

This Could Be the Last Time

THE BIOECONOMICS OF ERADICATING MALARIA



David L. Smith
and
Andrew J. Tatem

Each year, malaria kills approximately one million people and causes approximately 500 million clinical episodes, but today's outlook for doing something about malaria is cautiously optimistic. New funding and attention are available from international donor agencies to attack malaria with powerful new tools. After a lapse of nearly 40 years, malaria eradication again defines the long-term global agenda.

But barely a decade ago, malaria was one of the world's most neglected diseases. How did this happen? When malaria eradication failed the first time, funding and interest reached a low ebb. Resistance evolved to the cheap and effective first-line antimalarial drug chloroquine, and a bad problem got even worse.

The tide began to roll back when the leaders of nearly all the African countries still plagued by malaria met to determine how to stop it once and for all. These countries changed their drug policies and began to adopt artemisinin-based combination therapy, the most powerful antimalarial drug options ever. Large trials demonstrated that insecticide-treated nets were effective, and compared to most other public health interventions, they were extremely cheap. The stage was set for a new attack on an old enemy.

First, some history

The end of World War II was an era of unprecedented optimism about infectious diseases, including malaria. Two important developments literally made all the difference in most parts of the world. Before the war, malaria was treated with quinine, made from the bark of the cinchona tree. In 1946, mass production of chloroquine made cheap and effective drugs widely available. And before the war, vector control focused on larval mosquitoes but then DDT and other contact pesticides made it possible to kill adult mosquitoes and thereby halt transmission. There had never been anything that worked like DDT.

Optimism about malaria and other infectious diseases led to the formation of the ► World Health Organization (WHO), where malaria was recognized as a top public health priority. In 1955, the WHO coordinated a DDT spraying program and, in the first decade, the global burden of malaria was sharply reduced: 24 countries that eliminated malaria during this era remain malaria-free today.

By the mid 1960s, however, progress had slowed. The mosquitoes that transmit malaria had evolved resistance to DDT, and the low-hanging fruit had been plucked, leaving a set of harder problems to solve.

Over the next 25 years, donor fatigue set in and other public health priorities, including smallpox eradication, competed for funds. Meanwhile, environmentalists increased efforts to ban DDT. WHO abandoned the long-term goal for malaria eradication and, without clearly defined goals, international donor funding for malaria dried up.

The funding drought and DDT resistance left many countries vulnerable. Some countries, such as India and Sri Lanka, were on the brink of elimination, but then malaria came roaring back. In Madagascar, a plan to keep malaria from resurging was inadequately funded and poorly implemented, and malaria killed approximately 40,000 people. These are cautionary tales if malaria eradication should fail again.

The turning point

The seeds of today's optimism can be traced to a summit of African leaders in Abuja, Nigeria in 2000 to set new goals for malaria eradication in Africa. For the first time, Africans—not Europeans—were making decisions. The ► Abuja Summit generated political momentum, institutional synergy, and technical consensus on malaria. Summit participants, all high-level officials from 44 African nations and all of the major international donor organizations, signed a declaration and committed themselves to an intensive effort to halve the rate of malaria by 2010.

Malaria garnered the United Nation's attention and was given its own ► UN Millennium Development Goal. In the fall of 2007, Melinda and Bill Gates announced that their foundation's policy was to support malaria eradication as a long-term goal. Margaret Chan pledged the support of the WHO in her role as the director general. Malaria efforts have indeed come full circle.

For malaria eradication to succeed, what is needed is a strategic plan that builds on past efforts. Stable financing is critical, and a strategic plan must anticipate the evolution of drug and pesticide resistance. Meanwhile, investment is needed now to develop the tools of the future, including new drugs, public health pesticides (products that are safe, can touch skin, are noncarcinogenic, and so on), and vaccines.

Knowing the history of malaria eradication efforts merely keeps us from repeating past mistakes. A truly effective plan must be based on a combination of good medical intelligence and careful and quantitative logic.

Strategic planning for malaria control has one strong advantage over the efforts of the past—the information age has made it easier to assemble and analyze vast databases. The first global, evidence-based map of malaria, produced by the Malaria Atlas Project, provides a basis for large-scale malaria control planning and regional coordination.

Opposite: Women and children wait at a makeshift village health clinic in Madagascar. (AP Photo/Jerome Delay)

Mathematical models have been developed in conjunction with these maps to answer basic questions (Figure 1). What are the likely outcomes of scaling up malaria control? What coverage levels are required to achieve elimination and how long will it take to get rid of malaria?

Mathematical modeling is also playing a role in developing strategies to delay the evolution of drug or insecticide resistance by using combinations of drugs or pesticides, or by using multiple drugs or pesticide combinations in the same population. These strategies make it harder for resistance to evolve, because resistance must evolve to all the agents simultaneously in order to thrive. Other questions remain to be addressed, such as how different modes of malaria control can be used synergistically to make the tools last as long as they are needed.

Most of the countries that eliminated malaria during the first eradication program managed to keep it out. The take-away here is that an elimination strategy that works like a ratchet, forcing movement in one direction—eliminating malaria country by country—could shrink the malaria map in a sustainable way. Countries will find it easier to eliminate malaria if they import fewer cases from their neighbors, so regional coordination is essential.

Malaria control may not be a funding priority for some countries, however, so donors such as the United States should be ready to provide financial mechanisms, such as subsidies, to help countries

cooperate. The endpoint of all this bioeconomic analysis must be a strategic plan that is solidly grounded in malaria epidemiology and economics.

The first steps in this next—and possibly final—malaria eradication campaign, however, will correct another big mistake of the past: Africa was overlooked the last time malaria eradication was attempted. This time, Africa is scaling up vector control and access to effective drugs following the spirit of the meeting in Abuja. As countries reach their goals, the theory supporting global eradication will have its first big test.

Now is the time to think ahead and to make the most of this big push. If these gains can be solidified and extended, then it might be possible to shrink the malaria map until the last parasite is gone. ■

References

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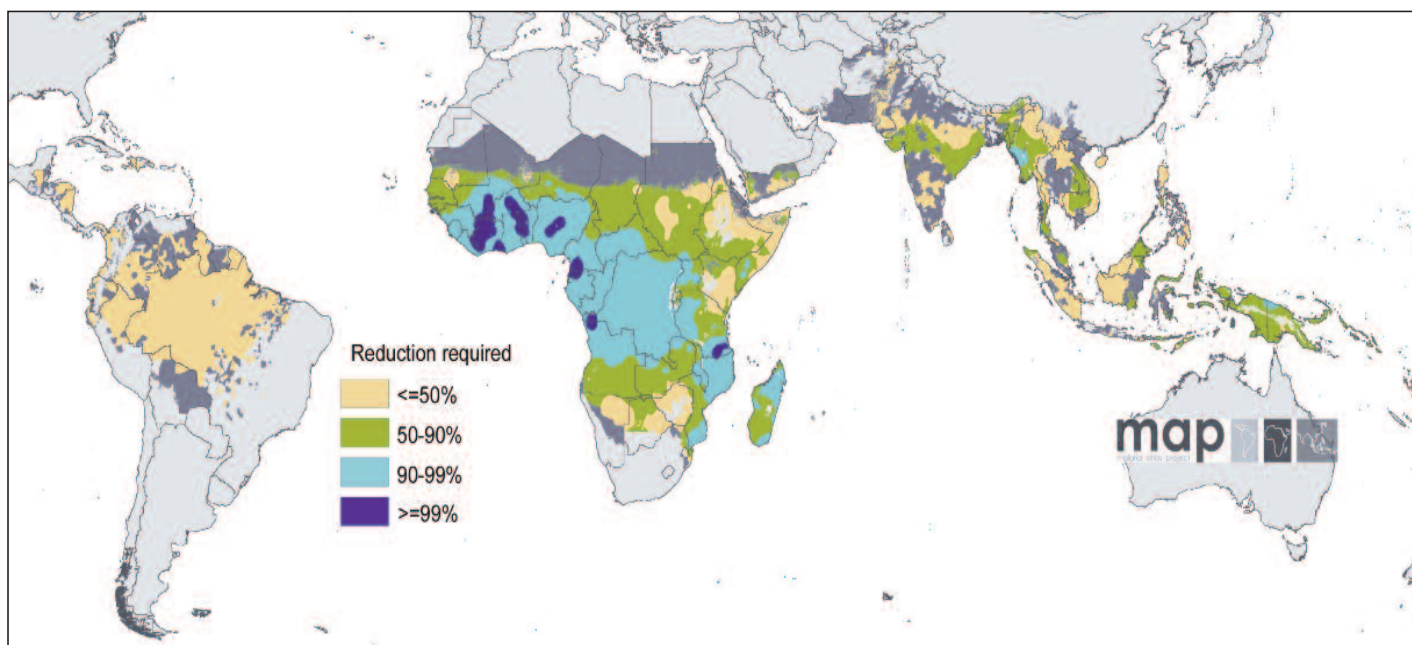


Figure 1: A key piece of information for strategic planning is the reduction in transmission intensity required to eliminate malaria, which is described by the number of new malaria cases per case. This map is based on a global map of malaria endemicity. It shows the proportional reduction in transmission intensity that would be required to interrupt transmission and serves as a basis for long-term regional coordination and planning. (► Malaria Atlas Project)