Towards the global equilibrium of COVID-19: statistical analysis of country--level data

Mark Last (Ben-Gurion University of the Negev)

Abstract

In our study, we explore the COVID-19 dynamics to test whether the virus has reached its equilibrium point and to identify the main factors explaining R and CFR variability across countries. We present a retrospective study of publicly available country-level data from fifty countries having the highest number of confirmed COVID--19 cases at the end of September 2021. Aggregated data included 213 976 306 COVID-19 cases confirmed in the selected fifty countries from the start of the epidemic to September 30, 2021.

The mean values of country--level moving averages of R and CFR went down from 1.118 and 6.3%, respectively, on June 30, 2020 to 1.083 and 3.6% on September 30, 2020 and to 1.015 and 1.8% by September 30, 2021. In parallel, the 10% to 90% inter-percentile range of R and CFR moving averages decreased from 0.288 and 13.3%, respectively, on June 30, 2020, to 0.151 and 7.7% on September 30, 2020, and to 0.107 and 3.3% by September 30, 2021.

According to a comparison of the country--level 180--day moving averages of R and CFR calculated on September 30, 2021, an increase of 1% in the Delta variant share is associated with an increase of 0.0009 (95% CI 0.000 to 0.002) in the average Reproduction Number R, while an increase of 1% in the total percentage of confirmed COVID-19 cases per country's population is associated with a decrease of 0.005 (95% CI 0.000 to 0.010) in the average R. Also, an increase of 1% in the total percentage of fully vaccinated people per country's population is associated with a decrease of 0.04% (95% CI 0.01% to 0.06%) in the average CFR. Other virological, demographic, economic, immunization, or stringency factors were not statistically significantly associated with either R or CFR across the explored countries.

The slow decrease in the country-level moving averages of R, approaching the level of 1.0 and accompanied by repeated outbreaks ("waves") in various countries, may indicate that COVID-19 has reached its point of a stable endemic equilibrium. A regression analysis implies that only a prohibitively high level of herd immunity (about 63%) may stop the endemic by reaching a stable disease-free equilibrium. It also appears that fully vaccinating about 70% of a country's population should be sufficient for bringing the CFR close to the level of a seasonal flu (about 0.1%).

Thus, while the currently available vaccines prove to be effective in reducing the mortality from the existing COVID-19 variants, they are unlikely to stop the spread of the virus in the foreseeable future. It is noteworthy that no statistically significant effects of government measures restricting the people's behavior (such as lockdowns) were found in the analyzed data.

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