Forecasting the end time of global COVID-19 infection with the effects of adaptive behaviors and vaccination

Guanghu Zhu[1], Yuhao Zhou[1], Zhaowan Li[1], Wei Wu[2], Jianpeng Xiao[2], and Wenjun Ma[3]

[1]Guilin University of Electronic Technology
[2]Guangdong Center for Disease Control and Prevention
[3]Jinan University School of Medicine

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Abstract

We developed a deterministic model with multiple compartments by a system of differential equations, which allows for simulating novel coronavirus (COVID-19) transmission dynamics with human adaptive behaviors and vaccine effects, aiming at predicting the end time of COVID-19 infection in global scale. Based on the surveillance information (reported cases and vaccination data) between January 22, 2020 and July 18, 2022, we validated the model by MCMC fitting method. We found that (1) if without protective and control behaviors, the epidemic could sweep the world in 2022 and 2023, causing 3.098 billion of human infections, which is 5.39 times of the current number; (2) there could be 645 million people avoided from infection due to vaccine; (3) if following current scenarios of protective/control behaviors and vaccine rate, the cumulative number of cases would increase slowly, leveling off around 2023, and the epidemic would end completely in June 2025, causing 1.024 billion infections. Our findings suggest that collective protection behavior and vaccination remain the key determinants of the global process of COVID-19 transmission.

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