

MALARIA ERADICATION: IS IT POSSIBLE?

More than 40 percent of the world's population is at risk of malaria. Each year, there are between one and three million deaths and five billion cases of this disease.¹ The majority of these deaths occur among young children; 850,000 children under age 5 die annually from malaria and 94 percent of these deaths occur in Africa.² Contracting malaria during pregnancy, particularly the first or second pregnancy, increases the risk of severe disease, including severe anemia, maternal death, miscarriage, premature birth or low birth weight.³

Recent calls for the eradication of malaria have raised questions about whether this goal can be achieved, what would be required and how long it would take. Although effective prevention and treatment measures exist, it is generally agreed that they are not adequate to eradicate the disease.⁴⁻⁶ Research is needed to develop new vaccines, medications and prevention tools to eradicate malaria.

This policy brief describes the disease, current tools used to combat malaria and additional tools needed to begin eradication efforts. In addition, the brief recommends policy actions.

Why is malaria complicated?

Four parasites cause malaria – *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae* – and all are transmitted through bites by specific types of *Anopheles* mosquitoes.⁷ Control, elimination and eradication are hindered by a complex life cycle that uses both mosquito and human hosts, the existence of multiple parasites and more than one type of *Anopheles* mosquito that transmits the disease.

Drug and insecticide resistance are emerging problems.^{8,9} Resistance demands the use of more expensive prevention and treatment tools, and it is associated with prolonged illness, increased hospitalization and death, and the spread of resistant malaria. Additional surveillance and research are needed to monitor the spread of resistance and develop affordable solutions.

Co-infection with other diseases can complicate diagnosis and treatment. For example, HIV/AIDS-malaria co-infections may raise HIV viral loads and increase the progression of HIV/AIDS. Potential drug interaction and toxicity make treatment difficult, and further study is needed. Misdiagnosis of malaria in HIV-infected individuals is also a problem, leading to

When a mosquito bites a person, the parasite moves from the human to the insect, where it deposits eggs in the gut. The eggs produce new parasites that migrate to the insect's salivary glands and are transferred to a new host when the mosquito bites again. In the human host, parasites travel to the liver where they mature and generate daughter cells that are released into the bloodstream. They infiltrate red blood cells, provoking an immune response and causing malaria symptoms – fever, headache, and vomiting.¹¹

incorrect treatment practices and the potential development of drug resistance.¹⁰

Current prevention and treatment tools

Prevention efforts often focus on controlling mosquitoes through the use of insecticide-treated bed nets (ITNs) and indoor spraying with insecticides.^{12, 13} ITNs can prevent about half of malaria cases and 29 percent of severe disease. They also provide protection against other insect-borne diseases.¹⁴⁻¹⁶ Yet, only 1 in 25 children in sub-Saharan Africa sleeps under an ITN.¹⁷ Indoor residual spraying (IRS) applies

long-lasting insecticides on the walls and roofs of houses, reducing the density of mosquitoes.¹⁸

- Long-lasting ITNs reduce the need to re-treat nets. Re-treatment can be relatively expensive and logistically difficult. Use of these long-lasting nets is particularly effective when there is full coverage of at-risk groups.¹⁴
- IRS effectiveness depends on the length of transmission seasons and the insecticide used.¹⁹ For example, two rounds of IRS should be provided in regions with high and sustained transmission.

In addition, intermittent preventive treatment (IPT) during pregnancy is used in areas with high and stable transmission of *P. falciparum* to protect the mother and infant.¹⁹

Widespread treatment with monotherapies has led to the development of drug resistance to first-line drugs (e.g., chloroquine and sulfadoxine-pyrimethamine), limiting their effectiveness. Artemisinin-based combination therapies (ACTs) produce a rapid response and are relatively affordable, tolerated by most patients, and effective even against multidrug-resistant parasites. Despite their higher price, ACTs are first-line treatments in regions where malaria is endemic (i.e., prevalent in or native to an area) or resistance is high. Wider use of ACTs may be possible in the future, as prices and supply restrictions should decrease in 2008.^{9, 19, 20}

What would eradication require?

The three main strategies for addressing infectious diseases are control, elimination, and eradication.²¹

Control – reduce the number of people newly infected or living with the disease; reduce deaths and disability due to the disease.

Elimination – reduce to zero the number of infections and cases in a geographic region; maintain the reduction over time.

Eradication – permanent global elimination of a disease; accomplished only once: smallpox was eradicated in 1980.

Extinction – total destruction of the infectious agent from both nature and the laboratory. This step has never been undertaken.

Prior malaria eradication efforts²³

- A 15-year campaign, beginning in 1955, that cost more than one-third of the World Health Organization's total expenditures and employed 500 people.
- Results of the campaign were mixed – some countries reduced or eliminated infections and cases of malaria; other countries saw negligible progress.
- Lessons learned from the campaign:
 - Programs need strong health systems and community involvement.
 - Programs need flexibility to meet country needs, rather than adhering to a rigid operations manual.
 - Research on new tools is needed, even if available technology is deemed adequate.
 - Malaria exists in geographically and demographically different locations – comprehensive strategies are needed, particularly in areas with high prevalence.

Strategy selection needs to consider the biologic nature and life cycle of the infectious agent, environmental context, social and political circumstances, commitment of existing and future resources and tools, and political commitment at local, national, regional and international levels.

Eradication of disease is more feasible when humans are the sole reservoir for the infectious agent.²² For example, smallpox is spread from person-to-person and requires a human host; malaria's life cycle is more complex. Intervention tools must be sufficiently effective in countering transmission, but simple enough for use under field conditions.

The costs and benefits of eradication need to be considered in context. Eradication programs need to be coordinated with other health programs and require sustained support – the goal is to maximize the effectiveness of the disease-specific eradication effort and to strengthen overall health programs. With limited health resources,

the decision to eradicate one disease may reduce the available resources for other health programs. Failure can result in a poorer health context in the country and a lack of will to support future eradication efforts on this or other diseases. However, success will result in a healthier population, stronger health systems and momentum for additional international support.^{5, 23}

Eradication efforts require thorough communication and surveillance collaboration. Currently less than 10 percent of malaria cases and deaths are tracked and reported.²⁴ Migration of infected people into areas with low malaria prevalence slows efforts, as new outbreaks may draw resources from the eradication campaign. Improved surveillance systems can help target interventions to areas most in need, evaluate program impact and anticipate future needs so that outbreaks can be quickly contained.²⁵

What is needed to achieve eradication?

Today's tools will allow us to control or eliminate malaria in some regions, assuming no changes in disease epidemiology. However, eradication requires expanding the use of and improving current tools; developing new diagnostic, prevention, and treatment technologies; and strengthening health systems.^{4, 5}

1. Research is needed to improve current tools and develop new ones:^{13, 19}
 - a. Improve long-lasting bed nets and IRS effectiveness, safety and quality.

- b. Determine effective strategies to distribute bed nets, particularly in rural areas.
- c. Develop vaccines that prevent malaria and expand testing of partially protective vaccines, particularly for young children.
- d. Develop new drug-based prevention and treatment measures.
- e. Develop easy-to-use diagnostics.

2. Analysis is needed to determine the affordability, cost-benefit and health effects of prevention and treatment options, including best scale-up options and optimal delivery systems.¹⁹
3. Strengthening health systems is critical to control, elimination and future eradication efforts – including improved infrastructure and additional health workers.²⁶
4. Program monitoring and evaluation efforts and surveillance systems need to be strengthened.
5. Stakeholders need to create coordinated national and regional strategies for control, elimination and future eradication efforts.
6. Studies are needed to determine the potential impact of climate change on the transmission of malaria.²⁷

The Global Health Council Supports the Following Measures

- Activities undertaken with the long-term goal of achieving malaria eradication. The Council supports comprehensive and coordinated control and elimination efforts to expand the use of existing interventions, and the development of new tools and stronger health systems to deliver life-saving interventions.
- The U.S. Leadership against HIV/AIDS, Tuberculosis and Malaria Act of 2008 (S. 2731/H.R. 5501) authorizes \$5 billion for malaria programs. The Council calls on passage of legislation that includes funding and strong policy provisions for HIV/AIDS, TB, and malaria.
- The Vaccines for the Future Act of 2007 (S. 569/H.R. 1391) proposes to accelerate the development of prevention technologies through public-private partnerships and economic incentives, supports clinical trials in developing countries, and expands purchase and delivery of existing vaccines.
- The Beating Infections Through Research and Development Act of 2007 (H.R. 1496) provides incentives to corporations to invest in research and development of diagnostic tests, vaccines, antibiotics and antivirals to identify, prevent or treat serious and life-threatening infectious diseases.

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