

## PERSPECTIVE

### MALARIA, NOT DOWN AND CERTAINLY NOT OUT

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Is malaria really “preventable and curable,” as recent World Bank and World Health Organization reports have suggested? Is it simply a matter of applying a few preventive measures, such as insecticide-treated bed nets, and of spending a lot of money, and then the lives of millions of African children will be saved? Or is the story a more complex one, in which the activities and characteristics of humans, mosquitoes, and malaria parasites must all be considered and requiring far more basic research before we can entertain any hope of truly alleviating the burden of malaria?

Americans generally know little about malaria; as one of our students commented recently, “I thought that malaria was a disease that had disappeared a long time ago. I didn’t have any idea that thousands of children die of it every day or that it also affects adults.” When Americans think about diseases in Africa, their questions are more often about HIV/AIDS than about malaria.

The reality, of course, is that malaria remains a very burdensome disease, not only in Africa but also in parts of Latin America and Asia. According to the Centers for Disease Control and Prevention, an estimated 1 million people die of malaria each year with 500 million at risk, and 75% of those who die are African children. Renewed efforts to prevent and treat this disease, and to raise money for prevention and treatment, are therefore essential. And as the recently released World Malaria Report 2005 points out, some strategies effectively save lives and reduce risk at the village level. These include the distribution of insecticide-impregnated bed nets; spraying houses with insecticides; and case management by means of new drug regimens based on artemisinin.

Unfortunately, these strategies are the beginning of the story rather than the end of it. The long-term success of strategies based on these tactics alone, sadly, seems unlikely. Nor does eradication of malaria parasites seem likely. First, we need to consider human behavior. The intensive use of insecticide-treated bed nets certainly reduces the prevalence of infection in infants and older children in Africa and does save lives. However, as a Nigerian friend asked, “Does this mean that people are supposed to spend all their time under bed nets?” Nigerian (and other African) children do not go to bed at dusk any more than American children do. Moreover, the distribution of bed nets to remote communities is not a simple process. It may be relatively easy for a health worker on a motor bike to carry bottles of pills or vaccine; but how does he transport bed nets? If the insecticide in the nets must be renewed regularly, how does one ensure that this will be done in a timely and safe way?

Even more important are the characteristics of mosquitoes and of the malaria parasites. It is well-known that mosquitoes

have adapted well to the presence of insecticides. That is, they have evolved resistance to chemicals such as DDT, so that ever larger quantities must be used. What is the effect of these chemicals on the children who will sleep under the bed nets, especially as more spraying of houses occurs and more insecticides are used to kill mosquitoes that will no doubt develop resistance to new insecticides as they did to old ones?

Likewise, malaria parasites have adapted well to the drugs that have been used against them. One of the reasons why malaria presents more of a problem today than a few years ago is that the very effective, and very cheap, drug that was used for years—chloroquine—is no longer effective. Many malaria parasites have evolved resistance to chloroquine and to various newer drugs as well.

There is reason to think that, over time, malaria will also lose its susceptibility to the new artemisinin-based drugs as their use becomes more widespread.

Is it important to increase financial support for our current strategies based on the distribution of bed nets and drugs? Certainly. That will indeed help save many lives in the short term. Are such strategies sustainable over the longer term? Most likely not. People will continue to get bitten by mosquitoes; mosquitoes will continue to evolve resistance to pesticides; and malaria parasites will continue to evolve drug-resistant strains.

What can be done? Overlooked in the ongoing discussion of bed nets, spraying, and case management is the fact that enormous progress has occurred in our basic understanding of malaria during the past 30 years. In 1976, William Trager, a professor at the Rockefeller University in New York City who died this past January, developed a method for cultivating human malaria parasites, work that laid the basis for many current programs of research on this disease. This culture method, combined with the recently obtained complete genome sequence of the parasite, has allowed scientists in laboratories around the world to conduct basic research that has led to the discovery of new potential drug targets and to identify parasite proteins for development of antimalaria vaccines. This basic research has the potential for developing additional inexpensive drugs as well as novel vaccines.

Additional funding for such research, however, is sorely needed.

In the absence of any real hope that the problem posed by malaria may soon be solved, we must rely on innovative programs of research that will provide the tools that will render our interventions sustainable. We must support those strategies that promise to save lives today while also conducting the research that will carry us through into the indefinite future. This disease will not be eradicated by serendipitous discoveries but rather will require a sustained effort on the biology and ecology of this most recalcitrant pathogen.

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