Co-Circulation effect for vector-borne diseases transmitted by Aedes Aegypti

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Nowadays, in addition to the Dengue fever, Zika, Chikungunya and Yellow fever are important arboviroses transmitted by the vector Aedes Aegypti. The existence of co-circulating different virus is a relevant feature for the complex dynamics of transmission in the population level: four serotypes of Dengue (DENV1-DENV4), ZIKV, CHIKV and YFV. In order to investigate the co-circulation effect between different virus, we consider a deterministic model that takes into account $n$ infections caused by different virus transmitted by the same vector. From the modelling point of view, we observe that one infection may attenuate or reinforce the other infection as well as it may increase or decrease the width and time delay between the peaks of their outbreaks. Analysing dengue data for different serotypes of some urban center in Central and South America, we calculate the force of infection and, as a consequence, the basic reproductive number for that model with $n$ co-circulating virus. For both scenarios of coexistence and changing prevalence in two consecutive epidemics, a non-nule co-circulation effect is observed by fitting Runge-Kutta simulations of the model with the data. We extend this analysis for co-circulating virus from actual data of Dengue and Zika epidemics in several urban centers in Bahia-Brazil; it also leads to no neutral scenarios of positive and negative co-circulation effect. Finally we also show how these results are affected for a stochastic version of the model whose dynamics is given by “birth and death” master equation.