NewsBites

Division of Parasitic Diseases and Malaria
Center for Global Health

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The mosquito is considered the world's deadliest animal. Here, an adult *Aedes aegypti* mosquito feeds.

VecNet: Global Mosquito Control and Surveillance

CDC entomologists visited the Puerto Rico Vector Control Unit facilities with the executive director.

Controlling mosquito-borne diseases like dengue, malaria, and Zika requires coordinated efforts that leverage knowledge and expertise within countries and regions to effectively control mosquitoes. Accomplishing these tasks is not easy.

Enter VecNet.

After years of collaboration, VecNet was established in 2020 and is co-implemented by CDC's Division of Parasitic Diseases and Malaria (DPDM) in the Center for Global Health (CGH) and the Division of Vector Borne Diseases (DVBD) in the National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) to directly address these challenges.

VecNet's goal is to reduce vector-borne disease burden by improving capacity within regional entomology networks for the surveillance and control of arthropods of public health importance. VecNet currently supports regional networks in the Caribbean, Pacific, Central America, West Africa, Southeast Asia, and the Horn of Africa.

"There are only a handful entomologists at CDC, and VecNet has allowed us to maximize CDC's expertise in this area to support global vector surveillance and control capacity," says Audrey Lenhart, Chief of DPDM's Entomology Branch. "VecNet is a prime example of a technical collaboration that is significantly stronger due to its cross-center participation."

Why We Need to Talk about *Anopheles stephensi*


Coastline of Lagos Island, Nigeria

Of the many types of mosquitoes that exist, the most dangerous ones are those that carry diseases – like malaria -- that harm or even kill people.

In 2012, routine public health tracking activities first detected that a mosquito species called *Anopheles stephensi* (*An. stephensi*) had found its way from its native habitat in Southern Asia to Africa. Since first being identified in Djibouti, it has since been identified in neighboring Ethiopia (2016), Sudan (2019), and Somalia (2019).

Most recently, in June 2022, Nigeria confirmed the presence of *An. stephensi* mosquitoes, making it the first country outside of the Horn of Africa.

Nigeria accounts for nearly one third of all global malaria cases and nearly one quarter of global malaria deaths. Modeling estimates have shown that if *An. stephensi* continues to spread it may result in an additional 126 million people at risk of malaria in Africa, particularly in urban areas. DPDM and the PMI *Anopheles stephensi* Task Force are supporting Nigerian activities to monitor and respond to this emerging threat.

DPDM is also providing support to the West African *Aedes* Surveillance Network (WAASuN) to train entomologists on morphological identification of *An. stephensi*. A July 20222 training in Cote d'Ivoire included participants from 18 West African countries, including Nigeria. In addition to morphological identification, participants learned from Ethiopian colleagues about how they are conducting *An. stephensi* surveillance and control activities.

DPDM is collaborating with Baylor University in Texas to study population genetics to identify where *An. stephensi* is coming from, how it is spreading, and how long it has been on the continent.

Giving a Boost to Malaria Treatment

Monoclonal antibody

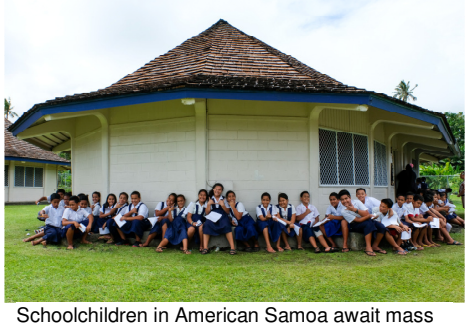
Malaria caused approximately 241 million illnesses and approximately 627,000 deaths in 2020. Sub-Saharan Africa accounts for 95% of all malaria cases and 96% of deaths globally, with 80% of these deaths among children <5 years old. The world's first malaria vaccine, RTS,S/AS01, was recently recommended for widespread use in areas with moderate to high malaria transmission. The vaccine carries the potential to significantly reduce illness and death from malaria in Africa but also has a complex 4-dose schedule and approximately 40% efficacy over 4 years. While DPDM is currently working on a study to evaluate the effectiveness of fractional-dose versus full-dose regimens of the RTS,S/AS01 malaria vaccine (see notable publications below), there is an urgent need for safe and more effective malaria vaccines and other novel interventions, such as monoclonal antibodies.

Monoclonal antibodies (mAbs) are proteins made in laboratories that act like antibodies in our bodies. Antibodies seek out the antigens (foreign materials) and stick to them in order to destroy them.

For more than 40 years, DPDM has collaborated with the Kenya Medical Research Institute (KEMRI) in western Kenya to evaluate tools to help prevent and control malaria. The collaboration has a highly experienced clinical trials unit that has been involved in phase 2, 3, and 4 trials of RTS,S/AS01 and conducted the largest phase 2 trial of the PfSPZ Vaccine in 5- to 12-month-old infants as well as a number of pharmaceutical clinical trials. Building on this strong collaboration and experience, DPDM and KEMRI are joining forces again, together with the Liverpool School of Tropical Medicine (LSTM), and with support from the CDC Foundation, to evaluate the safety and efficacy of L9LS, a human monoclonal antibody against *Plasmodium falciparum* malaria in Western Kenya. The study is expected to launch in fall 2022.

An intervention that could prevent malaria in children for a full 12 months in settings of perennial malaria transmission, such as Kenya, holds potential to reduce malaria morbidity and mortality substantially in this population.

New Tools for NTDs



Schoolchildren in American Samoa await mass drug administration (MDA) for lymphatic filariasis (LF).

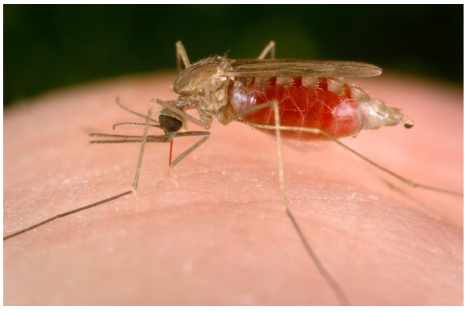
Several neglected tropical diseases (NTDs), such as lymphatic filariasis (LF), are also spread by mosquitoes. As NTD programs move closer to achieving control and elimination targets, diagnostic tests capable of supporting the needs of the program (e.g., identifying when transmission has been interrupted or when elimination has been achieved) are critical for success. Limitations in performance of existing diagnostic tests make it challenging to have confidence that these program endpoints have been achieved. Detection of pathogen antigens, specific antibodies or nucleic acid sequences holds promise for identifying active infections and could be employed at specific program stages.

During development of the World Health Organization (WHO) NTD road map for 2021-2030, common gaps across the NTD portfolio were highlighted, with recognition that a concerted effort is needed to address diagnostic gaps. DPDM staff actively participate in the WHO Diagnostics Technical Advisory Group tasked with reviewing and prioritizing diagnostic needs for NTD programs, defining use-cases and target product profiles (TPPs) for needed tools, working with national NTD programs, and implementing partners to support test development and validation, and providing guidance and recommendations on adoption of new tests.

DPDM scientists are working to develop and validate new NTD diagnostic approaches and evaluate existing tests. Rapid diagnostic tests (RDTs) to detect *W. bancrofti* (parasite species causing LF) circulating filarial antigen were evaluated at CDC and found to be promising and field trials are underway. In addition, DPDM staff have independently evaluated two new RDTs for onchocerciasis and are developing protocols for field testing. In conjunction with these efforts, DPDM staff are helping to build laboratory capacity in affected endemic countries to ensure quality data are available to programs for accurate decision making.

In Case You Missed It ...

World Mosquito Day



On August 20, 1897, a British doctor named Sir Ronald Ross discovered the malaria-spreading parasite in the gut of a female *Anopheles* mosquito. Each year on August 20, we recognize World Mosquito Day to remember Sir Ronald Ross's discovery and raise awareness of the insect responsible for 627,000 malaria deaths in 2020 as well as tens of thousands of deaths from other diseases. Learn more about diseases spread by mosquitoes and what CDC is doing about them globally.

Notable Publications

Efficacy of RTS,S/AS01E malaria vaccine administered according to different full, fractional, and delayed third or early fourth dose regimens in children aged 5–17 months in Ghana and Kenya: an open-label, phase 2b, randomised controlled trial. *The Lancet*. June 23, 2022.

Public Health Surveillance and Reporting for Human Toxoplasmosis — Six States, 2021. *Morbidity and Mortality Weekly Report*. July 15, 2022.

An experimental hut study evaluating the impact of pyrethroid-only and PBO nets alone and in combination with pirimiphos-methyl-based IRS in Ethiopia. *Malaria Journal*. August 20, 2022.

Wolbachia 16S rRNA haplotypes detected in wild *Anopheles stephensi* in eastern Ethiopia. *Parasites & Vectors*. May 24, 2022.

Genotyping *Cyclospora cayetanensis* from Multiple Outbreak Clusters with an Emphasis on a Cluster Linked to Bagged Salad Mix—United States, 2020. *Journal of Infectious Diseases*. June 15, 2022.

Onchocerciasis: Target product profiles of in vitro diagnostics to support onchocerciasis elimination mapping and mass drug administration stopping decisions. *PLoS Neglected Tropical Diseases*. August 3, 2022.

Defining elimination as a public health problem for schistosomiasis control programmes: beyond prevalence of heavy-intensity infections. *The Lancet Global Health*. September 2022.

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