

Mathematical Modeling and Dynamics of Immunological Exhaustion Caused by Measles Transmissibility Interaction with HIV Host

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ABSTRACT

This paper mainly addressed the study of the transmission dynamics of infectious diseases and analysed the effect of two different types of viruses simultaneously that cause immunodeficiency in the host. The two infectious diseases that often spread in the populace are HIV and measles. The interaction between measles and HIV can cause severe illness and even fatal patient cases. The effects of the measles virus on the host with HIV infection are studied using a mathematical model and their dynamics. Analysing the dynamics of infectious diseases in communities requires the use of mathematical models. Decisions about public health policy are influenced by mathematical modeling, which sheds light on the efficacy of various control measures, immunization plans, and interventions. We build a mathematical model for disease spread through vertical and horizontal human population transmission, including six coupled nonlinear differential equations with logistic growth. The fundamental reproduction number is examined, which serves as a cutoff point for determining the degree to which a disease will persist or die. We look at the various disease equilibrium points and investigate the regional stability of the disease-free and endemic equilibrium points in the feasible region of the epidemic model. Concurrently, the global stability of the equilibrium points is investigated using the Lyapunov functional approach. Finally, the Runge-Kutta method is utilised for numerical simulation, and graphic illustrations are used to evaluate the impact of different factors on the spread of the illness. Critical factors that effect the dynamics of disease transmission and greatly affect the rate and range of the disease's spread in the population have been determined through a thorough analysis. These factors are crucial in determining the expansion of the disease.

Keywords: Co-Infection, Lyapunov Function, Human Immunodeficiency Virus, Measles, Reproduction Number, Stability Analysis.