

## Modelling study estimates impact of relaxing control measures on possible second wave of COVID-19 in China

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New modelling research, published in *The Lancet* journal, suggests that China's aggressive control measures appear to have halted the first wave



of COVID-19 in areas outside Hubei province, the epicentre of the epidemic. However, given the substantial risk of the virus being reintroduced from abroad, and with economic activity increasing, real-time monitoring of COVID-19 transmissibility and severity is needed to protect against a possible second wave of infection, researchers say.

The study estimates that in regions outside Hubei, the instantaneous reproductive number of COVID-19—the average number of cases generated by a single infected individual during the outbreak —fell substantially after lock down measures were introduced on January 23, 2020, and has remained below 1 since then—suggesting that the epidemic has shifted from one that is expanding rapidly to one that is slowly shrinking.

However, mathematical modelling to simulate the impact of relaxing current control measures, suggests that premature lifting of these interventions will likely lead to transmissibility exceeding 1 again, resulting in a second wave of infection.

The findings are critical to countries globally that are in the early phases of lock down because they warn against premature relaxation of strict control measures, researchers say. However, the study did not specifically examine the effect of each intervention, or which one was most effective in containing the spread of the virus.

"While these control measures appear to have reduced the number of infections to very low levels, without herd immunity against COVID-19, cases could easily resurge as businesses, factory operations, and schools gradually resume and increase social mixing, particularly given the increasing risk of imported cases from overseas as COVID-19 continues to spread globally", says Professor Joseph T Wu from the University of Hong Kong who co-led the research.



He continues, "Although control policies such as physical distancing and behavioural change are likely to be maintained for some time, proactively striking a balance between resuming economic activities and keeping the reproductive number below one is likely to be the best strategy until effective vaccines become widely available."

Further analysis suggests that the confirmed case fatality risk (the probability of dying among confirmed cases of COVID-19 as officially reported) outside Hubei was 0.98%—which is almost six times lower than in Hubei (5.91%) - and varied substantially among different provinces, based on economic development and availability of health-care resources. Among the ten provinces with the largest number of confirmed cases, case fatality ranged from 0% in prosperous regions like Jiangsu to 1.76% in less developed provinces such as Henan.

"Even in the most prosperous and well-resourced megacities like Beijing and Shanghai, health-care resources are finite, and services will struggle with a sudden increase in demand", says senior author Professor Gabriel M Leung from the University of Hong Kong. "Our findings highlight the importance of ensuring that local health-care systems have adequate staffing and resources to minimise COVID-related deaths."

In December 2019, a novel <u>coronavirus</u> (SARS-CoV-2) emerged in Wuhan city and spread across China. Stringent restrictions on the movement of people and goods were introduced nationwide on January 23. These measures have impacted on people's livelihood and personal liberties, as well as lost economic opportunity. Since February 17, restrictions have been progressively relaxed in several provinces, and factories and offices are gradually reopening.

In the study, researchers analysed local Health Commission data of confirmed COVID-19 cases between mid-January and 29 February, 2020, to estimate the transmissibility and severity of COVID-19 in four



major cities—Beijing, Shanghai, Shenzhen, Wenzhou—and ten provinces outside Hubei with the highest number of confirmed COVID-19 cases. The number of new daily imported and local cases were used to construct epidemic curves for each location by date of symptom onset, and reporting delays—time lags between the onset of a disease and the reporting of cases—were incorporated in the modelling to calculate weekly reproduction numbers. The researchers also modelled the potential impact of relaxing control measures after the first wave of infection for different scenarios with rising reproduction numbers.

The analyses suggest that in regions outside Hubei, control measures should be lifted gradually so that the resulting reproductive number does not exceed 1, or the number of cases will progressively rise over the relaxation period. Moreover, the estimates suggest that once elevated, simply tightening control interventions again would not reduce the burden back to its original level, and would require extra effort to drive the reproductive number below 1 in order to revert to the pre-relaxation level—likely resulting in both higher health and economic loss.

"We are acutely aware that as <u>economic activity</u> increases across China in the coming weeks, local or imported infection could lead to a resurgence of transmission", says co-lead author Dr. Kathy Leung from the University of Hong Kong. "Real-time monitoring of the effect of increased mobility and social mixing on COVID-19 transmissibility could allow policymakers to fine tune control measures to interrupt transmission and minimise the impact of a possible second wave of infections."

Despite these important findings, the study has some limitations, including that the estimated reproductive numbers were based on the reported number of confirmed cases, and the time and dates of symptom onset were unavailable for some provinces and relied on data derived



from Shenzhen. Finally, a limited number of simulations for relaxing control measures were done, and did not specify which interventions or public responses to the epidemic might correspond to each of these scenarios.

Writing in a linked Comment, lead author Dr. Shunqing Xu (who was not involved in the study) from Huazhong University of Science and Technology in China says: "Case fatality rate (CFR) is one of the important unknowns of COVID-19...Leung and colleagues found the confirmed CFR was correlated with provincial per capita gross domestic product and the availability of hospital beds per 10,000. In Wuhan, the CFR was up to 5.08% by March 28, 2020. The remarkable difference in the CFR between these locations and Wuhan might be attributed to the difference in the degrees of health-care capacity. Therefore, consideration should be given to the variations in health-care capacity when implementing interventions."

**More information:** Shunqing Xu et al, Beware of the second wave of COVID-19, *The Lancet* (2020). DOI: 10.1016/S0140-6736(20)30845-X

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