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Series Editor: Ian Parry
Managing Editor: Felicia Day
Assistant Editors: John Anderson and Adrienne Foerster

Welcome to the RFF Weekly Policy Commentary, which is meant to provide an easy way to learn about important policy issues related to environmental, natural resource, energy, urban, and public health problems.

This week's commentary, by Dave Smith and Maciej Boni, who we are delighted to have with us at RFF, provides a brief history of attempts to control malaria. This enormously important topic is also very timely, given the development of effective new drugs to treat the disease and the current attention of the Gates Foundation and the global community on this issue. Eradicating malaria, which is responsible for a million or more deaths a year, would have huge benefits for people in Sub-Saharan Africa, and other regions.

Next week's commentary, by Jonathan Leape of the London School of Economics, will discuss London's attempt to reduce traffic congestion through cordon tolling, and whether this policy is a useful model for other cities like New York.

A New Chapter in the History of Malaria Control

Maciej F. Boni and David L. Smith

Malaria claims the lives of more than a million victims each year, 80 percent of whom are children from sub-Saharan Africa. Causing fever, anemia, malaise, and death in its most severe forms, its greatest impact is on children who have not yet built up the immunity required to combat severe malaria infections. Compounding the devastation wrought by the disease itself, malaria is often blamed for fevers caused by other infections. By interfering with proper treatment of non-malarial diseases, it contributes to higher death rates from other causes. Furthermore, it reduces economic growth in some African countries by more than 1 percent, costing over $1,000 a year in per-capita GDP. These staggering numbers are finally seeing the light of day.

For the first time in nearly 30 years, new donor money is available to build malaria-control programs. In October 2007, Melinda Gates officially announced the Gates Foundation's objective of malaria eradication. Leaders from the World Health Organization, the Global Fund, and the President's Malaria Initiative echoed the message in a surprising show of hope and unanimity about the scientific and donor communities' current capacity to eradicate malaria. The ensuing discussion broke a taboo in the malaria community - borne of previous failures to eradicate the disease - and the "e-word" was again spoken openly.

The world's first attempt to eradicate malaria came after World War II. Enthusiasm was stoked by two new tools for malaria control: dichloro-diphenyl-trichloroethane (DDT) and chloroquine. Control trials in the 1950s demonstrated that DDT was very effective at lowering malaria transmission. Soon the chemical was sprayed on the interior walls of houses all over the world. Its odor repelled some mosquitoes, and the residual DDT on the walls killed those mosquitoes that landed to rest after feeding on humans. The combination of effects worked quite well: in many areas where DDT was used, malaria transmission was severely disrupted, with 80 percent annual declines in the prevalence of infection. At about the same time, mass production of the antimalarial drug chloroquine provided a cheap and effective way of treating clinical malaria and curing infections.

To control malaria successfully and ultimately eliminate it, the key epidemiological concept to focus on is malaria's "basic reproductive number," which measures the expected number of infectious mosquitoes that would be generated by a single infectious mosquito. This number describes the amplification of the infection process and provides a measure of the control effort required to eliminate malaria. Estimates of the basic reproductive number for malaria suggest that it is may be as high as 10,000 in some African populations. This means that 99.99 percent of all transmission must be prevented in these areas to eliminate malaria. While drug use is critical for treating clinical malaria, it is not an effective way to reduce transmission. Initial elimination efforts in high-transmission areas met with mixed success, while efforts in low-transmission areas were more successful at ridding these regions of malaria.

By 1970, 24 countries had completely eliminated malaria, but there were equally many places where the effort had failed. Many of these countries were in Africa where early malaria-control programs substantially reduced malaria transmission, but were not enough to eliminate the parasite completely. Early trials in East Africa reduced the fraction of infected people from more than 60 percent to less than 10 percent, but did not sufficiently interrupt transmission. In the 1970s, the WHO organized a massive demonstration project in Garki, Nigeria to eliminate malaria, but when it failed, it seemed to be the nail in the coffin for global eradication efforts. Donor fatigue, DDT-resistant mosquitoes, and emerging environmental concerns about the overuse of DDT all contributed to the cessation of malaria-control programs in the 1970s. In regions where malaria had been eliminated completely (southern Europe and the Southeastern United States), it remained absent. But, in areas like India and Sri Lanka, where malaria was not entirely eliminated, the disease came back and re-established itself at its previous levels.

Maciej F. Boni
RFF Resident Scholar

Boni's interests revolve around the evolution and spread of infectious disease; specifically, influenza dynamics and antigenic drift, evolution of antibiotic resistance and antimalarial resistance, and detecting recombination in infectious pathogens.

David L. Smith
RFF Visiting Fellow

Smith's research is in mathematical epidemiology, emerging infectious diseases, infectious disease ecology, the evolution of antimicrobial resistance, and the bioeconomics of infectious diseases.

In the decades that followed, malaria became a neglected disease. To make matters worse, chloroquine-resistant parasites were imported into eastern Africa in 1978, and the subsequent spread of chloroquine resistance undermined treatment of malaria. Throughout the 1980s and 1990s, malaria mortality increased, even as other causes of mortality declined. Finally, within the past few years, rising malaria mortality has been slowed down by the mass distribution of insecticide-treated mosquito nets, and by switching from chloroquine to other, more effective drugs, most notably a new class of antimalarial drugs called artemisinins. For the current generation of research scientists and public health officials working in malaria control, the recent progress and the new flow of money have been a huge relief, and there is some evidence that control programs have begun to reverse malaria mortality in Africa.

Current research efforts at RFF are focusing on methods of drug distribution, preserving the lifespan of

artemisinin-based combination therapies, finding ways to reverse trends of increasing drug resistance, determining whether subsidies for certain drugs will allow more types of drugs to be used, and understanding if having more types of drugs in use will be beneficial to malaria control programs. The initial answers to these questions are coming out of mathematical models that allow us to evaluate hypothetical situations of how malaria might be eliminated in a particular country or region, and how effectively particular treatment strategies or drug subsidies would work in these places.

The worldwide community of malaria researchers is optimistic about the current treatment possibilities and eradication strategies, but enthusiasm for malaria eradication must be tempered with a serious assessment of realistic costs and timelines. The actions necessary to eliminate malaria ultimately will be carried out by individual governments that must rise to the challenges. Even the best efforts can be slighted if a country continually re-imports the disease from neighboring countries, if the necessary drugs, bednets, and insecticides cannot be secured for economic reasons and the elimination programs put in place are not sustainable. The coming global effort to eradicate malaria will derive its success from sustainability, coordination, a generous flow of money, and the diligence and will of scientists, doctors, public health workers, and government officials who recognize malaria eradication as a permanent public health benefit to future generations.

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To receive the Weekly Policy Commentary by email, or to submit comments and feedback, contact comments@rff.org.

Further Readings:

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