Effect of Vaccination Rate in Multi-Wave Compartmental Model

Contributed Talk

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This study explores the impact of vaccination rates on the dynamics of infectious disease transmission using the Susceptible-Infected-Exposed-Recovered-Vaccinated (SIERV) compartmental model (Figure 9). Initially, a single isolated SIERV model is analyzed, demonstrating transitions between multi-wave states (MWS), endemic equilibrium (EE), and disease-free equilibrium (DFE) as vaccination rates increase. Key transitions are mediated by Hopf and transcritical bifurcations, with the basic reproduction number (R_0) corroborating these findings. Expanding to a two-patch

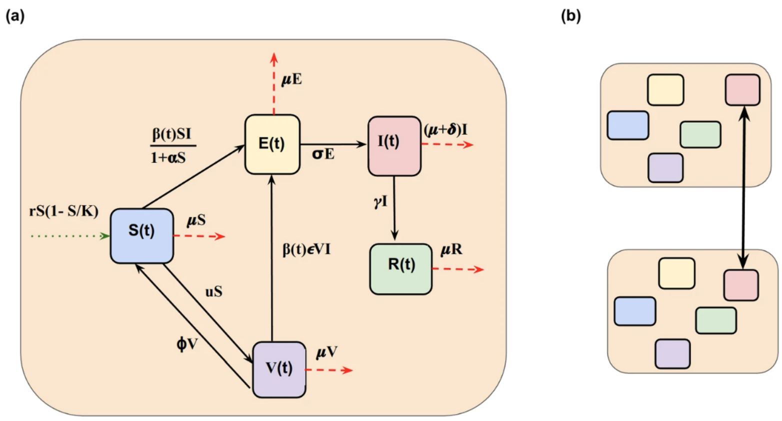

Figure 9: Schematic of the proposed model

community model with mean-field coupling among infected classes, additional dynamic phenomena such as birhythmicity, multi-stability, and EE states are identified. Interactions between dispersal strength, mean-field coupling, and vaccination rates significantly influence the dynamics. Stability analyses reveal synchronized dynamics across communities, with transitions mediated by bifurcations. The findings emphasize the importance of targeted vaccination strategies and intercommunity interactions in controlling disease outbreaks.

Keywords: Vaccination; Compartmental Model; Multi-Wave State; Epidemic Dynamics.