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On Aedes, Wolbachia and the Control of Urban Arboviruses

Wolbachia is a maternally transmitted bacteria, that has been shown to be capable of blocking the disease transmission of dengue, and recent results suggest that is also able to block chikungunya and zika. We present a model of infection by Wolbachia of an *Aedes aegypti* population, which take into account both the biology of this infection and the ecology of the vector. The objective is to use this model for evaluating the sustainable introduction of this bacteria into field population.

We provide a complete mathematical analysis of the model proposed and give the basic reproduction ratio R_0 for Wolbachia. We observe a bistability phenomenon: Two equilibria are asymptotically stable: the mosquito population completely uninfected or completely infected; also a third unstable equilibrium exists. This is a backward bifurcation situation, with the bistability occurring for biological parameter values. This is also an example of an epidemiological model with only vertical transmission.

We use the data of real trial of releases of infected mosquitoes in Cairns (Australia) to calibrate our model. The calibrated model behaves remarkably well vis á vis the observed data. We use it to simulate different scenarios of appearance of dengue. The simulations confirm our findings that a dengue epidemics will not occur if Wolbachia infections is sufficiently prevalent in the *Aedes* populations. This suggests that the introduction of Wolbachia can become an effective control tool for dengue.

This is joint work with Gauthier Sallet and Abderrahman Iggidr (INRIA), Jair Koiller (INMETRO), Mocyar Silva (FGV) and Claudia Codeço (FIOCRUZ).