Abstract

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) is a strain of Coronavirus that causes Coronavirus Disease 2019 (COVID-19). The respiratory illness responsible for the COVID19 pandemic began in December 2019 in Wuhan city, China. Mathematical modeling has enabled the epidemiologist to understand the dynamics of the disease, its impact and future predictions in order to provide the governments with the best policies and strategies to curb the spread of the virus. Deterministic susceptible-vaccinated-asymptomatic-infectious-recovered (SVAIR) model was formulated incorporated with time delay. The delay accounts for the time lapsed between exposure and infectious period. Furthermore, time delay and vaccination inversely affects the basic reproduction number hence play a major role in stabilizing the rate of infection. In this study delay differential equations (DDE) were formulated for the purposes of determining the stability of both disease free equilibrium (DFE) and endemic equilibrium point (EEP). It was found out that the model was stable at both Disease Free Equilibrium (DFE) and Endemic Equilibrium Point (EEP) and was attained whenever $R_0<1$ and $R_0<1$ respectively. Calculations based on secondary data from various works of literature and the WHO dashboard was used. The basic reproduction number (R_0) was computed using the next generation matrix (NGM) approach. Finally, numerical simulations were carried out using MATLAB for validation of the analytical results. Graphical representation shows that stability is achieved when T>5 days and that R_0= 0.95 at DFE. Furthermore at EEP it was noted that R_0 = 1.02 hence stability was guaranteed.