

Abstract

The research will explore the dynamics of the novel (COVID-19) disease, particularly a contagious viral infection which has killed millions of people worldwide. The virus spreads from person to person through direct or close contact if the precautions are not being fulfilled. We developed an SVEIR model using ODEs to examine the behavior of COVID-19 and assess its stability within human communities. For this purpose, the threshold parameter is computed for the model just to handle the disease. We have proved several fundamental properties of the model to verify well-posedness. Furthermore, the stability of the model at two main equilibrium points (DFE and EE) is investigated. Under the given conditions for the threshold parameter, both equilibrium points are asymptotically stable. The global stability is confirmed through the use of Lyapunov's function theory. We employed the RK4, and NSFD numerical techniques to solve the epidemic model. We have revised our this model to SVEQIHR to understand the disease behavior in humans. With the aim of potentially eradicating the disease within the population, we evaluate the effectiveness of three constant control strategies designed for both susceptible and infected individuals through simulations. A sensitivity analysis is conducted to pinpoint the most responsive parameters. We also introduce optimal control strategies that incorporate time-varying vaccination, quarantine and hospitalized approaches, focused on reducing infection rates, mitigating disease severity, and enhancing public health outcomes. The originality of this study lies in the use of the NSFD method to tackle control problems, thereby improving disease management and control via simulations.