Iran Red Crescent Med J. 2020 April; 22(4):e102685. doi: 10.5812/ircmj.102685.

Published online 2020 April 7. **Research Article**

Cross-Sectional Study of SARS-CoV-2 Epidemic in China and Implications for the World

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Received 2020 March 14; **Revised** 2020 April 02; **Accepted** 2020 April 04.

Abstract

Background: Mainland China has adopted the most decisive and proactive measures to contain the SARS-CoV-2 epidemic, which helps control the spread of the virus across the country.

Objectives: Early epidemiological investigations found that the SARS-CoV-2 epidemic was more critical in Hubei province (Hubei) than in rest parts of mainland China (Rest of China). A cross-sectional study was conducted to answer this urgent question and provide implications for the world.

Methods: Infected cases from Mainland China were divided into two groups: Hubei and the Rest of China. Prevention, quarantine, and treatment were based on *The Novel Coronavirus Infected Pneumonia Diagnosis and Treatment Standards*. Total confirmed cases, daily severe cases, total deaths, and total discharged cases were collected from January 20 to March 4 for statistical analysis.

Results: Hubei accounted for 83.9% of China's total confirmed cases and 96.3% of China's total deaths. The percentage of severe cases and the rate of fatality in Hubei were higher than those in the Rest of China ($P < 0.01$). Daily severe cases in Hubei hit the peak at 11,246 cases on February 18, compared to 989 cases on February 10 in the Rest of China. The percentages of daily severe cases in both regions declined throughout the epidemic, from 23.3% to 8.6% in Hubei compared to 15.0% to 1.3% in the Rest of China. The latest fatality rate in Hubei was 4.30%, which was much higher than 0.85% in the Rest of China. Up to March 4, 64.7% of China's total confirmed cases were cured, 3.86% died, and 31.5% were under treatment.

Conclusions: The implications for the world are cutting off the sources of infection and transmission routes, early detection, early isolation, and early treatment that can prevent the spread of SARS-CoV-2 and reduce the severity and fatality rate.

Keywords: 2019-nCoV, COVID-19, Cross-Sectional Study, Epidemiological Investigation, SARS-CoV-2

1. Background

Facing this previously unknown virus SARS-CoV-2 (1), China has adopted the most decisive and proactive precautionary measures and controls across the country in history (2). As of March 4, 2020, there were a total of 80,409 confirmed cases and 3,012 deaths in mainland China, which were made up of 67,466 and 12,943 confirmed cases and 2,902 and 110 deaths in Hubei and Rest of China, respectively. A total of 156 cases were diagnosed in Hong Kong (104 cases, two deaths), Macao (10 cases), and Taiwan (42 cases, one death). Totally 16,238 cases were reported overseas in 80 countries with 294 deaths, of which South Korea (6,088 cases, 41 deaths), Iran (3,513 cases, 107 deaths), Italy (3,144 cases, 107 deaths), and Japan (1,056 cases, 12 deaths) were the most affected countries. China's anti-SARS-CoV-2 campaign began on January 20 and has been going on for more than 40 days. Despite the concealment and delay at the beginning (3), it seems that the epidemic in China has been curbed. It is also evident that the SARS-CoV-2 epidemic has developed into a worldwide pandemic.

2. Objectives

Epidemiological investigations showed that the SARS-CoV-2 epidemic was more critical in Hubei than in the Rest of China. A cross-sectional study was conducted to compare Hubei with the Rest of China (4), analyze the reasons, and provide experience and inspiration for the world in fighting the pandemic.

3. Methods

3.1. Study Population

The study population was the confirmed SARS-CoV-2 cases in Mainland China. Infected cases from Mainland China were divided into two groups: Hubei and the Rest of

China. Prevention, quarantine, and treatment were based on *The Novel Coronavirus Infected Pneumonia Diagnosis and Treatment Standards* (5). The criteria for confirmed cases, severe cases, differential diagnoses, clinical classification, and discharge standards were adopted from the guidelines (6).

3.2. Data Collection

The data collected were based on those released daily by the Health Commission of Hubei province and the National Health Commission of the People's Republic of China on China's fight against the SARS-CoV-2 epidemic. The data included total confirmed cases, daily severe cases, total deaths, and total discharged cases from January 20 to March 4, 2020. The total number represents the cumulative number of infected cases, the daily number represents the number of cases on a particular day, and the growth rate is the number of cases in a particular day divided by that of the day before minus 100%.

3.3. Data Analysis

The data were input into SPSS V. 25 for data processing using statistical analyses such as the Pearson chi-square test to process the count data. Microsoft Office 2019 Excel was applied for drawing figures.

3.4. Ethical Considerations

The data used in this article were extracted from China's fight against SARS-CoV-2 epidemic data, which were available to the general public. No patients were directly involved in this study. Therefore, ethical approval was not required, and patient consent for publication is not required either.

4. Results

Total confirmed cases in Hubei accounted for 83.9% (67,466/80,409) of China's total confirmed cases in contrast to 16.1% (12,943/80,409) in the Rest of China. From February 22, the total number of confirmed cases in Hubei and the Rest of China had entered a plateau period, with growth rates of less than 1%, indicating the number of confirmed cases was going to reach the peak before long (Figure 1).

Daily severe cases hit the peak at 11,246 cases on February 18 and 989 cases on February 10 for Hubei and the Rest of China, respectively; afterward, the daily severe cases declined (Figure 2). Total deaths in Hubei constituted 96.3% (2,902/3,012) of China's total deaths versus 3.7% (110/3,012) total deaths in the Rest of China (Figure 3).

The percentage of severe cases and the fatality rate in Hubei were higher than those in the Rest of China. The percentages of daily severe cases in both regions had been declining throughout the epidemic, from 23.3% to 8.6% in Hubei compared to 15.0% to 1.3% in the Rest of China. The latest fatality rate in Hubei was about 4.30%, which was much higher than 0.85% in the Rest of China. The Pearson chi-square test was conducted that illustrated very significant differences in the percentage of severe cases and fatality rate between the two areas of China since January 24 and January 23, respectively ($P < 0.01$) (Figure 4).

Total discharged cases in Hubei occupied 77.8% (40,479/52,045) of China's total discharged cases in comparison with 22.2% (11,566/52,045) in the Rest of China. Out of China's total confirmed cases, 64.7% (52,045/80,409) were cured and discharged, 3.86% (3,012/80,409) died, and 31.5% (25,352/80,409) were under isolation and treatment (Figure 5).

5. Discussion

The total confirmed cases in Hubei province accounted for 83.9% of China's total confirmed cases; the more confirmed cases, the higher proportion of daily severe cases and the higher fatality rates. It is known that SARS-CoV-2 originated in Wuhan, Hubei province. Before locking down Wuhan on January 23, more than five million people had flowed out of the city, most of whom returned to their hometowns in Hubei province for the Spring Festival (7). That is why the total confirmed cases in Hubei made up the largest part. Moreover, China-WHO Joint Expert Expedition Group on Novel Coronavirus Pneumonia announced at a press conference in Wuhan on February 24 that the whole gene sequencing of 104 Novel Coronavirus strains isolated in different locations confirmed the homology of 99.9%; thus, virulence could not be used to explain the differences in the fatality. Consequently, it makes sense to deduce that the differences in the population-level effect of exposures on the SARS-CoV-2 epidemic had caused differences in the distribution of confirmed cases, the proportion of severe cases, and the fatality rate. As far as we know, when SARS-CoV-2 occurred, fever clinics in Hubei, especially Wuhan, were crowded with fever patients, causing severe cross-infection, coupled with the lack of beds in hospitals; doctors could only let them go home and isolate themselves, thus further resulting in the numbers of infected and severe patients. The fact that Wuhan had to quickly build multiple hospitals and square cabin hospitals to accommodate patients gave a vivid answer.

China provided the world with a month of preparation time and a wealth of experience in fighting the epidemic: the delay in isolation, quarantine, community con-

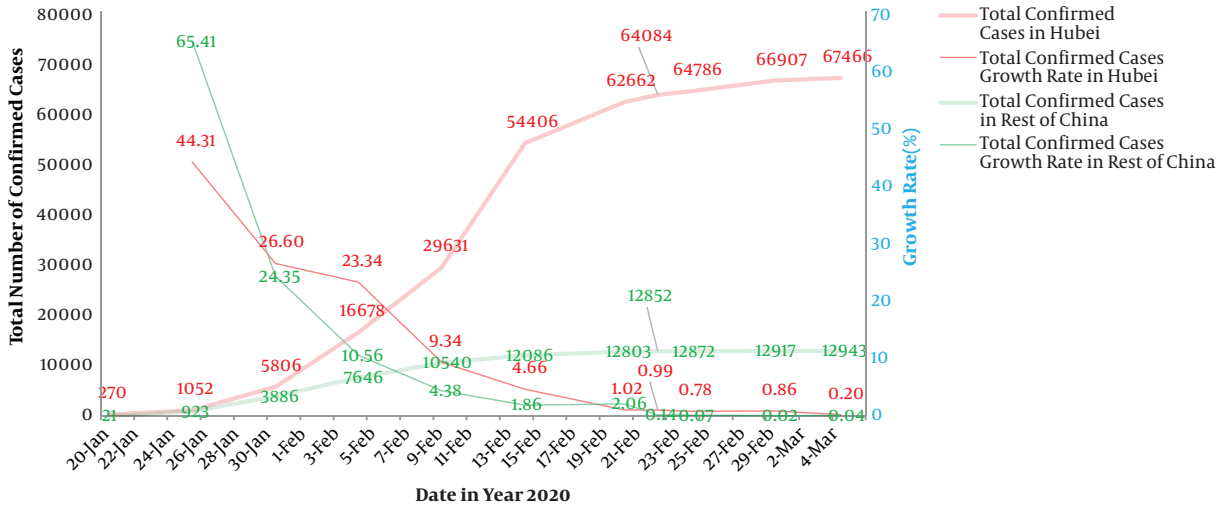

Figure 1. Total confirmed cases and its growth rates in Hubei and Rest of China

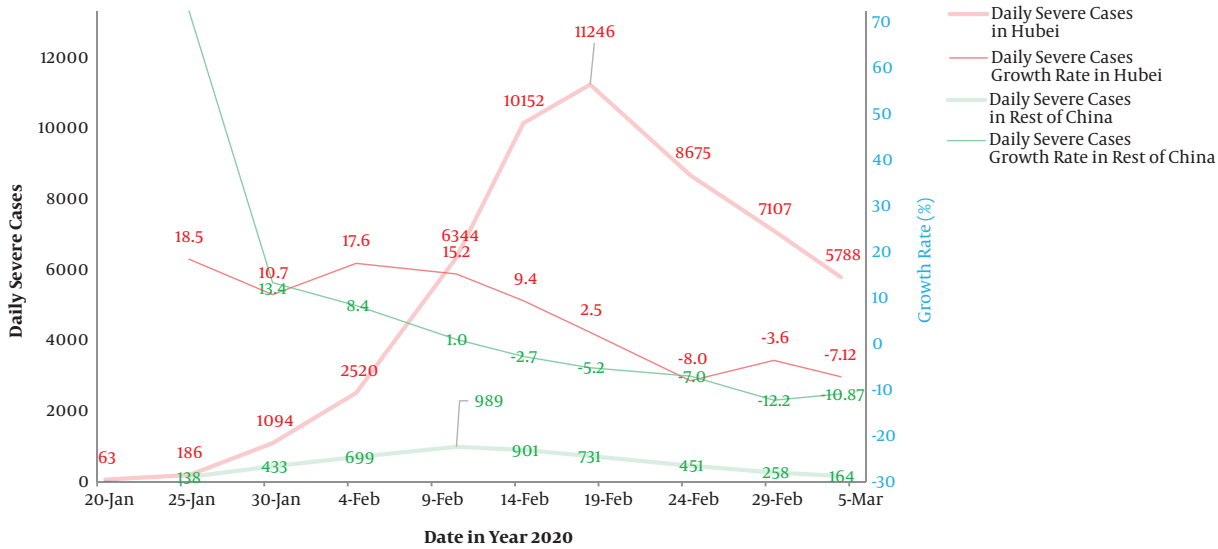

Figure 2. Daily severe cases and its growth rates in Hubei and Rest of China

tainment, and treatment could lead to an increase in the fatality. The critical period of prevention and control was delayed due to some reason (3), and the fact that clinical manifestations and diagnosis of the disease were not initially well understood (7). The latest fatality rate was 4.30% in Hubei, 0.85% in the Rest of China, and 3.86% in the whole of China. SARS-CoV-2 is less pathogenic than SARS-CoV (10%) and much less than MERS-CoV (40%) (8). Estimated R_0 for SARS-CoV-2 ranges from 3.3 to 5.5, which is higher than those of SARS-CoV (R_0 = 2 - 5) and MERS-CoV (R_0 < 1) (9), demonstrating that SARS-CoV-2 has a low fatality rate and high transmissibility (10). This explains why SARS-CoV-2 has infected so many people, but its fatality rate is less than that of SARS (11, 12).

The implications for the world are cutting off the sources of infection and transmission routes, early detection, early isolation, and early treatment that can make differences in the distribution of confirmed cases, the percentage of severe cases, and the fatality rate (13). Cutting off the source of infection and transmission routes is pivotal in containing the SARS-CoV-2 outbreak and has a guiding effect on the prevention and control of the worldwide

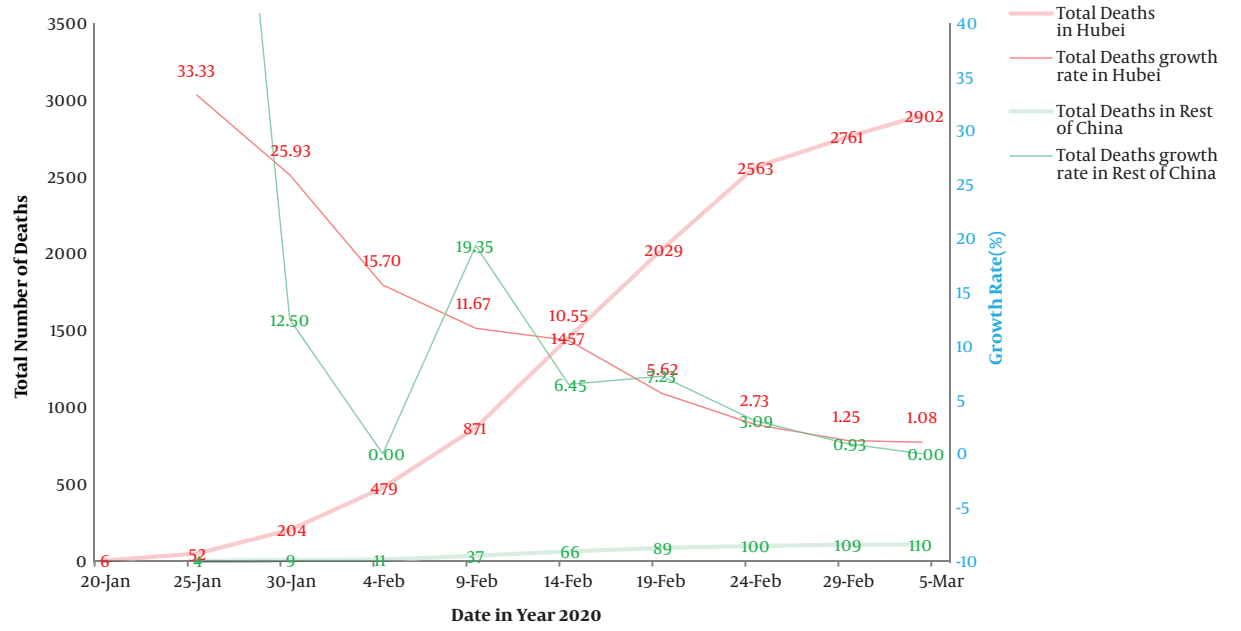

Figure 3. Total deaths and its growth rates in Hubei and Rest of China

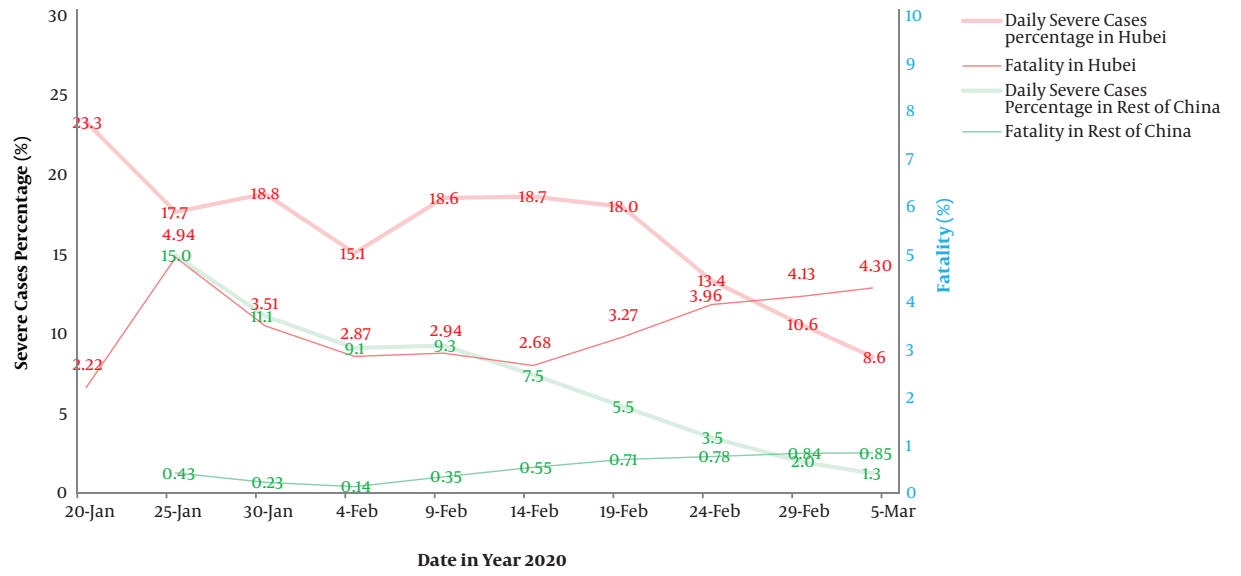

Figure 4. Daily severe cases percentage and fatalities in Hubei and Rest of China

pandemic (14). For example, the outbreaks after religious rallies in South Korea and Iran proved once again that the control of sources of infection and transmission routes is essential, and no rally should be held during epidemic periods. If the epidemic spreads to African countries, the prospect will be unimaginable. When an epidemic occurs, governments should take active measures such as early detection, early isolation, and early treatment to reduce the number of infections, which will lead to different results, as observed in the Rest of China.

This study is a cross-sectional analysis of the epidemiological data of Hubei province, where the epidemic orig-

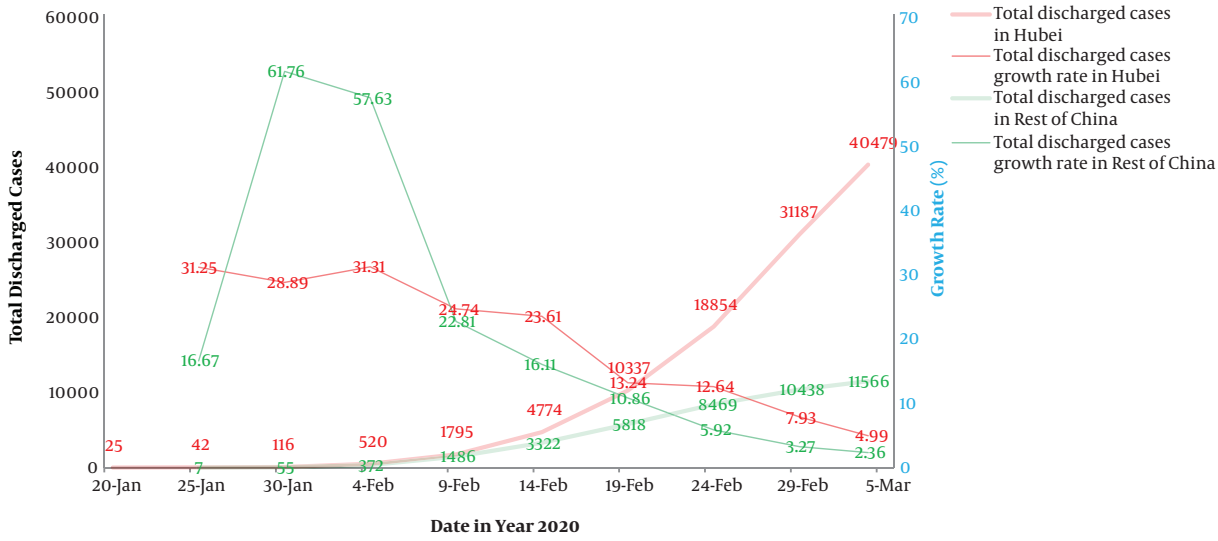

Figure 5. Total discharged cases and its growth rates in Hubei and Rest of China

inated, and other provinces and cities in Mainland China, which shared similar geographical distribution of the population. The provinces were easier to be affected by the epidemic than other parts of the world at the early stage of the outbreak. Therefore, the implications have vital guiding significance for the world's anti-SARS-CoV-2 pandemic at the late stage.

The data used in this study only provided total confirmed cases, daily severe cases, total deaths, and total discharged cases. Other specific information about gender, age, symptom statistics, days of hospitalization, medication status, underlying disease status, etc. was not provided. Conclusions drawn were only based on epidemic situations in Hubei province and the Rest of China.

5.1. Conclusions

A cross-sectional comparison of the SARS-CoV-2 epidemic between two different populations in China showed that Hubei accounted for 83.9% of China's total confirmed cases and constituted 96.3% of China's total deaths. The percentage of severe cases and the rate of fatality were higher in Hubei than in the Rest of China. The implications for the world are cutting off the sources of infection and transmission routes, early detection, early isolation, and early treatment that can prevent the spread of SARS-CoV-2 and reduce the severity and fatality.

Footnotes

Authors' Contribution: Youfu Ke participated in conceptualization, data collection, statistical analysis, manuscript drafting, and approval of the final version of the manuscript. Zemin Chen participated in database management, statistical analysis, critical review of the manuscript, and approval of the final version of the manuscript. Bo Peng participated in database management, manuscript revision, and approval of the final version of the manuscript.

Conflict of Interests: It was not declared by the authors.

Ethical Approval: The article uses China's anti-COVID-19 campaign data released by the Health Commission of Hubei province and the National Health Commission of the People's Republic of China every day. One can check these data from websites http://wjw.hubei.gov.cn/fbjd/dtyw/ and http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml. These data are transparent and can be used by anyone. Therefore, our data do not require registration, consent, etc.

Funding/Support: This research is self-funded.

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