

Comprehensive assessment of early reporting of emerging infectious diseases

Background

An international public health emergency has been declared by the World Health Organisation on 30th January 2020 after the outbreak of a novel coronavirus in China that was subsequently named COVID-19. Various pandemic preparedness indices and estimates from mathematical models are being used for predicting the disease spread and to inform decisions about the pandemic. However, the reliability of these tools has not been sufficiently measured. In this study, I aim to assess the early reporting of the basic reproduction number (R_0) of COVID-19 and assess the efficacy of Global Health Security Index (GHSI) scores in predicting pandemic preparedness.

Methods

I conducted a systematic review and meta-analysis of articles published between 1st December 2019 and 30th September 2020 estimating basic reproduction number. I also conducted a subgroup analysis by country, continent, study duration and method, whether mean or median was reported for reproduction numbers, the month of publication, and whether the study was conducted in Wuhan, Hubei including Wuhan or outside Hubei in China. GHSI scores for 2019 were obtained from the publicly available data from the GHSI website. Poisson regression, logistic regression and survival analysis were used to assess the association of GHSI scores with case rate, death rate and vaccination coverage and rate adjusting for socio-developmental index, universal health coverage, life expectancy and total fertility rate of the country.

Results

Out of the 15714 articles screened, 81 articles were included in the meta-analysis and 76 articles were synthesised narratively. The result from the meta-analysis shows that in the absence of a deliberate intervention for COVID-19, the R_0 was estimated to be 2.66 with a 95% confidence interval (2.41–2.94). Additionally, I found that as the GHSI scores increased, the number of COVID-19 cases and death rates increased as well. In terms of vaccination, however, the countries with higher scores are more likely to quickly achieve desired vaccination coverage.

Conclusion

Global understanding of infectious disease outbreaks remains weak. This study shows that there is still much theoretical and practical work to be done before we can properly understand the dynamics of emerging infectious diseases. R_0 is a highly variable and unreliable measure of pandemic risk, subject to much uncertainty and vulnerable to the influence of modelling assumptions, data quality and data timeliness. Until we have a clearer understanding of and consensus on how to use infectious disease models for the pandemic response, we cannot hope to prepare for the next pandemic.