University of Basel

The Resistant Mosquito

Video Transcript

The value of Insecticide Resistance Management

DAVID: Insecticide-based vector control tools account for nearly 80% of the gains over the past 20 years in reducing malaria. Two of the most effective tools are long-lasting insecticide-treated nets and indoor residual spraying.

Most insecticides used for vector control are repurposed from agricultural use. In that agricultural setting, malaria mosquitoes may be exposed to these insecticides. This means that the selection pressure on the mosquitoes increases, and they might become resistant to the insecticides.

Novel insecticides, specifically developed for vector control, may not face this challenge, but can be costly and time-consuming to develop. Widespread use of these insecticide-based interventions means that the major malaria mosquito species have developed and will continue to develop a resistance against these insecticides.

There are only a limited number of effective insecticides currently available. If resistance isn't expertly managed, the existing tools will lose their effectiveness, leaving at-risk populations vulnerable to malaria. Developing novel insecticides with the right properties for vector control can take a decade, and cost tens of millions of dollars. Manufacturers are not pre-disposed to investing these large sums, because vector control is a relatively small and unprofitable market, delivering a poor, or negative, return on the investment.

There is another option, though: when governments, donors, and companies work together through a so-called Public Private Partnership, or a PPP, the necessary funding for research and development can be mobilised. This helps ensure that new insecticides become available and are affordable.

However, a lot of time can pass between interventions failing in the field due to insecticide resistance and the introduction of replacements. This will likely cause an upsurge in malaria cases, because the at-risk population would be increasingly exposed to infectious mosquito bites.

In addition to the public health impact of losing vector control tools to resistance, there is also a tremendous economic impact. Economists estimated in the early 2000s that the annual cost of malaria on

the African economies was $12 billion. This includes the cost of health care, days lost in education and employment, the decline in productivity, lowered trade and foreign direct investment and tourism.

To show you some real-world examples, my colleague Andrew Saibu will introduce you to two projects where new tools were created to address insecticide resistance.

ANDREW: With the onset of widespread resistance to pyrethroids in the mid-2000s, malaria programmes have struggled to effectively implement Insecticide Resistance Management and use dropped significantly. The Innovative Vector Control Consortium, or IVCC, led Next Generation Indoor Residual Spraying, or NgenIRS, project helped introduce three new longer lasting, or third generation, non-pyrethroid insecticides across Africa. This enabled programmes to control the pyrethroid-resistant mosquitoes, but also to implement insecticide rotation.

These 3rd generation IRS products, when combined with pyrethroid based long-lasting insecticidal nets, or LLIN use, resulted in a further 22%-47% reduction in malaria cases. The impact of losing insecticide-based interventions to resistance is similar to those interventions being removed or stopped for other reasons. Malaria cases significantly increase when people have to suspend indoor residual spraying, or IRS. Conversely, we can observe significant reductions in cases when a 3rd generation IRS product has replaced pyrethroid-based interventions.

Following the success of the NgenIRS project, the 'New Nets Project' was created. This initiative has the objective of introducing 'resistance breaking' dual insecticide-treated bed nets. These can be integrated into Insecticide Resistance Management programmes.

The project is creating an evidence base for dual-insecticide nets that could replace the pyrethroid long lasting insecticidal nets that have become less effective in providing community protection, even if they continue to provide personal protection.

If today's vector control tools lost their effectiveness because of insecticide resistance, the impact on the health and wellbeing of millions of people living in malaria-endemic regions and on regional economic development would be huge.

There are also very large costs and timeframes associated with developing novel insecticides for vector control, and we can't rely on a conveyor belt of novel insecticides to get us out of trouble. Insecticide resistance poses a major threat to malaria elimination efforts.

NARRATOR: Vector control programmes can only make progress through robust Insecticide Resistance Management and the continual development and deployment of new insecticide-based interventions, used

as part of a wider integrated vector management approach. Implementing Insecticide Resistance Management as part of a wider vector control programme may bring extra cost, but the cost of failing to implement it will be much greater.