Importance of timely management of patients in reducing fatality rate of coronavirus disease 2019

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The outbreak of coronavirus disease 2019 (COVID-19) characterized with pneumonia, firstly occurred in Wuhan city, China, in December 2019 [1,2]. Since then, COVID-19 has spread in whole China as well as other countries. Although World Health Organization (WHO) declared the outbreak of COVID-19 as Public Health Emergency of International Concern on January 30, 2020 [3–5], COVID-19 has spread to more than 200 other countries and territories in the world, leading to nearly 2.88 million confirmed cases and an overall fatality rate 6.9% by April 27, 2020 [6], whereas as of February 1, 2020, just 24 countries had 11,953 confirmed patients (11,821 in China) [7]. Since COVID-19 is still being spread, the most critical task now is to control the transmission. Another important goal in facing COVID-19 is to reduce the fatality rate. Here we report the significant difference of the fatality rate of COVID-19 in Hubei province and other provinces of mainland China, and emphasize the importance of timely management of patients in reducing the fatality of COVID-19.

M A T E R I A L S   A N D   M E T H O D S

This was a retrospective analysis of all confirmed COVID-19 in mainland China up to April 27, 2020. The total number of patients and fatal cases and their geographic distribution (Fig. 1) were collected from daily released data by the National Health Committee of the People's Republic of China [8]. Statistical analysis was performed with SAS Version 9.4. The fatality rate rates were compared by the chi-squared test.

This study was approved by the institutional review board of Nanjing Drum Tower Hospital. Informed consent of patients was waived since this study was based on the publicly released data.

R E S U L T S

China took the comprehensive strict measures, including city quarantine, home staying, social distance, mask use in general population as well as many others since January 22, 2020 in Wuhan city, and then in the whole Hubei province and extending these measures to whole mainland China since February 1, 2020. The daily newly diagnosed patients decreased from peak 4000–5000 cases to less than 100 cases after March 6, and further reduced to about 10 cases or fewer after April 20, 2020.
patients of transmission. In other regions, the fatality rate was lower in Hubei, a province in mainland China. COVID-19 patients were confirmed in all 33 other provinces and special districts, in addition to Hubei province. The total numbers of confirmed COVID-19 patients and fatal cases in Hubei province and other 33 provinces are presented in Table 1.

Table 1
Comparison of the fatality rate of COVID-19 in Hubei province and other provinces of mainland China.

| Location       | Total patients | Fatal cases | Fatality rate (%) |
|----------------|----------------|-------------|-------------------|
| Mainland China | 82,836         | 4633        | 5.60              |
| Hubei province | 68,128         | 4512        | 6.62<sup>a</sup>  |
| Wuhan city     | 50,333         | 3869        | 7.69              |
| Other regions  | 17,795         | 643         | 3.61              |
| Other provinces| 14,798         | 121         | 0.82              |

<sup>a</sup> Compared to the fatality rate in other provinces of mainland China, \( \chi^2 = 770.7092, p < 0.0001 \).

<sup>b</sup> Compared to the fatality rate in other regions of Hubei, \( \chi^2 = 352.7458, p < 0.0001 \).

As of April 27, 2020, totally 82,836 patients with COVID-19 were confirmed in mainland China. Of them, 4633 were fatal, with an overall fatality rate 5.60% (Table 1). The fatality rate of COVID-19 in other provinces of mainland China was 0.82% (121/14,708), significantly lower than 6.62% (4512/68,128) in Hubei province (\( p < 0.0001 \)). In Hubei province, the fatality rate in Wuhan city (7.69%, 3869/50,333) was much higher than that in other regions (3.61%, 643/17,795, \( p < 0.0001 \)).

Since the daily release of COVID-19 information from January 21, 2020, the evolution of the fatality rate in Hubei province and other regions of mainland China is presented in Fig. 2, which shows that the fatality rate in other provinces of mainland China was always significantly lower than that in Hubei province.

Discussion and conclusion
In the present study, we found that the fatality rate of COVID-19 in other parts of mainland China was 0.82%, significantly lower than 6.62% in Hubei province, and in Hubei province, the fatality rate in other regions was lower than that in Wuhan city (3.61% vs 7.69%, \( p < 0.0001 \)) (Table 1). The lower fatality rate is less likely due to the attenuation of virus by spreading in humans because almost all patients in Hubei province were also caused by human-to-human transmission. As all patients in other provinces of mainland China caught COVID-19 within three months after COVID-19 outbreaks in Hubei, it is unlikely that the virus undergoes attenuation mutation in such a short period of time. A recent survey demonstrated no evidence of mutations based on the findings that the full length gene sequences of 104 isolates of SARS-CoV-2 collected from different parts of mainland China were 99.9% homology [9]. Thus, the lower fatality rate is not associated with virological factors.

We consider that the main reason of lower fatality rate in other provinces of mainland China is associated with the timely treatment of the patients. In a report with 62 hospitalized patients in Zhejiang province, the median time from onset of the illness to hospitalization was 2 days, only one patient required to admit to an intensive care unit, and there was no fatal patient [10]. Since the official announcement of COVID-19 outbreaks in late January 2020, all provincial and local governments have taken comprehensive measures to control its spread. Suspected patients with fever and/or cough received appropriate managements. Individuals with contacts with diagnosed COVID-2019 patients were strictly quarantined, and persons with contacts with anyone from Hubei province were requested to stay at home for two weeks. Most of patients indentified in other provinces of mainland China were among these monitored individuals. They had adequate rest during quarantine or home-stay, which is critical for self-limiting viral infections as there is no specific antiviral therapy against COVID-19. And they received necessary managements soon after the appearance of symptoms. Therefore, most patients actually received supportive treatment during the incubation period and very early phase of the disease.

By contrast, as a surging number of patients developed in Hubei, particularly in Wuhan, many of them received delayed managements because of the poor preparedness for the COVID-19 outbreaks, leading to progress to severe disease form with increased fatality rate. A retrospective analysis of consecutive 138 patients with COVID-19 hospitalized from January 1 to January 28, 2020 in a hospital in Wuhan showed that it took median 7 days to be hospitalized [11]. The whole scenario throughout Wuhan city was even worse and by middle February 2020, it took median 9.8 days for severe COVID-19 patients being hospitalized after onset of the illness [12]. Additionally, the delayed hospitalization should have transmitted SARS-CoV-2 to more other individuals.

The main limitation was that this study contained no detailed information about patients’ demographic data and other underlying diseases, which may influence the fatality rate. Nevertheless, the data from as many as 68,182 patients in Hubei and 14708 patients in other regions of mainland China provide reliable evidence that timely management of patients can reduce the fatality rate of COVID-19.

In summary, timely management of COVID-19 patients is critical for reducing the fatality rate. This will be valuable to encourage febrile patients with cough to see doctors as soon as possible so that the fatality rate can be significantly reduced in patients with COVID-19.
Fig. 2. Evolution of fatality rate of COVID-19 in Hubei and other provinces of mainland China. The arrow denotes that the fatal patients who were not diagnosed with COVID-19 in Hubei province at the earlier time were retrospectively confirmed and added to the death toll on April 17, 2020.

Authors’ contribution

Conceived and designed the study: YP, BX, GH, and Y-HZ; collected the data: YP, BX, and BS; analyzed the data: YP, BX, and BS; wrote the manuscript: YP and BX; critically revised the manuscript: GH and Y-HZ. All authors approved the final manuscript.

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Competing interests

None declared.

References

[1] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395(10223):497–506. http://dx.doi.org/10.1016/S0140-6736(20)30183-5.

[2] Li Q, Guan X, Wu P, Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Engl J Med 2020;382(13):1199–207. http://dx.doi.org/10.1056/NEJMoA2001316.

[3] World Health Organization (WHO). International Health Regulations Emergency Committee on novel coronavirus in China. Available from: https://www.who.int/news-room/events/detail/2020/01/30/default-calendar/international-health-regulations-emergency-committee-on-novel-coronavirus-in-china.

[4] Arshad Ali S, Baloch M, Ahmed N, Arshad Ali A, Iqbal A. The outbreak of coronavirus disease 2019 (COVID-19) – an emerging global health threat. J Infect Public Health 2020;13(4):644–6. http://dx.doi.org/10.1016/j.jiph.2020.02.033.

[5] Khan S, Siddique R, Ali A, Bai Q, Li Z, Li H, et al. The spread of novel coronavirus has created an alarming situation worldwide. J Infect Public Health 2020;13(4):469–71. http://dx.doi.org/10.1016/j.jiph.2020.03.005.

[6] World Health Organization (WHO). Coronavirus disease 2019 (COVID-19) situation report-98. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200427-sitrep-98-covid-19.pdf?sfvrsn=90323472.

[7] World Health Organization (WHO). Novel coronavirus (2019-nCoV) situation report-12. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200201-sitrep-12-ncov.pdf?sfvrsn=273c5d35.

[8] The Health Emergency Office of National Health Commission. Update of epidemic of coronavirus disease 2019 in China up to 24:00 on April 27, 2020. Available from: http://www.nhc.gov.cn/xcs/xxgzb/gzbd_index.shtml.

[9] Sohu News. Minimal mutations in new coronavirus. Available from: https://www.sohu.com/a/375656517_502689.

[10] Xu XW, Wu XX, Jiang XG, Xu KJ, Ying LJ, Ma CL, et al. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. BMJ 2020;368:m606. http://dx.doi.org/10.1136/bmj.m606.

[11] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. JAMA 2020;323(18):1061–7.

[12] News One Plus One of China Central Television. A sad fact released by the deputy director of the Medical Administration Bureau of the National Health Commission. Available from: https://news.sina.com.cn/c/2020-02-18/doc-imxstf2246878.shtml.