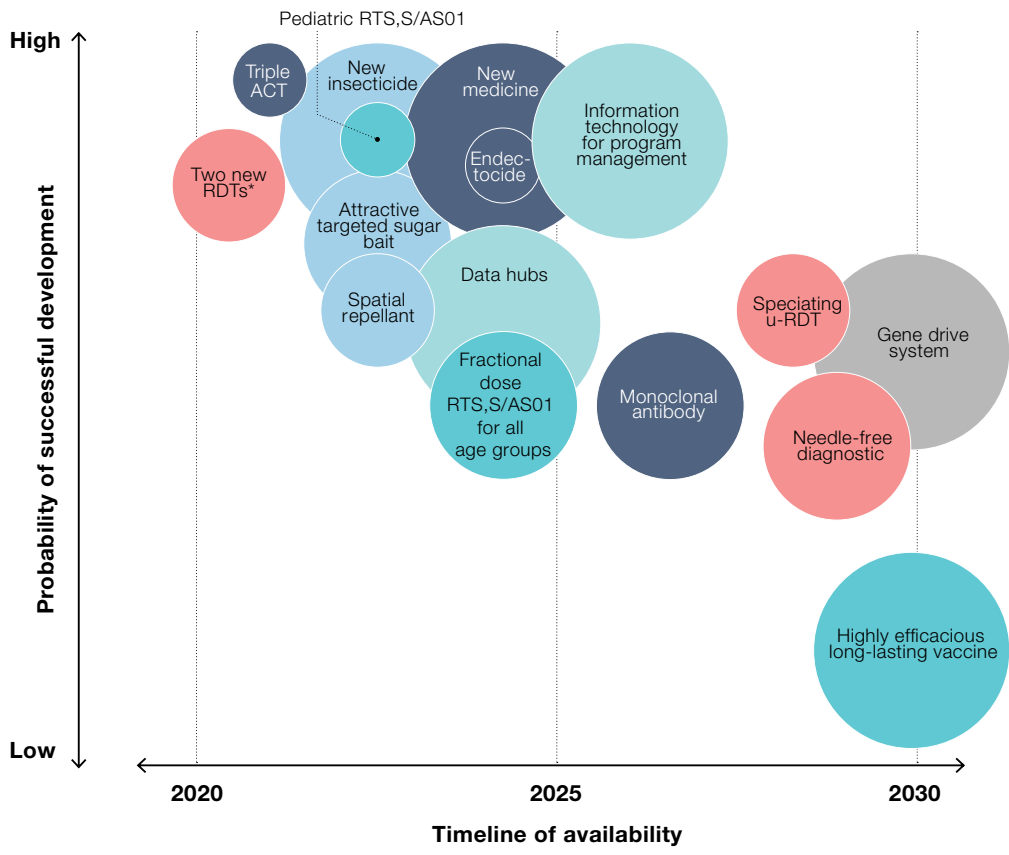
Learning from previous malaria eradication efforts

The first global campaign to eradicate malaria was launched by the World Health Organization in 1955. The Global Malaria Eradication Programme lasted for nearly fifteen years and succeeded in eliminating malaria from fifteen countries and significantly reducing transmission in several others.

However, the campaign experienced a series of setbacks and failures. When it formally came to an end at the World Health Assembly in 1969, it was decided that eradication should remain a long-term goal but should not be actively pursued due to numerous, seemingly insurmountable challenges.

Fifty years later, many of the major challenges identified during that first campaign still exist: complacency and lack of political will, poor leadership and management, insufficient funds, inadequate tools to eliminate in high transmission areas, and the relentless development and spread of drug and insecticide resistance. Yet, the malaria community is much better-positioned to address these challenges today. The citizens of malaria-endemic countries are much wealthier, healthier, and better educated than they were 50 years ago. There were more than 80 countries with a GDP per capita of less than US\$1,000 per year in 1969; today, there are fewer than 30 such countries in adjusted dollars. Technological capabilities have advanced beyond recognition compared to 1969, when the world was still 30 to 40 years away from widespread access to modern information and communications technology. New and highly effective tools, a strong product pipeline, five decades of scientific research and evidence generation, and invaluable lessons from previous and current disease eradication efforts are all available to guide eradication efforts. Most importantly, there is renewed energy and commitment to confront these challenges and finally eradicate one of humanity's most ancient and deadly diseases.

Figure 3: Research and development framework for malaria eradication



- Data and information technology
- Diagnostics
- Medicines
- Vaccines
- Insecticides
- Gene drive

This framework shows innovations according to the probability of successful development (vertical axis), the timeline of availability (horizontal axis), and their relative effect on accelerating eradication efforts (size of colored circle). Investment opportunities should be prioritized on the basis of the relative size of the colored circle and its probability of successful development. Product availability is based on prospective registration dates. ACT=artemisinin-based combination therapy. RDT=rapid diagnostic test. u-RDT=ultrasensitive rapid diagnostic test. *These include a *Plasmodium falciparum* RDT that does not rely on the detection of *pfrp2* and *pfrp3*, and a *P vivax* RDT.

“Although substantial progress can be made by improving management and optimizing the use of tools available now, new tools and strategies are essential for eradication by 2050.”

effectiveness of standard vector control interventions in areas with intense malaria transmission and where outdoor biting is common, and the spillover of zoonotic simian malaria into humans. Fortunately, tools with strong potential to overcome these challenges are either already

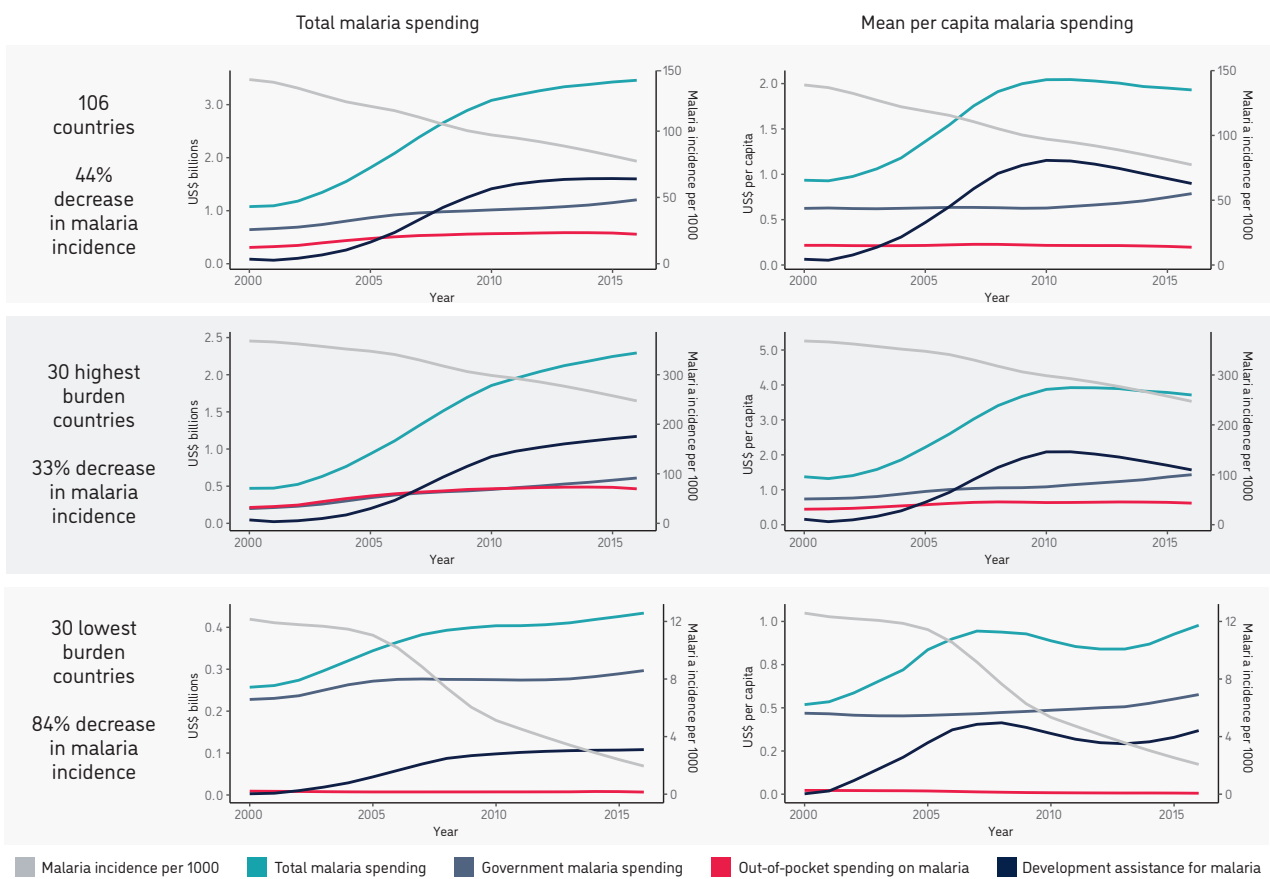
in the malaria community’s arsenal or are rolling out, and the research and development pipeline for new technologies has never been stronger. Molecular methods for diagnosis and surveillance, novel drugs and insecticides, and a malaria vaccine have all become available in recent years. The research and development pipeline is expected to yield additional new drugs and insecticides, innovative vector control strategies, and more sensitive and precise diagnostics over the coming decade. In the longer term, gene drive technologies have potential to radically reduce transmission in the most challenging settings.

Research and development targets for malaria eradication that are most promising and impactful are shown in Figure 3. New tools will be particularly valuable if they improve surveillance, have long durations of efficacy, do not require difficult or protracted compliance from individuals, counter drug and insecticide resistance, and are able to reduce malaria in high transmission settings.

Increasing eradication finance

Malaria eradication is likely to cost in excess of US\$6 billion per year. The world is already spending around US\$4.3 billion (Figure 4), and additional funds in the order of US\$2 billion a year can make a big difference. To reduce dependence on external donors, the extra money will preferably come from an increase of US\$1.5 billion in government malaria spending, especially in the most affected countries, and a modest increase of US\$0.5 billion in development assistance for malaria.

Figure 4: Total and per-capita malaria spending by source and malaria incidence for the 106 countries with endemic malaria in 2000 and for the 30 highest-burden and lowest-burden countries, 2000–16



Prepaid private spending is included in total spending but not shown on graphs. Development assistance for malaria includes only the amount spent in support of country programs and excludes spending for administration and global purposes. Spending per capita is per capita of total population. Malaria incidences are per 1000 total population. All dollars are 2018 US\$. Per-capita spending and malaria incidences are means of the country values for each group of countries.

Mobilizing an additional US\$1.5 billion from governments will be challenging, especially in the short term. Encouragingly, malaria spending has been rising faster than either GDP or total health spending in high burden countries, on average, demonstrating the commitment of individual countries and regions to ridding themselves of malaria. Strategies to increase public expenditure on malaria should be identified for each high burden country. These commitments can then be embodied in agreements between the countries and donors and should be generously incentivized.

Generating additional development assistance for malaria will also be challenging, given that development assistance for health in general has flat-lined in recent years. Beyond the two biggest funders – The Global Fund and US President’s Malaria Initiative – which must at least maintain the real value of their annual investments over the next few decades, new donors and smaller donors could readily do more. Following its own historic success in malaria elimination, China now has the opportunity to be a leading supporter of malaria eradication

in Africa and Asia Pacific. There are also opportunities for wealthier states in Asia Pacific, the Middle East, Europe, and the Americas to increase their role in supporting regional elimination and global eradication.

In addition to maintaining current spending, major contributors of development assistance for malaria need to carefully consider how they are allocating their resources. Modeling can determine what pattern of development assistance from all sources is most likely to lead to eradication in the shortest timeframe. In parallel, continued investment in effective program management and implementation, innovation, and technology development is critical to improve efficiency on the ground.

“Improved data-driven management, better targeting, especially of vector-control interventions, and leveraging private markets and outsourcing, all have the potential to achieve more with less money.”

Malaria eradication is worthwhile

Malaria is not just another infectious disease. It has had a devastating impact on communities for tens of thousands of years and has been the number one child killer across the tropics.

Today, it is still a leading cause of death in children under five in Africa, and it is responsible for more than a fifth of all post-neonatal childhood deaths in a dozen African countries. There are multiple reasons why malaria eradication is an overwhelmingly worthwhile enterprise.

Achieving eradication will:

- » *End the historic burden of disease and death due to malaria for good.*
- » *Permanently overcome the relentless evolution of drug and insecticide resistance.*
- » *Significantly contribute to the social welfare and economic prosperity in endemic countries and regions.*
- » *Support the achievement of several of the Sustainable Development Goals – including reaching universal health coverage, promoting equity, and reducing poverty – and strengthen global health security.*

“The ability of parasite and mosquito populations to select for resistance to any and all pressures that are applied is probably infinite, but the ability to discover and deliver new drugs and insecticides is not. The only way to end this arms race for good is eradication.”

Investing in eradication has benefits that reverberate throughout the health and development sectors, and these benefits greatly exceed the required costs. Once eradication has been achieved, the resources previously devoted to malaria can be allocated to other health priorities, further improving population health and strengthening economic development.

The alternative to malaria eradication is untenable

Rather than aggressively pursue eradication by 2050, the world could choose to maintain current efforts – business as usual, with potential for some enhancements – and wait for an unspecified time when the operational, technical, and financial requirements for eradication are more strongly in place. Countries with very low transmission would be encouraged to continue making progress toward elimination, while high burden countries would remain focused on reducing cases and deaths. Under this counterfactual, there would likely be a gradual decline in malaria incidence in much of the world over the course of several decades, particularly in areas experiencing rapid economic growth. But in high transmission countries, especially those in Africa, malaria would continue to be a significant cause of morbidity and mortality for an indefinite period of time. The poorest and most marginalized populations in malaria endemic countries would continue to be disproportionately affected, deepening existing inequities. In countries that eliminate, the risk of resurgence due to importation of malaria cases would be constant, requiring long term investment of resources by governments and global donors to maintain surveillance and response capacity and prevent re-establishment of transmission. Overcoming the threat of drug and insecticide resistance would become increasingly difficult and expensive. The Commission believes that maintaining a business as usual approach, even with some enhancements, is an unattractive and unstable policy option.

Malaria eradication within a generation: ambitious, achievable, and necessary

The feasibility of eradication by 2050 is an assertion, based on the balance of evidence and on the probability that particular challenges will be overcome. It cannot be proven in a rigorous or formal sense, but the evidence presented in the Commission's report supports this assertion.

The evidence also makes clear that malaria will not be eradicated under a business as usual scenario and that specific actions are required at country, regional, and global levels to ensure that eradication is achieved by 2050. These actions will be reinforced by a global commitment to pursue malaria eradication as a defined, time-bound goal.

Malaria eradication is a goal of epic proportions that requires high ambition and vision, together with an exceptional degree of international cooperation. While eradication is achieved by elimination, country by country and region by region, a global commitment to eradicate by 2050 brings purpose, urgency, and dedication to the task, well beyond a policy of simply eliminating where possible. It provides a rationale for countries to eliminate, knowing that their neighbors and regions are also committed. It spurs investment and innovation in high burden countries to accelerate the end game. And it motivates a prioritized and aggressive research agenda to rapidly develop and deploy the new tools required to achieve eradication within three decades. The Commission concludes that a time-bound commitment to eradicate is essential to bend the curve and create a world free of malaria by 2050.

The full report, "Malaria eradication within a generation: ambitious, achievable, and necessary," was published by The Lancet on 8 September 2019, and can be found at www.thelancet.com/commissions/malaria-eradication.

More information about the Commission and the report is available at www.malariaeradicationcommission.com.

