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The critical role of vector control in the fight against malaria

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Interview with Dr Jan Kolaczinski, Coordinator of the Global Malaria Programme's Entomology & Vector Control unit

Sprayer about to enter a house in western Kenya where the walls will be sprayed with insecticides to kill malaria-carrying mosquitoes.
Sven Torfinn/ WHO 2016

How would you define vector control?

In global health, a vector is any organism that is a vehicle for disease transmission. We use the term vector control to refer to the different methods used to prevent the vector from transmitting a disease. In the case of the malaria parasite, the vector is the female *Anopheles* mosquito.

Soon after a female mosquito hatches, she will go out looking for a blood meal to give her energy and the nutrition she needs to produce her eggs (males do not feed on blood but instead obtain the energy they need from plant nectar). If a female mosquito bites a person infected with malaria, she will pick up the parasites. However, she won't be able to pass on the parasites to another person until the parasites have matured inside her – a process that takes about 10 days. This gives us a window of opportunity to effectively kill the mosquito vector before she can infect someone else.

What are the most powerful vector control tools currently in use?

In short, to prevent malaria we essentially try to do 3 things: stop mosquitoes from getting infected, prevent them from surviving long enough to pass on the infection, and prevent people from getting infected. Two of the most effective tools we have to fight malaria are insecticide-treated mosquito nets (ITNs) and indoor residual spraying of insecticides (IRS).

The idea behind IRS is to apply insecticides to the inside walls of homes. These insecticides will kill mosquitoes when they rest on the walls after biting someone. IRS works really well and has been around for a long time, but it is logistically more difficult to implement than ITNs. Anyone who has had the experience of walking around in protective gear on a hot day with a heavy spray-tank of insecticide on their back will appreciate the effort it takes to do this year after year.

Depending on the length of an area's malaria transmission season and the insecticide formulation being used, an area at risk of malaria transmission will need to be sprayed once or even twice a year for malaria to effectively be controlled. And a high percentage of houses in a community need to be sprayed to get the effect you want – to ultimately reduce the lifespan of mosquitoes so they die before they can transmit the disease. So while it's very effective, some of the practicalities are challenging and that's part of the reason why ITNs were developed.

ITNs are incredibly effective and have had a huge impact over the years. ITNs alone were responsible for 69% of all of the malaria cases averted by interventions in Africa since 2001. They must be distributed along with health education, to help people understand how to use and care for them.

What is the role of the Global Malaria Programme's Entomology & Vector Control unit?

The main role of the unit is to set global norms, standards, and guidance based on robust evidence. We want to provide malaria endemic countries with the best possible advice on what they should be doing to control the disease or, if a country has already been successful in eliminating it, to prevent it from coming back. In order to do that, we first assess where gaps in guidance exist, convene a group of experts to assess existing evidence, and then develop appropriate recommendations based on the advice of these experts. In this process, it is important to note that any advice you give is only as good as the absorption and use of that advice.

Another role we play in our unit is to interact with countries and implementing partners to make them aware of new WHO recommendations and work with them to support implementation.

Can you talk a little bit about how to improve access to vector control tools, and what some of the challenges have been?

The ultimate goal is simply for everyone living in malaria endemic countries to have access to these tools and, in the case of ITNs, to be using them every night. But we're not there yet. We've made massive progress, but there continues to be significant gaps in coverage. Addressing these gaps will be critical to achieving successful control and, ultimately, malaria elimination. Of course, increased funding will be critical for improving coverage – obviously you need to have enough money to buy the tools and deliver them to communities. But we also need to be continually refining and improving our strategies.

The malaria community has been very effective in getting our core vector control tools into communities very quickly through mass distribution or large spray campaigns. But we know, for example, that system inefficiencies increase as coverage goes up. From survey data, you can see that some individuals are consistently missed by mass campaigns, while others have more than sufficient nets to cover the household. So one thing we need to work on is improving our understanding of where coverage gaps lie and how they are being created, to work out better ways of getting interventions to all those who need them.

Are there improvements you'd like to see with existing vector control tools?

There is research ongoing to make the tools we have more effective and longer lasting. I'd like to see long-lasting insecticidal nets (LLINs) become more durable. LLINs are treated with insecticides that can be effective for up to 3 years, but the nets can often tear and develop holes that make them become unusable before those 3 years are up. I think there is also some room to make the residual effect of IRS last longer, so that we do not have to spray as frequently.

Finally, we've been very successful at targeting mosquitoes that bite indoors with these interventions to date, but we know that malaria transmission continues to occur in certain areas. I think that, going forward, we will need to focus on developing ways to control malaria vectors that tend to bite and rest outdoors.