

Selected Recent Publications

[Impact of partially and fully closed eaves on house entry rates by mosquitoes](#)

Parasites & Vectors 3 July 2018

The authors report on their investigation of the effect of partial and complete eave closure on the house-entry rates of malaria vectors and other mosquitoes in southern Malawi. Results: House entry by malaria vectors was 14-times higher in houses with fully open eaves compared to houses with fully closed eaves adjusting for wall-type, number of people that slept in the house the previous night, cooking locations and presence of livestock. Houses with four small openings had 9 times more malaria vectors compared to houses with fully closed eaves. The catches of culicine mosquitoes caught in houses with fully closed eaves were not different from those caught in houses with the other treatments.

Conclusions: Closed eaves resulted in fewer malaria vectors in houses, with differences depending on the degree of eave closure. The ability of malaria vectors to locate any remaining entry points on improved houses, as demonstrated here, suggests that quality control must be an important component of implementing house improvement as an intervention. The lack of effect on culicine mosquitoes in this study could reduce acceptance of house improvement, as implemented here, by household residents due to continued nuisance biting. This limitation could be addressed through community engagement (e.g. encouraging people to close their doors early in the evenings) or improved designs.

[Semi-field studies to better understand the impact of eave tubes on mosquito mortality and behaviour](#)

Malaria Journal 22 Aug 2018

The current study reports on a series of semi-field studies aimed at improving the understanding of how eave tubes might impact mosquito mortality and behaviour.

Huts were modified in various ways to determine: (i) whether mosquitoes in this field setting naturally recruit to eave tubes; (ii) whether eave tubes can reduce house entry even in the absence of screening; (iii) whether mosquitoes suffer mortality if they attempt to exit a house via treated eave tubes; and, (iv) whether screening and eave tubes might deflect mosquitoes into neighbouring houses without the intervention. **Results:** Ninety percent more

mosquitoes (*Anopheles gambiae sensu lato*, and other species) entered huts through open eaves tubes compared to window slits. The addition of insecticide-treated eave tubes reduced mosquito entry by 60%, even when windows remained open. Those mosquitoes that managed to enter the huts exhibited a 64% reduction in blood feeding and a tendency for increased mortality, suggesting contact with insecticide-treated inserts prior to hut entry. When *An. gambiae* mosquitoes were deliberately introduced into huts with treated eave tubes, there was evidence of six times increase in overnight mortality, suggesting mosquitoes can contact treated eave tube inserts when trying to exit the hut. There was no evidence for deflection of mosquitoes from huts with screening, or screening plus eave tubes, to adjacent unmodified huts.

Conclusions: Eave tubes are a potentially effective way to target *Anopheles* mosquitoes with insecticides. That treated eave tubes can reduce mosquito entry even when windows are open is a potentially important result as it suggests that eave tubes might not need to be combined with household screening to have an impact on



malaria transmission. The absence of deflection is also a potentially important result as coverage of eave tubes and/or screening is unlikely to be 100% and it is important that households that do not have the technology are not disadvantaged by those that do.

[Efficacy of Olyset Duo, a bednet containing pyriproxyfen and permethrin, versus a permethrin-only net against clinical malaria in an area with highly pyrethroid-resistant vectors in rural Burkina Faso: a cluster-randomised controlled trial](#)

Lancet Published: 10 August 2018

In this two-group, step-wedge, cluster-randomised, controlled, superiority trial, standard LLINs were incrementally replaced with LLINs treated with permethrin plus pyriproxyfen (PPF) in 40 rural clusters in Burkina Faso. In each cluster, 50 children (aged 6 months to 5 years) were followed up by passive case detection for clinical malaria. Cross-sectional surveys were done at the start and the end of the transmission seasons in 2014 and 2015. Primary endpoints were the incidence of clinical malaria, measured by passive case detection, and the entomological inoculation rate. **PPF-treated LLINs provide greater protection against clinical malaria than do standard LLINs and could be used as an alternative to standard LLINs in areas with intense transmission of Plasmodium falciparum malaria and highly pyrethroid-resistant vectors.**

[Efficacy of Interceptor® G2, a new long-lasting insecticidal net against wild pyrethroid-resistant Anopheles gambiae s.s. from Côte d'Ivoire: a semi-field trial.](#)

Published online: 8 August 2018

This paper presents the results of an experimental hut study of the Interceptor® G2 net in Côte d'Ivoire.

[Do bednets including piperonyl butoxide offer additional protection against populations of Anopheles gambiae s.l. that are highly resistant to pyrethroids? An experimental hut evaluation in Burkina Faso](#)

Med Vet Entomol. 11 July 2018

This paper presents the results of an experimental hut study of three PBO LLINs (Dawa®Plus 2.0, Olyset®Plus, and PermaNet®3.0) carried out at two field stations in southwest Burkina Faso.

[Efficacy of two PBO long lasting insecticidal nets against natural populations of Anopheles gambiae s.l. in experimental huts, Kolokopé, Togo](#)

PLoS One. 11 July 2018

This paper presents the results of an experimental hut study of two LLINs with PBO, PermaNet® 3.0 and Olyset® Plus in Togo.

[Experimental huts trial of the efficacy of pyrethroids/piperonyl butoxide \(PBO\) net treatments for controlling multi-resistant populations of Anopheles funestus s.s. in Kpomè, Southern Benin](#)

Wellcome Open Research Latest published: 13 Jun 2018

This paper presents the results of an experimental hut study of two LLINs with PBO in Benin.

[Bed nets used to protect against malaria do not last long in a semi-arid area of Ethiopia: a cohort study](#)

Malaria Journal 20 June 2018

This study aimed to determine the attrition, physical integrity, functional survival, and bio-efficacy of LLINs (PermaNet® 2.0) under field conditions in south-central Ethiopia. The study showed that the median

serviceable life of LLINs is only 12 months. However, the bio-efficacy of the LLINs is acceptable for at least 24 months. Therefore, stronger and more efficient LLINs need to be developed for conditions similar to those studied here.

[**A low-cost, battery-powered acoustic trap for surveilling male *Aedes aegypti* during rear-and-release operations**](#)

PLoS One. 2 Aug 2018

Attract and kill tools using chemical attractants have attracted considerable attention for controlling female mosquitoes. This paper provides a look into affordable acoustic attraction technology for male *Aedes aegypti* and raises an obvious question—could this technology be adapted for population control for major disease vector species.

[**Effects of the removal or reduction in density of the malaria mosquito, *Anopheles gambiae s.l.*, on interacting predators and competitors in local ecosystems.**](#)

Med Vet Entomol. 25 July 2018

Most medical entomologists get asked the question about species removal and its impact on the ecosystem. These authors provide some answers at least for anophelines...“Most predators identified consume many other insect species and there is no evidence that any species preys exclusively on any anopheline mosquito. There is one predatory species with a specialisation on blood-fed mosquitoes including *An. gambiae s.l.*. *Evarcha culicivora*s a jumping spider, known as the vampire spider, found around Lake Victoria. There is no evidence that these salticids require *Anopheles* mosquitoes and will readily consume blood-fed *Culex*.

Opinion Article

[**The portfolio effect cushions mosquito populations and malaria transmission against vector control interventions**](#)

Malaria Journal 10 August 2018

Given the importance in modelling for malaria control, this opinion piece raises an interesting point for consideration. The authors argue that “there is an inevitable tendency for mathematical models to underestimate the complexity and associated resilience of natural biological systems. Expressed in simple interpretational terms, mosquito populations and malaria transmission will tend be more resilient against control efforts than face-value interpretation of data or predictive mathematical models suggest.” They go on to suggest that “it may be prudent to bear in mind the following rule of thumb: the more diverse and variable the life histories of malaria vectors are, the less likely it is that any given vector control approach will eliminate all the malaria transmission they mediate.”

[**Agent-based models of malaria transmission: a systematic review**](#)

Malaria Journal: Published 17 August 2018

If you are interested in malaria modelling this is worth a read. The paper provides a nice overview of agent-based models (ABMs). One take away for me was that the authors suggest that instead of trying to find a model that does it all, various models are better suited for specific questions and model selection should be tailored for the question at hand. The authors also discuss the potential for combining the strengths of validated models to enhance decision-making capabilities of ABMs particularly given the importance in using modelling to guide policy decisions.

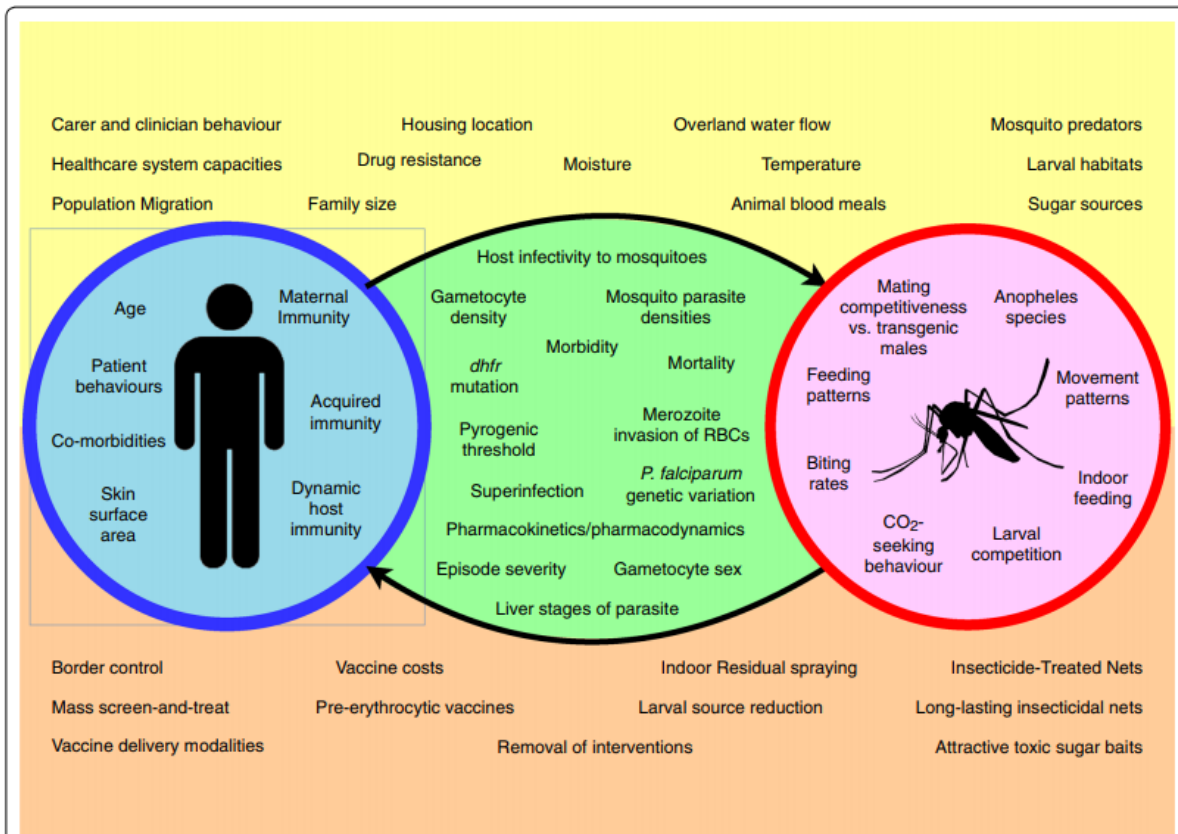


Fig. 3 Diagram outlining factors influencing malaria transmission that have been modelled by ABMs. Factors pertaining to humans and mosquitoes are in red and blue circles, respectively. Factors about the disease process are within the arrows linking these circles. Factors at the top and bottom of the diagram are environmental factors and interventions, respectively

[Eliminating malaria by 2040 among agricultural households in Africa: potential impact on health, labor productivity, education and gender equality](#)

Gates Open Research First published: 19 Jul 2018

The objective of this study is to examine how suppressing malaria among smallholder agricultural households in sub-Saharan Africa over the next two decades will affect progress towards achieving the Sustainable Development Goals.

Results: Our analysis found that achieving malaria eradication would prevent approximately 1 billion malaria cases and thereby decrease the number of lost work-days among agricultural households due to malaria morbidity by approximately 3.8 billion days. Eradicating malaria by 2040 would also increase the number of school days attended by children by 4.5 billion days while also reducing the number of caregiving days by women for malaria cases by approximately 1.9 billion days.

Conclusions: This article analyzed the impact of eradicating malaria among smallholder agricultural households in sub-Saharan Africa in terms of four of the Sustainable Development Goals. Greater recognition of the non-health benefits of achieving malaria eradication could catalyze the agricultural sector to intensify their contributions to eradicating malaria.

[Modelling the impact of insecticide-based control interventions on the evolution of insecticide resistance and disease transmission](#)

Parasit Vectors. Published: 28 Aug 2018

Background: Vector control is increasingly compromised by the evolution of insecticide resistance but there is little quantitative understanding of its impact on control effectiveness. We developed a computational approach that incorporates the stage-structured mosquito life-cycle and allows tracking of insecticide resistant

genotypes. The model is designed to simultaneously answer a series of questions that arise naturally from control programmes:

- What impact do insecticides have on the mosquito population: will it be driven to extinction and, if not, how will insecticide deployment affect mosquito numbers and adult female longevity?
- What impact will these changes in mosquito demography have on disease transmission: assuming the mosquito populations are not eliminated, will there still be ongoing transmission?
- How will different patterns of insecticide deployment select for resistance?
- How will the spread of insecticide resistance affect mosquito populations and compromise attempts to reduce disease transmission?

WHO News and Publications

VCAG News:

Launch of new website

A new, more streamlined, Vector Control Advisory Group (VCAG) website was launched on 31 May 2018. VCAG serves as an advisory body to WHO on new tools, technologies and approaches for the control of vector-borne diseases. Visit the website at: <http://www.who.int/vector-control/vcag/>. For feedback or related correspondence, please contact: vcag@who.int.

The report from the 8th Vector Control Advisory Group meeting held 15-17 May 2018 has been published online. It can be accessed at: <http://www.who.int/vector-control/publications/eighth-vcag-meeting-report/en/>.

Concise summary of products under VCAG review

A handy overview of the product classes and prototype/products under VCAG review for assessment of public health value has been published. It is a living document which will be updated periodically and can be accessed at: <http://apps.who.int/iris/bitstream/handle/10665/274451/WHO-CDS-VCAG-2018.03-eng.pdf>

Topics covered in the closed session in May were:

- Pesticides in national regulatory authorities 6
- Public health value of house screening for vector-borne disease prevention and control 6
- A short introduction to a novel RCT design 7
- Conditions for early terminations of trials 7
- Push–pull strategy for malaria control – new submission 8
- Peridomestic residual spraying for visceral leishmaniasis control – new submission 10
- Sterile Insect Technique / Incompatible Insect Technique - update 12
- Gene drive – population reduction - update 13
- Gene drive – Population alteration - update 16
- wMel Wolbachia - update 19
- Attractive targeted sugar baits - update 20
- Lethal house lures and eave tubes - update 22
- Spatial repellents - update 24

Save the date – VCAG meeting open session, 12 November 2018

The 9th meeting of the Vector Control Advisory Group (VCAG) is scheduled for 12-14 November 2018 at WHO headquarters in Geneva. An open session will be held on the first day of the meeting. Interested parties will be able to join the open session in person (space permitting) or by WebEx. Innovators, VCAG members and other stakeholders are also invited to send proposed presentation or discussion topics for this open session by 30 September 2018. All those interested in joining or proposing items should notify the Secretariat via email: vcag@who.int. A provisional agenda will be shared in due course.

Leishmaniasis vector control – a new webpage

A new page on vector control has been added to the leishmaniasis website of the WHO Department of Control of Neglected Tropical Diseases: <http://www.who.int/leishmaniasis/>. If you wish to request the addition of documents or links of relevance, please email directly to: postigoj@who.int

Save the date – MPAC meeting open sessions, 17-18 October 2018

Registration is open for the Malaria Policy Advisory Committee meeting open sessions to be held 17-18 October 2018 at WHO headquarters in Geneva. Among other topics, the community effect of long-lasting insecticidal nets will be discussed. The provisional agenda and further information for registration can be found here: <http://www.who.int/malaria/mpac/mpacmeetings/>

[Resistance webinar online](#)

The video and presentation from the WHO GMP webinar held 19 June to overview the Global report on insecticide resistance in malaria vectors: 2010–2016 is now available online. A summary of the Q&A session will soon be made available in English, French and Spanish. The materials can be accessed here: [Resistance webinar online](#) (scroll down and click on Technical webinar)

Useful websites and resources

Vector LearningXchange

Join [The Vector LearningXchange](#)

Become part of a community of malaria control stakeholders! [The Vector LearningXchanges](#) offers the most recent resources on vector control, insecticide resistance management, and IRS.

Vector LearningXchange hosted a webinar on Wednesday, July 11th with Jessica Long, a representative from [Dimagi](#), who discussed how digital tools can help strengthen and support malaria surveillance programs. Head over to the [Vector LearningXchange](#) to read a summary of the discussion and some key takeaways. If you missed the webinar, you can find the recorded session [here](#) and a downloadable version of Jessica's presentation [here](#).

Recently the Engaging Tools for Communication in Health at LSTM has launched three very novel and exciting games. Two based on vector biology and one on HIV. More details on the games can be found below or on the ETCH website (<http://etch.lstmed.ac.uk>). Two of the games, Resistance101 and Battle in the Blood can be downloaded on the App store and Google play (please do so and have some fun). These tools can be used to develop capacity, transfer knowledge and change behaviour at all levels. These projects were funded by, IVCC, EU and Horizon 2020 and ETCH, is now beginning to explore other potential ideas of where this technology could be used. The team would like to hear from anyone who has an interest in developing an idea and proposal. If you would like to discuss this in more detail, please contact the ETCH team at etch@lstmed.ac.uk

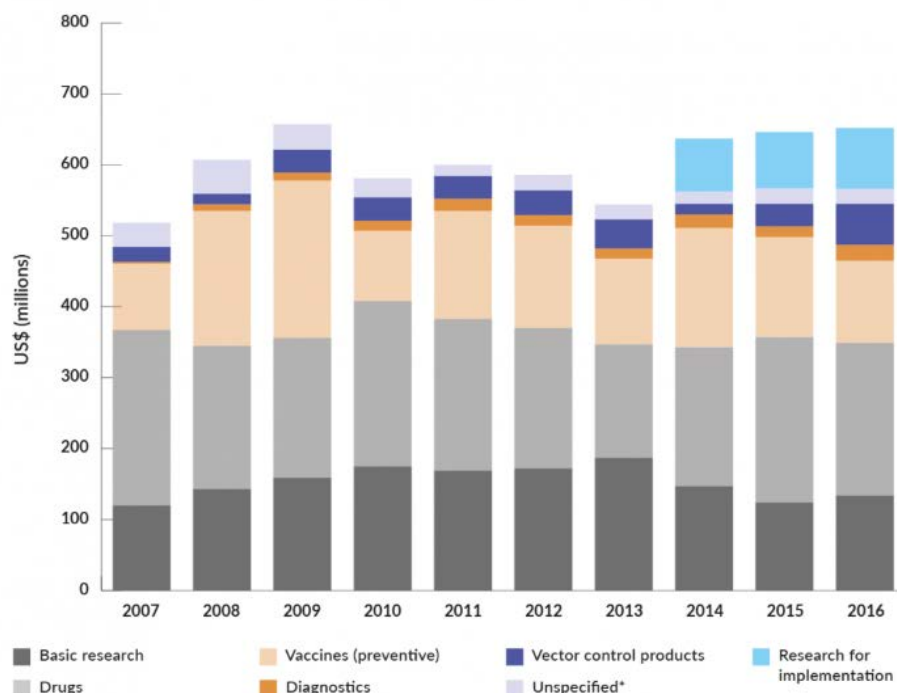
[Bridging the gaps in malaria R&D: An analysis of funding—from basic research and product development to research for implementation](#)

PATH MVI 19 JUN 2018

New report highlights a 'second valley of death' that threatens to keep developed malaria products from reaching those most in need.

The report includes six case studies on research for implementation including two on vector control: Case study 2: Reducing deaths with bednets Case study 6: Increasing access to new insecticidal products

Malaria research and development funding by product/area.



THE AMERICAN JOURNAL OF
TROPICAL MEDICINE AND HYGIENE

New Supplement Offers Recommendations for Safe and Ethical Testing of Gene Drive Mosquitoes



Gene drive technology offers the promise for a high-impact, cost-effective and durable method to control malaria transmission that would make a significant contribution to elimination. In this new *Journal* supplement, a multi-disciplinary working group considered the implications of low-threshold gene drive systems on the development pathway described in the WHO Guidance Framework for testing genetically modified (GM) mosquitoes, focusing on reduction of malaria transmission of *Anopheles gambiae* s.l. mosquitoes in Africa as a case study. The working group identified several resources that were considered important to support responsible field testing of gene drive mosquitoes.

[View the Supplement](#)

[VIDEO: The 7 Dwarfs Whistle While They Work To Fight Malaria](#)

Dated but a classic Disney video supporting malaria prevention and mosquito control education



Recent and upcoming events of note

The 2nd WIN international conference on “**Integrated approaches and innovative tools for combating insecticide resistance in arbovirus vectors**” will be held in October 01 - 03, 2018, at the [Grand Copthorne Waterfront Hotel](#) in Singapore.

Please visit the conference website <https://www.winsingapore2018.com/> to find all information related to the conference’s venue, registration, abstract submission, scientific programme, keynote speakers and sponsorship.

In the news

WHO certifies Paraguay malaria-free

San José / Geneva, 11 June 2018 – The World Health Organization (WHO) today certified Paraguay as having eliminated malaria, the first country in the Americas to be granted this status since Cuba in 1973.

“It gives me great pleasure today to certify that Paraguay is officially free of malaria,” said Dr Tedros Adhanom Ghebreyesus, WHO Director General, in a recorded statement. “Success stories like Paraguay’s show what is possible. If malaria can be eliminated in one country, it can be eliminated in all countries.”

In 2016, WHO identified Paraguay as one of 21 countries with the potential to eliminate malaria by 2020. Through the “E-2020 initiative,” WHO is supporting these countries as they scale up activities to become malaria-free. Other E-2020 countries in the Americas include Belize, Costa Rica, Ecuador, El Salvador, Mexico and Suriname.

02 JULY 2018 | PRESS RELEASE



Unitaid partners with APLMA to drive malaria elimination in Asia Pacific by 2030

Excerpt from the press release 2 July 2018—

The Asia Pacific Leaders Malaria Alliance (APLMA) and Unitaid today launched a collaborative platform to accelerate access to innovations to halt the spread of malaria and other mosquito-borne diseases in the Asia Pacific region...The new platform, known as the Vector Control Platform for Asia Pacific (VCAP), links national regulators, policy-makers, industry, academia and the global health community to boost development and use of antimalarial tools, such as mosquito nets and insecticides...“We need new tools to stop mosquitoes, but small markets and slow bureaucracies are instead killing innovation”, said Dr Ben Rolfe, CEO of the APLMA Secretariat. “It’s simple. We won’t eliminate malaria unless we get new recommended technologies to market

fast and this is the gap that the new vector control platform is looking to fill.” The knowledge-sharing platform is one of the first initiatives under a new Unitaaid/APLMA collaboration aimed at driving regional progress towards malaria elimination. The partnership links the two organizations with other malaria control stakeholders, through co-hosting specific events and identifying opportunities to support governments, donors and other partners...“The launch of this new platform comes at the right time as Unitaaid expands its investment portfolio in vector control,” said Lelio Marmora, Unitaaid Executive Director. “Even though insecticide-treated bednets and indoor sprays have been effective in preventing malaria to date, the reality is that we need new tools to address the emergence of insecticide and drug resistance if we are going to make headway in ending malaria.”

[PMI Welcomes Dr. Kenneth Staley as the New U.S. Global Malaria Coordinator](#)

On April 30th, PMI officially welcomed Dr. Kenneth Staley into his new role as the U.S. Global Malaria Coordinator, appointed by the President and with leadership and oversight of all U.S. Government activities to combat malaria globally. “With academic preparation and a distinguished career in public health, Dr. Staley is eminently qualified to carry on PMI’s outstanding legacy,” Congressman Gregory W. Meeks, co-chair of the House Caucus on Malaria and Neglected Tropical Diseases, said in a statement. “As PMI is being expanded to cover over half a billion people, it will be no easy task, but I believe Dr. Staley is equipped to lead the program to continued success.” [View Dr. Staley’s bio.](#)

[PMI Names Dr. Rick Steketee as the New Deputy US Global Malaria Coordinator](#)

Dr. Rick Steketee, MD, MPH is a medical epidemiologist with over 30 years of public health experience in infectious diseases. He spent 21 years as an active duty member of the U.S. Public Health Service, 15 of those years at the U.S. Centers for Disease Control and Prevention (CDC) and became CDC’s Malaria Branch Chief in 2000. Dr. Steketee joined PATH in 2005 and has been the Director of PATH’s Malaria Control and Elimination Program (MCEP) and Director of the Malaria Control and Elimination Partnership in Africa (MACEPA) since 2015. Dr. Steketee will assume the Deputy role in August.

[2018 PMI Twelfth Annual Report to Congress](#)

Because of the generosity of the American people, PMI’s program in fiscal year 2017 benefitted more than 480 million people at risk of malaria across sub-Saharan Africa and in targeted communities at risk for malaria in the Greater Mekong Subregion. PMI embarked on a five-country expansion with a budget allocated to new country implementation for year one totaling \$103 million, thanks to a sustained commitment and increased resources from the U.S. Congress. PMI’s Twelfth Annual Report to Congress, published on World Malaria Day (April 25, 2018), further details the U.S. Government’s leadership and technical and financial contributions to the fight against malaria. [Read the report.](#)

[Updated PMI Technical Guidance Now Available](#) [PDF, 2.7MB]

This document provides technical guidance and background across the suite of malaria interventions and approaches and serves as a reference tool for PMI country teams, national malaria control programs, and other partners implementing PMI-funded malaria activities. The guidance is updated on an annual basis to reflect the most recent global policies and the state-of-the-art of malaria control.

Disclaimer: Given the breadth of vector control related literature, we are unable to include all relevant work. This update is intended to focus primarily *Anopheles* biology and a subset of control topics with global relevance. Any views expressed in this update do not necessarily reflect the views or opinions of IVCC or NgenIRS. In many cases we directly quote sections of published work. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by IVCC or its funders. This document is intended solely for the use of the individual or entity to whom it is addressed. Please do not circulate more widely without the permission of the author.