

**OPTIMAL VACCINATION AND ISOLATION STRATEGY TO CONTROL THE SPREAD OF COVID-19 IN SRI LANKA**

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The coronavirus, SARS-CoV-2, which was responsible for the COVID-19 pandemic, caused historically unprecedented challenges on the global level. It is essential to understand the unique aspects of virus transmission dynamics to develop control techniques that can help to control pandemics. This study focused on the human-to-human and environment-to-human transmissions of COVID-19, considering the threshold level of SARS-CoV-2 for human infection. To minimize the economic impact of the disease and its related expenses, optimal control was incorporated to measure the optimal rate of vaccination and the optimal rate of isolation of symptomatic infected humans. In this optimal control problem, the main objective was to reduce the total number of people infected with the virus (both asymptomatic and symptomatic individuals) and the number of deaths due to disease while minimizing the overall cost of controlling the disease during the pandemic. The Pontryagin's maximum principle was applied to derive the necessary conditions that the optimal controls and corresponding states must satisfy, and the forward-backward sweep method was used to determine the optimal solution for the model. The model was solved for a 200-day period, considering a maximum allowable vaccination rate of 0.3% of the susceptible population per day and an isolation rate of 5% of the symptomatic infected individuals per day. The results indicated that both vaccination and isolation should be implemented at their respective maximum allowable levels. Specifically, vaccination should be carried out at a rate of 0.3% of the susceptible population for 102 consecutive days, while 5% of the symptomatic infected individuals should be isolated continuously throughout the entire period. With these controls, the infectious population can be reduced by 42.35%, and the deaths due to COVID-19 can be decreased by 29.27%. To develop evidence-based methods for combating upcoming pandemics, government officials and public health authorities can benefit significantly from these findings.

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