

Prediction of cumulative death cases in Brazil due to Covid-19 using mathematical models

ABSTRACT

The novel corona virus (2019-nCoV) infection has spread rapidly to other provinces and neighbouring countries since the emergence of the first cases at Wuhan, China. Estimation of the death cases by mathematical modelling can help to determine the potential and severity of the outbreak and to provide critical information on the type and intensity of disease response. In this paper, we present different growth models such as Von Bertalanffy, Baranyi-Roberts, Morgan-Mercer-Flodin (MMF), modified Richards, modified Gompertz, modified Logistics and Huang in fitting and analyzing the epidemic trend of COVID-19 in the form of total number of death cases of SARS-CoV-2 in Brazil as of 15th of July 2020. The MMF model was found to be the best model with the highest adjusted R² value with the lowest RMSE value. The Accuracy and Bias Factors values were close to unity (1.0). The parameters obtained from the MMF model include maximum growth of death rate (log) of 0.03 (95% CI from 0.02 to 0.028), curve constant (δ) that affects the inflection point of 0.7057 (95% CI from 0.68 to 0.73) and maximal total number of death (y_{max}) of 17,619,760 (95% CI from 9,705,100 to 34,994,517). The MMF model predicted that the total number of death cases for Brazil on the coming 15th of August and 15th of September 2020 will be 132,787 (95% CI of 123,422 to 142,863) and 212,166 (95% CI of 192,578 to 233,746), respectively. The predictive ability of the model utilized in this study is a powerful tool for epidemiologist to monitor and assess the severity of COVID-19 in Brazil in months to come. However, as with any other model, these values need to be taken with caution due to the unpredictability of the COVID-19 situation locally and globally.

Keyword: Total infection; Mathematical model; Pandemic; MMF; COVID-19