UCT PESTICIDE NETWORK DISCUSSION FORUM

Division of Environmental Health | UCT

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DISCUSSION DIGEST

Addressing Vector Control Challenges Including DDT Use

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This document summarises the University of Cape Town's (UCT) Division of Environmental Health's (DEH) Pesticide Community of Practice discussion held on the 18th of July 2024, titled 'Addressing Vector Control Challenges Including DDT Use'. View the discussion recording here, presentation slides here, and newsletter here. This digest presents the issues and points raised and the information shared by participants in response to questions prepared by the presenters:

- **Professor Basil Brooke** (National Institute for Communicable Diseases - NICD & South African Malaria Elimination Committee)
- **Chadwick Sikaala** (SADC Malaria Elimination 8 Secretariat)
- **Dr Nosiku Munyinda** (SADC Elimination 8 Technical Working Group & University of Zambia)

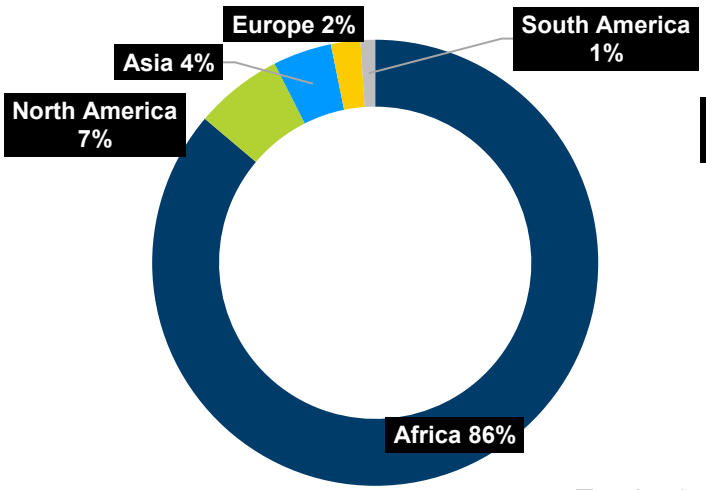
KEY MESSAGES

- A **key challenge to vector control globally is insecticide resistance,** with resistance to almost all 4 classes of insecticides noted across Africa
- *Anopheles funestus* is a major malaria vector of *Plasmodium falciparum* (a parasite that causes a **severe** form of malaria) in Africa. *A. funestus* is **highly resistant to pyrethroids** but **fully susceptible to DDT** (dichlorodiphenyltrichloroethane)
- DDT has been **historically instrumental** in reducing malaria cases, but DDT use is being phased out so **alternatives** such as the organophosphate pirimiphos-methyl are being considered despite being **more costly**
- **Vector control needs to be funded sustainably**, to ensure continuity, necessary to achieve appropriate control
- **Climate change** is impacting the distribution of malaria, where it may threaten previously unexposed areas and may even be reduced in others. It is also impacting the **seasonality** of certain vectors in some places where there is **no longer a seasonal break**
- Integrated vector management (IVM) is an **evidence-based rational decision-making process** to **optimise the use of resources** for vector control. IVM ensures **efficiency, efficacy**, and **ecological soundness** and **stability** of intervention application within available tools and resources. IVM enables the use of resources from other sectors and programmes to be leveraged, relying on **intersectoral collaboration**
- Many countries struggle with **inadequate resources** (e.g. human capacity, laboratory, infrastructure, financial). Other challenges include programmes working in **silos**, regional **misalignment of funding cycles** (affects supply chain etc.), and **differing registration processes** and **legislation** in countries (delaying insecticide procurement and use)
- Addressing challenges includes **promoting innovation**, adopting **new technologies**, **linking programmes and research** so that countries and institutions do not work in isolation, **improving surveillance and human capacity**, and advocating at higher levels to see how countries can work around misaligned planning and budget cycles

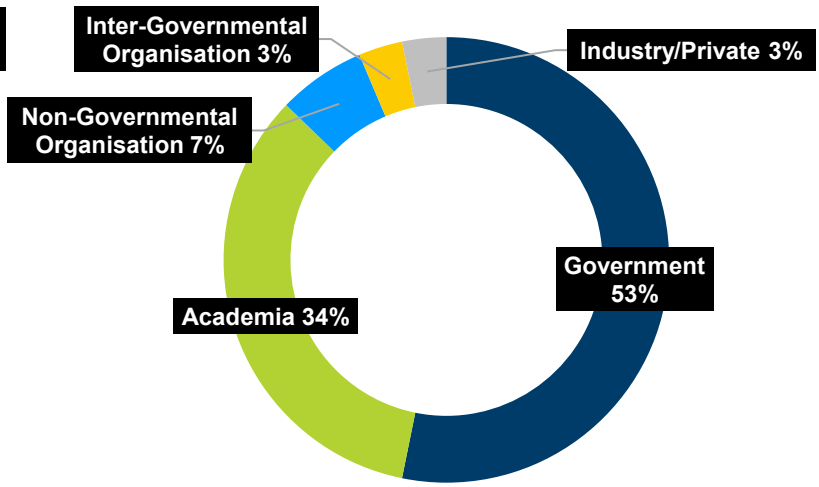
- Vectors do not follow borders, therefore **regional collaboration** (e.g. the Elimination 8)**, information-sharing** and **networks** are beneficial so countries can work together and quickly respond to and learn from each other, to address vector-borne diseases
- **Areas** where one resides drastically impacts their exposure risks to vectors, which is also frequently affected by **socioeconomic and environmental circumstances**
- A **hierarchy of control** is used in IVM, looking at 3 stages: 1. anti-larval stage, including larval source management, 2. anti-adult, looking at ways to eliminate adult vectors, e.g. indoor residual spraying (IRS), and 3. anti-bite, preventing exposure e.g. through nets and repellents
- Vector control is often left to the Ministry of Health, but **broadening collaboration within and beyond the health** sector is important in IVM. **Local government and communities** are also key role players
- Local communities can play a role e.g. in "**plugging holes**" where residual vector-borne diseases exist (areas being close to elimination, but resistance or vector behaviour change leads to persistence)
- **Community engagement** is key, where community-driven solutions aid vector control, especially where the community itself is involved in priority-setting. Activities such as training community leaders on vector identification and larval source management, environmental sanitation, e.g. cleaning gutters, collection of larval breeding sources like tyres and plastic containers for recycling, and simple/low-cost house improvements, and nature-based solutions.

Breakdown of Discussion Participant Demographics

Regional Representation



Sectoral Representation



Total = 95 participants live

PRESENTERS

Basil Brooke. Associate Professor Basil Brooke is the head of the NICD's Vector Control Reference Laboratory, Centre for Emerging Zoonotic & Parasitic Diseases, and is a member of the Wits Research Institute for Malaria (WRIM), University of the Witwatersrand. His collaborative research work over the past 20 years has primarily focused on identifying the entomological drivers of malaria transmission, especially insecticide resistance, and vector species assemblages and their corresponding behavioural/physiological traits. This work applies directly to the development of strategies designed to maintain effective malaria vector control in South Africa and the greater southern African region. He is also involved in the assessment of enhanced vector surveillance techniques, operational procedures for malaria outbreak response, new vector control products and alternative methods of control. Prof Brooke regularly consults with the World Health Organization (WHO) and United Nations Environment Program

(UNEP) on technical issues relating to malaria vector control policy and practice and serves on national and regional committees as part of the drive toward malaria elimination in southern Africa.

Chadwick H. Sikaala. Chadwick has regional experience in the fields of vector control and entomological surveillance. He was instrumental in scaling up vector control and community-based entomological surveillance programs in Zambia, before his engagement with the Elimination Eight Secretariat (E8S) as a Regional Entomologist/Vector Control Specialist, involved in regional capacity-building across eight countries (Angola, Botswana, Eswatini, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe). He is currently the head of Technical Support and Research.

Nosiku Munyinda. Dr Nosiku Sipilanyambe Munyinda is a lecturer and researcher at the Department of Environmental Health – School of Public Health at the University of Zambia. She is also an honorary senior lecturer at the Division of Environmental Health – School of Public Health at the University of Cape Town. She holds a BSc in environmental and natural resources management, an MSc in environmental engineering and sustainable infrastructure and a PhD in environmental health. Her research interests include environmental pollution and health effects, and climate change science, mitigation and adaptation. Dr Munyinda has a robust interface with policymakers, seeing her represent the University of Zambia on various national and international technical and project steering committees. She is a member of the Stockholm Convention Persistent Organic Pollutant Review Committee (POP-RC) and the Joint Meeting on Pesticide Management (JMPM).

CONTRIBUTIONS FROM PARTICIPANTS

Disclaimer: The information in this digest represents the opinions of members participating from different stakeholder groups expressed during the discussion. The views expressed in this document do not necessarily represent the opinion or the stated policy of the Swedish Chemicals Agency (KemI) or the Division of Environmental Health UCT, nor does citing trade names or commercial processes constitute an endorsement

The key discussion points raised by participants are presented under each question. Throughout the discussion, informal polls were conducted to help encourage discussion among the participants. They do not provide any representative data but rather provide a snapshot of the participants' views.

QUESTION 1
What are some examples of vector control challenges in your country, region, or globally?

South Africa
- Inadequate funding for vector control programmes
- Lack of sanitation and waste management in informal areas
- Lack of funding
- Lack of capacity-building
- Differences between the provinces regarding follow-up, e.g. 24 hours in KwaZulu-Natal versus 72 hours in Limpopo

Antigua and Barbuda
- Limited resources
- Issues with follow-ups and facilitation of education and training

Uganda
- Limited funding
- Limited research
- Lack of appreciation for some interventions
- Fears of the consequences for chemical approaches

Tanzania
- The use of pesticides for malaria control without research to assess human health impact
- Use of treated bed nets sometimes triggers allergic reactions which are not followed up
- Insecticide spraying is usually done by untrained spray service providers leading to poor control of the vectors
- Many pesticides used for vector control are unregistered and sold illegally

Zimbabwe
- Urban malaria cases increasing
- Insect resistance to pyrethroids
- Overall increase in favourable environment for mosquito breeding due to wastewater

Malawi

- Increasing resistance to insecticides e.g. in Malawi, most pyrethroids and carbamates have developed resistance towards Anopheles mosquitoes threatening the efficacy of long-lasting insecticidal nets (LLINs) and IRS
- High cost of alternative chemicals to combat the vectors
- Limited funding
- Operational and technical concerns e.g. reduced number of sprayed districts, procurement of low-quality insecticides and pumps by government

Iran

- The incidence of malaria has decreased in the past few years in Iran, and there were no indigenous cases in 2018 and 2019, the disease has been under control in the south of Iran in the last decade. However, this disease suddenly broke out in 2022

Guyana

- A vector control unit works closely with local partners to execute its duties
- Need for Improved data management and utilisation for vector control
- Lack of national framework for entomological monitoring and surveillance
- Need to improve community mobilisation
- Lack of human resource capacity within the vector control unit

General

- There is continuous application of different pesticides with the same mode of action which has led to resistance
- The inability of regions to utilise effective biopesticides such as Beauveria bassiana (fungal pathogens to control adult mosquitoes)
- Rapid urbanisation creates breeding grounds for vectors in poorly planned or maintained urban areas, leading to increased vector-borne diseases such as dengue and malaria

Poll Results

Poll 1. Do you think DDT should be retained for public health use and why?

- No x 6
- The neurotoxic and endocrine disrupting effects probably impact more people than malaria does
- DDT should not be retained. There are other safer methods to control mosquitoes
- We have efficacious alternatives to DDT in Zambia
- Unless for emergencies, DDT should not be used for public health. There are other methods of vector management that can be integrated instead of DDT use
- There are too many health risks and there are safer alternatives

Poll 2. Do you think vector control programmes in places affected by malaria/vector-borne diseases should receive donor funding or be domestically financed?

- We need donors funding because vector control programmes are very expensive
- This should be on a case-by-case basis
- Programmes should be funded domestically
- The product is expensive and will require donor funding
- Donor funding is necessary because treatment is expensive and finding or creating alternatives also needs funds
- Zambia: domestic funding ensures sustainability of vector control. Donor funding supplements government effort

QUESTION 2
What measures have been applied in your country or region for vector management?

Zambia

- The core interventions are IRS, and insecticide-treated nets (ITNs), supplemented by larval source management
- There is integrated vector management, but the environmental management aspect is not well-supported
- There is a National Malaria Elimination Centre with a National Malaria Elimination Strategy currently 2022-2026 in place

Tanzania

- ITN and IRS promoted by government
- Individuals spray whatever insecticide is available on the market

Nigeria

- Door-to-door distribution of ITN
- Monthly sanitisation of the environment happens in different communities and movement is restricted so that people take the time to clean gutters around their homes
- Insecticides have been made widely available for different price ranges but this is also a challenge as there have been many cases of misuse and overuse

Antigua and Barbuda

- Fogging (spraying of insecticides) is scheduled and controlled by the Ministry of Health

Guyana

- A vector control unit works closely with the Ministry of Health and central and local government

Mexico

- There is a regulation for IVM for malaria, dengue, and other products
- Mexico stopped using DDT years ago, but the current problem is dengue
- 15 highly hazardous pesticides (HHPs) are approved and used as larvicide, adulticide, and in ITNs
- For Mexico's experience in avoiding DDT for malaria control see https://www.sciencedirect.com/science/article/abs/pii/S1438463904702357

Malawi

- IRS with pyrethroids and organophosphates
- Use of larvicides and chemical repellents
- Environmental management: habitat management, waste management

South Africa

- IRS as routine vector control method, with DDT frequently being used
- Ongoing resistance management and surveillance through systems like Notifiable Medical Conditions Surveillance System managed by the NICD
- National Vector Control Strategy (2023-2027) highlights 5 strategic objectives aimed at protecting populations at risk of vector-borne diseases, monitoring the occurrence of disease vectors, developing capacity for outbreak response, increasing national knowledge and practices, and providing effective management and coordination for vector control implementation. Additionally, the strategy mentions vector control interventions such as IRS, long-lasting insecticidal nets, larval source management, and personal protection measures

Iran

- Use of insecticides targeting mosquitos of the Anopheles genus

Poll Results

Poll 1. Give examples of where and how integrated vector management approaches have been used. Include your country in your response

- In Zambia: IVM for malaria
- In the malaria control program - Zambia (National Malaria Strategic Plan)
- In Tanzania, IVM is used for training health officers who are supposed to implement it on the ground. However, pesticides take precedence

QUESTION 3
Do you think a systems approach is a viable solution to the vector management challenges raised during this discussion? Why/why not?

Yes

- A systems approach is a viable solution. Involvement and collaboration within sectors gives an alignment in the solutions provided and every sector will be up to date
- It allows a holistic approach to be taken with the integration of various interventions, enhanced coordination (multi-sectoral collaboration), sustainability, research and resource optimisation
- It takes the coordination of the community into account to maximise resources and results

- It aims to improve the efficacy, cost-effectiveness, ecological soundness, and sustainability of disease-vector control
- It is certainly the right direction to go in for vector control. IVM makes vector control more sustainable and cost-effective
- By looking at the entire ecosystem (interaction between the vector and the environment and the host), effective and more sustainable vector management strategies can be developed
- A systems approach can effectively address vector management challenges by considering various interconnected factors for more sustainable solutions
- It provides a joint solution towards similar problems
- It can be used to consider the key drivers to both exposure and transmission, for resistance management, and for the collaboration between health and other departments and organisations

Possibly

- South Africa has a unique issue in that malaria is becoming a mostly imported disease, with many outbreaks in areas where it is not endemic or expected

Poll Results

Poll 1. What alternatives to highly hazardous chemicals are currently being used, or are you aware of, in your country or region? Include your country

- India has taken the first step to eliminate dependency on DDT by promoting locally appropriate, cost-effective, and sustainable alternatives, including LLINS
- Zambia: Clothianidin based (such Sumishield, Fludora Fusion) and Actellic 300 CS insecticides are used
- BTI is used for larvicide
- In Antigua and Barbuda, alternatives include monitoring of pesticides and community toxic chemicals

Q&A

Several questions were answered live during the session (view the recording here), the rest, included in this digest, were answered through typed responses by Basil Brooke.

Question	Answer
There is a biopesticide for malaria control (Beauveria bassiana). Why has this not been considered?	Fungal control methods have good efficacy but are not easy to deploy on a wide scale and have very limited persistence. But research into this method continues
Why another organophosphate?	The only active ingredient under consideration currently is pirimiphos-methyl
Have there been cases of mosquito resistance to DDT in South Africa? How much protection can the net give when it isn't treated with DDT?	Bed nets are not treated with DDT. Most are treated with pyrethroid insecticides. There is some evidence of resistance to DDT in another vector in South Africa called Anopheles arabiensis, but it is very low-level and currently weak in effect
Is there any latest literature on the migration of malaria-causing mosquitos to non-endemic areas, e.g. from northern KwaZulu-Natal to Durban/Johannesburg, also given what was highlighted regarding climate change?	Mosquitoes can travel long distance by inadvertently getting caught in buses, cars, taxis, aeroplanes, trains etc. But malaria vector mosquitoes tend not to proliferate in high altitude areas with cold winters
What about the efficacy of Spinosad?	This is one of the potential innovations currently in an experimental phase for vector control

RESOURCES

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If you are not already a member, we invite you to join UCT's Pesticide Network to receive discussion updates and newsletters: http://eepurl.com/ijR8DX

The **Division of Environmental Health** (DEH) Pesticide Discussion Forum is a bi-monthly online seminar for pesticide regulators and resource persons, as well as students in the postgraduate Professional Masters in Chemical Risk Management (MCRM) and Diploma in Pesticide Risk Management (DPRM). Our aim is to provide support for managing pesticide risks and implementing risk reduction strategies.

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