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?
So why malaria – and why now?

The poverty connection

Unlike other deadly diseases, malaria is curable and preventable. Research has also demonstrated that the economic and social effects of malaria are devastating. Malaria keeps children away from school and access to work, if public 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 weren’t so successful, with malaria cases following 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 all-year-round. The climate factor at least partly explains why it is still the malaria burden. Around 90% of all malaria cases occur in Africa. Critics are quick to question why, 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 95%, 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 269 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) – walls and roofs sprayed with insecticide – has also been shown to reduce transmission, and WHO recommends its use in tandem with LLINs. Here again, distribution has been impressive, with 73 million people in Africa protected from malaria with IRS programs, up from 10 million in 2005. The last decade has also seen the arrival of artemisides, a new generation of antimalarial 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 21% in comparison with the beginning of the millennium. In 2015, 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 resurgence 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 mepacrine.

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 fail 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 UK 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.
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

Source: World Malaria Report 2010

Malaria distribution
- High risk
- Limited risk
- No risk
The great campaigner

An interview with Jeffrey Sachs

Can a disease as infectious as malaria ever truly be controlled — and is it worth the cost of trying? The answer, according to Professor Jeffrey Sachs, is an unequivocal “yes.”
Malaria stands out as one of the great success stories of the Millennium Development Goals.
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 test 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 has been 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’re proceeding 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 observed 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 – [it’s] often too far away. Transport costs in Asia, 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 what’s behind 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 sloppy 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 a major challenge? I regard this to be 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.
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, Urucará, 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.
One of the biggest advantages of the Interceptor® nets is that they can easily be installed by anyone. 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.

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.

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 Jabotê of just 100.

Malaria: The reality
Malaria: The science

Net value

How BASF’s Interceptor® mosquito nets save lives

Nearly 165 million mosquito nets made by different producers were supplied to at-risk 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). 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 ingredients 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 Werner. 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, copyleft 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 new 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 MOC, 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. Werner 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 an insecticide 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. After minutes after contact, the insecticide kills the mosquito.

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 with the battle against malaria.

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

The insecticide Fendona is applied to mosquito nets after touching the treated walls.

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

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.

Deep Partnerships

BASF’s contributions to fighting malaria

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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