Malaria hides in people without symptoms

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One of the Kenyan staff members hanging a CDC light trap for mosquitoes. Credit: Duke Research Blog

It seems like the never-ending battle against malaria just keeps getting tougher. In regions where malaria is hyper-prevalent, anti-mosquito measures can only work so well due to the reservoir that has built up of infected humans who do not even know they carry the infection.

In high-transmission areas, asymptomatic malaria is more prevalent than symptomatic malaria. Twenty-four percent of the people in sub-Saharan Africa are estimated to harbor an asymptomatic infection, including 38 to 50 percent of the school-aged children in western Kenya. Out of the 219 million malaria cases in 2017 worldwide, over 90 percent were in sub-Saharan Africa.

Using a special vacuum-like tool, Kelsey Sumner, a former Duke undergraduate now completing her Ph.D. at UNC-Chapel Hill, collected mosquitoes in households located in rural western Kenya. These weekly mosquito collections were a part of her pre-dissertation study on asymptomatic, or invisible, malaria. She visited Duke in September to catch us up on her work in Data Dialogue event sponsored by the mathematics department.

People with asymptomatic malaria carry the infection but have no idea they do because they do not have any indicators. This is incredibly dangerous because without symptoms, they will not get treated and can then infect countless others with the disease. As a result, people with an asymptomatic infection or infections have become a reservoir for malaria—a place for it to hide. Reservoirs are a group that is contributing to transmission at a higher rate or proportion than others.

Sumner's study focused on examining the effect of asymptomatic malaria on malaria transmission as well as whether asymptomatic malaria infections would protect a person against future symptomatic infections from the same or different malaria infections. They were particularly looking into *Plasmodium falciparum* malaria. In Kenya, more than 70 percent of the population lives in an area with a high transmission of this potentially lethal parasite.

"*P. falciparum* malaria is very diverse in the region," she said. "It's constantly mutating, which is why it's so hard to treat. But because of that, we're able to actually measure how many infections people have at once."

The researchers discovered that many study participants were infected with multiple, genetically-distinct malaria infections. Some carried up to fourteen strains of the parasite.

Participants in the study began by filling out an enrollment questionnaire followed by monthly questionnaires and dried blood spot collections. The project has collected over nearly 3,000 dried blood spots from participants. These blood spots were then sent to a lab where DNA was extracted and tested for *P. falciparum* malaria using qPCR.

"We used the fact that we have this really diverse *falciparum* species in the area and sequenced the DNA from falciparum to actually determine how many infections people have," Sumner said. "And

then, if there's a shared infection between humans and mosquitoes."

Sumner and her team also visited symptomatic participants who would fill out a behavioral questionnaire and undergo a rapid diagnostic test. Infected participants were able to receive treatment.

While people in the region have tried to prevent infection through means like sleeping under insecticide-treated nets, malaria has persisted.

Sumner is continuing to analyze the collected DNA to better understand asymptomatic malaria, malarial reservoirs and how to best intervene to help stop this epidemic.

"We're basically looking at how the number of shared infections differ between those that have asymptomatic malaria versus those that have symptomatic malaria."

She and her team hypothesize that there are more asymptomatic infections that would result in and explain the rapid transmission of malaria in the region.

Provided by Duke University