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Epidemiological assessment of Wolbachia-based biocontrol for reduction of dengue morbidity

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Presenter Information

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Epidemiological assessment of *Wolbachia*-based biocontrol for reduction of dengue morbidity

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Wolbachia-based biological control has recently emerged as an ecologically friendly and potentially cost-effective method for prevention and control of dengue and other arboviral infections. When deliberately infected with *Wolbachia*, major vector species, such as *Aedes aegypti* females, lose their vectorial competence and become less capable of transmitting the virus to humans. Thus, *Wolbachia*-based biocontrol aims to replace wild vectors (fully capable of transmitting arboviral infections) by *Wolbachia*-carrying insects that bear a reduced transmission capacity. The population replacement can be achieved by releasing mosquitoes that were transinfected with *Wolbachia* during the process of mass-rearing.

In this presentation, we propose a sex-structured model describing the dynamics of two sup-populations of adult mosquitoes: the wild insects (males and females that are *Wolbachia*-free), and those deliberately infected with *Wolbachia*. This model is biologically viable, well-posed, and reflects the two significant features of *Wolbachia*: maternal transmission and cytoplasmic incompatibility. The model also exhibits bistability that agrees with the principle of competitive exclusion.

Using this mosquito population dynamics model, we further construct a dengue transmission system of SEIR-SEI type to perform an epidemiological assessment of *Wolbachia*-based control for prevention of dengue morbidity. As an example, we simulate this type of preventive control applied to Cali, a sizeable Colombian city commonly considered a hyperendemic area regarding dengue morbidity.