The New Global War on Malaria

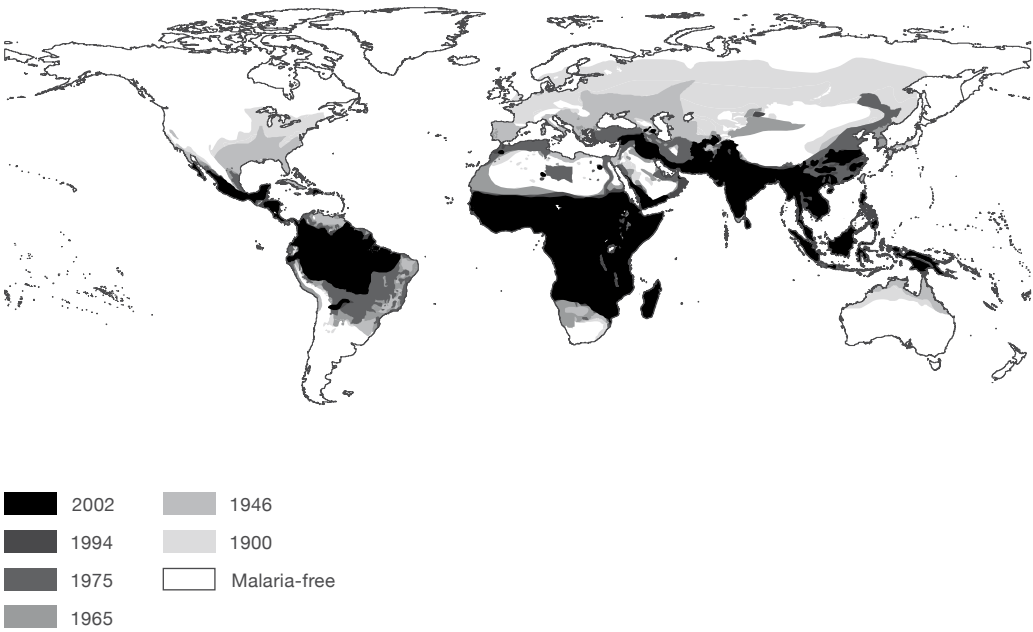
Jeffrey D. Sachs and Raymond G. Chambers

The global control of malaria has followed a tortuous path during the past half century. There have been great and lasting successes but also tremendous failures of will and policy reversals. The world is girding up again for a new assault on the disease, the first concerted attempt in decades to bring the disease under control, and the first time in history that Africa is at the very epicentre of the global commitment. There are good chances for success in the next five years and beyond, but any progress in short-term control will have to be complemented by dramatically increased research and development for new solutions.

Ecological roots of the control challenge

As the late, great entomologist Andrew Spielman of Harvard University always emphasized, "malaria is a disease of place". That is, transmission is heavily dependent on the local geography. The first thing to understand about the control challenge, therefore, is the role of geography. Most importantly, for understandable reasons, the range of malaria transmission has shrunk during the past century. One hundred years ago, malaria was transmitted in temperate, sub-tropical, and tropical conditions. Today, the disease is almost entirely concentrated in the tropics, with tropical sub-Saharan Africa accounting for roughly 90% of the disease and deaths. The shrinking range of coverage is shown in Figure 1, where the map displays how the range of transmission has narrowed from its widest extent to a narrower band around the equator in the course of the past century.

Figure 01: The Declining Range of Transmission during 1900–2002[1]



Human malaria is a constellation of four closely related diseases (with a fifth strain recently identified). All are caused by the protozoan Plasmodium, and all are transmitted by the female mosquito of the genus Anopheles. One of the protozoan strains, *Plasmodium falciparum*, is life threatening, while the others are usually not fatal though they may be seriously debilitating. This paper focuses on the control of *P. falciparum*. Unless otherwise noted, "malaria" refers therefore to *P. falciparum*.

Malaria transmission depends intimately on ecological conditions as well as on the nature of human settlements and human control efforts. There are three major ecological conditions:

1. Ambient temperature;
2. Precipitation (as a determinant of breeding sites for the mosquitoes); and
3. The species of Anopheles mosquito.

It is important to understand each of these ecological factors to understand the challenge of malaria control.

Malaria is transmitted between humans when a female Anopheles takes a blood meal from one infected person, thereby taking up the parasite into the mosquito, and then takes another blood meal some 14 days later from another person, thereby transmitting the parasite to that individual. The period between the two bites is known as "sporogony". The higher the ambient temperature, the shorter the biological period of sporogony, and the faster the mosquito becomes infective. If sporogony takes too long because the ambient temperature is too low, then the mosquito dies before transmitting the infection to another human being. In general, the ambient temperature must be at least 18 degrees Celsius to support transmission.

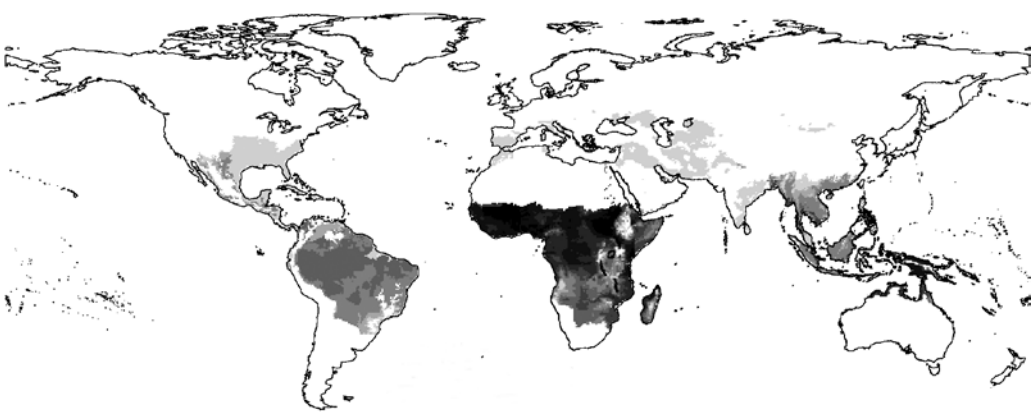
Precipitation matters for transmission because rainfall provides the collections of water that serve as the breeding sites for the mosquito larvae. A long dry season, for example, can break malaria transmission. The species of Anopheles matters mainly due to the propensity of the mosquito species to bite humans, as opposed to cattle or other animals. The proportion of blood meals taken on human blood as a share of all blood meals is called the Human Biting Index (HBI). When the HBI is near 1 (meaning that all feeding is on humans, and none on cattle or other animals), then the mosquito species is a powerful transmitter of the disease. When the HBI is near zero (meaning that most bites are on animals rather than humans), then the species is a weak transmitter of the disease. In fact, since the disease is transmitted only when two blood meals in a row are taken on humans, the probability of transmission is proportional to the HIB raised to the squared power.

It turns out, much to its bad luck, that African mosquito species are nearly complete human biters (HBI close to 1), while in Asia, for example, the HBI is around 0.3. In Africa, the probability of transmission is therefore proportional to $1 \times 1 = 1$, while in Asia the probability of transmission is proportional to $0.3 \times 0.3 = 0.09$, or roughly one-tenth of the transmission probability in Africa.

More generally, we can say that tropical Africa has all the factors for intense malaria transmission: High ambient temperatures year round; enough rainfall to support year round, or near year round breeding; and nearly complete human biters. The result is that Africa's ecology puts Africa in a unique situation, with the world's worst malaria transmission – by virtue of its ecology.

The ecological conditions conducive to malaria transmission can be summarized in a single statistic called Vector Competence (VC). In a study a few years ago, one of us (Sachs) worked with a number of colleagues in entomology and geographic information systems to map the VC in all parts of the world.[2] Figure 2 shows the result. We see that Africa has by far the world's most favourable ecology for malaria transmission (and hence least favourable from the point of view of the human beings living there!). Africa's ecological conditions are matched only by parts of Papua New Guinea. Other tropical regions (with high year-round temperatures) are, by and large, also favourable ecologies, but with mosquito species that have lower human biting rates.

Figure 02: Malaria Ecology Index[3]



Stability Index

0.00 – 0.05	8.01 – 12.00
0.06 – 1.00	12.01 – 18.00
1.01 – 2.00	18.01 – 26.00
2.01 – 5.00	26.01 – 39.00
5.01 – 8.00	

Ecology and disease control

Epidemiologists summarize the challenge of controlling an infectious disease by the Basic Reproduction Number (BRN) of the disease, sometimes denoted as Ro. The BRN measures a key concept: How many people will a single infected individual infect if placed in a susceptible (but uninfected) population. If that number is greater than 1, then the disease propagates in a growing chain reaction. If, on the other hand, a single infected individual on average infects less than 1 other person, then the infection dies out on its own. The key to control is to take steps to ensure that the BRN is less than 1.

Consider the following example. Suppose that in a natural condition, a region has a BRN equal to 2. That is, a newly arrived individual infected with malaria is likely to infect two other people. Each of those will infect two others, and so forth. The infection, once introduced, would tend to spread rampantly in the population. Now suppose that control measures are taken to limit transmission. For example, the health services improve so that each infected individual is treated – and cured of infection – much more rapidly once symptoms become evident. This not only saves the infected individual, but cuts down on transmission as well, since the infected individual spends far less time being a "reservoir" for infection of others. When the mosquito bites the cured individual, the mosquito no longer picks up the parasites for transmission to others. Similarly, the use of insecticides or the introduction of screen doors rather than open doors might sharply cut down on the number of mosquito bites per person per day.

This too could cut BRN, perhaps below 1. Indeed, if BRN is reduced from 2 to less than 1, then nature itself will take its course and snuff out an infection. Each person is then likely to transmit the disease to fewer than even 1 other person. It is not necessary to track down and stop every single infection. It is merely necessary to prevent enough infections such that the Basic Reproduction Rate is less than 1.

Now, here's the catch, which helps to explain Africa's special predicament. Suppose that there are two locations, one with a BRN equal to 2 and the other with a BRN equal to 20 (by virtue of temperature, breeding site, and mosquito species). In each place, a special control effort is introduced which cuts down mosquito bites by half, and which speeds up the treatment and cure of infected individuals. In each case, the BRN falls by two thirds. In the first location, the BRN falls to 0.67, and the disease no long-

er creates a self-reinforcing epidemic. Indeed, it dies away on its own once BRN <1. In the second location, the BRN falls to 6.67, still much greater than 1. The disease transmission remains intense, though less than earlier. The actual proportions infected with malaria may change little, since the BRN remains far above 1.

A brief history of control from an ecological perspective

The biological pathways of malaria transmission were unknown until the late 19th Century and early 20th Century, when the great work of scientists including Charles Louis Alphonse Laveran, Patrick Manson, Ronald Ross, and Giovanni Battista Grassi deciphered the complex life cycle and transmission mechanisms of malaria. Until then, the disease was generally attributed to the bad air of swamps and low-lying areas, and hence, mal (bad) – aria (air). The new science uncovered the process by which the pathogen is ingested by a blood-feeding female mosquito and then transmitted to a human being in a later blood meal by the mosquito.

This discovery gave rise to the modern era of malaria control, and the main tools of control were quickly recognized. These included:

1. Human behaviour, notably avoiding places and times of the day where anopheles mosquitoes take blood meals;
2. environmental controls to reduce breeding sites, including drainage of swamps and other breeding sites, the use of chemical larvicides, and the use of fish that feed on mosquito larvae;
3. treatment of malaria patients with quinine, not only curing the patients but also shortening the period of infectivity of the patient and thereby the transmission to others;
4. bed netting, screen doors, and other mechanical barriers between the mosquitoes and humans to reduce biting rates; and
5. the use of insecticides and repellants, such as pyrethrum-based insecticides.

There were several notable accomplishments in the first half of the 20th Century. The island of Cuba was the site of the first comprehensive mosquito control campaign in 1901, after the occupation by the United States (US) following the Spanish-American War. General William Gorgas led this effort, a prelude to his efforts in the Panama Canal Zone during 1905–1910

to clear mosquitoes to enable construction of the Canal. In the US South, the Tennessee Valley Authority undertook malaria control actions in the 1930s. The Rockefeller Foundation supported Fred Soper on a remarkable campaign to rid Brazil of *A. gambiae*, which had been introduced from Africa into the mining regions of the Amazon. Soper used pyrethrum spraying and larvicides in a successful campaign. The greatest breakthroughs in control efforts came during and after World War II, however, with the discovery and mass production of the insecticide Dichloro-Diphenyl-Trichloroethane (DDT), and the discovery and synthesis of chloroquine as an effective treatment of illness. These two tools allowed an enormous advance in control efforts.

The progress of malaria control was largely dictated by four considerations:

1. The Basic Reproduction Number of the site in pre-control conditions, dictating the extent of control needed to interrupt transmission;
2. the physical geography of the location, which determines the ease of mosquito control;
3. the economic development level of the site, affecting the frequency of mosquito-human contacts and bites; and
4. the economic importance of the target site, determining the human and financial resources devoted to the control effort.

Thus, malaria control was favoured in the following conditions:

— Temperate zones, where temperatures were sufficiently cool to limit sporogony and thereby keep the basic reproduction number near 1.
— Islands (such as Cuba), making the control of the mosquito populations easier and with much less risk of reintroduction from areas outside of the control area.
— High-priority regions, such as the Panama Canal Zone, where enormous human and material resources could be devoted to transmission control.
— Ecologically favourable areas, such as the Brazilian Amazon, where control is undertaken against a newly introduced species of mosquito rather than an endemic (naturally occurring) species in the area.
— Richer areas, where economic development (e.g. urbanization and/or improved homes with screen doors and windows) leads to reduced contact between Anopheles mosquitoes and human populations.

A powerful example of favourable ecological conditions was the US South. As a sub-tropical region with cool nights and winters, temperatures were often below the threshold rate of 18 degrees Celsius for transmission. Thus the Basic Reproduction Number was little above 1 in the pre-control environment, and transmission was seasonal rather than year round. Small declines in mosquito abundance or biting rates would suffice to break transmission. Such declines ensued in the period of the 1930s and 1940s, often before formal malaria control measures were undertaken. The declines resulted from improved housing, including the introduction of screen doors and windows; the drainage of swamp-lands and other breeding sites as part of local development efforts; and the increasing urbanization, which reduced breeding sites of the mosquito and biting rates (notably since Anopheles do not generally thrive in the polluted water sites of cities).

The discovery of DDT as an effective pesticide in 1939 gave rise to the vision of malaria eradication. It was felt by public health experts that the new insecticide made possible the eradication of the disease, if DDT were used simultaneously and intensively throughout the world. From the start, it was hypothesized that there would be a short window of opportunity until the mosquito developed DDT resistance. WHO launched the Malaria Eradication Programme in 1955. Ironically, despite being called a "global" programme, the effort completely bypassed sub-Saharan Africa, where it was felt that high transmission rates (that is, high BRNs) made control through DDT unfeasible.

The WHO eradication effort lasted between 1955 and 1966. It has been recorded in history as a failure, though in fact it had remarkable successes in ridding many regions of malaria transmission, or at least in dramatically reducing the fatality rates associated with the disease in those regions. The successes, once again, followed the basic logic of disease ecology. Where the basic reproduction number was low enough, i.e. close to 1, control efforts could break transmission. Where the BRN was far above 1, control efforts would rarely suffice to break transmission. Therefore, successes tended to be achieved in areas where the combination of relatively cooler temperatures, dry months (i.e. without breeding sites), and specific Anopheles species with sufficiently low human biting rates, made possible the interruption of malaria. This included most of the sub-tropical regions of the world, around the Mediterranean, the Black Sea, and large parts of the Americas and Asia. Islands were also especially favoured, as described above. Africa, as mentioned earlier, was bypassed.

During 1969–1976, the WHO led an intensive study of malaria control in a holo-endemic African site in Garki, Nigeria. An intensive effort was made there to break transmission through a combination of environmental controls, including DDT spraying, and case management of patients. This famous study was also recorded as a failure because it failed to break transmission despite an intensive effort. Ironically, though, the Garki trial was enormously successful at reducing illness and mortality. If the goal of the study had been defined as "malaria control", rather than malaria elimination, it would have been treated in history as a success, rather than remembered as a failure. This misinterpretation was very costly in public health thinking, because it erroneously led to the unfounded conclusion that malaria control efforts in sub-Saharan Africa "would not work".

By the 1970s, malaria control efforts were being radically scaled back. The eradication program was deemed a "failure" since global transmission was not broken. Not only did DDT resistance develop, as long feared, but the findings of environmentalist Rachel Carsons and others that DDT entered the animal food chain as a persistent chemical, with cumulative and adverse ecological effects higher in the food chain, led to an enormous environmental backlash against the use of DDT in malaria control. This was another misunderstanding. The public backlash against DDT did not distinguish between the heavy applications of DDT used in the open fields as a crop pesticide, versus the very low doses of DDT used in thin-film residual spraying inside households for malaria control with negligible environmental harms.

The 1980s saw a serious backsliding in malaria control efforts in many places, and a surge of malaria deaths in Africa. The first-line, low-cost treatment with chloroquine increasingly lost efficacy as wide-spread chloroquine resistance developed in regions of high drug use, especially in Africa and Southeast Asia. The end of DDT use in many places led to a recovery of Anopheles populations and a resurgence of transmission. Still, to summarize the conditions at the end of the 1980s, the picture was mixed rather than bleak:

— Many regions in the temperate and sub-tropical regions enjoyed continued success in preventing a return of malaria transmission, following the successful interruption of transmission during the preceding decades.
— Many regions, for instance in Latin America, continued to use DDT and other insecticides with effective results, even in areas where some DDT resistance was noted.

— Fatality rates generally remained lower than pre-control era rates, even in places where transmission returned following a period of interruption. There was, however, always the risk of epidemic rebounds in such locations, especially as populations had lost acquired immunity during the interruption period.
— Sub-Saharan Africa faced the worst situation of all, since comprehensive control efforts had never been tried (despite the evidence of successful reduction of morbidity and mortality in the Garki experiment) and the low-cost treatment with chloroquine was rendered increasingly ineffective due to drug resistance.

Beginning in 1992, the WHO once again introduced a global malaria control programme. This time, however, the focus was put on effective case management (i.e. treatment) to reduce mortality, and on a more limited effort of prevention than during the eradication period. The four pillars of the control strategy included: Early diagnosis and prompt treatment; selective and sustainable prevention efforts; early detection and control of epidemics; and strengthened local capacities in basic and applied malaria research. Despite these intentions, however, few additional financial and human resources were devoted to malaria control, especially in sub-Saharan Africa. By the end of the 1990s all signs were pointing to an alarming increase in disease burden and mortality rates in Africa, as public health investments withered under the weight of reform and chlorquines declined continued.

The roll-back malaria era since 1998

Dr. Gro Harlem Brundtland became Director General of the World Health Organization in 1998 with a commitment to reverse the dramatic deterioration of malaria control in Africa. She launched a new "Roll Back Malaria Initiative" alongside UNICEF, the World Bank, and UNDP to combine more intensive case detection and treatment, integrated vector control, and epidemic surveillance and control measures. Gradually, with considerable delays in mobilizing the needed funds and political will, the Roll Back Malaria effort has gained traction, and has made possible the adoption of new bold, yet realistic, targets of malaria control in Africa.

Two new technological developments considerably brightened the prospects for malaria control since the late 1990s. The first was the rise of insecticide-treated bed nets as a major measure of disease prevention. Bed

nets have been in use for a century, but the treatment of bed nets with insecticides is only recent. Studies have shown that half or more of the protective effect of the bed nets lies not in the mechanical barrier afforded by the net (which often fails anyway because of holes, tears, or simply the mosquito's ability to get around the barrier), but in the dual role of the insecticide in repelling the mosquito or killing it through contact when the mosquito alights on the net. Insecticide-treated nets themselves have experienced a true revolutionary breakthrough when nets were engineered in which the insecticide would last through many years of use and repeated washing, rather than requiring the re-treatment of the nets with insecticides. Long-lasting insecticide-treated nets, effective for 4–6 years without retreatment, provide the most powerful single prevention tool at the household level.

The second breakthrough was the introduction of new low-cost alternatives to chloroquine. Several alternative anti-malaria medicines have been introduced, but many have also rapidly lost their efficacy through the rapid development of resistance by the pathogen. The key breakthrough in the past decade is the development and widespread adoption of Artemisinin-based Combination Therapies (ACTs), in which the drug artemisinin is combined with another anti-malarial medicine, with the objective of protecting both drugs against the development of resistance through their use in combination. Artemisinin is the discovery by Chinese scientists of the active molecular agent of a traditional herbal medicine for malaria control using the wormwood plant (Artemisia annua).

The WHO Commission on Macroeconomics and Health,[4] which one of us (Sachs) directed, called strongly for the scaled up effort on malaria control. The Commission reported the evidence that malaria not only takes an enormous human toll in Africa, but also contributes to an enormous economic loss and is a barrier to economic growth. Investments in malaria control thus offer an enormous return in lives saved and improved, and in economic benefits for Africa. This logic and evidence contributed to the decision by the African countries to adopt new and bold continent-wide targets at a malaria summit in Abuja, Nigeria, convened by President Olesegun Obasanjo in April 2000. The summit established the Abuja Targets for malaria control, to halve mortality by the year 2010, and to achieve 60% coverage of bed net prevention and prompt case treatment by the year 2005. This summit marked the invigoration and empowerment of Africa's political leadership in the control challenge.

The Abuja Declaration, the recommendations of the WHO Commission on Macroeconomics and Health, and the drama of the AIDS pandemic, all added a sense of urgency to the control of malaria, AIDS, and tuberculosis (TB). In the course of the work of the WHO Commission, Sachs called for the establishment of a global fund for AIDS at the International AIDS Conference in Durbin, South Africa, in July 2000. UN Secretary General Kofi Annan expanded that call in a path-breaking and world-changing address at the Abuja AIDS Summit in April 2001, where he first called for a Global Fund for AIDS, TB, and Malaria. In May 2001, the Secretary General's proposal for a Global Fund was endorsed by the US Government. Several other donor countries quickly joined the new Fund. It began operations in 2002. From the start it has played a crucial role in the scaling up of malaria control efforts, especially by providing funding for long-lasting insecticide bed nets (LLINs) and for artemisinin-combination therapies (ACTs).

The case for comprehensive malaria control, especially in sub-Saharan Africa (accounting for 90% of worldwide cases of *P. falciparum* and deaths), gained momentum in the next six years. The US Government joined the effort through a new President's Malaria Initiative (PMI) launched in 2005. The UN Millennium Project[5] strongly recommended a mass distribution of LLINs, along the lines of the pioneering distribution efforts led by the United Nations Children's Fund (UNICEF) and the International Federation of Red Cross and Red Crescent Societies (IFRC). This recommendation was endorsed by the UN General Assembly in September 2005. The World Bank adopted a Booster Programme for Malaria to speed disbursements. Various NGOs, most notably Malaria No More (MNM) and the United Nations Foundation's Nothing But Nets (NBN) project, have alerted the broad US and European publics to the potential and the importance of malaria control. The Millennium Villages Project (MVP), a partnership of the UN, the NGO Millennium Promise, and the Earth Institute, demonstrated the efficacy of combining the free mass distribution of bed nets with the mass availability of ACTs. Across sites in the MVP, malaria has been sharply reduced. Several other success stories, led by other projects, have also been recorded, leading to rising hopes for the success of comprehensive control. Public awareness has also risen sharply as mass media (such as the popular "American Idol" show) have taken on the cause of malaria control, notably through the mass distribution of bed nets.

Global control on the path to eradication

Comprehensive malaria control has come within reach, leading the Secretary General Ban Ki-moon to launch a bold initiative on World Malaria Day, 25 April 2008, to achieve 100% coverage of malaria control interventions (bed nets, indoor spraying in some locations, and rapid diagnostics, combined with effective case management with early diagnosis, community health workers, and free availability of ACTs).[6] His call to action is supported by the Roll Back Malaria Partnership, and is described in the Global Malaria Action Plan of RBM.[7] It is envisioned as a key step on the way to the eventual eradication of malaria, a step which will require the development of an effective malaria vaccine. Policy, therefore, will proceed in two parallel tracks: The first uses the current technologies (including LLINs, ACTs, indoor residual spraying, and rapid diagnostic tests) to bring malaria transmission, morbidity, and mortality to low levels; the second promotes the development of new tools, notably a vaccine.

The Global Malaria Action Plan sets out the basic modalities and estimated costs for comprehensive control, putting the costs at around USD 2–3 billion per year in sub-Saharan Africa, to be covered mostly by external donors. The aim is to cut deaths from malaria by at least half compared with 1990, and to bring deaths to "near zero preventable" levels by 2015. The budget guidelines of RBM are in conformity with the estimates recently published by McCord, Teklehaimanot, and Sachs (2007)[8] which also estimate the costs at USD 3 billion per year. These costs include LLINs (100% coverage), medicines, community health workers, indoor residual spraying (partial coverage), and diagnostic tests.

The basic modality for delivery will be through the leadership of the public sector of each country, supported by international financing and national budgets. In each country, the government and civil society will make a comprehensive national plan, and submit it for funding support to the Global Fund and other donors including the World Bank, the US PMI, and philanthropic donors who will be partners with the official donors. Countries have embraced the Secretary General's call for universal coverage of essential interventions by 31 December 2010 and are considering the date a deadline for results, not an aspirational goal. Round 8 of the Global Fund, for instance, saw an over 75% success rate in sub-Sahara Africa for malaria control proposals, each of which aimed for universal coverage. Coverage of nets will generally be free, and medicines for free or at very highly subsidized rates. The goal is to achieve a dramatic drop in malaria deaths to

nearly zero by 2015 and beyond. Transmission of the disease will still occur, but at far lower levels than today, and the infections will be treated systematically to prevent serious illness and deaths.

Fighting malaria will also be a boon for other diseases. There is mounting evidence that dual infection with HIV and malaria fuel the spread of both diseases in sub-Saharan Africa (Abu-Raddad, Patnaik and Kublin, 2006). When people with AIDS contract malaria, it causes a surge of HIV virus in their blood, making them more likely to infect a partner. At the same time, people with weakened immune systems, compromised by HIV, are more likely to contract and die from malaria. Reducing malaria infections will therefore help protect against HIV-transmission and reduce mortality rates in people living with AIDS. An example from Uganda shows that the use of cotrimoxazole prophylaxis and insecticide-treated nets (ITNs) among HIV infected children is associated with a dramatic reduction in the risk of malaria.[9]

In addition to the humanitarian case for fighting malaria, a related economic case for rapid scale-up has been well established.[10] It is estimated that malaria costs the continent of Africa an estimated USD 12 billion a year in direct health costs and lost productivity, and much more through lost economic growth.[11] Making the investment in a thorough malaria control strategy would repay itself several-fold in higher gross domestic product (GDP) in Africa, through a reduction of health costs, increased productivity, and accelerated economic development. To quote from the 2008 Global Malaria Action Plan:

> "Malaria usually affects some of the poorest, most marginalized populations in the world. Minimizing the burden enables individuals to continue to go to work and school as well as lessening time away from work caring for the sick. This promotes economic growth and can diminish the cycle of poverty. These investments in malaria control can have a significant positive impact on a region's economy. Some analyses have estimated the annual economic burden of malaria to be at least USD 12 billion per year of direct losses, plus many times more than that in lost economic growth. This means that if USD 2.3 billion is needed annually to control malaria in Africa, then every USD 1 invested into malaria control could enable more than a USD 5 gain."

Conclusions

The year 2008 marked three anniversaries: The sixtieth year of the Universal Declaration of Human Rights (1948), the thirtieth year of the Alma-Ata Declaration of Health for All (1978), and the mid-point of the fifteen-year period of the Millennium Development Goals (2000–2015). It is fitting, therefore, that it also marks the emergence of a new global consensus on the dramatic scaling up of malaria control, aiming at the eventual eradication of the disease once an effective vaccine is added to the arsenal. Proven cost-effective prevention and treatment tools, combined with recent increases on malaria-control funding, are enabling countries across the continent to significantly decrease the deaths and financial burden of malaria. We know what we can do, what will work, and yet how much more we have to do. Investing in rapid scale-up of malaria interventions will save millions of lives, produce billions of dollars, and build the platform from which other diseases can be attacked. Having this knowledge and the resources to stop the deaths of 3000 children every day is an obligation. These children have a right to these life-saving resources. We are looking at an historic opportunity to end a public health crisis, one we cannot afford to miss.

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He is the author of hundreds of scholarly articles and many books, including the New York Times bestsellers *Common Wealth: Economics for a Crowded Planet* (Penguin, 2008) and *The End of Poverty* (Penguin, 2005).

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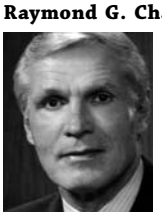

Secretary-General for Malaria. Mr. Chambers is a philanthropist and humanitarian who has directed most of his efforts towards children. He is the Founding Chairman of the Points of Light Foundation and co-founded, with Colin Powell, America's Promise Alliance. Mr. Chambers is Co-Founder of the National Mentoring Partnership, and Founding Chairman of both The Millennium Promise Alliance and Malaria No More. Mr. Chambers is also the Founding Chairman of the New Jersey

Performing Arts Center and is a member of the President's Council on Service and Civic Participation. His board memberships include The National Mentoring Partnership, The Points of Light Foundation/Hands on Network, America's Promise Alliance, Communities in Schools, University of Notre Dame, and American Museum of Natural History. He is the former Chairman of Wesray Capital Corporation, which he co-founded with William E. Simon. In February 2008, the Secretary-General of the United Nations appointed Mr. Chambers as the first Special Envoy of the Secretary-General for Malaria.