Effects of Multiple Transmission Pathways on Zika Dynamics

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Abstract

Although the Zika virus is transmitted to humans primarily through the bite of infected female Aedes aegypti mosquitoes, it can also be sexually and vertically transmitted within both populations. In this study, we develop a new mathematical model of the Zika virus which incorporates sexual transmission in humans and mosquitos, vertical transmission in mosquitos, and vector to human transmission through bites. Analysis of this deterministic model shows that the secondary transmission routes of Zika increase the basic reproductive number of the virus by 5%, shift the peak time of an outbreak to occur 10% sooner, and have important consequences for Zika control strategies. Furthermore, sensitivity analysis show that the basic reproductive number is most sensitive to the mosquito biting rate and transmission probability parameters and reveal that the dynamics of juvenile mosquito stages greatly impact the peak time of an outbreak. These discoveries deepen our understanding of the complex transmission routes of ZIKV and the consequences that they may hold for public health officials.
