

Mathematical Modelling and Fractional-Order Analysis of Zika Virus Transmission Dynamics with Vaccine Acceptance and Public Awareness

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Abstract

Zika virus is still a major health issue globally because it is spreading fever, joint pains with devastating complications to the vulnerable populations. It is crucial to learn its dynamics of transmission in order to prevent and control it. In the current study, a mathematical model of the fractional-order is developed in which vaccine acceptance and public awareness are considered as intervention strategies. The model employs the Caputo fractional derivative to model memory and time effects that affect the real-life epidemics trends. The LaplaceAdomian Decomposition Method provides the population with analytical insights and semi-analytical solutions and maintains the model complexity and accuracy. The variables of vaccine hesitancy and awareness are treated as dynamic and cause population transitions. To describe the behavior of the disease, stability analysis and the basic reproduction number are calculated. The numerical simulations show that fractional-order dynamics significantly lower infection rates and the probability of spreading the infection and are likely to spread the outbreak pattern and demonstrate the efficiency of vaccination and awareness programs. This model would offer useful knowledge to assist policy makers and health administrators in the development of specific interventions to curb the spread of the Zika virus.

Keywords

ZIKA Virus; Caputo fractional-order derivatives; Vaccination; public knowledge levels; Laplace Adomian Decomposition Method.

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