

Creating Chemistry

For a sustainable future

Issue one 2012

 **BASF**

The Chemical Company

Malaria: A winnable war?

United Nations advisor Jeffrey Sachs explains why malaria control is a battle worth fighting. Interview page 14

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Fighting the war on malaria

Malaria kills 780,000 people every year – most of them in Africa. Its effects have trapped millions in an endless cycle of poverty, but thanks to a massive international push to control the disease, it may finally be losing its grip. Could this be the beginning of the end for malaria?

The statistics may appear bleak: Every 45 seconds a child dies of malaria and over 780,000 people in total die from the disease every year. Yet compared with two years ago – when it was estimated that a child died of malaria every 30 seconds, with nearly one million total fatalities worldwide – those figures offer some hope.

The truth is, cases of malaria are falling – thanks to what is arguably the most organized collective campaign against the disease the world has ever seen. Since the late 1990s, efforts to reduce the malaria burden have been gathering pace, with public health organizations, aid agencies, governments and private enterprises combining their resources. This is organized through a set of new inter-agency partnerships and initiatives that include the Global Fund to Fight AIDS, Tuberculosis and Malaria, as well as the President's Malaria Initiative in the United States, and Roll Back Malaria.

The collective effort is focused on achieving U.N. Millennium Development Goals (MDGs) – one of which is to halt and begin to reverse the incidence of malaria and other major diseases by 2015. The Roll Back Malaria partnership has taken this still further with a goal of near-zero deaths from malaria by 2015 – with the ultimate aim of eradicating malaria altogether.

20%

Malaria causes 20% of all childhood deaths in Africa.

85%

85% of all malaria deaths occur in children under the age of five.

40%

Malaria accounts for approximately 40% of public health spending in sub-Saharan Africa, 20% to 50% of inpatient admissions and 50% of outpatient admissions.

4.2 million

It is estimated that 4.2 million lives would be saved by full coverage of malaria control measures – i.e. use of nets, spraying, diagnosis, drugs – by 2015 in the 20 most at-risk African countries.

Below Pregnant women and children are the most vulnerable to malaria. It contributes to the deaths of an estimated 10,000 pregnant women and up to 200,000 infants each year in Africa alone.



So why malaria – and why now?

The poverty connection

Unlike other deadly diseases, malaria is both curable and preventable. Research has also demonstrated that the economic and social effects of malaria are devastating. Malaria keeps children away from school and adults from work; it pulls families into poverty and keeps them there.

Predictably, its greatest impact is on the world's poorest – those who simply cannot afford treatment or who have limited access to healthcare. Overall, malaria causes an average loss of 1.3% of annual economic growth in countries with high transmission rates. Tackle malaria and you go a long way to tackling

endemic poverty in many countries.

This isn't the first time the world has tried to stop malaria. In 1955, the World Health Organization (WHO) submitted an ambitious proposal for the eradication of malaria worldwide. Some countries managed it; others were less successful, with initial reductions followed by sharp increases once efforts ceased.

Climate apparently made the difference between success and failure: In temperate countries where malaria is a seasonal disease, eradication was possible. Not so for countries where malaria is rife all year round. The climate factor at least partly explains why it is sub-Saharan Africa that bears the brunt



Above Innovations in medicine and technology are allowing earlier diagnosis and more accurate treatment.

Percentage of households owning at least one insecticide-treated net, 2010

(Source: UNICEF global malaria databases 2011)



Left The distribution of insecticide-treated nets is central to malaria control strategy: These nets have been shown to reduce malaria transmission by 90%.

with 73 million people in Africa protected from malaria with IRS programs, up from 13 million in 2005.

The last decade has also seen the arrival of larvicides, a new generation of anti-malarial drugs, and Rapid Diagnostic Tests, which enable earlier diagnosis and more accurate treatment.

The distribution of these technologies together with better case management and education has delivered positive results. Eleven African countries have reported a decrease of at least 50% in malaria cases between 2000 and 2009. By 2009, the annual number of malaria deaths had fallen by 20% in comparison with the beginning of the millennium. In 2010, Morocco and Turkmenistan were certified by the Director-General of WHO as having eliminated malaria.

A challenging future

In other words, the push to reduce malaria cases is working – but there are still plenty of challenges ahead. Of particular concern is the distribution of nets. Roll Back Malaria estimates that 100 million LLINs must be financed and distributed globally every year, to sustain coverage and replace worn-out nets. But with distribution bottlenecks still an issue in some countries, this is proving difficult to achieve – as is the organization of IRS.

A resurgence in cases has been observed in parts of at least three African countries: Rwanda, Sao Tome and Principe, and Zambia. The reasons for this are uncertain, but one possible cause is a relaxation of control efforts; in Sao Tome and Principe, the resurgences followed a year in which IRS wasn't deployed, for example.

There is also the ever-looming threat of resistance to commonly-used insecticides, and drug resistance. In Cambodia, artemisinin-based drugs – currently hoped to be the most effective form of malaria treatment – are now taking longer to take effect. It's unclear as to why, but it was in the same region that resistance developed to the older antimalarial drugs chloroquine and mefloquine.

These challenges cannot be addressed unless the global community sustains its investment and interest in the 2015 goal. There is now growing concern that the campaign may fall victim to its own success: As the burden of disease falls away, political resolve could weaken and financial commitments diminish. Given the current global recession there is a genuine fear that malaria control could move down the list of development priorities. And yet there is hope: Only recently the U.K. government announced it would be increasing its investment in the malaria campaign, for example. If the global community manages to sustain momentum, the eradication of malaria could be a distinct possibility. ■

of the malaria burden: Around 90% of all malaria cases occur in Africa.

Critics are quick to question why, if eradication didn't work in the 1950s, it will work now. But much has changed: Advances in public health knowledge, treatment and technology have allowed the development of coherent and effective malaria control strategies, as set out by WHO and in the Global Malaria Action Plan.

Getting results

The last decade has also seen a series of innovations that make fulfillment of the 2015 goal achievable. The first of these is the long-lasting insecticide-treated net

(LLIN). Lasting at least three years, these nets have been shown to lower transmission by 90%, malaria incidence by 50%, and child mortality by 15%. Over the last few years, there has been a massive international push to deliver these nets: WHO has reported that 289 million nets were delivered to sub-Saharan Africa between 2008 and 2010. That is enough to cover 76% of the population at risk.

Indoor residual spraying (IRS) – where walls are sprayed with insecticide – has also been shown to reduce transmission, and WHO recommends it be used in tandem with LLINs. Here again, distribution has been impressive,

The malaria cycle

How malaria spreads – the cycle of infection

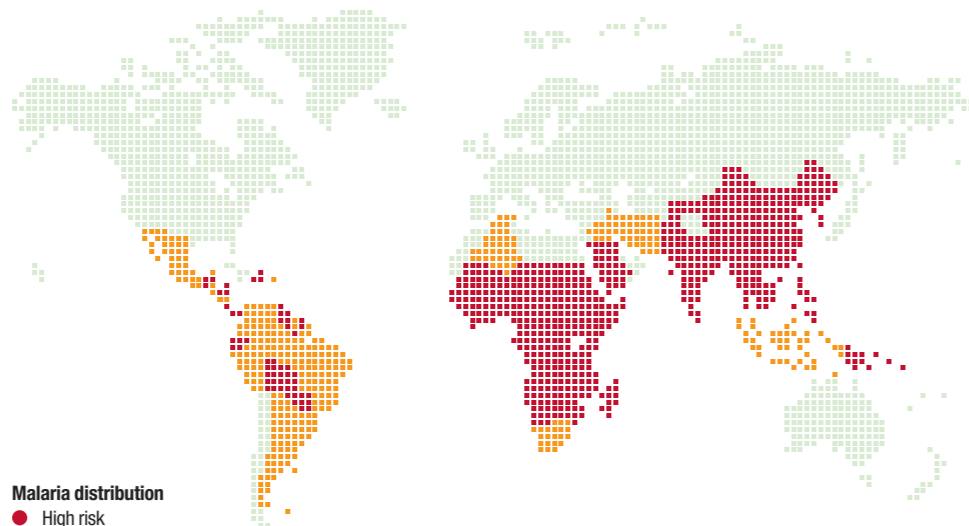
Malaria is a disease caused by a parasite called *Plasmodium*. It is transmitted exclusively through the bites of female *Anopheles* mosquitoes. When an infected mosquito bites a human, the parasites enter the blood. Within 30 minutes they infect the liver. Between six and nine days later, the parasites leave the liver and enter the bloodstream where they invade red blood cells. As the parasites multiply, the red blood cells burst, releasing thousands more parasites into the bloodstream where they infect other blood cells. It is at this point that the person will suffer from high fever, chills, nausea and anemia. When another mosquito bites the infected human, the parasite is transferred to that mosquito. While in the second mosquito, the malaria parasite goes through several stages of growth, which takes between 10 and 21 days, depending on the parasite species and the temperature. When the second mosquito bites someone else, the cycle begins again.

Why species and climate matter – the perfect storm

About 20 different *Anopheles* species are locally important around the world. Some prefer to bite animals, while others prefer to bite humans. Some have longer life spans, which gives the malaria parasite the time it needs within the mosquito to develop. If the mosquito dies, the parasite dies with it. The hotter the climate, the less time it takes for the parasite to develop.

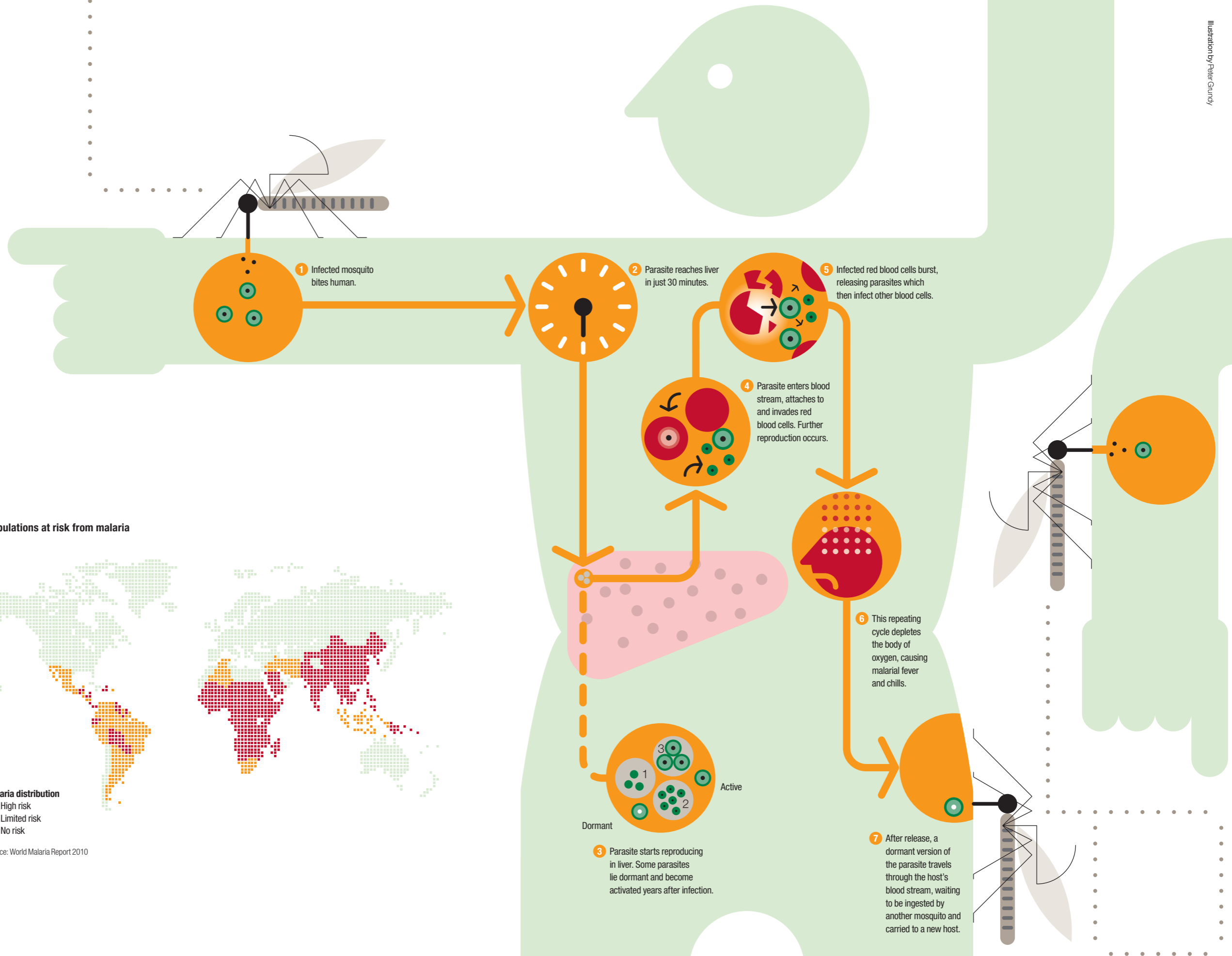
In sub-Saharan Africa, the *Anopheles gambiae* mosquito both prefers to bite humans and has a longer life span. The climate also allows the mosquito to survive year-round – and the heat helps the parasite to develop quickly. As if this weren't sufficient, Africa is also home to the deadliest form of the malaria parasite: *Plasmodium falciparum*. It is for all these reasons that an overwhelming 90% of malaria deaths occur in Africa. ■

Populations at risk from malaria



Malaria distribution
 ● High risk
 ● Limited risk
 ● No risk

Source: World Malaria Report 2010



Professor Jeffrey Sachs is the Director of The Earth Institute, Quetelet Professor of Sustainable Development, and Professor of Health Policy and Management at Columbia University in New York. He is also Special Advisor to United Nations Secretary-General Ban Ki-moon. From 2002 to 2006, he was Director of the United Nations Millennium Project, and Special Advisor to United Nations Secretary-General Kofi Annan on the Millennium Development Goals, the internationally agreed goals to reduce extreme poverty, disease, and hunger by the year 2015.

The great campaigner

An interview with Jeffrey Sachs

Can a disease as infectious as malaria ever really be controlled – and is it worth the cost of trying? The answer, according to Professor Jeffrey Sachs, is an unequivocal “yes.”



Pioneering economist Jeffrey Sachs has campaigned long and hard to engage the global community in the fight to end poverty – of which controlling malaria is a key part. Indeed, he was among the first to bring the importance – and feasibility – of malaria control to the world’s attention. Today, the malaria community is galvanized around the U.N.’s Millennium Development Goals (MDG) to halt and begin to reverse the incidence of malaria and other major diseases by 2015. As Special Advisor to the U.N. Secretary-General on the Millennium Development Goals, Sachs understands more than most what needs to happen to make the deadline.

Creating Chemistry: The developing world is beset with problems, from disease to conflict, weak governance and extreme poverty... why is malaria so important?

Jeffrey Sachs: Malaria is a major killer and barrier to economic development because not only does it cause illness and death, it impedes investment and has pervasive effects that delay or block economic growth. But it’s also an absolutely controllable disease, and one can make tremendous progress in fighting it at very low cost. So the combination of it being a major scourge and yet controllable makes it a very high priority for action.

One of the U.N.’s Millennium Development Goals is to halt and begin to reverse the incidence of malaria by 2015. Do you think this goal is still achievable?

The goal is being met right now. There’s a tremendous reversal in almost all parts of the world – most notably in sub-Saharan Africa, which is the epicenter of the global malaria burden. This progress could be even more dramatic between now and 2015 if the steps that are currently underway are strengthened and implemented as planned. Malaria stands out as one of the great success stories of the Millennium Development Goals.

Why has it been so successful?

Malaria is subject to rigorous control through a set of known and established protocols. Malaria control has two major dimensions: One is vector control* to block transmission, and the other is case management to treat cases of the disease. These are interacting because better treatment is also a kind of transmission control.

There’s been a suite of very important technologies not only developed but implemented in the last 15 or so years: a new class

of medicines based on artemisinin; new Rapid Diagnostic Tests which have removed the need for microscopy; much better vector control capability because of long-lasting insecticide-treated nets (LLINs); and better systems for community-based treatment. When you put all that together you have the potential for very significant control.

The other two things that have changed over the last 10 years are increased financing to implement these measures, and improved systems from the global to the local level. This has been a very, very major effort – and a fight also, to gain attention, to mobilize resources and build systems – but it’s bearing fruit.

So do you think working towards that goal is a matter of simply reinforcing what’s in place now?

There’s always a need for continuing innovation, especially since malaria medicines and vector control technologies can lose their efficacy through resistance – either of the mosquito to insecticides, or the parasites to medicine. What we know right now is that this very powerful combination of action requires a whole system of delivery. That means resources: natural resources, human resources, organizational capacity, political will. And keeping such systems in motion is not simple.

This is not a market-driven process by and large. It’s a public policy-driven process – which makes it harder than if this were a matter of selling products on an open market.

A tremendous amount of energy, leadership and intellectual effort needs to go into sustaining a high-intensity control effort. So far there has been a lot of progress – and it has required breaking through a lot of barriers of ignorance and indifference. In many parts of the world high income countries are needed to support much of this, and that has happened. Now we face another challenge: Rich countries are all in economic and political crisis right now. Whether they are able to sustain this effort is probably the most important question.

Do you think political will is waning?

Certainly in Europe, the United States and Japan, aid budgets are under attack – even though the total cost of malaria control that is needed at \$3 billion to \$4 billion a year is tiny. Mobilizing that level of funding is very difficult because malaria gets swept up in the general frenzy to cut development aid that is occurring in U.S. Congress and elsewhere. So this is a very difficult period. And I would say that in Europe,

the will to keep up this fight is limited and fragile. So we’ve had great success, but I don’t think we can guarantee against backsliding.

So how do you maintain momentum and keep donors engaged and committed?

Well, it requires a tremendous amount of legwork. In the early years I was heavily involved in campaigning: Helping to set up the Global Fund, the President’s Malaria Initiative in the United States, campaigning for the mass distribution of bed nets and many other components. And I can tell you – you face a lot of blank stares from senior officials for many, many years. So it requires people who are ready to spend a tremendous amount of time trying to educate, control, shame, pressure and advise people. We need as many champions of that sort who can speak loudly, clearly, boldly and ethically about this – I think this is key. Success requires a tremendous sustained effort by lots of stakeholders.

What role does private enterprise have to play?

Companies have a major role to play in providing quality products and improving technologies. And I would say [their role is also] critically – and unusually in some ways – working with public sector organizations, or multilateral organizations like the Global Fund, or working with the U.N. Secretary-General, to ensure that the public-private partnerships needed for success are operating effectively. So I think companies have multiple roles – both as developers and providers of technology, as capable scale managers, and as partners in public-private partnerships. And CEOs need to appreciate that they are among society’s most important political actors, because politicians listen to them. They have to explain to politicians who are overwhelmed, overstretched, and not necessarily aware of the great progress that has been made, that this fight against malaria needs to be sustained and scaled up.

For years you’ve argued the case for an integrated approach to tackling poverty – through fighting disease, increasing agricultural productivity and so on. The Millennium Villages project put the theory into practice in 33 villages – with positive results. Could you tell us a bit about that?

This project is now in about 15 countries. Leading scientists work together with local communities to apply best practice technology to achieve the Millennium Development Goals. >>

“Malaria stands out as one of the great success stories of the Millennium Development Goals.”

Jeffrey Sachs

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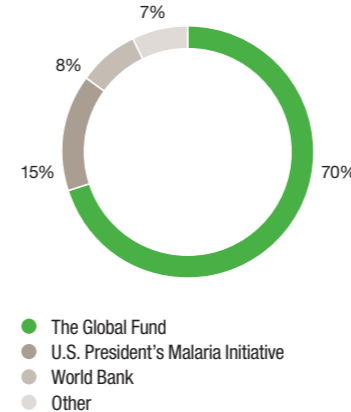
* A vector is an organism that carries pathogens that are transferable to humans – such as the malaria pathogen *Plasmodium falciparum*, which can be transferred to people via mosquitoes of the genus *Anopheles*.

Right Jeffrey Sachs, Special Advisor to the Secretary-General, takes part at the U.N. Global Compact Leaders Summit 2010 Closing Press Briefing, New York. On the left of the photograph is Chad Holliday, Chairman of Bank of America, and on the right of the shot is Georg Kell, Executive Director of the U.N. Global Compact.

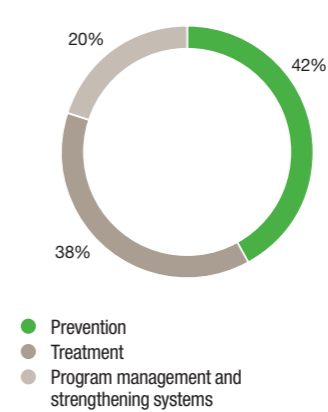


Funding the fight

Percentage of total malaria financing by organization, 2003–2009



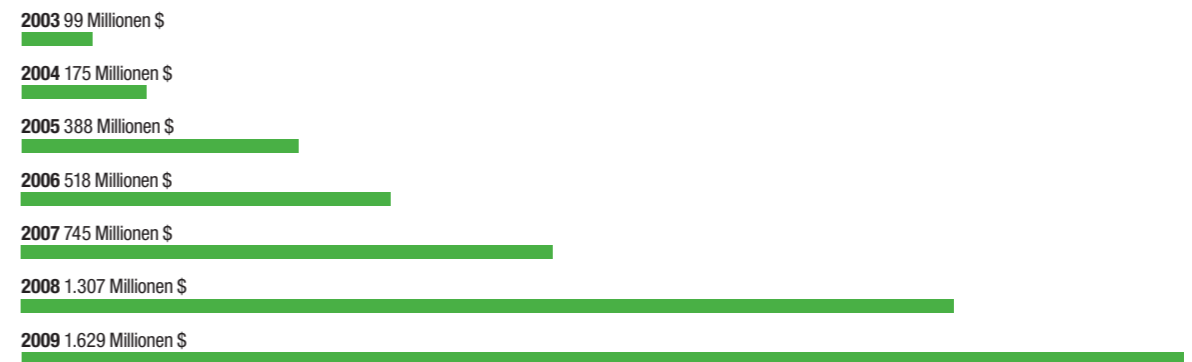
How the funding support is used in Africa



Over the last decade, external funding commitments towards malaria control have increased over fifteenfold. Most of the funding is supplied via three organizations: the Global Fund, the U.S. President’s Malaria Initiative (PMI) and World Health Organisation (WHO), with the rest provided by around 18 countries and several agencies as bilateral funding. According to the Roll Back Malaria (RBM) partnership, there is a direct correlation between funding and intervention coverage – in other words, the funding works. Yet while funding levels appear to have peaked at \$1.6 billion a year, this is still just 25% of the estimated \$5 billion to \$6 billion a year needed to achieve the Millennium Development Goals for malaria.

Source: RBM’s report *Malaria Funding and Resource Utilization: The First Decade of Roll Back Malaria*.

Annual funding commitments of the Global Fund, World Bank, U.S. President’s Malaria Initiative (PMI), countries and multilateral donors participating in the Development Assistance Community (DAC)



Source: RBM’s report *Malaria Funding and Resource Utilization: The First Decade of Roll Back Malaria*.



Left United Nations Children Education Fund's former executive director Ann Veneman and leading U.S. economist Jeffrey Sachs dance with Kenyan students in Sauri village, Siaya District, 450 kilometers west of the Kenyan capital Nairobi. Veneman and Sachs visited Sauri to look at development projects targeting children.



Left For many people, health clinics are simply too far away, making integrated community-based treatment essential.

Malaria control is one of the priorities. We use a community-based malaria control methodology: mass distribution of LLINs, community health workers to help households use the nets properly, and a community health workers' system which covers all households to observe cases of malaria in the community and then apply treatment within the community – saving the time required to travel to clinics and thereby saving many lives.

Community health workers carry mobile phones with an expert, text message-based system to enter the results of Rapid Diagnostic Tests for individual patients, and then receive instructions by text on dosage and follow-up advice for the households. So this is the holistic system of community-based malaria control including vector control and case management. It is cutting edge, and the results are striking: a very significant reduction of malaria incidence, mortality rates in children under five, and overall disease burden from malaria across sites. The project has built systems for highly successful, on-the-ground malaria control.

What would you say to the criticism that the results of the Millennium Villages can't be replicated everywhere?

It's the opposite. In Nigeria, the Millennium Village project is being taken from two main sites to 113 local government areas; so from a coverage of about 50,000 people to about 20 million people. We just signed an agreement with the government of Rwanda to scale up the lessons of the Rwandan villages to a national scale. Similarly, we'll proceed in Senegal with the same type of scale-up. So the use of systems – especially information and communications technology (ICT) systems that are readily replicable and that can be documented and rigorously costed – is why this project is so important.

We've also issued a world report on optimum deployment of community health workers and we've estimated the cost of such deployment to be roughly \$5 to \$6 per villager in a rural area. We're working with governments to scale up community-based health workers as a frontline tool in the control of disease. Not just for malaria, but also with other problems such as chronic hunger and safety in childbirth.

So the whole project is designed for scale-up by using open source ICT and using vigorous costing and system development.

Why is such an integrated approach so important?

Significant gains have been achieved by the mass distribution of LLINs –

something for which I campaigned for over a decade. But I've also stressed that vector control needs to be combined with effective case management. And in the African context, effective case management can't be done as a clinic-based service – [clinics] are often too far away, transport is weak, there are too few higher-level health workers such as registered nurses or clinical operatives – so we need community-based treatment. But this requires a system: training of health workers, logistics, staffing, supervision, monitoring, data management. So you can't do these things haphazardly or with the magic bullet of something as wonderful as the LLINs.

A lot of the public discourse is about the magic of the single tool, and of course it's good for the public to understand some of the key inputs. But it worries me a lot because [while] the big success of the last couple of years has been the mass distribution of bed nets – and there is more availability of artemisinin-based combination therapies – there hasn't yet been a proper scaling up of primary health systems. This is what the Global Fund should invest in, but it is under financial attack by donor governments in the West, basically because of the spillover of the budget crisis. And I think this is the weakest point of the malaria campaign right now. The 2015 campaign will not work unless we massively scale up the training and supervising of health workers.

Isn't government corruption still also a major challenge?

I regard this to a very large extent as an information challenge as much as a morality challenge, in that the mismanagement and misuse of money is a phenomenon everywhere in the world. There has to be very strong diligence. We have to use ICT to make sure inputs go where they're supposed to go and to make sure we're tracking outputs and outcomes so that we know how these projects are doing and can make adjustments as necessary.

What would you like to see happen next?

The single most important thing right now is that the Global Fund for financing malaria control should remain robust to 2015 and should support the scaling-up of primary health systems globally – especially community-based malaria control strategies around community health workers. If this is done – if the Global Fund is properly financed, and if countries are able to obtain funding from it for effective community-based malaria control, we will succeed. ■

A vaccine against malaria?

Developing an anti-malaria vaccine has proved challenging – but after decades of research, two recent breakthroughs are inspiring new hope. First, a vaccine called RTS,S from pharmaceutical company GlaxoSmithKline. According to a study published in the *New England Journal of Medicine* around 15,000 infants and young children were vaccinated with RTS,S with promising results. This is the first time a vaccine has reached this stage of clinical development. A long-term analysis is not yet available, but initial findings indicate that in one group of children, the risk of contracting malaria was reduced by as much as 56%. The number of severe cases of malaria also fell by 47%.

The vaccine's effectiveness is still too low for widespread use – a vaccine is not usually considered for production until it is effective in 70% to 80% of those vaccinated.

The second recent breakthrough holds even more promise: Scientists at the Wellcome Trust Sanger Institute in Cambridge, U.K., have discovered a single receptor the parasite needs to be able to invade human blood cells and complete its life cycle in the human body. It is hoped that this discovery of the parasite's 'Achilles' heel' can be exploited to develop an effective vaccine that could contribute to the eradication of malaria worldwide.

However, experts say it's too early to celebrate just yet: It is still unclear how a vaccine could be distributed to everyone, especially in the poorer areas of Africa. Vaccines like RTS,S must be refrigerated until they are administered and can only be given by trained professionals, so local infrastructure and healthcare systems are often not adequately equipped. The affected countries would have to rely on financial support from developed countries, and this has tailed off in recent years. As Dr. Oliver Moldenhauer of aid organization *Médecins Sans Frontières* remarked in an interview with the German online magazine *Der Spiegel*: "Admittedly, significant progress has been made, but that should not result in cuts to malaria prevention and treatment. We need more mosquito nets and drugs."

To find out more, visit:
Roll Back Malaria: www.rbm.who.int

“Malaria is an absolutely controllable disease, and one can make tremendous progress in fighting it at very low cost.”

Jeffrey Sachs ▶▶

Making a difference

While sub-Saharan Africa bears the brunt of the malaria burden, other areas of the world are under similar strain. In some states in Brazil, particularly those located near the Amazon forest, malaria is the major public health problem. The small community of São José do Jabote, Uruará, is in one such malaria hotspot.

Here, the warm climate and abundant water supply offer ideal conditions for the malarial mosquito to survive, thrive and infect the human population. The consequences for São José do Jabote's men, women and children have been dire.

Four years ago, malaria was as rife as the common cold, with each person in São José do Jabote contracting the disease at least three times a year. School attendance had plummeted and, unsurprisingly, the community's educational objectives were under threat. It was here that BASF, in partnership with Foundation for Health Surveillance in Amazonas (FVS – AM), launched a study to assess the effectiveness of Interceptor®, BASF's long-lasting insecticidal net.

In late 2008, the project kicked off: Interceptor nets were placed in every house in São José do Jabote. Residents were also coached on how to use the nets and what they were for. The results were impressive. Just two years later, the incidence of malaria had fallen by 97%, with only one person in every 12 contracting the disease. The positive effects rippled throughout the community. Free from malaria, the children were finally able to regularly attend school – allowing the community to meet its literacy objectives in just two years. These effects typify one of the major targets of the U.N. Millennium Development Goals – namely, that a healthier, more educated population is key to sustainably support poverty reduction.

BASF is convinced that supporting and engaging in simple local projects can bring life-changing benefits. The results in São José do Jabote bear this out. ■



Left The introduction of Interceptor®, BASF's long-lasting insecticidal bed net, led to a 97% reduction in cases of malaria in São José do Jabote, Brazil. The entire community of São José do Jabote benefited, particularly young people who are most affected by malaria.



Left The São José do Jabote community in Brazil is located in the lower Amazonas region in the district of Uruará, on the left bank of Jatapú River.



One of the biggest advantages of the Interceptor® nets is that they can easily be installed by a single person. Residents in São José do Jabote received simple coaching on how to use the product, and could then set up nets in their homes themselves, without the need for any complicated tools, skills or help. This ease of use has helped Interceptor nets become widely accepted in the area.



Left There is no major road infrastructure in the region, thus river transport is the main form of travel. FVS – AM teams traveled monthly to São José do Jabote to monitor how the fight against malaria evolved. The results were astonishing: The rate of malaria fell from 3.52 cases per person in 2007 to only 0.12 cases per person in 2010.

Below Education is another key element of the initiative from BASF and FVS – AM: Schoolchildren color pictures of mosquitoes to learn more about the insect that caused 465 cases of malaria in 2007 among a population in São José do Jabote of just 132.

Right A nurse takes a blood sample from a São José do Jabote child. The blood will be tested for the presence of the *Plasmodium falciparum* parasite.

Below To successfully combat malaria, the villagers learned more about how to use and care for the Interceptor® bed nets. This included special education programs for São José do Jabote's children that helped them understand the importance of mosquito control.



Net value

How BASF's Interceptor® mosquito nets save lives



Above BASF's Interceptor® nets in action in Brazil.

Nearly 165 million mosquito nets made by different producers were supplied to malaria zones in 2010 – with around 145 million going to sub-Saharan Africa alone. The percentage of at-risk households owning at least one net has risen from 3% in 2000 to 50% in 2011. According to the World Health Organization (WHO), as long as there is no effective vaccine against malaria, mosquito nets will continue to be a decisive tool in malaria control.

To meet WHO recommendations, nets must last for three years and 20 washes and contain an insecticide that kills mosquitoes after brief contact – such as BASF's mosquito net Interceptor®. It is thus recommended by the WHO as a "long-lasting insecticide-treated net" – or LLIN.

The nets are most effective when used in combination with other malaria control products (see box on right). Dr. Egon Weimüller, Head of the Public Health business at BASF, explains that collaboration between the private sector and aid organizations is also essential: "For instance, we work very closely with aid organizations who distribute the nets as they are crucial in supporting the process on-site."

Making nets truly effective

While ordinary nets will keep mosquitoes at bay, they won't prevent them biting

through the mesh or flying on to find other unprotected victims. Not until the net has been treated with an insecticide can the cycle of malaria transmission be effectively disrupted.

Interceptor nets are coated with alpha-cypermethrin. Harmless to humans, this active ingredient had already been used in the BASF insecticide Fendona® before the company began research on Interceptor in 2004 at WHO's request. The biggest challenge was attaching the active ingredient to the net's synthetic fiber in such a way that the net would remain effective for at least three years and 20 washes. The solution was Interceptor's special odorless coating, which continues to protect against mosquitoes after multiple washes.

While LLINs like Interceptor have been a positive milestone in the fight against malaria, there are still challenges ahead. Widespread use of the active chemical agents can result in mosquitoes developing resistance. This can trigger a fatal cycle: If the insecticide fails to affect even a minimal proportion of mosquitoes due to natural resistance, these mosquitoes survive, reproduce and multiply while their contemporaries die off. In a worst-case scenario, the resistant mosquitoes could eventually become so numerous that the malaria infection rate increases again.

Breaking the cycle

It's possible to break this cycle by developing a new active agent – but at around \$200 million, development costs are high. So high, in fact, that the last time a new active agent for mosquito nets was introduced was 23 years ago. "Financial resources are limited, especially in the area of public health," explains Weimüller. Companies have to go through a costly process to gain WHO approval for their public health products; often, shortly after a product has been brought to market, copycat goods start to appear.

These circumvent the research costs, which inhibits development activities at research companies.

Developing a new solution

Despite the challenges, BASF still has a solution up its sleeve: the insecticide chlorfenapyr. The company is currently in the process of developing a next generation of malaria control products based on this active ingredient, which has already proven safe and effective in other BASF insecticides for crop protection and urban pest control – thus making it possible to accelerate development. In the fight against malaria, however, the insecticide marks an innovation: Whereas traditional insecticides affect structures of the mosquito's central nervous system, chlorfenapyr disrupts cell metabolism. Because it works differently, this insecticide will help stem malaria in areas of current insecticide resistance.

Introducing this insecticide into public health schemes still involves a lot of investment and work. BASF is working with the London School of Hygiene & Tropical Medicine (LSHTM) and the Innovative Vector Control Consortium (IVCC). While both institutes are responsible for lab testing and field studies, BASF is handling development, registration, approval and sales. Dr. Robert Sloss, Portfolio Manager for public health products at the IVCC, stresses: "New approaches that safeguard and expand the arsenal of active agents currently available are essential. That's the only way we are going to get a handle on the ever-increasing levels of resistance."

Initial tests have confirmed the effectiveness of the new active agent against insecticide-resistant mosquitoes. Weimüller says: "We also hope that this cooperation and the positive results will provide additional motivation for all parties involved in the fight against tropical diseases." ■

The science behind the innovation

The Interceptor® mosquito net by BASF remains effective against mosquitoes even after several years. So how does it work?



1. The net fibers are coated with a polymer binder combined with an insecticide. The binder attaches the active agent to the fiber in such a way that it remains evenly distributed across the surface for years.



2. The mosquito lands on the net.



3. Brief contact with the net is enough to seal the mosquito's fate.



4. A few minutes after contact, the stunned mosquito falls to the ground – this is called the 'knock down.' The insecticide has disrupted the structures in its central nervous system.



5. Almost all mosquitoes die within a few minutes.

BASF's contributions to fighting malaria

Our 5-Pillar Action Plan focuses not only on products designed to control the insects that disseminate disease, but also actively pursues collaborative partnerships and initiatives with the international public health community, as well as developing innovative solutions to help win the battle against malaria.



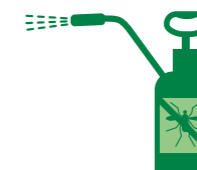
To find out more, visit: www.publichealth.basf.com

1 Interceptor® nets



Interceptor nets offer protection, especially at night, from mosquitoes that spread malaria. They are treated with Fendona®, an insecticide that kills mosquitoes on contact.

2 Fendona®



The insecticide Fendona is applied to interior residential walls by trained professionals. The mosquitoes die after touching the treated walls.

3 Abate®



Residential areas can be protected when standing water is treated with the larvicide Abate to prevent mosquito larvae from developing.

4 Partner organizations



BASF is a partner with various aid organizations that are trying to put an end to malaria and improve health systems in the affected countries.

5 New products



Mosquitoes are becoming immune to the existing active ingredients. BASF is therefore working on a new generation of products to combat malaria.

africa's water **loves** treatment

In Africa, Guinea worm cases have been drastically reduced since 1986 by using our Abate® larvicide: an efficient water treatment product that kills insect larvae and makes contaminated sources safe again. When eradicating life-threatening diseases means helping communities to grow stronger, it's because at BASF, we create chemistry. www.basf.com/chemistry