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SYNOPSIS

03/16/2020

Review of "Early dynamics of transmission and control of COVID-19: a mathematical modelling study"

Article citation: Kucharski AJ, Russell TW, Diamond C, Liu Y, Edmunds J, Funk S, et al. Early dynamics of transmission and control of COVID-19: a mathematical modelling study. Lancet Infect Dis. 2020 Mar 11 [Epub ahead of print]. Available from: https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30144-4/fulltext

One-Minute Summary

- This study describes a mathematical model estimating transmission of coronavirus disease 2019 (COVID-19) based on cases in Wuhan, cases elsewhere in China, and internationally exported cases, combined with international flight pattern data.
- The model estimated that the reproduction number (number of secondary cases per index case) dropped from 2.4 (95% Credible Interval (CI) 1.2-4.8) on January 16, 2020 (one week before travel restrictions in Wuhan were put into place), to 1.1 (95% CI 0.4-2.4) on January 31, 2020 (one week after travel restrictions were put into place).
- The model results suggest that in Wuhan, there were approximately 10 times more symptomatic cases in late January than were reported as confirmed cases.
- Based on the median reproduction number prior to travel restrictions, the study estimates that a single introduction of 2019-nCoV would have a 17%–25% probability of causing a large outbreak; four or more infections resulted in an over 50% chance of an outbreak.

Additional Information

- The model assumed that the outbreak commenced with one case on November 22, 2019.
- The model found that the number of confirmed compared to modelled exported cases from Wuhan was concordant in the 20 countries that were most connected to China, except for the US, France and Australia, which had more confirmed cases than modelled cases.
- Sensitivity analyses modelling a larger number of initial cases, different mobility data, and allowing presymptomatic cases to transmit all observed a similar decline in the reproductive number from more than two to almost one in the last two weeks of January 2020.
- The uncertainty in the reproductive number estimates following the February 2020 decline resulted from a paucity of data to inform transmission changes during this period.
- The model found that it may still take several introductions of cases for an outbreak to establish in a new location. The authors note that this highlights the importance of rapid case finding and subsequent isolation to reduce the chances of onwards transmission.

PHO Reviewer's Comments

- The authors have made an online tool so that users can explore these risk estimates if new data become available (https://cmmid-lshtm.shinyapps.io/new_outbreak_probability/).
- All data and code required to reproduce the analysis are available at: https://github.com/adamkucharski/2020-ncov.

Citation

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