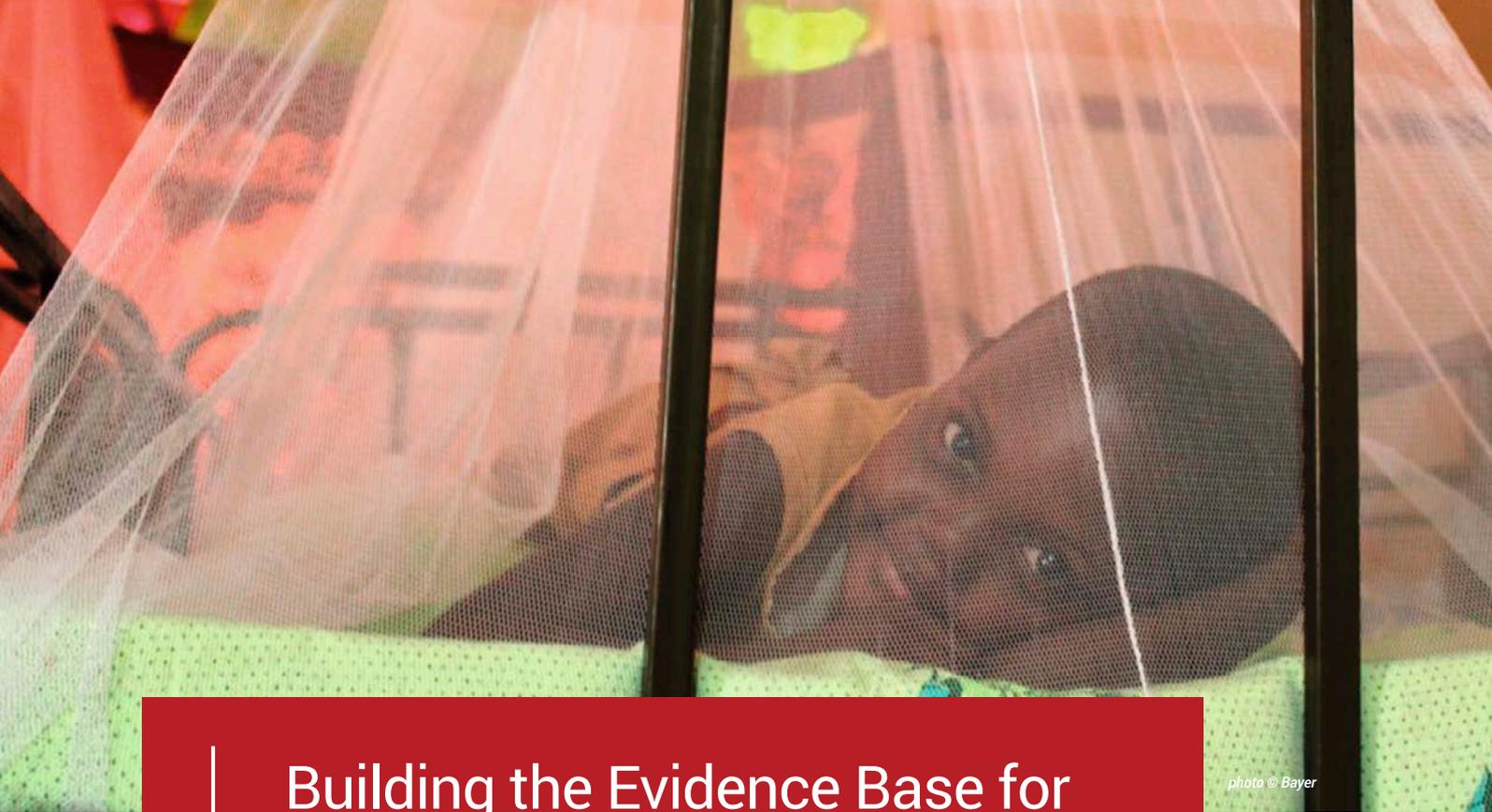




IVCC

Vector Control
10 Challenges
and 10 Solutions



Building the Evidence Base for Dual Active Ingredients (AIs) Nets

photo © Bayer

Dual AI nets present the best prospect of overcoming widespread resistance to the pyrethroid insecticides currently used in Long Lasting Insecticidal Net (LLIN) and to averting resistance developing to non-pyrethroid insecticides.

Access to new LLINs which are effective against pyrethroid-resistant mosquitoes requires sufficient evidence to support a WHO policy recommendation. They need to be affordable and cost effective compared to pyrethroid only LLINs. Demand is currently low because of these market uncertainties.

The Solution

Funded by Unitaid and the Global Fund, IVCC is leading a consortium of partners in the New Nets Project (NNP), which has the goal of making innovative net technology to control pyrethroid resistant mosquitoes more widely available to malaria programmes throughout Africa.

This will require achievement of a full policy recommendation from the World Health Organization (WHO) and market affordability through the project's market-shaping interventions that include a volume guarantee and co-payments in support of Interceptor® G2 and Royal Guard® nets. Randomized control trials and a combination of evidence and operational pilots will generate the data needed to inform a future policy decision and optimize the planning and implementation of multi-product campaigns.



Outdoor Transmission of Malaria

Credit: Mohamed Moumine Traoré, Bamako University

As mosquitoes continuously adapt to their environment, outdoor transmission of malaria has emerged as an area of particular concern.

Historically, much of the focus on vector control tool development has been on interventions targeting indoor biting such as bed nets and indoor residual sprays.

IVCC identified an important gap in the vector control toolbox and put out a call for proposals to find possible new outdoor intervention tools to help fill the gap.

The Solution

The 2015 call for proposals identified Attractive Targeted Sugar Baits (ATSB®) as a possible tool to help address outdoor transmission. A Proof of Concept trial (POC) was conducted in Mali in 2016/17.

The encouraging results led to the creation of a product development plan to extend the entomological evaluation to Kenya and Zambia. In parallel, further work is being undertaken to enhance the durability and manufacturing of the ATSB® station before launching a large epidemiological evaluation. IVCC hopes that by 2024 this potential new product class for outdoor biting will be available for use across sub-Saharan Africa.



| Growing the IRS Market

The use of Indoor Residual Spraying as a malaria prevention tool has been in decline since 2010 because of widespread resistance to pyrethroids. There was an urgent need for multiple affordable products that could be used in rotation within a competitive market to enable expanded coverage.

The Solution

IVCC conceived and led the Unitaid-funded NgenIRS programme which, through a number of partnerships, including manufacturers, donors, implementers and national malaria programmes, reversed the downward trend in the IRS market, laying the foundation for expanded coverage and the introduction of three next generation IRS products that could enable Insecticide Resistance Management (IRM) strategies for the first time.

Thanks to the NgenIRS programme, 16 countries have been able to deploy these next generation IRS products at scale and 38% less expensive than before the project was initiated. This resulted in a reversal of the downward market trend with over 30 countries now using next generation IRS. Overall, the introduction of these products resulted in a 22% to 47% reduction in confirmed cases recorded in the public health system, compared to similar communities without IRS. This translates into an estimated 4.8 million cases averted and 14,314 lives saved. Although the NGenIRS programme formally closed in early 2020, the impact on cases averted and lives saved will continue for many years.



Testing Novel AIs in Long Lasting Insecticide Nets (LLINs)

To develop new formulations of Novel-AIs at scale for use on LLINs, product developers need access to laboratory facilities which can produce medium-scale Masterbatch formulations in a controlled and safe manner. Masterbatches will allow formulation development for LLINs to be scaled-up which will speed up the product development process.

The Solution

IVCC has partnered with specialist polymer formulation company Avient to construct and bring online a medium scale production laboratory which will support the formulation development on, as yet, unregistered chemistry.

This unique facility in China which will be operational from 2021 will be available to current and future innovation partners, providing a platform for work on individual and combination Novel AIs to avoid delays in bringing new LLINs to the market.



photo © Bayer

Increasing the Efficiency of Indoor Residual Spray (IRS) Application

IRS is a proven vector control intervention. Significant advances have been made in introducing next generation formulations which, when used in rotation, manages insecticide resistance development.

However the inefficient application of the insecticide onto the wall of a house can increase costs if over sprayed or reduce its effectiveness if undersprayed.

The Solution

IVCC has partnered with the Goizper Group to develop and test a new spraying device, the iK Smart Light, to improve the application of the insecticide onto wall surfaces by reducing variability in coverage.

The device is designed to easily and continuously guide spray operators and will provide supervisors with simple information, through an app on their phone, to evaluate the spraying quality of the operators and improve training.

Working with Abt Associates and Goodbye Malaria recent results indicate that spray operators using the iK Smart Light can reduce training time, insecticide wastage and improve the monitoring and evaluation of field applications which could potentially make a significant difference in the cost and coverage of an IRS programme. IVCC is now working with the private sector and national programmes to develop new distribution models to further grow the market and enable expanded coverage.



Credit: Dr Andy Hardy, Aberystwyth University, UK

Identifying Waterbodies that are Mosquito Habitats

Standing waterbodies can be prime mosquito habitats. Traditionally these waterbodies are treated with larvicides to kill the mosquito before they have a chance to develop and transmit malaria.

However, identifying these waterbodies at scale and at speed is challenging as they can be numerous and spread over a large area.

The Solution

IVCC is partnering with the Zanzibar Malaria Elimination Program and the Department of Geography and Earth Sciences at Aberystwyth University to explore the potential to use drones and freely available satellite imagery to map potential mosquito larval habitats with greater accuracy. A smartphone or tablet can then efficiently and accurately direct field-based larviciding teams.



Generating High Quality Field Data at Internationally Recognized Standards (GLP)

Generating high quality field trials data is essential for the registration of novel vector control products.

These data must be reliable, reproducible and internationally recognized. Until recently African vector control field trial sites lacked formal quality management systems (QMS) for the conduct of field testing which delayed the development and introduction of vector control interventions into malaria endemic countries.

The Solution

IVCC, in partnership with the London School of Hygiene & Tropical Medicine, has invested funding and resources to strengthen the quality and reliability of data generated by seven trials facilities across sub-Saharan Africa.

Infrastructure improvements, new equipment, training programmes and the introduction of new Standard Operating Procedures (SOPs) have helped two trials facilities achieve Good Laboratory Practice (GLP) certification. A further five are expected to achieve full GLP certification in 2021.

A network of GLP certified trials sites across Africa, together with the GLP certified Liverpool Insect Testing Establishment (LITE) facility at the Liverpool School of Tropical Medicine (LSTM), will increase capacity for manufacturers of vector control products to generate high quality data for inclusion in their product dossiers submitted to the WHO product evaluation process.



Bioavailability of Insecticides on Mud Wall Surfaces

Spraying the interior walls of houses with insecticides to kill mosquitoes is a key vector control intervention used to control malaria.

Mud remains a common indoor wall surface in Africa. The effectiveness of different IRS formulations on mud surfaces is known to vary between geographic areas and the type of IRS formulation. However, information on which properties of muds can most affect the residual efficacy of insecticides has been lacking, making it difficult to design the most effective IRS formulation to perform on a various mud types.

The Solution

A project was initiated by IVCC in 2012 to sample muds from across Africa that are used on the interior walls of houses and to characterise these samples in terms of their effect on the residual efficacy of IRS formulations and in terms of their physical/chemical properties.

We looked for correlations between these properties of the muds sampled from African villages and residual efficacy of IRS treatments in the same villages. From this analysis, the variability in the porosity of these muds appeared to be most closely associated with variation in residual efficacy. Our hypothesis, therefore, is that more porous muds absorb insecticides from the surface of IRS treated walls more quickly, reducing the availability of insecticide residues for pick up by mosquitoes.

Recent IRS formulation by IVCC industry partners to reduce the interaction of insecticides with mud substrates appears to confirm our hypothesis. Further laboratory studies on the interaction between IRS formulations and these same mud samples through cone bioassays will be conducted with mosquitoes to look at residual efficacy, supported by analysis of surface available insecticides and insecticides adsorbed into the mud substrate using state-of-the-art analytical techniques which will further assist in the development of formulations with better residuality. In addition, IVCC has been working with collaborating tests facilities in Africa and President's Malaria Initiative (PMI) VectorLink to trial a field test to measure the porosity of wall substrates: the RILEM tube test.

If successful, it may be possible to develop a test that would allow vector control programmes to be able to predict how many months of residual efficacy they might expect when applying IRS formulations in different geographies on different muds.



Keeping Industry Innovators Engaged in the Fight Against Malaria

The agrochemical industry plays a critical role in the search for new public health insecticides and their delivery.

The emergence of insecticide resistance means that new AIs, repurposed chemistry from agriculture and novel formulations are desperately needed for use on established vector control interventions such as nets and IRS

Challenging and unstable market and long lead time conditions combined with the high risk and cost of development mean that agrochemical partners could easily focus on more profitable parts of their business.

The Solution

In partnership with the Bill & Melinda Gates Foundation, five of the leading agrochemical companies working in insecticide development (BASF, Bayer, Mitsui Chemicals, Sumitomo and Syngenta) signed the ZERO by 40 public declaration at the 2018 Commonwealth Heads of Government Meeting (CHOGM) in London, committing their organisations to staying the course, collaborate and, where possible, pool technology until malaria can be eradicated.



Developing Vector Control Interventions for the Indo-Pacific Region

The growth in some Indo-Pacific countries of malaria and other vector borne diseases has become a major priority for the Australian Government.

As part of its Health Security Initiative, the Australian government sought help in identifying and developing appropriate vector control tools which could be deployed in various settings across the Indo-Pacific region.

The Solution

With a grant from the Australian Government, IVCC established an Advisory Group to help identify which vector control products should be tested based on impact, geographical focus and need.

These priorities were underpinned by the completion of three interlinking landscaping studies to assess the technical, regulatory and market access conditions. IVCC has now initiated two major projects.

NATNAT will build a framework to allow the rapid assessment and adoption of vector control tools in Papua New Guinea. Project BITE will evaluate the entomological and epidemiological protective and residual efficacy of bite prevention tools in forest packs delivered to forest rangers and forest goers in Cambodia.



Overcoming the challenges listed would not have been possible without the generous support of IVCC's funding partners.

The Bill & Melinda Gates Foundation, UKaid, Unitaid, USAID, The Global Fund, Australia Aid and the Swiss Agency for Development and Cooperation (SDC).

We are extremely grateful for their continued support.

