Mosquito

No flight, no bite – 'Mosquito grounding' bed net nearly halves malaria infection in Tanzania children

Long-lasting insecticidal nets are the cornerstone of malaria control in sub-Saharan Africa. However, the recent resurgence in malaria is partly due to the bed nets' effectiveness being compromised by widespread resistance to pyrethroid insecticides in Anopheline mosquitoes. Chlorfenapyr, a different class of insecticide, works very differently to pyrethroids, causing wing muscle cramps that stop the flight muscles from functioning.

To generate evidence for the effectiveness of chlorfenapyr nets (and two other next-generation nets), a large cluster randomised trial took place in Misungwi, Tanzania.

After 24 months, malaria infection was reduced by 37% in children that received the chlorfenapyr net compared to those receiving standard pyrethroid net. The trial showed that chlorfenapyr nets were safe, decreased malaria infection and cases in children, and were cost-effective.

This trial generated vital evidence for the WHO and malaria control programmes to help guide decisions regarding which type of nets to distribute when mosquitoes are resistant to pyrethroids.

Monitoring for the presence of invasive mosquito species

The invasion of *An. stephensi* mosquitoes in the Horn of Africa represents a significant threat which may jeopardise malaria control, particularly in urban areas that were formerly malaria-free. Novel vector surveillance methods are urgently needed, which are quick and easy to implement.

The use of environmental DNA (eDNA) for simultaneous detection of mosquito species, *An. stephensi* and *Ae. aegypti*, in artificial breeding sites and detection of insecticide resistance genes of the two species was validated, using 50ml and 1L containers.

The study demonstrates *An. stephensi* and *Ae. aegypti* eDNA deposited by a single larva was detectable under lab conditions. Characterization of molecular insecticide resistance mechanisms, using genomic sequencing was also possible from eDNA. *An. stephensi* eDNA was remarkably stable, and detectable almost two weeks later.

eDNA surveillance could be implemented in local endemic communities as part of citizen science initiatives, and in cargo ports at points of country entry, to monitor the spread of invasive malaria vector species.

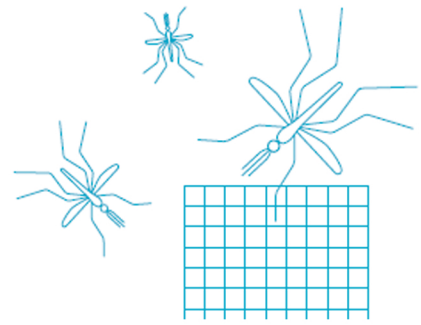
New insecticide for indoor residual spraying (IRS) tested in southern Benin

Indoor residual spraying (IRS) has contributed to recent reductions in malaria. However, its impact is threatened by the development of insecticide resistance in malaria vectors. VECTRON T500™, a new broflanilide IRS product, has shown potential to provide improved and prolonged control of pyrethroid resistant malaria vector populations. The prolonged activity of VECTRON T500™ could also have positive implications on the cost-effectiveness of IRS when applied in communities.

In Benin, VECTRON T500™ was compared to a WHO prequalified IRS product to see whether it's impact on malaria transmission was similar. Approximately 11,000 households in 16 villages enrolled in the study received IRS with VECTRON T500™ or a WHO prequalified product. The IRS application was performed in May 2021 and the impact on malaria transmission is being evaluated over 12-18 months post-intervention.

So far VECTRON T500™ has shown prolonged residual efficacy lasting over 18 months in Benin. Results on its impact on entomological indices of malaria transmission (vector density, entomological inoculation rate, species composition, insecticide resistance) in village communities will be available at the end of 2022.

VECTRON T500™ shows potential to provide substantial control of malaria transmitted by pyrethroid resistant mosquito vectors when applied as indoor residual spraying and its long-lasting efficacy will likely make it a cost-effective alternative to currently recommended IRS insecticides.



Does my skin microbiome explain why I get bitten by mosquitoes?

Some people get bitten more often by mosquitoes than others and are therefore at increased risk of contracting deadly vector borne diseases like malaria. There are natural differences in human body odour between people who are highly- and poorly-attractive to mosquitoes. This study investigated if this differential attractiveness is associated with differences in skin microbiome composition (the mix of microorganisms, such as bacteria, fungi and viruses that live on the skin).

Two cohorts of 100 twin pairs in the UK and The Gambia were recruited. Skin microbiome, body odour and socks (for behavioural testing with mosquitoes) were collected and tested for participants attractiveness to mosquitoes. Using genetic sequencing, samples were tested to look for differences in the skin microbiome composition between the twins.

In the UK cohort, differences were found in skin microbiome composition between highly- and poorly-attractive groups, with 10 differing bacterial sequences identified between the groups. The trial then investigated differences in metabolic pathways and the role of compounds in these pathways in attractiveness to mosquitoes. Work is ongoing for the Gambia cohort.

In the future, products using specific microbial compounds could be used to improve current odour-based technology or to develop next generation vector control tools.

Mass drug administration (MDA) with Ivermectin: a promising tool for malaria elimination

Progress in malaria control has stalled. To reverse this trend, novel and innovative interventions are needed. This cluster-randomised trial assessed the combined effect of mass drug administration (MDA) with two drugs (ivermectin and dihydroartemisinin–piperaquine) on malaria transmission and malaria vector survival. Ivermectin acts by killing mosquitoes who feed on people who have taken the drug, whilst dihydroartemisnin-piperaquine kills the parasites within the human.

The intervention group (16 villages) received three monthly rounds of MDA, and significantly reduced malaria prevalence and incidence compared to the control group (16 villages). Although there was no difference observed on vector survival, the intervention resulted in significantly lower vector density and the mosquito killing effect of ivermectin at individual level was evident up to 21 days post-treatment.

Ivermectin could represent an additional tool for malaria control to further reduce malaria transmission in combination with other interventions. Another LSHTM collaborative project is ongoing in the Bijagós archipelago comparing MDA using dihydroartemisinin-piperquine, with and without the addition of Ivermectin. This will help elucidate the added benefit of the Ivermectin.

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