

Background Information on Malaria

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This information has been gathered by the Malaria Foundation International with contributions from over thirty international medical and scientific experts and from the UK Department for International Development.

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EXECUTIVE SUMMARY

Burden of Disease

MALARIA had been eliminated or effectively suppressed in many parts of the world. It is now undergoing a resurgence. It is a public health problem today in more than 90 countries inhabited by some 2,400 million people -- 40 percent of the world's population. Malaria is estimated to cause up to 500 million clinical cases and over one million deaths each year. Every 30 seconds, a child somewhere dies of malaria. In any given year, nearly ten percent of the global population will suffer a case of malaria. Most survive after an illness of 10-20 days. Children are especially vulnerable to malaria. In Africa, where 80% of malaria cases are treated at home, the disease kills one child in twenty before the age of five. Pregnant women are also at high risk. There is a fourfold increase in risk of disease and a two-fold increase in death rates. In many African countries about 10% of hospital admissions are for malaria, as are 20-30% of doctor's visits.

Resurgence of Malaria

Malaria is returning to areas from which it had been eradicated, and spreading in to new areas, such as Central Asia, and Eastern Europe. More people are now dying of malaria than thirty years ago.

Economic Costs and barriers to development

Over a quarter of a very poor family's income can be absorbed in the cost of malaria treatment, quite apart from the cost of prevention, or the opportunity cost of labour lost to illness.

Each bout of malaria causes its victim to forego, on average, 12 days of productive output.

Malaria infection can be chronic and unremitting in parts of the world with high transmission intensity, such as coastal Africa. Persons may receive hundreds of

infectious mosquito bites a year, with the result they are perpetually weakened by the parasite. Children face particular risks.

People are most at risk of malaria during the warm and rainy seasons; this is usually when there is most agricultural work that needs to be done.

Malaria and fear of malaria prevents investment and tourism into new regions, further hampering economic development.

There are several factors which contribute to this:

- Drug resistance is a growing problem, chloroquine is an extremely safe and cheap drug, but in Asia and an increasing area of Africa and South America the resistance levels are high. In some areas of Asia there is resistance to all the major drugs.
- Mosquitos are developing resistance to the major classes of insecticide which have been used to control the disease.
- Population and demographic changes have resulted in more people moving into densely populated areas, thereby increasing transmission.
- Human environmental changes such as road building, mining, deforestation, and new agricultural and irrigation projects have created new breeding sites.
- Migration, climatic change and the creation of new habitats have all resulted in people who have no natural immunity to the disease being exposed. This results in much higher rates of disease and death.
- In many regions, malaria control programs have deteriorated or been abandoned.

Infection Illness and Disease

The malaria pathogen is not a bacterium; it is not a virus. It is a unicellular parasite.

There are four different species of the malaria parasite. Two are most common. *Plasmodium falciparum*, which is found globally but is commonest in Africa, is the most aggressive species, often killing through coma or anemia. *Plasmodium vivax*, which ranges widely throughout Asia, Africa, the Middle East, Oceania and the Americas (and is resurgent in Eastern Europe), can cause recurring and debilitating infection, but rarely kills.

Fever is the first symptom. Several hours later, the fever drops and chills set in. Two to four days later, the cycle repeats. More serious forms of malaria can affect the brain and the kidneys. Progression of symptoms from initial fever to death can take as little as 24 hours.

Much of the long-standing disability from malaria is attributable to the anaemia that it causes.

Reasons for the Resurgence of Malaria

Over the last decades control of malaria has been neglected and under-funded. Until the 1990s major agencies were wary at taking up the challenges posed by malaria because they are difficult.

Many national health ministries need increased technical capacity and financial resources if they are to tackle infectious diseases effectively.

Basic health services, which have been characterized by declining levels of funding, low staff morale and inadequate drug supplies, have been unable to address the challenges of effective diagnosis and prompt treatment.

Pharmaceutical companies have spent relatively little on research. Research Efforts

The total amount spent on malaria research globally accounting for all governmental charitable and non-governmental sources in 1993 was \$84 million.

A vaccine is needed. Development of such a vaccine is complicated by the parasite ability to change its immunological identity, and thereby conceal itself from the immune responses that might otherwise be stimulated by a vaccine.

Vaccines have been tested in animal models and there are eight ongoing clinical trials for vaccines. There are other candidate vaccine in the pipeline.

New drugs are required particularly in areas such as Asia where drug resistance is a major problem. Such drugs must be affordable for poor people.

Epidemiological research is required so that epidemics can better be predicted, and contingency plans made. Social and Operational research is required to ensure that strategies for prevention treatment and control are adapted to the situations which occur in each country.

Recent Initiatives on Malaria

[The Multilateral Initiative on Malaria](#) began as a joint African-American-European project that brought together representatives from thirty-seven countries, three charities and three intergovernmental agencies in Senegal in 1997. Already it is beginning to increase to the co-ordination of research efforts.

The African Initiative on Malaria responded to the call from the ministers the Organization of African Unity in 1997. This coalition of national governments, the World Bank, multilateral agencies such as UNICEF and bilateral donors, will be co ordinated by WHO.

The Roll Back Malaria Initiative brings these ongoing efforts together. It was announced by Dr. Gro Harlem Brundtland in her [inaugural speech](#) as Director General of WHO on May 13th 1998 with the following words:

"I propose that together we Roll Back Malaria. Not as a revamped vertical program but by developing a new health sector wide approach to combat the disease at global, regional and country and local levels.

Why malaria? Many have asked this question. For my part the answer is simple, I have learned it from many in this room and by traveling to your countries, particularly in Africa.

Malaria is the single largest disease in Africa and a primary cause of poverty. Every day 3000 children die from malaria. Every year there are 500 million cases among children and adults.

Who said that infectious diseases were becoming yesterday's problem? The human suffering is unacceptable and so is the economic burden and impediment to progress. Time has come to respond with a new approach. Time has come to Roll Back Malaria.

Why now? Because the call is there. We have enough knowledge, skills and tools to launch a new concerted effort. Africa is responding. African leaders are committing to a renewed effort to control malaria. Africa should be spearheading the project.

I believe we should answer Africa's call and that of other regions if they choose to engage. I will invite a broad range of stakeholders to join us in this initiative, UNICEF, the World Bank, industry, foundations and all others who have a stake, a commitment and a contribution to make.

I encourage the leaders of the G8 countries to answer the call when they meet later this week.

Let me stress: Roll Back Malaria will not exclude work on other diseases. To the contrary. Successful containment is no endpoint. Rolling Back Malaria is no victory unless health systems are equipped to sustain the gains.

That means connecting the services with the primary location for action; the family - the home - and the mother. Efforts against all infectious diseases will benefit. Drawing upon what we learn we will be ready for a fast track on a future Roll Back TB - and a reinvigorated action against HIV/AIDS and the tropical diseases."

1.

THE SCALE: WHY MALARIA MATTERS

"MALARIA which had been eliminated or effectively suppressed in many parts of the world, is undergoing a resurgence. It is a public health problem today in more than 90 countries inhabited by some 2,400 million people -- 40 percent of the world's population. Malaria is estimated to cause up to 500 million clinical cases and 2.7 million deaths each year. Every 30 seconds, a child somewhere dies of malaria. The global effects of the disease threaten public health and productivity on a broad scale and impede the progress of many countries toward democracy and prosperity."

Institute of Medicine of the National Academy of Sciences of the United States (1996)

* * * THE HUMAN DIMENSIONS OF MALARIA ARE STAGGERING. It is, by far, the most devastating and deadly parasitic disease in the world. Although an ancient disease, environmental disturbance, malnutrition and the failure of drugs once used to control the disease have conspired to make death by malaria more frequent now than at any point in history:

- In any given year, nearly ten percent of the global population will suffer a case of malaria. Most survive after an illness of 10-20 days. Many do not.
- Africa is terribly affected, and accounts for over 90% of reported cases of malaria. About 10% of hospital admissions are for malaria, as are 20-30% of doctors' visits. As bad as that is,

experts foresee as much as a 20% annual increase in Africa's rate of malaria-related illness and death. No Western disease is nearly so prevalent or growing at anything like that rate.

- Children are especially vulnerable to malaria. In Africa, where 80% of malaria cases are treated at home, the disease kills one child in twenty before the age of five. Globally, the death rate is equal to seven jumbo jets, full of children, crashing every day.
- Pregnant women are also especially at risk. In highly malarious parts of Africa, women are more than four times as likely to suffer clinical attacks of malaria during pregnancy than at other times; but only half as likely to survive bouts of life-threatening illness.
- In comparison to other infectious diseases, malaria kills about as many persons per year as AIDS has done in the last 15 years. About 30 times as many persons die of malaria every day, as died in the infamous Zairian Ebola virus outbreak of 1995.
- Westerners who visit malarious countries, however briefly, are not immune! Several thousand return home from travels each year and are hospitalized with malaria. Travelers have contracted "airport malaria" while waiting on planes that were being refueled in malarious areas.
- Expatriates and soldiers who live abroad are at even greater risk. Malaria was the number one cause of hospitalization among American troops deployed to Somalia; the number two cause among troops in Vietnam (after combat injury); and a leading cause among diplomats, missionaries and aid workers.
- Blood transfusion can also transmit malaria. Two persons in the United States died of malaria in this way in 1997
- Each year, the world over, malaria destroys, through premature death and disability the equivalent of at least 35 million years of healthy, productive human life a figure that dwarfs the human cost of better-recognized infectious diseases such as Ebola or AIDS.

SOURCES: World Health Organization; US Agency for International Development; Wellcome Trust; Institute of Medicine, National Academy of Sciences (USA); *Transactions, Royal Society of Tropical Medicine and Hygiene* (UK); *Social Science and Medicine*; Centers for Disease Control; Office of the US Army Surgeon General; Harvard Malaria Project; World Bank.

2. THE REEMERGENCE AND SPREAD OF MALARIA

"THE GLOBAL "RE-EMERGENCE" OF MALARIA has several underlying causes. Population and demographic changes have resulted in more people moving into densely populated areas, thereby increasing transmission. Human environmental changes such as road building, mining, deforestation, and new agricultural and irrigation projects...have created new breeding sites... [and] in many regions, malaria control programs have deteriorated or been abandoned." The World Resources Institute; United Nations Environment Programme; United Nations Development Programme, and the World Bank (1998)

* * *

A plague is coming back and we have only ourselves to blame. In a fight, the worst error is to misestimate a foe, and that is what we did with malaria. By failing to deal resolutely with malaria in the past, scientists and politicians have bequeathed today's children a parasite stronger than what they knew. We are now poised to perpetuate that error and be submerged, or fight back.

- Insecticide resistance was the first mistake, the legacy of a scientifically naive, politically uncommitted effort to eradicate malaria in the 1950s and 1960s. Global DDT spraying to kill mosquitoes succeeded in controlling malaria for a time: in only 8 years, Sri Lanka went from a million cases of malaria a year to only seventeen. Then the American Congress cut its funding for spraying, and the mosquito evolved resistance to DDT. Within a decade, malaria rebounded to nearly a million cases a year.
- Drug resistance was the second mistake, the legacy of foolishly overusing antimalarial drugs. Some countries even laced salt with chloroquine, the drug of choice. Errors like that, or the money-saving trick of taking a partial, rather than complete, course of drug treatment, caused the malaria parasite to evolve resistance. Now chloroquine, the cheapest, safest, and most effective drug we have ever known is rapidly losing its effectiveness.
- Environmental changes and human mobility are a third mistake. Industrial works in the tropics, such as mining or logging, create puddles of still water that are the mosquito's dream habitat. Malaria transmission explodes just as a crop of outsiders with no immunity to the disease come into work camps. Indigenous people also suffer unprecedented onslaughts of malaria. Incidence of malaria among Yanomami Indians in the Amazon have leapt almost seventy-fold since contact with industrial works. Now, a quarter of Yanomami die of malaria, in what is reckless genocide by malaria
- Political ignorance and budget cuts are a fourth mistake. For the Yanomami, who have been brought disease but no outside help because malaria research and control budgets have suffered huge cuts, it may be the last mistake. International health is a sitting duck when politicians balance budgets. The creation of wars and refugees, another politicians' foible, provides conditions ideal to the aggressive spread of malaria among displaced persons.
- In the future, we will still make mistakes. Climate change may be a new threat. The malaria parasite grows faster in warm areas. Even a tiny global warming will push malaria into Africa's urban centers and into temperate zones outside the tropics - places where persons have no immunity and fall easily to malaria. As recently as the early 1900s, malaria cases were 500,000 a year in the south of the US; and it was only in the 1960s that malaria was eradicated from Italy. Europe and the US still suffer a handful of cases each year.

SOURCES: MIT Technology Review; World Health Organization; R. Desowitz, *The Malaria Capers*; L. Garrett, *The Coming Plague*; The World Resources Institute, United Nations Environment Programme, United Nations Development Programme, and the World Bank; Institute of Medicine, National Academy of Sciences (USA).

3. ECONOMIC COSTS AND BARRIERS TO DEVELOPMENT

"MALARIA HAS BEEN CALLED THE "LAZINESS" DISEASE because it is so debilitating. The most prevalent disease in poor rural regions, malaria produces recurrent infections with attacks of fever in warm and rainy seasons, just when workers are needed to collect crops."

The World Resources Institute; United Nations Environment Programme; United Nations Development Programme, and the World Bank (1998)

"WHEN A SUBSTANTIAL PROPORTION of a country's population is ill with malaria for five or six months each year, sustained economic development is very difficult to achieve. Countries thus

compromised cannot easily become active trading partners...nor are they positioned to decrease their dependence on foreign aid. Similarly, when child survival is threatened by

malaria and other infectious diseases, family planning and environmental quality are simply not priorities."

Institute of Medicine of the National Academy of Sciences (1996)

* * * MALARIA IS A "DISEASE TAX" ON ECONOMIC AND HUMAN DEVELOPMENT. To put it simply, a person ill for weeks or months at a time is not a productive person. In afflicting entire races and nations, malaria squelches development; discourages inward capital investment; stultifies global trade; and generally depresses the standard and quality of life for the world's most disadvantaged persons. Yet the marginal cost of reversing malaria's toll is, comparatively speaking, small.

- Over a quarter of a very poor family's income can be absorbed in the cost of malaria treatment, quite apart from the cost of prevention, or the opportunity cost of labour lost to illness.
- Each bout of malaria causes its victim to forego, on average, 12 days of productive output.
- Malaria infection can be chronic and unremitting in highly diseased parts of the world, such as Africa. Persons may receive hundreds of infectious mosquito bites a year, with the result they are perpetually weakened by the parasite.
- Cash estimates of malaria's direct costs underestimate the problem because lost income is only the tip of the iceberg. If each day of malaria-related disability were valued at \$1 of lost income, then malaria's annual cost is about \$13 billion globally. But if we add in the value of lost social services ? such as care for the elderly (when the young die), or childrearing (when parents die) then the cost of malaria is very much greater.
- Attacking global diseases is a bargain. Since smallpox was eradicated in 1977, the total US total investment of \$32 million is returned to the US as savings every 26 days! Every dollar spent on the measles, mumps and rubella vaccine results in a \$21 savings later.

SOURCES: Tropical Medicine and Parasitology; Institute of Medicine, National Academy of Sciences (USA); MIT Technology Review; World Bank; National Science and Technology Council, White House Office of Science and Technology Policy.

4. INFECTION, ILLNESS AND DISEASE

"FOR CENTURIES distancing beyond recorded history, malaria has been a pregnant ladykiller. Malaria also kills the children; in regions of intense transmission, 40 percent of the toddlers may die of acute malaria. Malaria also kills the immunologically "unsalted" adult migrants from teeming Third World cities who pioneer new agricultural lands, soldiers of the Western world battling to save democracy in tropical nations, tourists, businessmen. In 1990 the age of rocket ships and genetic engineering 250 million people will get malaria and at least 2.5 million will die of the infection - needless deaths. Malaria is not an AIDS; the curative antimalarial drugs are available. Malaria is not like cancer; the most intimate details of malaria's causation are known. Malaria is not like the epidemic of drug addiction; given the resources, successful antimalarial campaigns can be implemented."

Robert Desowitz, *The Malaria Capers* (1991)

"THE BLIGHT OF BENIN. The blight of Benin. Few go out but many come in"
West African colonists" lament, circa nineteenth century

* * * THE MALARIA PARASITE IS A TRICKSTER. It is not a bacterium; it is not a virus. It is a form of unicellular life as sophisticated as the cells of our bodies. It is the evil opposite of our immune cells, and that makes it a nasty foe. Passing from person to person via the bloody feasts of mosquitoes, the parasite assumes a different "disguise" with each infection, dodging the victim's immune system and whatever experience it had with malaria in the past. In brief, the parasite has perfected the trick, over millions of years and trillions of infections, of waylaying us like neophytes every single time.

- There are four different species of malaria parasite that go by the collective name of *Plasmodium*. Two are most common. *Plasmodium falciparum*, which is found globally but is commonest in Africa, is the most aggressive species, often killing by coma or anemia. *Plasmodium vivax*, which ranges widely throughout Asia, Africa, the Middle East, Oceania and the Americas, can cause recurring and debilitating infection, but rarely kills.
- Not all persons with the parasite have disease, but some are carriers without symptoms. A mosquito can draw blood from these persons, and some weeks later, transmit the parasite to another person, who may be more vulnerable. The parasite takes refuge in that person's liver, and later erupts into the blood, where it invades his or her red blood cells and begins to replicate.
- Fever is the first symptom. The fever moves in cycles as the parasites destroy one bunch of blood cells and, in larger numbers than before, take over another bunch. At its peak, a person's fever can soar to 41°C (106°F). Several hours later, the fever drops and chills set in. Two to four days later, the cycle repeats.
- Cerebral malaria is the most dreaded form of disease, and is unique to *P. falciparum*. Red blood cells infected by the parasite are sticky and can gum up the capillaries of the brain. The victim enters a coma, and if he is lucky enough to return, brain damage can be the result.
- Death can strike in as little as 24 hours from first symptoms: or in less time than it takes to get from a village to a clinic! Thus, better access to clinics is essential to turning the tide on malaria.
- Even at a clinic, death is nearby. Village clinics are almost always poorly equipped. The clinic is unlikely to own a microscope, which is essential to diagnose malaria. If the clinic has antimalarial drugs, they may be useless because increasingly the parasite is likely to be drug resistant. And in the case of cerebral malaria, sterile intravenous equipment is needed? a tall order in remote Africa.
- Anemia is another threat. The parasite's cyclical attacks on red blood cells can result in death by blood loss. As a last-ditch effort, the victim is sometimes given a transfusion. Without a way to test the donor's blood for HIV, if the victim survives malaria, he or she will be lucky to not get AIDS.
- Pregnant women are malaria's easiest prey. The normal weakening of the immune system during pregnancy makes infection more likely, and the routine anemia of pregnancy gives the parasite a deadly leg-up. Pregnant women are four times as likely to get the disease, and half as likely to survive cerebral malaria. If they do, their fetus may not: the extreme fevers often cause spontaneous abortion.

SOURCES: World Health Organization; Institute of Medicine, National Academy of Sciences (USA); *Transactions, Royal Society of Tropical Medicine and Hygiene* (UK); *Social Science and Medicine*; *Bruce-Chwatt's Essential Malariology*.

5. OBSTACLES TO EFFECTIVE CONTROL

A. WEAK POLITICAL COMMITMENT

"THE UNFORTUNATE FACT is that foresight and compassion are no match for politics and profits in setting priorities for disease research. When malaria comes here, we'll seriously get to work on it. But sadly, not until then."

Daniel S. Greenberg in *The Washington Post* (1998)

- There is the healthy, wealthy world; and the ill, poor nowhere. In sub-Saharan Africa alone, malaria destroys 76% more years of productive life than do all cancers in all economically developed countries. Yet the US spends fifty times as much on cancer research as malaria research. This is typical: in Canada, the difference is forty-fold..
- Vanquishing malaria is like fitting together a puzzle. First you lay out the pieces: talking about the problem; training scientists and doctors; providing research funding. Then you build the edges: introducing control measures to the field; teaching communities to use them; studying how the disease fights back against control; designing new drugs and vaccines. Then you fill the center: testing new drugs and vaccines; sharing those that work. The last piece makes a picture of health. But it takes political will, in the beginning, to open the puzzle box!
- Africa is asking for that political will; is anyone listening? In 1997, the 53 African heads of state passed a resolution at the Organization of African Unity, to ask for help against malaria. Without scientific tools themselves, African countries must rely on developed countries to hear their plea.
- With a commitment, disease control is possible. Politicians acted to eradicate smallpox from the face of the earth for about \$300 million. In a campaign of less than a decade, 97% of cases of guinea worm were eliminated it will be driven extinct within five years. In just one day in 1997, India vaccinated 130 million children against polio. Similar "vaccination days", paid for by governments, the WHO and groups like the Rotary Club, will destroy this killer of children by the year 2000..

SOURCES: World Bank; Wellcome Trust; Medical Research Council (Canada); Organization of African Unity; Carter Center; Rotary International.

B. THE LOOMING CRISIS OF DRUG RESISTANCE

"TODAY, RESISTANCE IS EMERGING AND SPREADING faster than new drugs can be developed...Given the speed with which parasites are becoming resistant and the length of time required to develop new drugs (even accelerated development takes 5 to 10 years from discovery to clinic), we face a looming crisis: multidrug-resistant malaria with no safe, effective alternatives for treatment. This problem exists today in Southeast Asia and will occur in most other malaria-endemic areas within the next decade."

Massachusetts Institute of Technology, *Technology Review* (1997)

"NOT A SINGLE major Western pharmaceutical company is now developing new drugs for malaria."

Institute of Medicine of the National Academy of Sciences of the United States (1997)

- The "good" strains of malaria are difficult to treat; the "bad" ones are impossible. Careless drug use has caused malaria parasites to evolve survival strategies against drugs. In most areas, malaria parasites resist at least one drug. In others, they resist all known drugs. There are no failsafe treatments a state of affairs not known since the discovery of quinine in the 17th century.
- Malaria prevention is also in jeopardy. Travelers to malarious areas take antimalarial drugs to avoid getting the disease, but the parasite can resist prophylactic drugs too. There is no prescription that guarantees a traveler absolute safety from malaria.
- Things are getting worse, not better. Today, only government and university labs do malaria drug research, on a budget under that of the 1980s. The US military has invented most of the drugs used in the last 50 years, yet its drug research program advances on just \$5 million a year, and even this is threatened by cuts.

SOURCES: WHO; Journal of the American Medical Association; New Scientist; Nature.

C. THE QUEST FOR A VACCINE

"...A VACCINE that can prevent illness and death of malaria could be one of the most important advances in medicine, with the potential for improving the lives of hundreds of millions of people." [emphasis in original]

"IN SPITE OF GROWING SCIENTIFIC OPTIMISM, the pace of vaccine development appears to be slowing because of diminishing public funds, fragmented public sector efforts, and limited interest within the vaccine industry."

Both from Institute of Medicine of the National Academy of Sciences (1996)

FINDING A CHEAP, EFFECTIVE MALARIA VACCINE IS THE HOLY GRAIL OF RESEARCH. Unlike drugs that prevent or treat the disease only so long as they are taken, vaccines confer enduring, even life-long, immunity to disease. If a good vaccine is distributed widely enough, it is even possible to forever wipe the disease from the face of the earth.

- Researchers have yet to develop a successful malaria vaccine in humans, although they have succeeded in immunizing many types of animals, from rats to monkeys. The last step is proving elusive, even though studies over 20 years ago proved that humans can be successfully immunized in the laboratory.
- The barriers to vaccine development are not so much technical as financial. Although eight clinical trials are now underway globally, many other candidate vaccines are kept out of trials because research funding is so petty. US military scientists alone possesses a half dozen candidate vaccines ready for human

testing, but with a budget of just \$4 million a year, they cannot do the job. European, Australian and South American labs are in a similar bind.

SOURCES: *Parasitology Today*; Military Infectious Diseases Research Program, US Department of Defence; *New York Times*; *Nature*.

D. POOR COORDINATION OF RESEARCH

"THE URGENT NEED is to put malaria on the scientific, media and political agenda, and in particular to identify it as a priority for research, both in the developed North and in those areas of the South where the disease is endemic... We recognize that the control of malaria in Africa will require a long-term collaboration between scientists in the North and South...[and] commitments from the industrialized countries to funding, and from African leaders to support scientist and health and research infrastructures in their countries."

Scientific representatives of seven countries, the World Bank, the World Health Organization, Organization of African Unity, and the Wellcome Trust (1997)

NO ONE COUNTRY WILL SOLVE MALARIA. A disease endemic to 100 countries needs multilateral effort to conquer. Rich states must give of their funds and technological expertise; poor states must supply facilities and cooperate, especially in field research.

- The [Multilateral Initiative on Malaria](#) (MIM) began as a joint African-American-European project that brought together representatives from thirty-seven countries, three charities and three intergovernmental agencies in Senegal in 1997. Despite a plea for joint action to save lives in Africa, countries have so far responded with token funding donations, nowhere near the hundred's of millions of dollars now needed and which could become available with a serious global commitment.

SOURCES: Institute of Medicine, National Academy of Sciences (USA); Ralph Nader; World Health Organization.

6. OPTIMISM FOR DISEASE CONTROL: TOOLS IN HAND

"CONSIDERING THESE DIVERSE UNDERLYING FACTORS makes it clear no single strategy will be effective in reducing the burden of malaria. A comprehensive malaria control strategy requires three interdependent and complementary components: disease management, surveillance, and prevention, including environmental management."

The World Resources Institute; United Nations Environment Programme; United Nations Development Programme, and the World Bank (1998)

THERE ARE THINGS WE CAN DO TODAY TO ATTACK MALARIA. Though we need to research new tools, our existing tools can already save many, probably even most, lives.

A. BASIC RULES OF MALARIA CONTROL

- Taking a bite out of the mosquito. If people are taught how, they can wage war on mosquitoes: by filling ditches or covering containers where water stagnates and mosquitoes breed; by stocking ponds with fish that eat mosquito eggs; by using insecticides judiciously and in the right places; by insect-screening their homes; and by planting water-hungry trees to dry out muddy soils. These are just a few of the measures to destroy mosquito breeding sites.
- Managing the illness. Like many diseases, malaria is less likely to kill if it is detected early and treatment is started at once. This means families must be taught to recognize the telltale signs of malaria, especially in children; and well-staffed, well-stocked clinics must be nearby to give medical care. Considering that the disease can progress in 24 hours from first symptoms to death, a dense network of caregivers and clinics throughout the countryside is a must too many children die now in the arduous journey to a clinic.
- Tracking the disease, and where it will strike next. Much of malaria's bite can be mitigated if it is anticipated first. For instance, by tracking the spread of drug resistant parasites, prescriptions can be changed before people die because they are given ineffective drugs. Keeping an eye out for new environmental changes or refugee movements means preventative or curative resources can be sent to meet the disease before an epidemic begins.

SOURCES: World Health Organization;.US Agency for International Development; The World Resources Institute, United Nations Environment Programme, United Nations Development Programme, and the World Bank.

B. BEDNETS: BITING BACK AT THE MOSQUITO

- Taking care of number one - Avoiding mosquito bites, is a cheap and very effective way to reduce deaths. Mosquitoes bite at night, by sleeping under a mosquito net impregnated with a natural, biodegradable insecticide derived from chrysanthemums lowers one's risk of disease greatly.
- Saving children's lives for a few dollars. More than 20 studies of bednets have proven that they are effective at reducing child mortality, not only from malaria, but from other diseases too. In studies, bednets have reduced mortality by at least 20%, and as much as 63%. According to WHO, if all of Africa's children used bednets, about half a million lives a year could potentially be saved.
- Bednets are so cheap, they can be given away. Nets cost \$5-10, and a year's natural insecticide under \$1, making bednet donation programs cheap and well within the means of governments and large companies. With will and commitment properly managed integrated programmes with the incorporation of bednets, better use of available drugs, and further needed research could all be a reality.

SOURCES: International Development Research Centre (Canada). World Health Organization; *Annals of Tropical Medicine and Parasitology*.

7. SCARCITY OF FUNDING FOR RESEARCH:

"GLOBAL INVESTMENT IN MALARIA RESEARCH over the past ten years has been very low compared with other disease areas, and appears to be declining further. Expressed as investment in research per death, malaria research ? at approximately \$42 per fatal case receives less funding, by one or two orders of magnitude, than other diseases such as cancer, HIV/AIDS or asthma."

The Wellcome Trust (1996)

"RICH COUNTRIES STUDY THE DISEASES THAT AFFLICT THEIR CITIZENS. For the ailments of the poor world, they offer sympathy and perhaps a few bucks."

Daniel S. Greenberg in *The Washington Post* (1998)

THE LACK OF MALARIA RESEARCH FUNDING IS INSTITUTIONALISED

NEGLIGENCE: Governments and industry have cut malaria research spending, often radically, in an epoch of increasing disease prevalence, and decreasing options for disease treatment or control.

- The total amount spent on malaria research globally accounting for all governmental, charitable, and non-governmental sources in 1993 was about \$84 million. By contrast, a single agency of the US Government will spend about \$2.5 billion on cancer research this year.
- Pharmaceutical companies have malaria research, though the need (and their profits) is greater than ever. Currently there is little activity by major Western pharmaceutical company's in developing new drugs for malaria.
- As we approach the millenium the global malaria research budget is, in real terms, smaller than it was in the 1980s.
- Subsidies into lives saved: for the price of a single year's subsidies to its tobacco farmers, the European Union could support the global malaria research program until the year 2009. At present rates, 30 million people (equal to the populations of Belgium, Denmark, Greece and Ireland combined) will die of malaria between now and that date.
- Swords into plowshares: for the price of a single B-2 Stealth Bomber, the United States could support its current malaria research program until the year 2034, or the global program until 2016.

SOURCES: The Wellcome Trust; *The Washington Post*; Institute of Medicine, National Academy of Sciences (USA); *Nature*; Center for Study of Responsive Law (Washington); EC Directorate General for Agriculture; Central Intelligence Agency.

8. HUMANITY'S CHALLENGE

"WE COME THEN TO SOCIAL INTELLIGENCE as our remaining option to counter the evolutionary drives of the microbial world. That intelligence must include a profound respect for the ecological factors that enhance our vulnerability... [The] preponderant changes are the sheer expansion of our species, with high population densities, and much the worse, egregiously stratified by standards of economics, nutrition, housing and public health. At the same time we have unprecedented mixing of people: a million passengers a day cross national boundaries by air... One could hardly have concocted a

better-calculated recipe for a tinderbox, as AIDS already harshly teaches. From this perspective, we have never been more vulnerable; this vulnerability must be matched against the extraordinary sophistication of the science and technology that we are, in principle, able to pit against these threats."

Dr. Joshua Lederberg, Nobel Laureate in Medicine, and father of molecular genetics
Journal of the American Medical Association (1996)

"DUTY arises from our potential control over the course of events."

Professor Alfred North Whitehead, Philosopher and scientist

THE SCIENTIFIC INTELLIGENCE IS READY. WHAT ABOUT THE POLITICAL? There is no doubt that our present technologies can yield effective drugs, vaccines, and other clinical tools to combat malaria. There is also no doubt that while we develop those tools, environmental and personal control measures like bednets can save lives. The only question is whether the political intelligence can be found to fund malaria research and control decently, or whether malaria will fester, a totem of humanity's ignorance.

- [Roll Back Malaria](#) On March 13, 1998, the World Health Organization announced a global campaign, allying the WHO, the World Bank and governments of the developing and developed world alike, to Roll Back Malaria. The program aims to halve malaria deaths by 2010, and have them again by 2015, primarily through rebuilding health care and malaria control in developing countries. It remains to be seen whether governments respond with money to Roll Back Malaria, or just words.

The pressure must be kept on! Because it is such a challenging disease, it is difficult to predict how the war against malaria will progress, except in the case that citizens do not act, and nothing happens. Speak or write to your politicians; tell them that the health of poor children matters no less than rich children; demand that your country support health before weapons, and lives before corporate subsidies; watch that you are heard; and remember when you vote!