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ESTIMATING THE PROPORTION OF SEXUAL TRANSMISSION ON ZIKA VIRUS SPREAD

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The recent Zika virus outbreak has been spreading rapidly which in turn makes it a global public health hazard. Zika virus may cause serious health problems like microcephaly and GBS. One rare property of the Zika virus compared to most vector-borne diseases is the fact that the virus is transmitted both by mosquitoes and by direct sexual contact. To quantify the amount of sexual transmission, we formulate and analyze a compartmental model of Zika virus spread considering both vector-borne and sexual transmission (see Fig. 1).

We showed the positivity and boundedness of solutions, global stability of the disease-free equilibrium, existence of endemic equilibria and an analytic expression for R_0. We tted the proposed model to Zika case data from Colombia. We estimate the reproduction numbers, namely direct (sexual) transmission, vector transmission and the basic reproduction number (R_0). The analysis revealed that the sexual transmission contribution to R_0 is [14.62% (95% CI 3.6926.2)] for the proposed model. For this model, the estimated R_0 to be 1.94 (95% CI 1.672.11), the direct transmission reproduction number to be 0.4 (95% CI 0.11 0.66), and the vector transmission reproduction number to be 1.52 (95% CI 1.331.64). Further, to shed some light on controllability, we performed global sensitivity analysis and analyzed some contour plots. From this study, we conclude that sexual transmission may increase the risk of Zika, but it is not sufcient to create an outbreak by itself [1].

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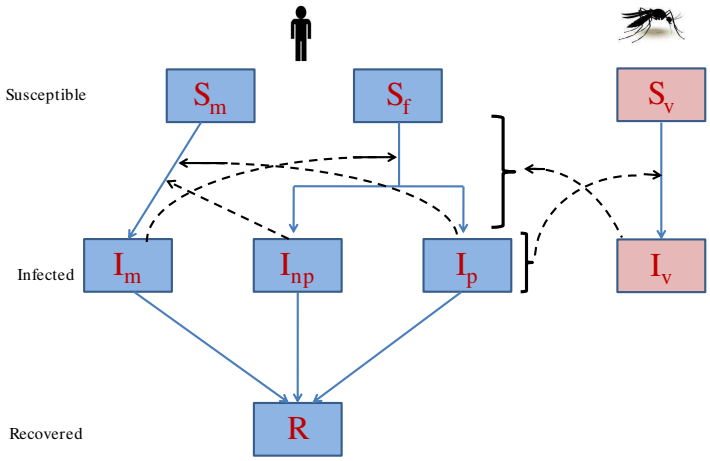

Figure 1: Flow diagram for the Zika virus model involving sexual and vector transmission. Blue nodes are human compartments and red nodes are vector populations. Solid blue lines represent the conversion rate and dashed black lines represent the infection rate. S_m - susceptible male, S_f - susceptible female, I_m - infected male, I_{np} - infected non-pregnant female, I_p - infected pregnant female, R - recovered human, S_v - susceptible vector, I_v - infected vector.

References

[1] Sasmal S. K., Ghosh I., Huppert A., and Chattopadhyay J. (2018). Modeling the Spread of Zika Virus in a Stage-Structured Population: Effect of Sexual Transmission. *Bulletin of mathematical biology* 80(11) 3038-3067. https://doi.org/10.1007/s11538-018-0510-7

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