

## NEWS

# Shrinking the Malaria Map From the Outside In

A debate is brewing over how best to fight malaria: Go for the quick wins, or the worst places first, or both?

Richard Feachem wants to “shrink the malaria map.” By that, he and his Global Health Group at the University of California, San Francisco (UCSF), mean wiping out malaria at its “natural margins”—those countries on the edge of malaria transmission where the disease has just a tentative foothold—and working inward. It’s going for the “low-hanging fruit,” he says. “It’s a no-brainer.”

That’s not how some of Feachem’s colleagues see it. No one questions the value of eliminating malaria, which means stopping disease transmission in a geographically defined area—where it’s feasible today, although exactly what is feasible where and when, and what it might cost, is hotly debated. But many malaria hands worry that shrinking the map will divert money and attention from a far more urgent task:

reducing the horrific toll of malaria in central Africa, where five countries account for 50% of all global deaths from the disease and elimination is not possible. In those countries, scaling up the use of existing tools—for instance, blanketing the population with insecticide-treated bed nets and ensuring fast, free access to malaria drugs—could have a huge payoff. Indeed, several countries, such as Zambia and Rwanda, have slashed cases



### No conflict.

Richard Feachem proposes a simultaneous attack on malaria’s strongholds and weak spots.

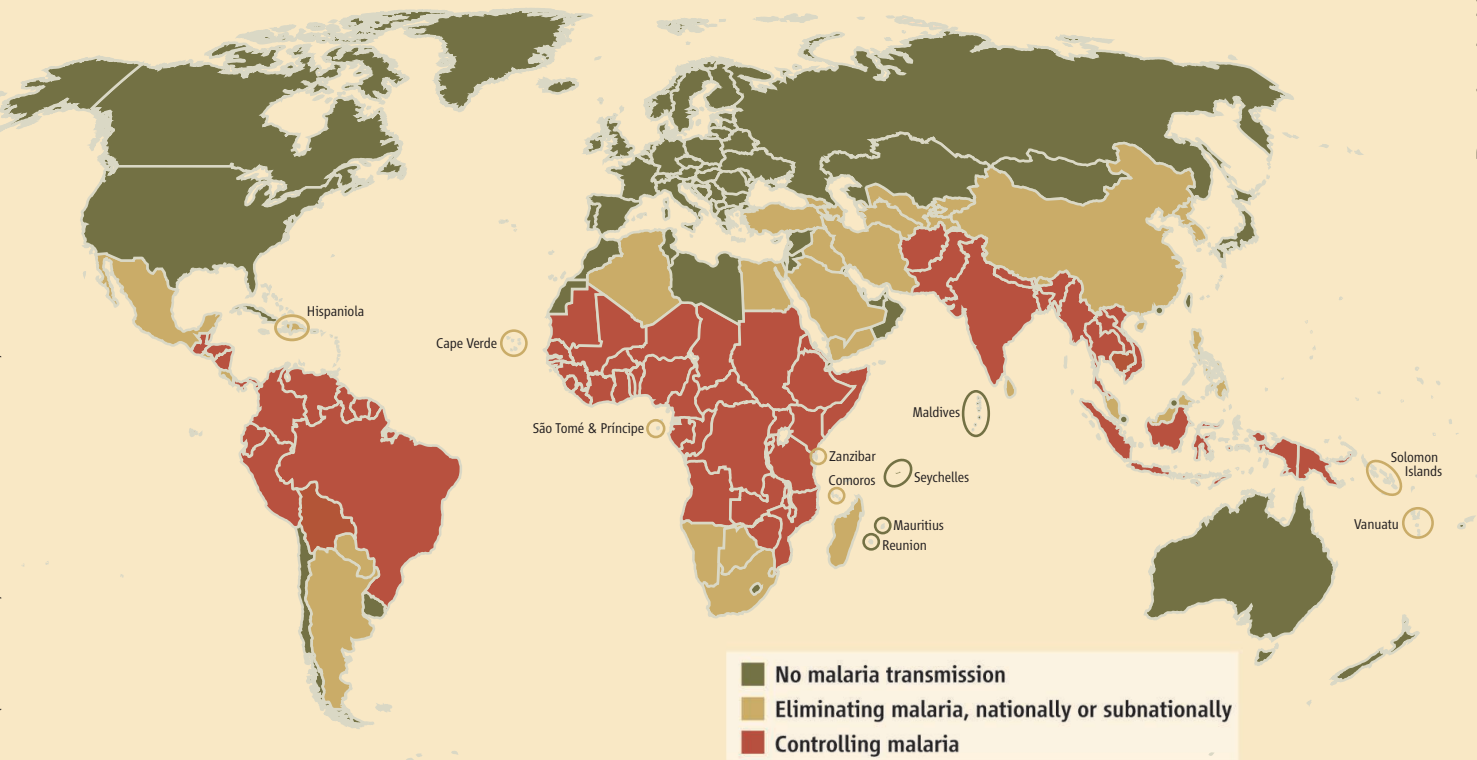
by more than 50% (see p. 842).

“There is not enough money for next year. So what investment would save the most lives and bring credibility to malaria control?” asks Carlos Campbell, who directs the malaria control program at PATH, a nonprofit in Seattle, Washington. “Do you work with Namibia and Botswana, which have very little malaria, and try to shrink the map, or do you use that money on bed nets for the DRC [Democratic Republic of the Congo]?”

Feachem, who has assembled a large brain trust known as the Malaria Elimination Group, agrees that the bulk of donor funds and efforts should be concentrated in the highest burden countries. But he thinks the world can and should pursue both strategies. There is “absolutely no conflict” between the two, he says. He sees elimination as a piece of a three-part strategy that must be pursued simultaneously for “getting to a malaria-free world”: Control malaria in the “heartland,” eliminate it at the edges, and invest heavily in radical new tools that someday might make it possible to wipe the disease off the face of the earth.

Many countries have already eliminated malaria—Canada and the United States, for example, and all of Western Europe. Several

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## Tuberculosis & Malaria

others are in the process, including Algeria, China, and Mexico, all on the northern boundary of transmission, and Argentina and the South Pacific island of Vanuatu on the southern boundary. In these places, the environment is less conducive to malaria transmission. At least as important, the countries tend to be high- or middle-income, with sufficient funds, political will, and strong enough health systems to devote to chasing the last few malaria cases and ensuring the disease doesn't come back.

Feachem and the Malaria Elimination Group have published a 200-page prospectus, *Shrinking the Malaria Map*, that is essentially a how-to manual for getting local transmission to zero. In it they optimistically identify 39 countries as "eliminators" on the margins (see map, p. 849). Some of them, such as Haiti and the Dominican

Republic, will be at best an enormous challenge (see sidebar, below).

Getting from low to zero transmission anywhere is a big leap, Feachem says. In addition to continuing high-level control with existing tools, it requires an exquisitely sensitive surveillance system to detect and treat every case and monitor for the parasite's return once it has been eliminated. Reintroduction is a huge threat—success totally depends on your neighbors, explains Feachem. That's why islands are considered the lowest of the low-hanging fruit.

Four countries at the southern tip of Africa, where malaria transmission is now low, illustrate the challenges. South Africa, Swaziland, Botswana, and Namibia have declared their intention to eliminate malaria by 2015. The ambitious goal has been met with "skepticism," says Oliver Sabot of

the Clinton Health Access Initiative, but CHAI, in partnership with the UCSF Global Health Group, is helping those four countries achieve it. South Africa and Swaziland are making steady progress, Sabot says; Namibia and Botswana less so. Namibia boasts a strong health care system and good malaria control, he says, but it shares a border with Angola, which "has virtually no health care system and no control, and there is nothing to stop malaria from flowing across the border."

Robert Snow, who heads the Malaria Public Health and Epidemiology Group in Nairobi, is one of the skeptics. "Elimination costs a huge amount of money. Some of those are very poor countries. Is it an appropriate goal given the other health problems they face?" he asks.

Sabot contends that shrinking the map

## Elimination Meets Reality in Hispaniola

There is absolutely no reason for malaria to persist on the island of Hispaniola, says Donald Hopkins, longtime disease fighter and vice president for health programs at the Carter Center in Atlanta. All the other islands in the Caribbean have rid themselves of this mosquito-borne disease. And the Dominican Republic (D.R.), which shares the island with Haiti, has driven cases to remarkably low levels. By many counts, the country is well on the path to elimination, its stated aim. But it can't get there unless Haiti, where malaria is rife, achieves the same goal. Hispaniola's fledgling program to eliminate malaria, now sidetracked by the earthquake, illustrates the difficulties that arise when ambitious goals collide with reality.

In 2006, Haiti reported 33,000 confirmed cases of malaria; experts at the U.S. Centers for Disease Control and Prevention (CDC) peg the number at closer to 200,000 and warn that it may surge as the million or so people displaced by the 12 January earthquake remain in crowded camps with no protection from mosquitoes and the rainy season upon them. The D.R., by contrast, reports about 3000 cases a year, a number believed to be fairly accurate, and those are found mostly along the border with Haiti and among migrants from that impoverished country. Still, the D.R.'s success in slashing cases—and the successes of the neighboring islands in wiping out the disease—show that malaria elimination on Hispaniola is technically feasible.

The biology is certainly obliging. Hispaniola is one of the few places in the world where the malaria parasite is still susceptible to chloroquine, a cheap and safe drug. Just one parasite, *Plasmodium falciparum*, transmits malaria on the island, as opposed to several in Africa, and although it causes the most lethal form of malaria, it is relatively susceptible to treatment.

There's just one vector, too—*Anopheles albimanus*, or "white hands," because of its distinctive white legs—and it is not very good at transmission, explains Angel Solís, an entomologist working with the Dominican health ministry. Unlike *A. gambiae*, the main vector in Africa, *albimanus* does not preferentially bite humans; a cow makes a fine meal. Nor does it prefer to bite indoors, where humans congregate—all factors that contribute to relatively low transmission there compared with Africa.

Finally, as an island, Hispaniola is protected by vast expanses of ocean,



**Reaching out.** Community health worker Jonel Mompremier pricks a boy's finger to test his blood for malaria parasites in Ouanaminthe, Haiti.

with no other malaria-endemic countries nearby. So if the parasite can be eliminated, chances are low that it will get back in.

Richard Feachem and colleagues at the University of California, San Francisco, have flagged Hispaniola as an "eliminator" on their malaria map (see main text, p. 849). And in 2006, the International Task Force for Disease Eradication (ITFDE), an expert group Hopkins chairs at the Carter Center, declared malaria elimination from Hispaniola "technically feasible, medically desirable, and ... economically beneficial."

But there is more to elimination than favorable biology, says Robert Newman, head of the Global Malaria Programme at the World Health Organization. A country or region must have a strong health system, lots of money, and a government or donors willing to invest in surveillance long after the disease has disappeared. "All the stars must be aligned," he says. Even before the earthquake, Haiti's malaria program, and even its public health system, essentially existed in name only. "There is a lack of nearly

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gives countries that have already controlled malaria a much-needed goal: “The whole idea of shrinking the map is to give them a future to look to.” But even he worries that some countries, such as Ghana and Nigeria, are jumping on the elimination bandwagon prematurely, “without an awareness of what it actually means” either technically or financially. “From what we see so far, the expectation that a high-burden country can dramatically reduce funding for malaria once elimination is achieved is often false.”

Everyone agrees that “before going down the chute” of elimination, each country should conduct a rigorous feasibility assessment, says Robert Newman, head of the Global Malaria Programme at the World Health Organization (WHO). Unfortunately, he says, the data needed are sorely lacking. He and other experts laud Feachem’s group

and CHAI for leading the way in collecting them, and they point to a recent analysis CHAI and others did with the government of Zanzibar as the gold standard.

Zanzibar is one of the poster children for aggressive malaria control. With donor help, the islands massively scaled up interventions and reduced transmission dramatically. Now the government is grappling with what to do next, says Sabot: concentrate on sustaining those gains or try to stop transmission on the islands altogether?

The CHAI analysis concluded that malaria elimination in Zanzibar is technically feasible but would be “very challenging” both operationally and financially. “It would likely be substantially more costly than maintaining control” for the next 20 years, Sabot says. What tipped the scales is the risk of reintroduction. Although it’s

surrounded by water, Zanzibar is very close to mainland Tanzania, where malaria transmission is robust, and “there’s a ferry every hour,” says Newman. And once the parasite got in, it would quickly resurge, given the efficiency of the vector there.

“Many of us were surprised the feasibility assessment said that it is not practical in the near term,” says Newman. “And if an island setting shows elimination is challenging now, it will be challenging in other areas.” Newman says WHO plans to work with the Malaria Elimination Group to develop evidence-based guidelines to help countries decide whether to move from control to elimination. “Data and assessment should drive public health policy. You don’t want to set policy on enthusiasm, but you don’t want to rain on it either.”

—LESLIE ROBERTS

everything in Haiti,” says Nguyen-Dinh Phuc, a malariologist recently retired from CDC who has worked extensively on the island. “For malaria, they don’t have enough people trained in microscopy; they don’t have Ph.D. entomologists, or epidemiologists with expertise in malaria surveillance.”

Even so, after ITFDE’s proclamation, the Carter Center decided to see if it could prod the two countries to collaborate to eliminate malaria and another mosquito-borne disease, lymphatic filariasis (*Science*, 5 February, p. 634). The odds were against them, as elimination requires cross-border cooperation. “There was a lot of wariness between the two countries,” says Hopkins. “The impetus to collaborate was not strong.”

But the benefits far exceeded the risk of failure, Hopkins says. With a small amount of money and a considerable amount of technical expertise, the Carter Center helped launch a pilot project in 2008 in the border towns of Dajabón, D.R., and Ouanaminthe, Haiti, which straddle the infamous Massacre River. The location, the site of one of the bloodiest encounters between the two countries, was chosen deliberately: Not only is it a hot spot of transmission, but experts reasoned if the two could collaborate there, they could anywhere.

As part of the pilot project, Dominican malaria experts have been giving their Haitian counterparts a crash course in the malaria-fighting techniques the D.R. has long employed. They include active surveillance to track down every single malaria case; the replacement of presumptive treatment, in which any person with fever is treated for malaria, with confirmed laboratory diagnosis; and fast and free treatment with chloroquine to address the illness and primaquine to help reduce disease transmission. The campaign also includes

vector-control measures, such as bed nets and insecticide spraying, and monitoring for any signs of drug resistance.

Within a year and a half, the project, led by David Joa Espinal on the Dominican side and Joanel Mondestin on the Haitian, had trained 10 community health workers, distributed 1200 bed nets, hired and trained three microscopists, and bought four microscopes, 11 motorbikes, two computers, and 37 cell phones.

It was such a success, albeit a modest one, that in October 2009, with former President Jimmy Carter at their side, the health minister of each nation unveiled a binational plan to scale up these efforts across the entire island. The price tag: \$194 million over 10 years. Both presidents endorsed the plan, and Carter vowed to lobby the donor community for support.

Then the earthquake hit, and more urgent needs claimed priority. But as Haiti recovers, Hopkins and colleagues hope the idea of eliminating malaria and lymphatic filariasis can be revived.

The first order of business is to build a functioning public health system, with malaria control as a key component, says Larry Slutsker, who heads the malaria branch at CDC. Since the earthquake and several malaria outbreaks, CDC has had a team of malariologists on the ground to try to establish the rudiments of a control program in Port-au-Prince.

“Let’s keep the elimination goal—it is great to have a plan, and benchmarks—but let’s be realistic about what needs to be done first,” says Slutsker.

—L.R.

Leslie Roberts visited Dajabón and Ouanaminthe on a reporting trip in October 2009.



**Easy access.** Malaria hitches a ride into the D.R. with the throngs of Haitians who cross the Massacre River on market day.