The novel coronavirus disease (COVID-19) outbreak trends in mainland China: a joinpoint regression analysis of the outbreak data from January 10 to February 11, 2020

Syed Mahfuz Al Hasan[a], Jennifer Saulam[b], Kanae Kanda[a], and Tomohiro Hirao[a]

[a] Department of Public Health, Kagawa University, Kagawa, Japan.
[b] Department of Food Processing and Nutrition, Karnataka State Akkamahadevi Women's University, India.
Correspondence to Syed Mahfuz Al Hasan (email: mahfuz@med.kagawa-u.ac.jp)

(Submitted: 17 February 2020 – Published online: 18 February 2020)

RECOMMENDED CITATION

Al Hasan SM, Saulam J, Kanda K & Hirao T. The novel coronavirus disease (COVID-19) outbreak trends in mainland China: a joinpoint regression analysis of the outbreak data from January 10 to February 11, 2020. [Preprint]. *Bull World Health Organ*. E-pub: 17 February 2020. doi: http://dx.doi.org/10.2471/BLT.20.253153

Abstract

Objective We provide the trends and significant changes in the novel coronavirus disease (COVID-19) outbreak in mainland China from Jan 10 to Feb 11, 2020.

Methods We used the daily outbreak notification report from Jan 11 to Feb 12, 2020, provided in the official website of the National Health Commission of China. We used joinpoint regression analysis to identify significant changes in the temporal trends of the outbreak.

Findings Cases and deaths due to the COVID-19 increased drastically by 24.6% and 24.7% per day, respectively, in the mainland China from Jan 10 to Feb 11, 2020. Since Jan 22, the number of cases soared up until Jan 26 (^{2} =518.79; P<0.001), followed by an alarming and further drastic increase until Feb 01, about 1887 cases/day. Since the early-Feb, the number increased overwhelming by 3497 cases/day in mainland China, and with some hope, since Jan 07 the cases have been increasing at a reduced rate whole over the mainland China. The death toll started to climb up since Jan 22 (^{2} =19.44; P<0.001) until Jan 28 and then has been severely increasing by 1.5-fold in every 4-5 days interval. Alarmingly, since Feb 07, the death toll has been increasing by 100·33 deaths/day and about 96% of these deaths were from the Hubei province.

Conclusion The number of COVID-19 cases soared up drastically since Jan 22 and situation deteriorate further since the early-Feb. With some hope, since Feb 07, cases have been increasing at a reduced rate; whereas, death trend has been increasing continuously at a concerned rate.

Introduction

It now becomes a global emergency from Wuhan to the World. Since Dec 8, 2019, several cases of pneumonia of unknown etiology were reported in Wuhan, Hubei province, China.[1,2] They shared a connection with the Huanan South China Seafood Market in Wuhan, and now it has been confirmed that the disease, the novel coronavirus disease (COVID-19)[3], is caused by a novel coronavirus, the 2019 novel coronavirus (2019-nCoV).[4] Cases of COVID-19 are no longer limited to Wuhan. The cases detected outside Wuhan, together with the detection of infection in a family cluster and documented infection in health-care providers caring for patients with COVID-19 indicate human-to-human transmission and put forth the risk of a much wider spread of the disease.[5] As of Feb 16, 2020, there have been a total of 70,548 confirmed cases, 1,770 deaths, and 546,016 close contacts have been traced in Mainland China.[6] Outside China, as of Feb 16, a total of 683 confirmed cases from 25 countries and the first death outside China, in the Philippines, Japan, and France have been reported.[7]

The outbreak has been declared as a public health emergency of international concern (PHEIC) by the World Health Organization (WHO) because of suspicions that the coronavirus may reach countries with feeble health care systems.[8] The Chinese government's response to this new outbreak has been swift and decisive. The government has shown promise to transparency and their efforts made to investigate and contain the current outbreak. The government was decisive in closing the seafood market in Wuhan and was a very rapid development of a national and international consortium helped in the swift analysis of the virus and in making the sequences publicly available within a few days.[9] The measures China has taken so far are good not only for the country itself but also for the rest of the world.[8] Moreover, in response, Chinese cities with a combined population over 57 million people, comprising Wuhan and other cities in the surrounding Hubei province, were placed on full and partial lockdown since Jan 23-24, 2020.[10] Many New Year events and tourist attraction have been closed to prevent mass gathering. Numerous domestic and international airports and domestic train stations have adopted temperature screening measures to detect individuals with fever. Moreover, to mitigate the spread and of the virus, the Chinese government has progressively implemented metropolitan-wide quarantine on several cities since Jan 23-24, 2020.[11]

Tracing and monitoring continuously the trends and changes in the course of the COVID-19 outbreak is very important to mitigate this epidemic threat. Obtaining and analyzing information about what has happened until now and what might happen in future is very essential to understand and control the 2019 novel coronavirus outbreak at the global level. In this study, we provide the trends and significant changes in the novel coronavirus disease (COVID-19) outbreak in Mainland China from January 10 to February 02, 2020. We have also identified some of the important points of time where the outbreak trends have changed significantly and discussed some of the possible drivers that might have acted to change the trends in the outbreak.

Methods

Sources of data and compilation

In this study, data were extracted from the daily outbreak notifications from Jan 11 to Feb 12, 2020, provided in the official website of the National Health Commission of the People's Republic of China.[6] During the stated period each day's outbreak notification report was documented and translated from the Chinese language to English. A comma-separated values (.csv) file was compiled for each day translated outbreak notification report. The report was thoroughly read by the researchers for several times and outbreak statistics data were extracted from the report. From the 33 reports, we had extracted data on newly confirmed cases, newly death cases, cumulative report of confirmed cases, cumulative report of death cases, cases and death in Hubei province, and the number of close contacts have been tracked of each day from Jan 10 to Feb 11, 2020. Those data were compiled in an excel datasheet. A cumulative report of confirmed cases, cumulative cases of death and the number of close contacts have been tracked was inferred as the core variable of this study. We then calculated the newly confirmed cases, newly death cases, case fatality proportion for each day. We then matched our calculated value with the reported values in the outbreak notification report. This compiled data set then was again converted to the comma-separated values (.csv) file for the trend analysis.

Trends analysis

To analyze the temporal trends and to identify significant changes in trends in the novel coronavirus disease (COVID-19) outbreak in mainland China from Jan 10 to Feb 11, 2020, we performed a

joinpoint regression analysis.[12] We used Windows-based statistical software, the Joinpoint Regression Program (version 4.7.00, National Institute of Health, Bethesda, MD, United States) for performing the joinpoint regression by using the joinpoint models. With this analysis, it is possible to identify days when a significant change in the linear slope of the trend is detected over the study period. The best fitting points, called 'joinpoints', are chosen when the rate changes significantly. The analysis starts with the minimum number of joinpoints and tests whether one or more joinpoints (in this study up to 4) are significant and must be added to the model. To describe linear trends by period, the estimated regression coefficients (²) is then computed for each of those trends.[12,13] Moreover, the average daily percent change (ADPC), calculated as a geometric weighted average of daily percent changes of various segments,[14] was used to quantify the overall changes in total cases, total deaths, case fatality, and people were in quarantine due to the COVID-19 outbreak in mainland China over the study period from Jan 10 to Feb 11, 2020.

Results

The total number of confirmed cases with coronavirus disease 2019 (COVID-19) increased alarmingly more than 1000-fold from Jan 10 to Feb 11, 2020, along with the death toll increased by as much as 816-fold during the 33-day time span (Table 1). During the onset of the outbreak, all the cases were reported from the Hubei province but as of Feb 11, about 75% of the cases were from this province. But the province has shared almost 96% of the death toll until Feb 11. The case fatality proportion of this outbreak did not change significantly from Jan 10 to Feb 11, 2020. As a response to this frightening outbreak, the number of people was in quarantine increased significantly by 610 times (Initially, 739 persons on Jan 10 to 451,462 persons on Feb 11, 2020).

Trends in confirmed cases of the coronavirus disease 2019 (COVID-19)

Table 1 reveals that the number of confirmed cases of the coronavirus disease 2019 (COVID-2019) increased significantly ($P < 0.05$) by as much as 24.6% per day from Jan 10 (41 confirmed cases) to Feb 11 (44,653 confirmed cases). In mainland China, the number of confirmed cases with COVID-19 started to increase gradually from Jan 10 to Jan 22 (² = 35.12) after an initial 6 days of stable trend (Figure 1A) and since then soared up significantly ($P < 0.001$) at an alarming rate by 518.79 cases per

day until Jan 26. More alarmingly, during Jan 26 and Feb 01, the number of cases increased by 3.64 times higher than from Jan 22 to Jan 26. The situation getting worse from Feb 01 to Feb 07, within this 7-day time span, COVID-19 patients increased drastically from 14,380 cases to 34,546 cases (^{2} = 3496.85; $P < 0.001$). On Feb 03, the number of confirmed cases increased to almost 500-fold from the initial phase on Jan 10, 2020, and by Jan 30, already have passed the number of cases during the SARS-CoV outbreak in 2002[15] (Figure 1A). With some hope, since Feb 07, the number of cases with COVID-9 has been increasing at a reduced rate (^{2} = 2556.55; $P < 0.001$) in mainland China, especially in the Hubei province (^{2} = 2168.73; $P < 0.001$) after the most noticeable and highest increasing trend during Feb 01 and Feb 07. In Hubei province (Figure 1B), the number of confirmed cases soared up significantly since Jan 25 by almost 990 cases per day until Jan 30 and then the rate increased to almost double, 1789.13 cases per day until Feb 02. Since Feb 02, the count further increased drastically by 2824 cases per day until Feb 07. The other provinces showed the upward trend in COVID-19 cases since Jan 22, 2020 and the rate of increase almost doubled after Jan 25 (^{2} = 502.17; $P < 0.001$). Since Jan 28, the cases increased significantly at a concerned rate (^{2} = 751.96; $P < 0.001$), but the rate of increase slowed thereafter. The number of daily new cases with COVID-19 also increased significantly in mainland China (Figure 3A) since Jan 23 by an alarmingly high rate of 274.44 added cases per day until Feb 05. Most of these new cases were from Hubei where since Jan 25, the number of new cases increased overwhelmingly by 251 additional cases on each successive day (Table 2). Whereas, since Jan 21, the number of new cases soared up significantly (^{2} = 84.77; $P < 0.001$) in other provinces in mainland China until Jan 29 and then slowed down (^{2} = 24·98) until Feb 03. Recently, since Feb 05, in Hubei province (^{2} = -179.95; $P < 0.001$) and since Feb 03, in other provinces (^{2} = -61.14; $P < 0.001$) in mainland China have been observing the downward trends in daily new cases. The number of close contacts tracked increased markedly since Jan 27 in mainland China (Figure 3C). From Jan 25 to Feb 01 the number of close contacts tracked increased significantly by 23,624 persons per day (Table 2) which increased considerably by 1.3 times until Feb 07 (^{2} = 30,691.91; $P < 0.001$). Since Feb 07, the number of close contacts tracked has been increasing at a slower rate of 27,130 persons per day.

Trends in deaths due to the COVID-19

The number of deaths in mainland China due to the 2019 novel coronavirus (2019-nCoV) outbreak has already passed the death toll of SARS-CoV outbreak in 2002[15] within only 31 days of the first outbreak death (Figure 2A). The numbers of death was almost stable from Jan 10 to Jan 21 and during these period total 9 deaths were reported in mainland China. Since Jan 22, the death toll started to climb up swiftly and the trend (Figure 2A) has been determined by the death trend in the Hubei province (Figure 2B). From Jan 22 to Jan 28, the number of death toll increased by 19.44 deaths per day in mainland China and 18.11 deaths per day in the Hubei province. During Jan 28 and Feb 02, the total death in mainland China increased drastically from 132 deaths to 361 deaths (^{2} = 45.77; p < 0.001) and about 95% of these deaths were from Hubei province. Since Feb 02, the death toll soared up alarmingly by 71.92 deaths per day until Feb 07 and about 97% of these deaths were from the Hubei province. Recently, the situation has been worsening frighteningly since Feb 07, about 100 deaths recoded per day due to the COVID-19 and 96% of these deaths were from Hubei province. Moreover, since Feb 07, the death toll has been increasing by 13.9% per day in mainland China and 13.8% per day in Hubei province (Table 3). Since Jan 23, the death toll in the Hubei province has been increasing by 22.4% per day. The number of death per day started to increase since Jan 21, 2020 (Figure 4A) by 3.89 additional deaths in each successive day until Jan 28. Since Jan 28, death per day has been increasing by 5.41 additional deaths in each successive day in mainland China and mostly from the Hubei province. Since Jan 25, about 5 additional deaths have been occurring due to the COVID-19 in each successive day in the Hubei province (Table 2). In addition, the average daily percent change in the death toll in each day in Hubei province increased by 13.3% per day since Jan 23 (Table 3). The case fatality proportion showed much variability during the study period (Figure 3D). From Jan 10 to Jan 13 it was almost stable and during this period case fatality was 2.44. Since Jan 13, the case fatality showed much variability with ups and downs until Jan 22, 2020. Since Jan 22, the case fatality proportion in mainland China (^{2} = -0.04; p = 0.002) and since Jan 28 in Hubei province (^{2} = -0.04; p < 0·169) showed a slightly downward trend and reached to almost 2.50 in mainland China and 3.19 in the Hubei province on Feb 11, 2020.

Discussion

As of Feb 16, 2020, alarmingly, there have been a total of 70,548 confirmed cases and 1770 deaths have been traced due to the novel coronavirus disease (COVID-19) outbreak in Mainland China.[6] Outside China, a total of 683 confirmed cases from 25 countries and the three deaths outside China have been reported.[7] The situation is getting worse day after day and the COVID-19 outbreak becoming a threat to public health worldwide. It is now becoming urgency to analysis the ongoing situation of the COVID-19 outbreak. An essential feature of the current response to epidemics is the growing hub on exploiting all accessible data to inform the response in real-time which will be supportive of the evidence-based decision making.[16] In our study, we planned to explore the trends in the novel coronavirus disease (COVID-19) outbreak in mainland China in real-time with the available data that we have extracted from Jan 10 to Feb 11, 2020. In this study, we have provided the trends and statistically significant changes that occurred till now during the COVID-19 outbreak in mainland China from Jan 10 to Feb 11, 2020. We have also recognized some of the important points of time during this outbreak where the trend has changed significantly. Our analysis shows that the COVID-19 outbreak soared up in mainland China since Jan 22 by 518.79 cases per day and from Wuhan spread to all the provinces in mainland China. In Hubei province, the outbreak soared up drastically since Jan 25 until Jan 30. The outbreak situation started to deteriorate drastically since Jan 26 in the mainland China and since Jan 25 in the Hubei province. Since Jan 26, in mainland China, the number of COVID-19 cases further increased severely by 1887.29 cases per day until the early-Feb. Since the early-Feb, the trends in COVID-19 outbreak increased overwhelmingly whole over the mainland China as cases increased by 3497 cases per day and deaths toll increased by 72 deaths per day until Feb 07. With some hope, the cases have been increasing at a reduced rate since Feb 07 and the new cases per day trends showed a significant downward trend. On the other side, the death trend frighteningly has been showing upward trends, almost 100 deaths per day since Feb 07 in mainland China and 96% of these deaths were from Hubei province. Considering the 14 days incubation period of the virus[17], we hypothesize that the spread of the virus soared up significantly since the Jan 9-10, 2020 and again since Jan 17-18, there might be a large number of people in Wuhan who had exposed

to the virus and then after Jan 23, the infected persons without symptoms have spread the virus to other provinces of mainland China and overseas and this might be the reason of the striking upward trends in the COVID-19 outbreak since the early-Feb.

Our study team has been analyzing the outbreak trends since Jan 25 and based on our analysis, we provide the information that from Jan 10 to Jan 18, the trends in confirmed cases were almost stable in the Hubei and all other provinces in Mainland China. Moreover, during this period, 3 deaths were reported and all are from the Hubei province.[6] Our analysis also showed that the death trends were almost stable during this period. Qun Li and colleagues[18] reported the characteristics of cases in different time periods based on the onset of illness. In that report, cases with illness onset between Jan 12 to Jan 22 provided some evidence of human-to-human transmission of the 2019 novel coronavirus which later became more strong by Jasper Fuk-Woo Chan and colleagues[5] which indicates the risk of a much wider spread of the disease. During Jan 10 to Jan 18, the trend in confirmed cases was stable but might be during this period the wider spread of the virus was going on without any noticeable symptoms which resulted in the overwhelming increased trends the outbreak since Jan 22 and again since the early-Feb.

Since Jan 22, the number of COVID-19 cases started to soar up in mainland China and since Jan 26 the cases increased drastically which is mainly driven by the number of cases in the Hubei province especially, cases from Wuhan. During Jan 22 and Jan 26, the outbreak increased by about 519 cases per day in mainland China. Since Jan 22, reporting of cases from the other provinces of China had contributed to this figure. Moreover, this increasing cases trend was 14.8 times higher than the earlier trend from Jan 10 to Jan 22. Considering the incubation period[17] - the time it takes for an infected person to develop symptoms- it may be hypothesized that the spread of the virus and human-to-human transmission started to increase significantly since Jan 9-10. During this initial rapid increase of the outbreak, it is required to drastically reduce the with-in population contacts rates through cancelation of mass gatherings and to limit the population mobility.[11] We hypothesize, based on our trend analysis and the probable incubation period of the virus, that on Jan 18-19, there might be a big gathering happened in Wuhan that caused the rapid exposure of the virus from the person-to-person

transmission and might be this worked as a super-spreader of the virus. This might have caused the overwhelmingly increasing trends in the outbreak and alarmingly since the early-Feb. Since the early-Feb, the number of COVID19 cases increased at the highest rate during this outbreak and it increased by almost 3500 cases per day in mainland China, about 2824 cases in the Hubei province, and about 752 cases per day in other provinces in mainland China. In addition, since early Feb, the death toll also increased severely in mainland China by 72 deaths per day until Feb 07 and 69 deaths per day in the Hubei province.

Considering the human-to-human transmission of the 2019 novel coronavirus (2019-nCoV), seemingly, the first and the most effective measure taken was to quarantine on travel in and out of Wuhan, Hubei province[10] to stop the spread of the virus though it already had spread in small scale to other provinces and internationally.[19] Based on our trend analysis, this positive lockdown initiative on Jan 23-24 has shown a negative effect but for the betterment of the coming days, it was highly required where shreds of evidences[5,18] from human-to-human transmission of the virus become stronger. This lockdown has made thousands of people to leave Wuhan and spread to the other province of mainland China and internationally.[11] Moreover, this lockdown made the Wuhan residents rushed to stockpile essential goods, food and fuel; which might have increased the more person-to-person contacts within the Wuhan and other regions under the lockdown process. Our trend analysis has shown that since Jan 22, the outbreak trend in Hubei and the other provinces of mainland China markedly increased alarmingly by 50-fold in the other provinces and by 28-fold in the Hubei province than the previous trend. Moreover, the number of new cases per day increased by 17-fold in mainland China since Jan 23 and 16-fold in the Hubei province since Jan 25. In addition, the number of COVID-19 cases increased by almost 3.6 to 2.0 times in every 5-6 days interval since Jan 26. In an earlier stage of this outbreak, the cases of the novel coronavirus disease (COVID-19) have been doubling in size approximately every 7.4 days in Wuhan, reported in a study.[18] On a positive side, if we considered the Jan 23-24 lockdown effect as the last large population motility then we expect that the alarming upward trend of the outbreak might be started to reduce its rate since Feb 6-7. Based on this expectation, our trend analysis has shown that, since Feb 07 the COVID-19 cases have been

increasing at a reduced rate from the trend during Feb 01 to Feb 07. Since Feb 07 the cases has reduced by 1.4-fold in mainland China and 1.3-fold in the Hubei province. Since Feb 05, the new COVID-19 cases has been reducing by 180 cases per day in the Hubei province and since Feb 03, about 61 cases per day in other provinces in mainland China. On the frightening side, the death toll has not been reducing like the cases trend. The death trend has been showing upward trend with continuously increasing rate at 4-5 days interval. Since Feb 07, death trend has been increasing at a marked and highest rate during the outbreak, 100 deaths per day in mainland China and about 96% from Hubei province where 94 deaths per day was analyzed. Since Feb 09, the death toll from other provinces increased at a reduced rate.

Nonetheless, our study has several major limitations. We were highly deficient in explaining the possible drivers that might have acted to change the trends during this outbreak. Many factors together with their interplay might have affected the changes in the trends. Moreover, our hypothesis on the possible period of exposure of the virus was based on the incubation period of the virus and the trends in confirmed cases; which might never be sufficient to describe the exposure period of the virus. Moreover, it was very tough for us to explain death trend due to the COVID-19 outbreak in mainland China and the possible drivers for the changes. This is because we have lack of information, almost none, about the clinical and other parameters to explain the trends. For this research we have extracted the data from the official website of the National Health Commission of the People's Republic of China; one modeling analysis has reported that there may be cases going undetected and the outbreak has caused more cases in Wuhan than have currently been reported.[20,21]

Despite these limitations, this is the first-ever study in the scientific literature which has provided the trends and significant changes in the novel coronavirus disease (COVID-19) outbreak in mainland China, which is now becoming the major threat and deep concern for the public health worldwide. We have identified some of the important points of time where the outbreak trend has changed significantly. Moreover, we report the recent ongoing trends of the outbreak. In a nutshell, the significant changes that occurred during the ongoing novel coronavirus disease (COVID-19) outbreak are summarized in Figure 4. In summary, the outbreak drastically soared up significantly since Jan 25

in the Hubei province and since Jan 22 in other provinces in mainland China. Since Jan 22, the outbreak spread to all the provinces in mainland China. Since the early-Feb, the outbreak changed for the worst as the case and death toll showed drastic upward trends. Since Feb 07, the cases has been increasing at a reduced rate while the death toll increasing at a market rate.

Funding

No funding source for this research

Acknowledgments

The authors thank and grateful to all the health workers and doctors who are working in mainland China.

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. doi:10.1016/S0140-6736(20)30183-5.

2 Lu H, Stratton CW, Tang YW. Outbreak of Pneumonia of Unknown Etiology in Wuhan China: the Mystery and the Miracle. J Med Virol 2020; : jmv.25678.

3 World Health Organization. Coronavirus disease (COVID-19) situation reports. Situation report-23. Geneva, Switzerland, 2020.

4 Zhu N, Zhang D, Wang W, Li X, Yang B, Song J et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med 2020; : NEJMoa2001017.

5 Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020. doi:10.1016/S0140-6736(20)30154-9.

6 National Health Commission. National Health Commission's Daily briefing on novel coronavirus cases in China. Beijing, China, 2020.

7 World Health Organization. Novel Coronavirus (2019-nCoV) situation reports. Geneva, Switzerland, 2020.

8 World Health Organization. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Geneva, Switzerland.

9 Nkengasong J. China's response to a novel coronavirus stands in stark contrast to the 2002 SARS outbreak response. Nat Med 2020. doi:10.1038/s41591-020-0771-1.

10 Crossley G. Wuhan lockdown ‘unprecedented’, shows commitment to contain virus: WHO representative in China. Reuters. 2020; : Online.

11 Wu JT, Leung K, Leung GM. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. Lancet 2020.https://www.sciencedirect.com/science/article/pii/S0140673620302609 (accessed 6 Feb2020).

12 Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med 2000; 19: 335–51.

13 Lerman PM. Fitting Segmented Regression Models by Grid Search. Appl Stat 1980; 29: 77.

14 Clegg LX, Hankey BF, Tiwari R, Feuer EJ, Edwards BK. Estimating average annual per cent change in trend analysis. Stat Med 2009; 28: 3670–3682.

15 World Health Organization. Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. Geneva, Switzerland, 2004.

16 Polonsky JA, Baidjoe A, Kamvar ZN, Cori A, Durski K, Edmunds WJ et al. Outbreak analytics: a developing data science for informing the response to emerging pathogens. Philos Trans R Soc B Biol Sci 2019; 374: 20180276.

17 Yasinski E. Scientists Zero in on the Novel Coronavirus’s Incubation Period. Sci 2020.

18 Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y et al. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. N Engl J Med 2020; : NEJMoa2001316.

19 World Health Organization. Coronavirus disease (COVID-19) situation reports. Situation report-27. Geneva, Switzerland, 2020.

20 Zhao S, Musa SS, Lin Q, Ran J, Yang G, Wang W et al. Estimating the Unreported Number of Novel Coronavirus (2019-nCoV) Cases in China in the First Half of January 2020: A Data-Driven Modelling Analysis of the Early Outbreak. J Clin Med 2020; 9: 388.

21 Imai N, Dorigatti I, Cori A, Donnelly C, Riley S, Ferguson NM. Estimating the potential total number of novel Coronavirus cases in Wuhan City, China. London, United Kingdom, 2020.

22 World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) situation update. Geneva, Switzerland, 2019.

23 Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet 2020. doi:10.1016/S0140-6736(20)30185-9.

Tables

Table 1. Summary statistics of the 2019 novel coronavirus (2019-nCoV) outbreak in mainland China from Jan 10 to Feb 11, 2020

	Jan 10	Feb 11	n-fold[a]	ADPC (95% CI)[b]
Total Cases (n)	41	44653	1089.10	24.6 (23.1 to 26.1)[d]
Hubei province	41	33453	815.93	23.4 (22.1 to 24.7)[d]
Other provinces	0	11200	---	36.7 (34.5 to 38.9)[d]
Hubei proportion (%)	100	74.92	0.75	-0.8 (-1.1 to -0.4)[d]
Total death (n)	1	1113	1113.0	24.7 (21.7 to 27.8)[d]
Hubei province	1	1067	1067.0	24.6 (21.5 to 27.8)[d]
Other provinces	0	46	---	15.7 (13.2 to 18.1)[d]
Hubei proportion (%)	100	95.87	0.96	-0.1 (-0.4 to 0.1)
New cases per day (n)	0	2015	---	30.1 (26.0 to 34.4)[d]
Hubei province	0	1638	---	29.4 (23.5 to 35.7)[d]
Other provinces	0	377	---	23.0 (16.3 to 30.1)[d]
Death per day (n)	0	97	---	18.7 (15.0 to 22.4)[d]
Hubei province	0	94	---	18.5 (12.9 to 24.3)[d]
Case fatality proportion (%)	2.44	2.49	1.02	-0.2 (-3.0 to 2.8)
Hubei province	2.44	3.19	1.31	0.7 (-2.8 to 4.3)
Total Quarantine (n)[c]	0.74	451.46	610.08	22.3 (20.1 to 24.5)[d]

[a]Values of the changes in the summary statistics are given as an absolute figure; directions of the changes from Jan 10 to Feb 11, 2020 in Mainland China.
[b]ADPC is the average daily percent change in the summary statistics, calculated as a geometric weighted average of the calculated daily percent changes (DPCs) in the various segments of the trends from Jan 10 to Feb 11, 2020, by using the joinpoint regression analysis; in parentheses, 95%CI, the 95% confidence interval of the ADPC is presented.
[c]Values are given in per thousand people.
[d]Denotes that the average daily percent change, ADPC, is significantly different from 0 for the entire trend from Jan 10 to Feb 11, 2020 (two-sided $p < 0.05$).

Table 2. Trends in cases, deaths, case fatality and people was in quarantine due to the 2019 novel coronavirus (2019-nCoV) outbreak in mainland China from Jan 10 to Feb 11, 2020[a]

	Trend 1		Trend 2		Trend 3		Trend 4		Trend 5	
	Period	**^{2} [b]**	**Period**	**^{2} [b]**	**Period**	**^{2} [b]**	**Period**	**^{2} [b]**	**Period**	**^{2} [b]**
Total Cases	Jan 10 – Jan 22	35.12[d]	Jan 22 – Jan 26	518.79[d]	Jan 26 – Feb 01	1887.29[d]	Feb 01 – Feb 07	3496.85[d]	Feb 07 – Feb 11	2556.55[d]
Hubei province	Jan 10 – Jan 25	52.05[d]	Jan 25 – Jan 30	989.57[d]	Jan 30 – Feb 02	1789.13[d]	Feb 02 – Feb 07	2823.97[d]	Feb 07 – Feb 11	2168.73[d]
Other provinces	Jan 10 – Jan 22	5.40	Jan 22 – Jan 25	268.84[d]	Jan 25 – Jan 28	502.17[d]	Jan 28 – Feb 06	751.96[d]	Feb 06 – Feb 11	427.92[d]
Hubei proportion	Jan 10 – Jan 19	0.06	Jan 19 – Jan 25	-8.18[d]	Jan 25 – Jan 28	2·37[d]	Jan 28 – Feb 06	1.36[d]	Feb 06 – Feb 11	0.78[d]
Total deaths	Jan 10 – Jan 22	0.60[d]	Jan 22 – Jan 28	19.44[d]	Jan 28 – Feb 02	45.77[d]	Feb 02– Feb 07	71.92[d]	Feb 07 – Feb 11	100.33[d]
Hubei province	Jan 10 – Jan 22	0.53[d]	Jan 22 – Jan 28	18.11[d]	Jan 28 – Feb 02	45.46[d]	Feb 02– Feb 07	69.35[d]	Feb 07 – Feb 11	93.96[d]
Other provinces	Jan 10 – Jan 22	0.09[d]	Jan 22 – Jan 30	1.18[d]	Jan 30 – Feb 05	0.51[d]	Feb 05 – Feb 09	6.13[d]	Feb 09 – Feb 11	4.32[d]
Hubei proportion	Jan 10 – Jan 17	0.31	Jan 17 – Jan 20	-3.91[d]	Jan 20 – Feb 03	0.55[d]	Feb 03 – Feb 11	0.23		
New cases per day	Jan 10 – Jan 23	15.83	Jan 23 – Feb 05	274.44[d]	Feb 05 – Feb 11	-264.41[d]				
Hubei province	Jan 10 – Jan 25	15.38	Jan 25 – Feb 05	250.94[d]	Feb 05 – Feb 11	-179.95[d]				
Other provinces	Jan 10 – Jan 21	0.79	Jan 21 – Jan 29	84·77[d]	Jan 29 – Feb 03	24.98	Feb 03 – Feb 11	-61.14[d]		
Death per day	Jan 10 – Jan 21	0.27	Jan 21 – Jan 28	3.89[d]	Jan 28 – Feb 11	5.41[d]				
Hubei province	Jan 10 – Jan 20	0.11	Jan 20 – Jan 25	2.85	Jan 25 – Feb 11	4.96[d]				
Case fatality	Jan 10 – Jan 13	-0.04	Jan 13 – Jan 16	0.76	Jan 16 – Jan 19	-1.07[d]	Jan 19 – Jan 22	0.44	Jan 22 – Feb 11	-0.04[d]
Hubei province	Jan 10 – Jan 16	0.39[d]	Jan 16 – Jan 19	-0.97	Jan 19 – Jan 25	0.68[d]	Jan 25 – Jan 28	0.68	Jan 28 – Feb 11	-0.04
Quarantine[c]	Jan 10 – Jan 22	0·12	Jan 22 – Jan 27	8.15[d]	Jan 27 – Feb 01	23.62[d]	Feb 01 – Feb 07	30.69[d]	Feb 07 – Feb 11	27.13[d]

[a]Trends analysis identified jopinponits, which are points where line segment of trends are joined. Each joinpoint denotes a statistically significant change (P = 0.05) in the trend of the 2019 novel coronavirus (2019-nCoV) outbreak data from Jan 10 to Feb 11, 2020.

[b]^2 is the estimated regression coefficients for a specific trend; ^{2} was calculated from the linear joinpoint model.

[c]Values are given in per thousand people.

[d]Denotes that the regression lines slope is significantly different from 0 for a specific trend (P < 0.05).

Table 3. Average daily percent changes (ADPC) in cases, deaths, case fatality proportion and people in quarantine due to the Novel Coronavirus (2019-nCoV) outbreak in mainland China on different day's interval from Jan 23 to Feb 11, 2020[a]

	Jan 23 – Feb 11[b]	Feb 07 – Feb 11[c]
Total Cases	23.1 (22.0 to 24.2)[d]	8.8 (7.2 to 10.5)[d]
Hubei province	24.0 (22.5 to 25.4)[d]	9.0 (7.6 to 10.3)[d]
Other provinces	22.5 (20.9 to 24.2)[d]	8.1 (7.0 to 9.3)[d]
Hubei proportion	0.7 (0.1 to 1.4)[d]	1.9 (1.7 to 2.1)[d]
Total deaths	22.1 (19.7 to 24.6)[d]	13.9 (11.7 to 16.1)[d]
Hubei province	22.4 (19.9 to 25.0)[d]	13.8 (11.6 to 16.1)[d]
Other provinces	18.7 (15.4 to 22.0)[d]	21.6 (15.8 to 27.7)[d]
Hubei proportion	0·2 (0·1 to 0·4)[d]	-0·3 (-0·5 to 0·0)
New cases per day	12.1 (9.5 to 14.8)[d]	-9.2 (-13.0 to -5.1)[d]
Hubei province	16.8 (11.7 to 22.1)[d]	-8.5 (-14.1 to -2.5)[d]
Other provinces	6.7 (3.6 to 9.9)[d]	-5.2 (-7.6 to -2.7)[d]
Death per day	13.4 (10.3 to 16.6)[d]	8.5 (5.9 to 11.1)[d]
Hubei province	13.3 (10.2 to 16.6)[d]	7.4 (4.4 to 10.5)[d]
Case fatality	-1.6 (-2.8 to -0.4)[d]	1.8 (0.2 to 3.4)[d]
Hubei province	-1.3 (-2.8 to 0.3)	1.9 (-1.4 to 5.3)
Quarantine	23.0 (20.1 to 26.0)[d]	8.3 (5.3 to 11.5)[d]

[a]ADPC is the daily percent change calculated within different day's interval since Jan 23. Average daily percent change calculated as a geometric weighted average of the calculated daily percent changes (DPCs) in the various segments of the days from Jan 23 to Feb 11, 2020; in the parentheses the 95% Confidence interval is presented.

[b]The time span indicates the period since the lock down in Wuhan where Wuhan suspended all public transport and all outbound trains and flights were halted.[10]

[c]Denotes the time span when the confirmed cases trends showed downward slope extracted from the joinpoint analysis.

[d]Denotes that the average daily percent change, ADPC, is significantly different from 0 for the entire trend from Jan 23 to Feb 11, 2020 (two-sided $p < 0.05$).

Figures

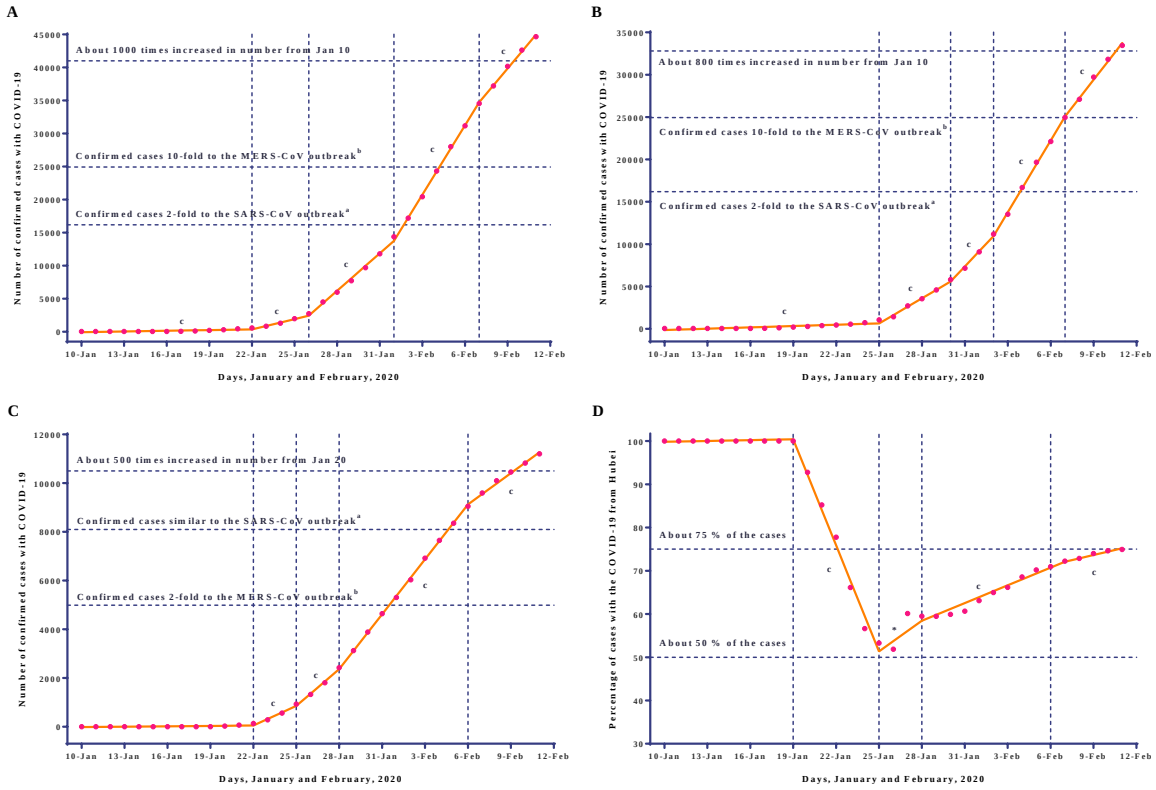

Fig. 1. Joinpoint regression analysis of the confirmed cases during the 2019 novel coronavirus (2019-nCoV) outbreak in mainland China from Jan 10 to Feb 11, 2020

SARS-CoV: Severe Acute Respiratory Syndrome coronavirus. MERS-CoV: Middle East Respiratory Syndrome coronavirus.

Notes: Joinpoint regression analysis of the number of confirmed cases of coronavirus disease 2019 (COVID-19) in mainland China (A), Hubei province (B), other provinces in mainland China except Hubei (C), and percentage of total cases from Hubei (D) from Jan 10 to Feb 11, 2020. The vertical dotted lines represent the joinpoints. The horizontal dotted lines represent the n-times increased in number of cases from the number of cases on Jan 10, 2020.[6] [a]Denotes the number of confirmed cases infected with the SARS-CoV.[15] [b]Denotes the number of confirmed cases infected with the MERS-CoV.[22] [c]Denotes that the regression lines slope is significantly different from 0 for a specific trend ($p < 0.05$).

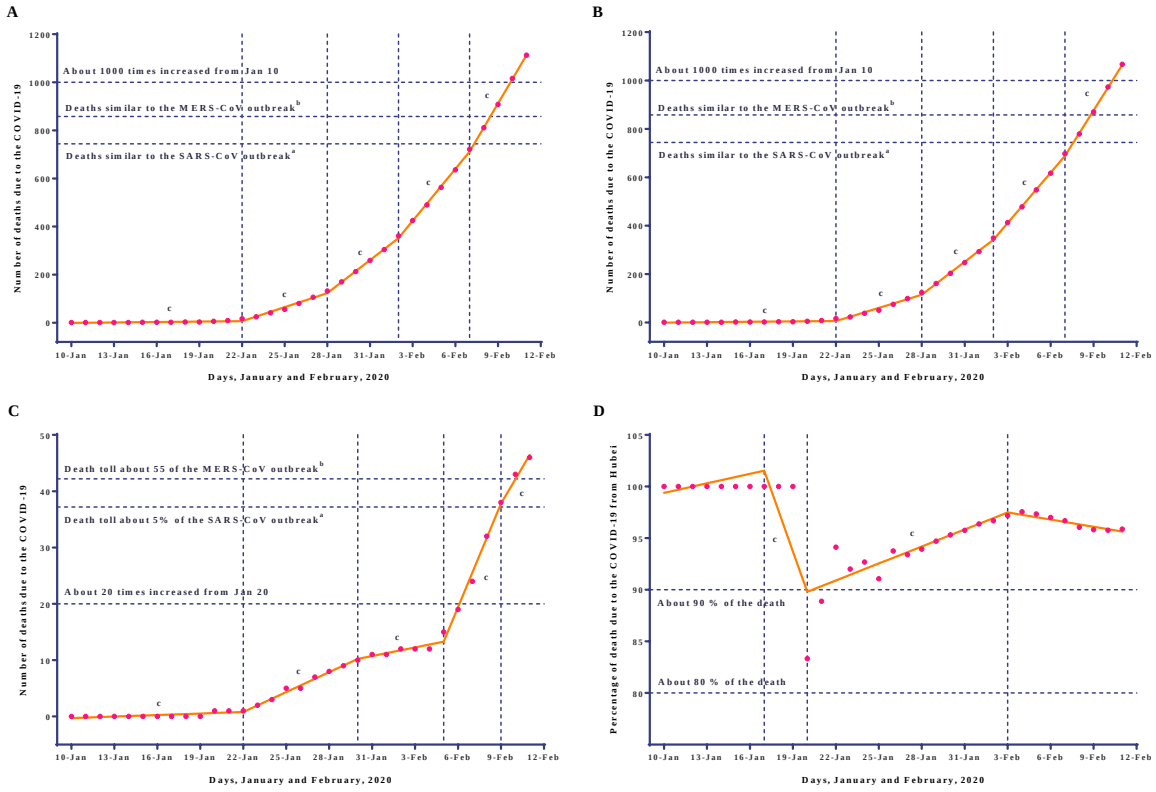

Fig. 2. Joinpoint regression analysis of the death toll due to the coronavirus disease 2019 (COVID-19) in mainland China from Jan 10 to Feb 11, 2020

SARS-CoV: Severe Acute Respiratory Syndrome coronavirus. MERS-CoV: Middle East Respiratory Syndrome coronavirus.

Notes: Joinpoint regression analysis of the number of deaths due to the coronavirus disease 2019 (COVID-19) in mainland China (A), Hubei province (B), other provinces in mainland China except Hubei (C), and percentage of total cases from Hubei (D) from Jan 10 to Feb 11, 2020. The vertical dotted lines represent the joinpoints. The horizontal dotted lines represent the n-times increased in death from the number of deaths on Jan 10, 2020.[6] [a]Denotes the number of deaths reported during the SARS-CoV.[15] [b]Denotes the number of deaths reported during the MERS-CoV.[22] [c]Denotes that the regression lines slope is significantly different from 0 for a specific trend ($p < 0.05$).

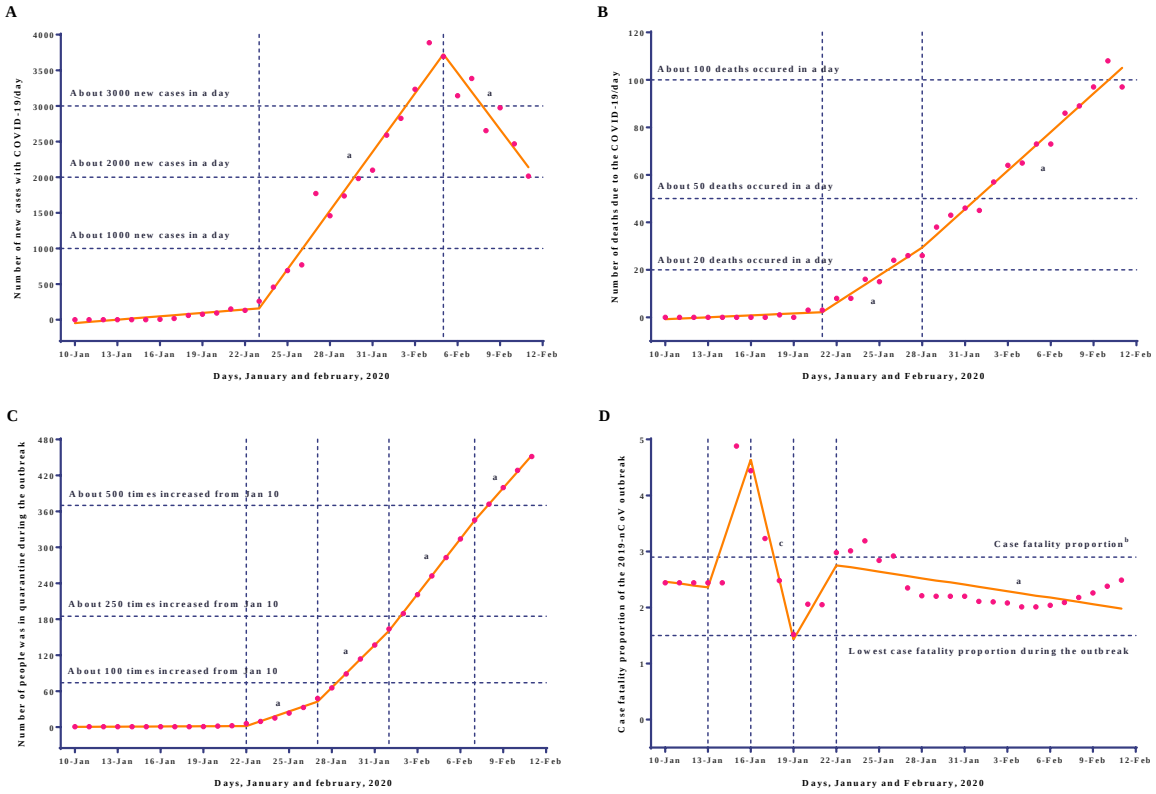

Fig. 3. Joinpoint regression analysis of the new cases per day, deaths per day, people in quarantine, and case fatality proportion due to the 2019 novel coronavirus (2019-nCoV) outbreak in mainland China from Jan 10 to Feb 11, 2020

Notes: Joinpoint regression analysis of the number of new cases per day (A), deaths per day (B), people in quarantine (C), and case fatality proportion of the coronavirus disease 2019 (COVID-19) in mainland China from Jan 10 to Feb 11, 2020. The vertical dotted lines represent the joinpoints. The horizontal dotted lines represent the n-times increased in number from Jan 10, 2020.[6] [b]Represented the case fatality proportion of this outbreak as on the data updated up to January 21, 2020, and was reported in the Lancet.[23] [a]Denotes that the regression lines slope is significantly different from 0 for a specific trend ($p < 0.05$).

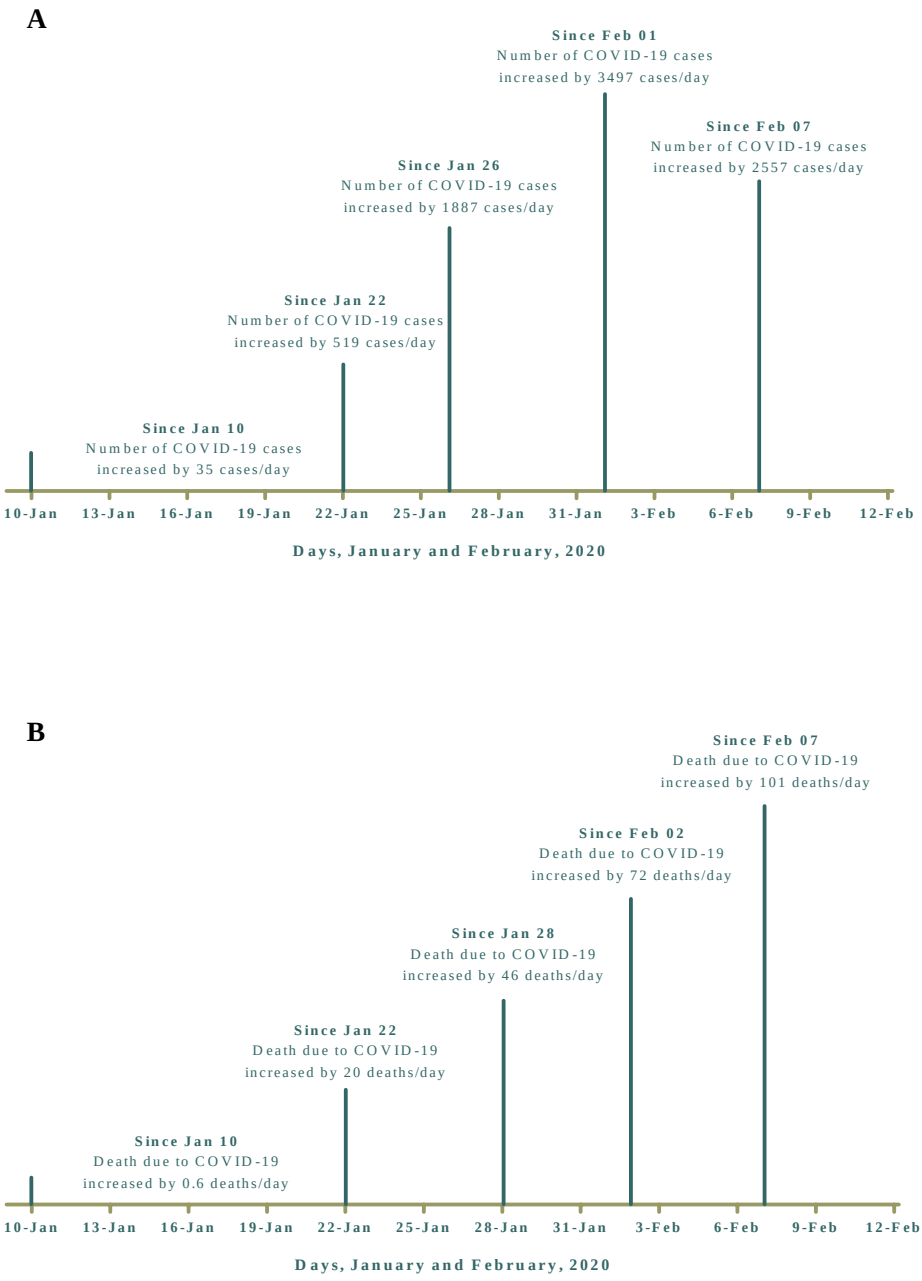

Fig. 4. Timeline of the significant changes in the novel coronavirus disease (COVID-19) outbreak

Notes: The points in time of significant changes in COVID-19 cases (A) and deaths (B) are denoted by the vertical lines. Joinpoint regression analysis identified joinpoint of changes during the novel coronavirus (COVID-19) outbreak in mainland China by using the data from Jan 10 to Feb 11, 2020.