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MATHEMATICAL MODELLING OF SPREAD OF COVID-19 IN SRI LANKA

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COVID-19 is caused by a new strain of coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). In this study, a Susceptible-Infected-Recovered (SIR) model, that describes the dynamics of COVID-19 in Sri Lanka, was developed. For the model development, the human population (N) was divided into five compartments, as Susceptible (S), Asymptomatic infectious (I_A), Symptomatic infectious (I_S), Recovered (R) and Dead (D). The transmission rates of I_S and I_A were taken to be β_S and β_A respectively. Using the available parameter estimates in the literature, β_S and β_A were calculated from the recorded COVID-19 data for Italy, and Florida in USA in 2020. The data were collected starting from the day of the first recorded patient until the day of lockdown of Italy and Florida. Then, the transmission rates β_S and β_A were estimated using Python to best fit the available COVID-19 data in Italy and Florida. Next, the model was simulated for a possible epidemic in Sri Lanka using these estimated parameters. Secondly, the model developed was modified to check the dynamics of disease transmission when the symptomatic individuals are hospitalized and isolated and/or under lockdown. The second model developed was further modified to check the dynamics of disease transmission with random PCR tests to identify the asymptomatic individuals. According to the simulation results, without any control methods, the epidemic could reach the peak within 91 days with a total of 14,387,598 cases throughout the epidemic in Sri Lanka. Further, from the results, it is clear that the infected individuals decrease under the control methods, such as hospitalization, isolation, lockdown and PCR testing, and could prevent having an epidemic.

Keywords: Asymptomatic, COVID-19, PCR tests, SIR model, Symptomatic