

Mathematical Modeling and Analysis of COVID-19 Pandemic

Authors : Thomas Wetere

Abstract : Background: The coronavirus disease 2019 (COVID-19) pandemic (COVID-19) virus infection is a severe infectious disease with the highly transmissible variant, which become the global public health treat now. It has taken the life of more than 4 million people so far. What makes the disease the worst of all is no specific effective treatment available, its dynamics is not much researched and understood. Methodology: To end the global COVID-19 pandemic, implementation of multiple population-wide strategies, including vaccination, environmental factors, Government action, testing, and contact tracing, is required. In this article, a new mathematical model incorporating both temperature and government action to study the dynamics of the COVID-19 pandemic has been developed and comprehensively analysed. The model considers eight stages of infection: susceptible (S), infected Asymptomatic and Undetected(IAU), infected Asymptomatic and detected(IAD), infected symptomatic and Undetected(ISU), infected Symptomatic and detected(ISD), Hospitalized or threatened(H), Recovered(R) and Died(D). Results: The existence as well as non-negativity of the solution to the model is also verified, and the basic reproduction number is calculated. Besides, stability conditions are also checked, and finally, simulation results are compared with real data. The results demonstrates that effective government action will need to be combined with vaccination to end the ongoing COVID-19 pandemic. Conclusion: Vaccination and Government action are highly the crucial measures to control the COVID-19 pandemic. Besides, as the cost of vaccination might be high, we recommend an optimal control to reduce the cost and number of infected individuals. Moreover, in order to prevent COVID-19 pandemic, through the analysis of the model, the government must strictly manage the policy on COVID-19 and carry it out. This, in turn, helps for health campaigning and raising health literacy which plays a role to control the quick spread of the disease. We finally strongly believe that our study will play its own role in the current effort of controlling the pandemic.

Keywords : modeling, COVID-19, MCMC, stability

Conference Title : ICAAMM 2022 : International Conference on Applied Analysis and Mathematical Modeling

Conference Location : Miami, United States

Conference Dates : March 11-12, 2022