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Letter to the Editor

Epidemiological characteristics and transmission model of Corona Virus Disease 2019 in China


Dear Editor,

We read with interest the recent report by Zhang and colleagues in this Journal,¹ who described the continuous evolution and dissemination of Corona Virus Disease 2019 (COVID-19). They analyzed the genomes and found the degree of diversification of 2019-nCoV was much smaller when compared with influenza A viruses. However, the transmission characteristics of Corona Virus Disease 2019 in China were also needed to be considered.

Since December 2019, an increasing number of new pneumonia cases appeared in Wuhan, China. The etiology of these infectious has been reported to be a novel coronavirus (2019-nCoV),² and the disease was named as COVID-19 by World Health Organization (WHO) since Feb 11, 2020. Then, the virus (2019-nCoV) has rapidly spread across China and to at least 23 countries, including Thailand, South Korea, Japan and USA.^{3–6} By Feb 11, more than 44,000 confirmed cases of COVID-19 and more than 1100 deaths have been reported in China.

The information of COVID-19 cases from Dec 29, 2019 to Feb 11, 2020 in China were collected from the website of National Health Commission of the People's Republic of China (NHCPRC), the website of Health Commission of each province or city. The collected information includes the number of confirmed cases, dead cases, suspected cases, and cured cases. The epidemiological data were summarized and described by each week since Jan 1, 2020, including the number of new and total confirmed cases, dead cases, and cured cases. Meanwhile, we used the map of China and Hubei province to show the change of the total number of confirmed cases, dead cases and cured cases.

Until Feb 11, 2020, a total of 44,730 confirmed cases and 1114 dead cases were reported in China. Among all the confirmed dead cases, 43.72% (19,558/44,730) and 73.61% (820/1114) came from Wuhan. Fortunately, the number of new cured cases has also been increasing, and a total of 4742 cases have been cured until Feb 11, 2020. Among all the cured cases, 44.35% (2103/4742) came from other provinces, which was higher than Wuhan city (29.08, 1379/4742).

The total number of confirmed, dead and cured cases in each province in China and each city in Hubei province were revealed in Figs. 1 and 2, respectively. We could find the transmission from Wuhan to other cities in Hubei and to other provinces in China. The COVID-19 confirmed cases only appeared in Wuhan until Jan 14, 2020 (A3). From Jan 15, 2020 to Jan 21, 2020 (A4), new cases were reported in thirteen provinces ($n=42$), especially in Guangdong ($n=26$). In addition, new cases were reported only in Huanggang ($n=12$) in Hubei province. From Jan 22 to Jan 28 (A5), there

were 3179 new cases reported in all seventeen cities in Hubei province and 2377 new cases in all other provinces or cities except Xizang, mainly concentrated in Central and South China, East China.

In the last week (A7), until Feb 11, 2020, the top five provinces of total confirmed cases in China were Hubei (33,366), Guangdong (1219), Henan (1135), Zhejiang (1131), and Hunan (946); the top five provinces of mortality were Hubei (2.54%), Gansu (2.33%), Heilongjiang (2.12%), Hainan (2.07%) and Xianggang (2.04%); and the top five provinces of cured rate were Ningxia (37.93%), Gansu (27.91%), Hunan (27.80%), Qinghai (27.78%) and Zhejiang (24.67%). Meanwhile, the top five cities of total confirmed cases in Hubei province were Wuhan (19,558), Xiaogan (2751), Huanggang (2398), Suizhou (1129) and Jingzhou (1110); the top five cities of mortality were Qianjiang (5.56%), Wuhan (4.19%), Jingmen (3.45%), Tianmen (3.41%) and E'zhou (3.25%); and the top five cities of cured rate were Shenlongjia (70.00%), En'shi (18.72%), Huanggang (14.09%), Shiyan (13.06%) and Xianning (12.38%).

The current COVID-19 is the third epidemic caused by coronavirus in the 21st century, but current number of COVID-19 infected cases have already surpassed the previous two diseases: severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).^{7,8} In our study, we found the number of total confirmed and dead cases is increasing all the time until Feb 11, 2020, and seemed not to stop increasing in the near future. The situation is even worse in Hubei province, especially in Wuhan. By the study deadline, more than 40% of the total confirmed cases and more than 70% of the dead cases in China came from Wuhan, as infected cases were first reported in Wuhan. Nevertheless, the mortality rate of COVID-19 (2.49%) is still much lower than the other two diseases until now, which is 10% for SARS-CoV and 37% for MERS-CoV, respectively.^{9,10}

The higher number of COVID-19 infectious may be related with the late identification of this coronavirus and the large-scale movement of population.² The occurrence time is near the spring festival (Jan 25, 2020) in China. According to tradition, this is a holiday for Chinese people to reunite home. The legal rest period for this holiday is 7 days and most people moved from their work cities to their hometown, especially from Wuhan to other cities in Hubei provinces.

From the respect of transmission character, we could found an obvious geographic discrepancy over time. And the disease spread to almost the whole China just for 14 days. Several factors may attribute to this phenomenon, for instance, the movement of asymptomatic and potential infected cases from Wuhan, the density of population in these cities, the control measures in these cities, etc. Of which, the first one may be the most important. We also collected the personnel flow information from Wuhan to other cities according to the information of bus, train and plane. The data confirmed our inference.

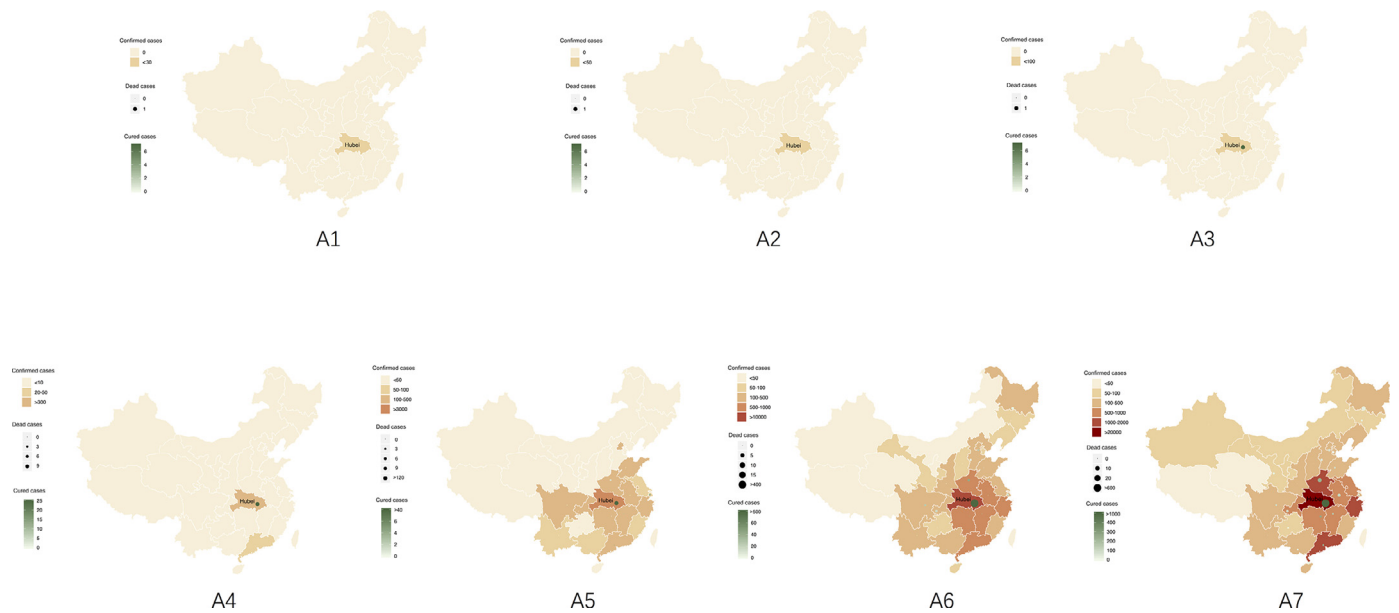


Fig. 1. The number of total confirmed, dead and cured cases in China: A1, before Jan 1, 2020; A2, until Jan 7, 2020; A3, until Jan 14, 2020; A4, until Jan 21, 2020; A5, until Jan 28, 2020; A6, until Feb 4, 2020; A7, until Feb 11, 2020.

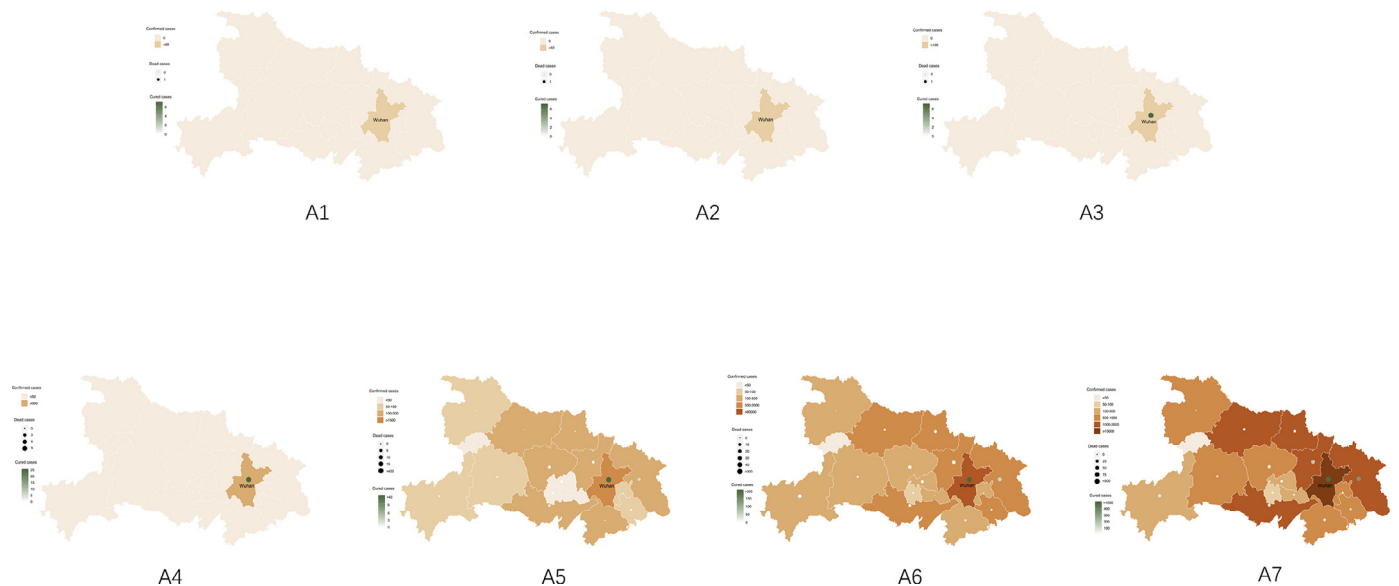


Fig. 2. The number of total confirmed, dead and cured cases in Hubei province: A1, before Jan 1, 2020; A2, until Jan 7, 2020; A3, until Jan 14, 2020; A4, until Jan 21, 2020; A5, until Jan 28, 2020; A6, until Feb 4, 2020; A7, until Feb 11, 2020.

In conclusion, we found the number of COVID-19 cases is still increasing greatly by the study deadline. Meanwhile, we found an obvious geographic discrepancy on the cases over time about the transmission character. More cases occurred in those cities in which more population moved from Wuhan. Effective control measures should still be implemented to reduce the transmission in future.

Declarations of Competing Interest

The authors declare no conflict of interest.

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