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Modeling dengue transmission with viral load and antibody levels

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Dengue fever is a vector-borne disease causing millions of infections every year. This makes dengue a significant public health concern in many regions worldwide. In addition, there is no specific treatment for dengue or severe dengue, which emphasizes the importance of mathematical models for dengue fever [1] combined with control strategies for this disease.

Motivated by works [2, 3], we present a new vector-host model, which considers the micro-dynamics of viral load and antibody (Ab) levels. This consideration is crucial to improving the model, allowing the study of the antibody-dependent enhancement phenomenon (ADE) [4] and the incorporation of control strategies, such as vaccination.

For an initial investigation, we consider the viral load and antibodies of only a single dengue serotype. This leads to a particular case with an associated delayed model. For the obtained delayed differential equation, we present the theoretical and numerical study of the endemic equilibrium and the basic reproduction number. The numerical results also allow us to conclude that the model presents expected behavior for the dynamics examined.

Keywords: dengue fever, vector-host models, delay differential equations, numerical simulations

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