ON A TWO-STRAIN EPIDEMIC MATHEMATICAL MODEL WITH VACCINATION

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ABSTRACT

In this paper, we study mathematically a two strains epidemic model taking into account non-monotonic incidence rates and vaccination strategy. The model contains seven ordinary differential equations that illustrate the interaction between the susceptible, the vaccinated, the exposed, the infected and the removed individuals. The model has four equilibrium points, namely, disease free equilibrium, endemic equilibrium with respect to the first strain, endemic equilibrium with respect to the second strain and the endemic equilibrium with respect to both strains. The global stability of the equilibria has been demonstrated using some suitable Lyapunov functions. The basic reproduction number is found depending on the first strain reproduction number R_0^1 and the second reproduction number R_0^2. We have shown that the disease dies out when the basic reproduction number is less than unity. It was remarked that the global stability of the endemic equilibria depends, on the strain basic reproduction number and on the strain inhibitory effect reproduction number. We have also observed that the strain with high basic reproduction number will dominate the other strain. Finally, the numerical simulations are presented in the last part of this work to support our theoretical results.

***K*eywords** SEIR · COVID-19 · vaccination · non-monotone incidence

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