Inheritable bacterium controls Aedes mosquitoes' ability to transmit Zika

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Aedes mosquitoes infected with *Wolbachia*. Credit: Gutemberg Brito IOC Fiocruz

Aedes mosquitoes carrying the bacterium *Wolbachia*—found inside the cells of 60 percent of all insect species—are drastically less able to

transmit Zika virus, say researchers at Brazil's Oswaldo Cruz Foundation (FIOCRUZ) in a study published May 4 in *Cell Host & Microbe*.

This is the first report on the effect of *Wolbachia* bacteria on Zika virus. Originally inserted into *Aedes* eggs as part of the Eliminate Dengue Program, the bacterium is passed on from mother mosquitoes to offspring, so it is a sustainable control agent. The approach is already being piloted to control Dengue virus transmission and, with the proper resources and approvals, there's infrastructure in place to increase the scale of current trials to also help tackle the Zika epidemic.

Wolbachia bacteria were first identified in 2005 as a way to combat mosquito-borne infections. After four years, researchers were successful in their attempts to isolate the bacterium from fruit flies and get it inside *Aedes* mosquitoes' eggs, without using any genetic alteration. They expected *Wolbachia* to shorten mosquitoes' lifespans, but the bacterium provided an added bonus, in that it heavily reduced the Dengue virus replication in the mosquito. The bacterium, it seems, has the same effect on Zika transmission. The same effect was previously seen on Chikungunya virus, also transmitted by *Aedes* mosquitoes.

"The idea has been to release *Aedes* mosquitoes with *Wolbachia* in the field over a period of a few months, so they mate with *Aedes* mosquitoes without *Wolbachia* living in the place and, over time, replace the mosquito population," says senior author Luciano Moreira of the Oswaldo Cruz Foundation. He is also actively involved in the Eliminate Dengue Program, a non-profit that is testing the approach in 40 locations around the world.

"Zika and Dengue belong in the same family of viruses, so with the outbreak in Brazil, the logical idea was to test the mosquitoes carrying *Wolbachia* by challenging them with Zika virus and see what would happen" he says.

Moreira's team gave Brazilian field mosquitoes and *Wolbachia*-infected mosquitoes Zika virus by feeding them human blood infected by two recent strains of the virus that is circulating in Brazil. After two weeks, the researchers saw that mosquitoes carrying *Wolbachia* had fewer viral particles in their bodies and saliva. The tests showed that the virus present in the mosquito saliva was not active—meaning that, after biting, the mosquito would not be able to transmit Zika virus. The reason for this drop in viral reproduction is unknown, but one theory is that because *Wolbachia* lives inside of the mosquito's cells, if the virus goes inside the cell to replicate, then there is an internal competition for resources. Surprisingly, this drop held true no matter how many *Wolbachia* the mosquito carried.

"*Wolbachia* showed to be as effective on Zika as the most important Dengue experiments we did," Moreira says. He cautions that the strategy is not 100 percent effective nor will it eliminate the virus. "We know that there will not be only one solution for Zika—we have to do this alongside different approaches, like vaccines or insecticides, besides the public measures to control *Aedes* breeding sites."

He is currently discussing the *Wolbachia* approach with the Brazilian Ministry of Health, hoping to raise the resources and public support to test its effect on Zika in the field.

More information: *Cell Host & Microbe*, Dutra et al.: "Wolbachia blocks currently circulating Zika virus isolates in Brazilian Aedes aegypti mosquitoes" DOI: 10.1016/j.chom.2016.04.021

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