Modelling the third wave of the COVID-19 pandemic in Malaysia

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ABSTRACT

Introduction: The COVID-19 pandemic has spread rapidly across the globe and negatively affected healthcare systems worldwide. The objective of this study was to develop Susceptible-Exposed-Infected-Recovered (SEIR) models to forecast daily COVID-19 cases during the third wave in Malaysia. **Materials and methods:** SEIR models were developed using the R programming software ODIN interface which were fitted into the Malaysian daily COVID-19 case numbers from 1 April 2021 to 14 July 2021, allowing for the approximation of parameters consisting of incubation period (I), removal rate (L) and disease transmissibility (R). Effects of vaccination was accounted by determining the time varying function for the vaccination rates based on two scenarios; achieve 80% population fully vaccinated by (a) 31 October 2021 and (b) 31 December 2021. Weighted vaccine efficacy was set at 70%. Subsequently forecasts of daily COVID-19 cases based on scenarios (a) and (b) were provided from 15 July 2021 to 31 December 2021. **Results and conclusion:** Our model calibration estimated that (I), (L), and (R) were 5.2 days, 0.25, and 1.2, respectively. A polynomial ($y=20.452x2 – 2E + 06x + 4E +10$) and Logarithm ($y=-58000\ln(x) + 327680$) equations was determine to account for the vaccination rates. Scenarios (a) and (b) forecasted that the outbreak would peak on 25 August 2021 with 23,590 cases and 15 September 2021 with 27,051 cases respectively, and subsequently showed a reducing case trend till 31 December 2021. As of 31 December 2021, the highest daily case observed was on 26 August 2021 with 24,599 cases which was very close to the model estimation. The observed cases closely mirrored the down going trend forecasted in scenario (a) until 26 October 2021. Trend of observed cases from November to December 2021 was well within the model forecast range of scenario (a) and (b). SEIR models developed accounting for the effects of vaccination were able to provide reasonable forecasts of daily case trend during the third wave of COVID-19 in Malaysia.

Keywords: SEIR, COVID-19, modelling, outbreak