

Roles of meteorological conditions in COVID-19 transmission on a worldwide scale

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Abstract

The novel coronavirus (SARS-CoV-2/ 2019-nCoV) identified in Wuhan, China, in December 2019 has caused great damage to public health and economy worldwide with over 140,000 infected cases up to date. Previous research has suggested an involvement of meteorological conditions in the spread of droplet-mediated viral diseases, such as influenza. However, as for the recent novel coronavirus, few studies have discussed systematically about the role of daily weather in the epidemic transmission of the virus. Here, we examine the relationships of meteorological variables with the severity of the outbreak on a worldwide scale. The confirmed case counts, which indicates the severity of COVID-19 spread, and four meteorological variables, i.e., air temperature, relative humidity, wind speed, and visibility, were collected daily between January 20 and March 11 (52 days) for 430 cities and districts all over China, 21 cities/ provinces in Italy, 21 cities/ provinces in Japan, and 51 other countries around the world. Four different time delays of weather (on the day, 3 days ago, 7 days ago, and 14 days ago) as to the epidemic situation were taken for modeling and we finally chose the weather two weeks ago to model against the daily epidemic situation as its correlated with the outbreak best. Taken Chinese cities as a discovery dataset, it was suggested that temperature, wind speed, and relative humidity combined together could best predict the epidemic situation. The meteorological model could well predict the outbreak around the world with a high correlation ($r^2 > 0.6$) with the real data. Using this model, we further predicted the possible epidemic situation in the future 12 days in several high-latitude cities with potential outbreak. This model could provide more information for government's future decisions on COVID-19 outbreak control.