

Regional Differences in the Spread of COVID-19 in the World and the Rationale for the Effectiveness of PCR Testing

A 100 times greater spread in Western countries than in Asia and countries with a positive rate of less than 7% presented a considerably

Coronavirus disease 2019 (COVID-19) has been spreading globally. Countries are struggling to respond within their own nations, but are not paying sufficient attention to differences among countries in the spread of infection. "It is important to analyze these data calmly from a scientific perspective to find new strategies for ending the ongoing spread of infection around the world," says Chiba University professor Akihiro Hisaka.

Professor Hisaka, a specialist in modeling and simulation in the medical and pharmaceutical fields, thinks that his knowledges on kinetic analysis can be applied to analyzing the spread of infection. The research group he leads focused on differences in infection trends across regions and used machine learning to analyze data including the number of population-adjusted daily test-positive cases and population-adjusted daily deaths in 49 countries around the globe. This analysis quantitatively revealed, for the first time in the world, that the number of daily test-positive cases was almost constant after the infection spread and that there were significant regional differences. The same analysis also found that the number of deaths was decreasing in countries that were active in polymerase chain reaction (PCR) testing.

The results showed that the number of deaths per day per 100 million people is approaching a constant value 30 days after the spread of the infection in many countries. The estimated number (median) was 1180 people in Western countries (Europe, North America, and Oceania), 128 people in the Middle East, 97 people in Latin America, and seven people in Asia (excluding the Middle East), revealing a remarkable regional difference of about 100-fold (Figure 1). The results also revealed that, while Western countries showed a similar increase trend, Asian countries had different patterns in the number of deaths.

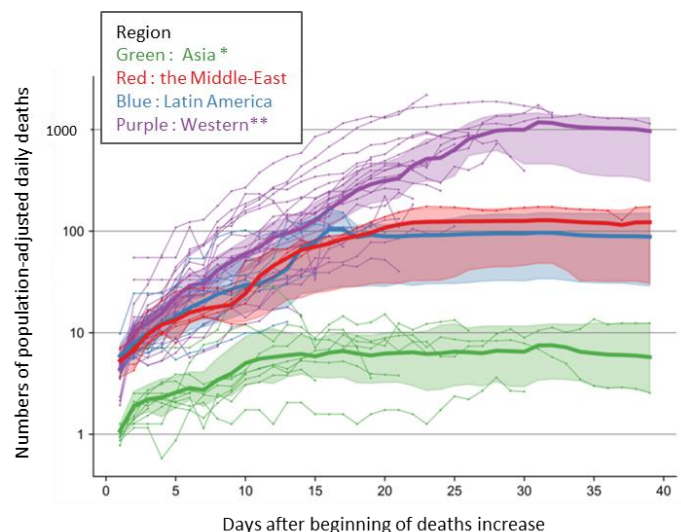


Figure 1 Estimation of the time course of number of population-adjusted daily deaths by machine learning analysis classified by the global region.

*Asia (excluding the Middle-East),

**Western (Europe, Oceania, and North America),

The researchers compared the number of daily deaths and the status of PCR implementation in Western countries, which show similar tendencies in the spread of COVID-19. Results showed that, although there was no relationship between population-corrected deaths and the number of PCR tests, there was a clear relationship between the test-positive rate of PCR tests and the number of deaths. In general, the test-positive rate will decrease if an adequate number of people are tested. The results indicate that among countries with a similar level of spread, those with a positive rate of less than 7% had a daily mortality rate of only 15%, lower than those with higher test-positive rates (Figure 2). They also indicate no difference in the estimated death toll between countries with positive rates of 7.0-16.9% and those with rates of 17.0-28.0%. In other words, this result suggests that maintaining a positive rate below a certain level is important for controlling the number of deaths.

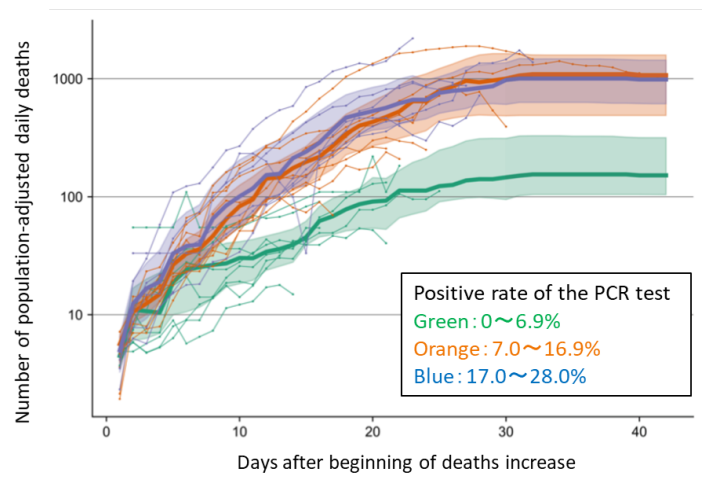


Figure 2 Estimation of the time course of number of population-adjusted daily deaths by machine learning analysis classified by the positive rate of the PCR test in Western countries. Each colored area represents 5 to 95% confidence interval of the median estimated by bootstrap analysis.

"Regional differences may be caused by national policies, the rate of aging, the welfare system including BCG vaccination, the medical environment, and national characteristics, but may also be due to genetic factors," explains Professor Hisaka.

Professor Hisaka also noted that "this is the first data to show a clear regional difference in COVID-19 spread patterns and demonstrate the effect of PCR testing by distinguishing regions quantitatively. And also this means positive rate of PCR test can be critical indicator to decrease mortality rate. However, with full understanding that the burden on medical staff all over the world should never be increased, we suggest it is necessary to focus on the future and positively support sufficient volumes of PCR testing basis this scientific rationale."

Reference:

Hisaka, A. et al. "Global Comparison of Changes in the Number of Test-Positive Cases and Deaths by Coronavirus Infection (COVID-19) in the World"

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