Commentary

Evaluation of non-pharmaceutical factors determine transmissibility of COVID-19: Useful insights and future challenges

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Since late 2019, COVID-19 has spread worldwide and become a global health threat [1]. In Western Pacific region, a variety of public health measures have been implemented to delay and reduce local transmission, including physical distancing, school and workplace closure, lockdown, and so forth [2]. Although we can expect significant reduction of COVID-19 cases with such interventions, detailed evaluation of their effect would be necessary because these interventions can be implemented at the expenses of substantial productivity loss [3]. That is, we need to optimize the combination of non-pharmaceutical interventions in order to minimize productivity loss in our society.

Meanwhile, meteorological factors like temperature also attract interests of a large number of people because SARS-CoV-2 is expected to have seasonality similar to other coronavirus strains [4]. Actually, a few studies found negative association of COVID-19 incidence with temperature and humidity [5,6]. However, it is difficult to estimate true influence of meteorological factors because most countries introduced a wide range of interventions within a short period.

In the \textit{Lancet Regional Health – Western Pacific}, Fang and colleagues predicted the potential effective reproduction number (\(R_t\)) in 41 cities of China under different level of control measures [7]. The authors combined the national surveillance data, the crowdsourced data, and the meteorological data to estimate \(R_t\) value and assess the impacts of potential risk factors on daily \(R_t\). Consequently, they found that a higher local transmissibility of COVID-19 was associated with a low temperature, a relative humidity near 70–75\%, and higher intracity and intercity human movement. They also reported that the decrease in intracity human movement reduced the transmissibility by 36\%, compared to 5\% for restriction of intercity transportation.

Their findings give us both useful insights and future challenges. First, they underscored that human movement was a substantial driver for local transmission. Furthermore, the authors pointed out intracity movement was more influential than intercity movement. This was consistent with other studies, for instance, Davies and colleagues from UK reported that intensive, lockdown-type restriction was required to bring the epidemic under control [8]. Additionally, the authors concluded that non-pharmaceutical interventions other than human movement restrictions were also effective. According to their results, this type of interventions can reduce \(R_t\) by 39\%. Their prediction shows that level-1 emergency response (includes cleaning, ventilation and disinfection of public transportation, screening vehicles and travelers from areas where cases have been reported, quarantine visitors from Wuhan City/Hubei Province, cancel public gatherings, and so forth) alone will bring \(R_t\) down to near or below 0.5 for most cities for the whole year of 2020. This might be good news because it shows a possibility that COVID-19 will be under control without human mobility restriction. Of course, we should be deliberate when we apply their findings to our own countries, nevertheless, they would provide us some useful insights.

In contrast, the authors also elucidated that it is difficult for us to examine the relationship between meteorological factors and incidence of emerging infectious diseases precisely. They reported association between a higher local transmissibility of COVID-19 and a low temperature and a relative humidity near 70–75\%, however, the present (at the beginning of September 2020) situation does not seem to coincide with these findings. In July 2020, the number of newly reported cases in China had increased again,
regardless of high temperature in China [9]. Although the effect of other factors such as non-pharmaceutical intervention they examined in this study should be taken into consideration, at least high temperature does not seem to play a critical role in determining transmissibility of COVID-19. So far, we are not sure whether the activity of SARS-CoV-2 has cyclical seasonality like seasonal influenza virus or not.

Like other previous studies, as they stated, the relatively short study period which covers only January and February of 2020 might make it difficult to estimate the effect of meteorological factors. Validation with more data will be necessary in this area. In other words, quantifying the effect of meteorological factors is a future challenge for modelling studies of COVID-19.

On the whole, Fang and colleagues demonstrated the present location of modelling study of COVID-19. It enabled us to estimate the effect of non-pharmaceutical interventions quantitatively, which have mitigated the disease burden of COVID-19. The insights provided by such type of studies will be beneficial for appropriate health policy decision making. More data and further studies about meteorological factors will make these findings robust than they are.

Declaration of Competing Interest

The author declares no competing interests.

References

[1] Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country-based mitigation measures influence the course of the COVID-19 epidemic? The Lancet 2020;395:931–4. doi:10.1016/S0140-6736(20)30567-52.
[2] Cowling BJ, Ali ST, Ng TYW, et al. Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study. Lancet Public Health 2020;5:e279–88. doi:10.1016/S2468-2667(20)30090-6.
[3] Dickens BL, Koo JR, Lim JT, et al. Modelling lockdown and exit strategies for COVID-19 in Singapore. The Lancet Regional Health - Western Pacific 2020;0. doi:10.1016/j.lanwpc.2020.100004.
[4] Kissler SM, Tedijanto C, Goldstein E, Grad YH, Lipsitch M. Projecting the transmission dynamics of SARS-CoV-2 through the post-pandemic period. Science 2020;eabb5793. doi:10.1126/science.abb5793.
[5] Sarkodie SA, Owusu PA. Impact of meteorological factors on COVID-19 pandemic: Evidence from top 20 countries with confirmed cases. Environ Res 2020;110101. doi:10.1016/j.envres.2020.110101.
[6] Tobias A, Molina T. Is temperature reducing the transmission of COVID-19? Environ Res 2020;186:109553. doi:10.1016/j.envres.2020.109553.
[7] Fang LQ, Zhang HY, Zhao H, Che TL, et al. Meteorological conditions and non-pharmaceutical interventions jointly determined local transmissibility of COVID-19 in 41 Chinese cities: a retrospective observational study. The Lancet Regional Health – Western Pacific. doi:10.1016/j.lanwpc.2020.100020.
[8] Davies NC, Kucharski AJ, Eggo RM, Gimma A, Edmunds WJ. Centre for the Mathematical Modelling of Infectious Diseases COVID-19 working group. Effects of non-pharmaceutical interventions on COVID-19 cases, deaths, and demand for hospital services in the UK: a modelling study. Lancet Public Health 2020;5:e379–85. doi:10.1016/S2468-2667(20)30133-X.
[9] ChinaWHO coronavirus disease (COVID-19) dashboard; 2020 https://covid19.who.int accessed Sept 3.