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Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in
Wuhan, China

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ABSTRACT

Background To help health workers and the public recognize and deal with the 2019 novel coronavirus (2019-nCoV) quickly, effectively and calmly with an updated understanding.

Methods

A comprehensive search from Chinese and worldwide official websites and announcements was performed between 1 Dec 2019 to 9:30 am 26 Jan 2020 (Beijing time). A latest summary of 2019-nCoV and the current outbreak was drawn.

Results Up to 24 pm 25 Jan 2020, a total 1,975 cases were confirmed infection of 2019-nCoV in China mainland with a total of 56 deaths occurred. The latest mortality was approximately 2.84% with a total 2,684 cases still suspected. The China National Health Commission reported the details of the first 17 deaths up to 24 pm 22 Jan 2020. The deaths included 13 males and 4 females. The median age of the deaths was 75 (range 48-89) years. Fever (64.7%) and cough (52.9%) were the most common first symptoms in deaths. The median days from first symptom to death were 14.0 (range 6-41) days, and tended to be shorter among people of 70-year old or above (11.5 [range 6-19] days) than those with ages below 70-year old (20 [range 10-41] days, $P=0.033$).

Conclusion: The infection of 2019-nCoV is spreading and increasing nationwide. The first occurred deaths were majorly elderly people who might have faster disease progresses. The public should still be cautious in dealing with the virus and paying more attention to protect elderly people from the virus.

Keywords: coronavirus, infection, epidemiology

INTRODUCTION

While Chinese people are heading home and celebrating for the Spring Festival, they are also facing unprecedented panic caused by the outbreak of pneumonia previously of unknown etiology in Wuhan, China since last December [1]. A novel coronavirus was soon identified as the causative

virus for the outbreak and tentatively named as 2019-nCoV by World Health Organization (WHO) [2-3]. Currently, the emerging viral infections stirred a grave concern for a possible influenza pandemic [4]. During Spring Festival travel rush, Wuhan located in China's translocation hub has seen hundreds of thousands of people leave the city and potentially carry the virus with them. The virus is currently spreading fast in China mainland. By 25 Jan 2020 a total 1,975 cases has been confirmed infection nationwide and with another 2,684 suspected cases [5].

The 2019-nCoV is considered a relative of the deadly severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) coronaviruses, both of which are characterized by flu-like symptoms including fever, cough and anhelation and have the possibility of transmission from animals to humans [6-7]. The SARS was traced to animals including what was initially thought to be palm civets [8] but was later identified as the bats [9]. The 2019-nCoV was associated with contact with a local seafood market that illegally sold wildlife including poultry, bats, marmots, and snakes in Wuhan. Two very recent studies have suggested that bats [10] or snakes [11] to be the potential natural reservoir of 2019-nCoV. However, based on the latest statement by WHO on 23 Jan 2020, the source of 2019-nCoV is still unknown [12]. The 2019-nCoV appears to cause symptoms similar to SARS based on clinical data from the initial 41 cases of the 2019-nCoV [13], and seems to be capable of spreading from human to human and between cities [14], according to two latest studies [13-14] published in Lancet on 24 Jan 2020.

Although WHO suggested that the current event did not constitute a Public Health Emergency of International Concern (PHEIC), they also indicated that the situation was urgent and needed further

examination [12]. At present, in context of a lack of definite and effective treatment, the most direct and effective way is to take protective measures including improving personal hygiene, wearing a medical mask, having enough rest, keeping ventilation and avoiding the crowding to prevent the disease for every individual. Updating the understanding of the disease caused by 2019-nCoV infection is currently urgently warranted. Thus, we conducted the current study aiming to help health workers and the public recognize and quickly, effectively and calmly deal with the diseases.

Methods

Data sources and searches

A comprehensive search from Chinese and worldwide official websites and announcements [1,5,15-24] was performed between 1 Dec 2019 to 9:30 am 26 Jan 2020 (Beijing time). The relevant data of distribution of infection on each reported day including 31 Dec 2019 [1], 10 Jan 2020 [15], 20 Jan 2020 [16], 21 Jan 2020 [17], 22 Jan 2020 [18-19], 23 Jan 2020 [20-21], 24 Jan 2020 [22-23], and 25 Jan 2020 [5,24] were obtained.

Statistical analysis

Retrieved data were recorded into Microsoft® Excel for Mac (version 16.30) and analyzed. Continuous variables including the ages, days to death were expressed as median and range deviation. The Mann–Whitney U test was utilized to compare significant differences among continuous data. The SPSS version 22.0 (SPSS Inc., Chicago, IL, USA) was used to for statistic analysis. It was regarded as statistical significance when the *P* value was less than 0.05. The EDRAW Max version 9.3 (EDRAW Max Inc., Shenzhen, China) was used to for cartography. Data from 20 Jan 2020 [16], 22 Jan 2020 [18-19] and 25 Jan 2020 [5,24] were utilized for China map [16,19,24] and world map [5,16,18] drawing, respectively.

Results

The distribution of 2019-nCoV infection in China and worldwide is shown in Table 1 and Figure 1. As listed in Table 1, according to the first official announcement by the Wuhan Municipal Health

Commission [1], a total 27 patients were diagnosed with viral pneumonia (later confirmed as 2019-nCoV related pneumonia) up to 31 Dec 2019. All cases occurred in Wuhan, Hubei, China, including 7 severe cases but no death then.

As of 10 Jan 2020 [15], the confirmed 2019-nCoV infection increased to 41 cases all in Wuhan with 1 death first reported. Nine days later on 20 Jan 2020[16], the infected cases increased to 217 cases, of which 198 in Wuhan, 14 in Guangdong and 5 in Beijing. In addition, four cases were confirmed outside China (Thailand/Japan/South Korea, 2/1/1) [16]. The confirmed cases have increased fast since 20 Jan 2020, to 440 cases with 9 deaths up to 21 Jan 2020 [17], to 571 with 17 deaths up to 22 Jan 2020[18], to 830 with 25 deaths up to 23 Jan 2020 [20], to 1,287 with 41 deaths up to 24 Jan 2020 [22].

From the latest report as of 25 Jan 2020 [5,24], a total of 1,975 patients involved in 30 provinces (autonomous regions and municipalities) were confirmed infection of 2019-nCoV in China mainland with a total 56 deaths. The latest mortality was approximately 2.84% with a total of 2,684 additional suspected cases [5]. Other 3 involved Chinese regions reported 10 cases of confirmed infection (Hong Kong/Taiwan/Macau,5/3/2) [5]. Besides, twenty-three cases were confirmed outside China (Thailand/Singapore/Malaysia/France/United States/Japan/South Korea/Vietnam/Nepal/Australia, 4/3/3/3/2/2/2/2/1/1) as of 25 Jan 2020 [5].

Previously, the China National Health Commission reported the details of the first 17 deaths up to 22 Jan 2020 [18]. As shown in Table 2, the deaths included 13 males and 4 females. The median age of the deaths was 75 (range 48-89) years. Before admission, eleven cases were complicated with other diseases and five had past surgery history. Fever (64.7%) and cough (52.9%) were the most common first symptoms in deaths. The median days from first symptom to death were 14.0 (range 6-41) days, and tended to be shorter among people of 70-year old or above (11.5 [range 6-19] days) than those with ages below 70-year old (20 [range 10-41] days, $P=0.033$).

Discussion

Our study has demonstrated the fast spreading of the novel virus in China mainland since the first official announcement on 31 Dec 2019 by the Wuhan Municipal Health Commission [1]. The infection has very quickly increased between 20 Jan 2020 and 25 Jan 2020 according to National Health Commission [5,16-18,20,22]. Possibly, detection and reporting of the infection has been

attached more importance since it was nationwide reported. Another possible reason for the fast spreading would be the Spring Festival travel rush that thousands of millions people were on the move heading home and the virus would definitely spread quickly especially along with those coming out from Wuhan.

Our study also demonstrated that the 2019-nCoV had caused a total 1,975 infections and 56 deaths in 26 days since the first official announcement [1]. The current mortality of the 2019-nCoV is approximately 2.84%, which is lower than that of 9.6% of the SARS-CoV that spread globally to 30 countries/regions, infected 8,098 people and killed 774 patients from Nov 2002 to Jul 2003 [25], and lower than that of 34.4% of the MERS-CoV, which spread globally to 27 countries/regions, infected 2,494 people and killed 858 patients from Sep 2012 to Sep 2019 [26]. However, in the first 3 months from Nov 2002 to Feb 2003 [27], Guangdong, China had only witnessed a diagnosis of the atypical pneumonia initially considered chlamydia pneumoniae (later confirmed as caused by SARS) in 305 cases with 5 deaths. Taken together, although the current mortality is lower than that of the SARS-CoV and the MERS-CoV, it seems that the 2019-nCoV is very contagious. The public should be cautious about the development of disease.

Our study also showed that the first occurred deaths were mainly elderly people. Although most of them had comorbidities or surgery history before admission, the potential association of underlying medical conditions and 2019-nCoV-associated death was not clear. By far, the median days of first symptom to death were 14 days, which were comparable to that of also 14 days (median) of MERS [28]. For SARS, it was reported that the average duration of first symptoms to hospital admission was 3.8 days, and admission to death was 17.4 days for casualties [29]. Our study also found that people of 70-year old or above had shorter median days (11.5 days) from the first symptom to death than those with ages below 70-year old (20 days), demonstrating that elderly people might have faster disease progresses than younger people. Similar results were found in SARS that mean duration from admission to death was 5.7 days for people aged 80-93 years, 9.4 days for those aged 60-79 years and above 12.0 days for those under 60 years of age [29]. It was also reported that older age (>60 years) was a risk factor that correlated with mortality in MERS [28]. From the above, although a definite comparison could not be drawn by far, the public should pay attention to elderly people who might be more vulnerable to the 2019-nCoV.

Currently there is a lack of definite and effective treatment. The health workers and public should be cautious in preventing and controlling the disease. The United States Centers for Disease Control and Prevention made an update and interim guidance [30] and provided a patient under investigation (PUI) form [31], which was available for suspected cases. Patients with the following criteria should be considered a PUI in association with the 2019-nCoV. First, those who had fever combined with symptoms of lower respiratory illness (e.g., cough, breathing difficulties), and had Wuhan travelling history in the last 2 weeks before symptom onset or close contact with an ill person who was also under investigation for 2019-nCoV. Second, those who had a fever or had symptoms of lower respiratory illness (e.g., cough, breathing difficulties), and close contact with an ill lab-confirmed 2019-nCoV patient.

Additionally, the WHO also provided an interim guidance for infection prevention and control when a novel coronavirus was suspected [32], and further improved the guidance by indicating that patients with mild symptoms and without chronic conditions or symptomatic patients no longer requiring hospitalization might be cared for in home environment [33]. Another aspect worth noting is that health workers should minimize the possibility of exposure when collecting and transporting lab specimens of suspected infected patients [32,34]. A goggle was necessary when health workers were questioning patients at fever clinic or performing operations for suspected patients since the virus might infect the eye conjunctiva through droplets. It would be interesting to test if robotics might be used in questioning or treating the infected or suspected patients that will definitely decrease the possibility of exposure of health workers.

Although the etiology is still unclear, some scholars suggest that 2019-nCoV and SARS/SARS-like coronaviruses may share a common ancestor resembling the bat coronavirus HKU9-1 [10]. The 2019-nCoV may interact with human ACE2 molecules via its S-protein for human-to-human transmission [10]. However, future studies are warranted to uncover the source of the virus and potential mechanisms for human-to-human transmission.

Conclusion

The infection of 2019-nCoV is spreading fast with increasing infected patients nationwide. The future development of the disease is not clear but the public should be cautious in dealing with the virus since it may be very contagious. The first occurred deaths were majorly elderly people who

might have faster disease progression. The public should pay more attention to protect elderly people who have contracted the virus.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

FigureFigure 1: Distribution of confirmed 2019-nCov infection in China and worldwide as of 20 Jan 2020 at 18 pm (Beijing time) (A); 22 Jan 2020 at 24 pm (Beijing time) (B); and 25 Jan 2020 at 24 pm (Beijing time) (C).

The provinces/regions are shaded in different colors indicating different degrees of infection.

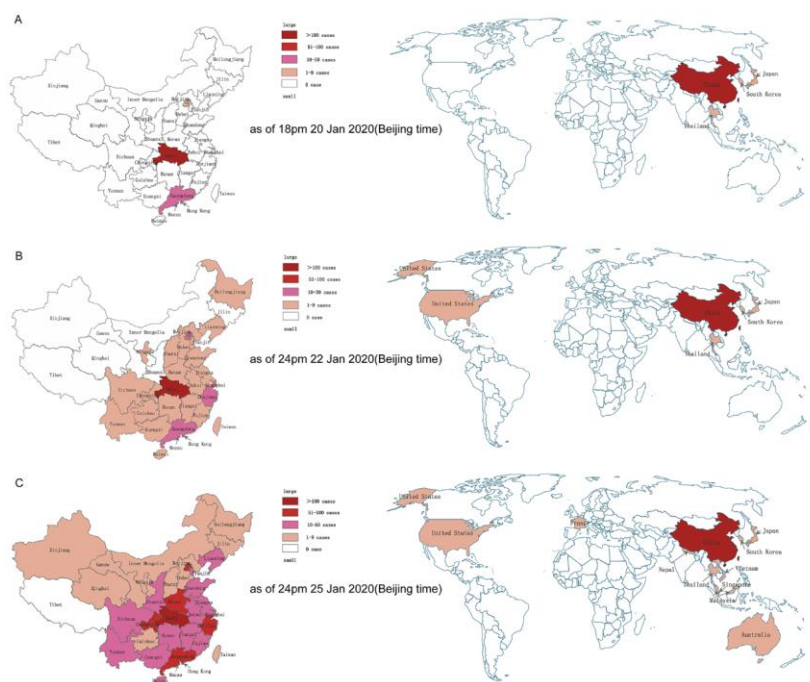


Table 1. Presentation of the increased cases of 2019-nCov infection up to 25 Jan 2020 at 24 pm (Beijing time)

| @ Date | Diag nose d case s in Chin a main land | Se ver e Ca ses | De ath s | Mor talit y | Susp ecte d Case s | Involved provinces/regions in China mainland | Othe r invo lved Chin ese regi ons | Other Count ries |
|-----------------------------------|--|---------------------------------|----------------|-------------------|------------------------------------|--|---|------------------------|
| #3 1 Dec 20 19 [1] | 27 | 7 | 0 | 0 | NA | Wuhan(27)/Hubei(27) | | NA |
| 10 Jan 20 20 [15] | 41 | 7 | 1 | 2.44 % | NA | Wuhan(41)/Hubei(41) | | NA |

| | | | | | | | | |
|--|-----|---------|--------|-----------|-----|--|---|---|
| *2 0 Jan 20 20 [16] | 217 | N A | N A | NA | 7 | Wuhan(198)/Hubei (198), Guangdong(14), Beijing(5) | | Thaila nd(2) , Japan(1), South Korea (1) |
| 21 Jan 20 20 [17] | 440 | 10 2 | 9 | 2.05 % | NA | Hubei(375), Guangdong(26), Beijing(10), Shanghai(9), Zhejiang(5), Chongqing(5), Sichuan(2), Jiangxi(2), Tianjin(2), Shandong(1) Henan (1), Hunan(1), Yunnan(1) | | Thaila nd(3), Japan(1), South Korea (1) |
| 22 Jan 20 20 [18 - 19] | 571 | 95 | 17 | 2.98 % | 393 | Hubei(444), Guangdong(26), Shanghai(16), Beijing(14), Zhejiang(10), Chongqing(6),Sichuan(5) , Henan (5), Guangxi(5), Hainan(4), Tianjin(4), Hunan(4),Jiangxi(2), | Hon g Kon g(1) , Mac au(1) , Tai | Thaila nd(3), Unite d States (1), Japan(1), |

| | | | | | | | | |
|--|-----|---------|----|-----------|----------|--|--|--|
| | | | | | | Liaoning(2), Shandong(2), Yunnan(1),Anhui(1), Fujian(1),Guizhou(1),Sh aanxi(1),Ningxia(1), Heilongjiang(1),Hebei(1) ,Jiangsu(1) The rest cases unlocated | wan(1) | South Korea (1) |
| 23 Jan 20 20 [20 - 21] | 830 | 17 7 | 25 | 3.01 % | 107 2 | Hubei(444), Guangdong(53), Zhejiang(27), Beijing(26), Shanghai(20), Anhui(15) , Guangxi(13),Hunan(9),C hongqing(9),Sichuan(8), Jiangxi(7), Shandong(6), Henan (5), Hainan(5), Tianjin(5), Fujian(5), Jiangsu(5),Heilongjiang(4), Liaoning(3), Guizhou(3), Shaanxi(3),Gansu(2), Xinjiang(2),Hebei(2), Yunnan(2), Shanxi(1),Ningxia(1),Jili n(1), | Hon g Kon g(2) , Mac au(2) , Tai wan(1) | Thaila nd(3), Unite d States (1), Japan(1), South Korea (1), Vietna m(1) , Singa pore(1) |

| | | | | | | The rest cases unlocated | | |
|--|------|---------|----|-----------|----------|---|---|---|
| 24 Jan 20 20 [22 - 23] | 1287 | 23 6 | 41 | 3.19 % | 196 5 | Hubei(729), Guangdong(78), Zhejiang(62), Chongqing(57), Hunan(43), Anhui(39),Beijing(36), Shanghai(33), Henan (32),Guangxi(23), Shandong(21),Jiangxi(18) ,Jiangsu(18),Sichuan(15) , Liaoning(12), Fujian(10), Heilongjiang(9),Hainan(8), Tianjin(8), Hebei(8), Shanxi(6), Yunnan(5),Shaanxi(5), Guizhou(4), Gansu(4), Jilin(3),Xinjiang(2), Ningxia(2), Inner Mongolia(1) The rest cases unlocated | Hon g Kon g(5) , Tai wan(3), Mac au(2) | Thaila nd(4), Singa pore(3) , Franc e(2), Unite d States (2), Japan(2), South Korea (2), Vietna m(2) , Nepal (1), |
| 25 Jan | 1975 | 32 4 | 56 | 2.84 % | 268 4 | Hubei(1052), Guangdong(78), Henan (83), | Hon g Kon | Thaila nd(4), |

| | | | | | | | | |
|-----|--|--|--|--|--|--------------------------|------|---------|
| 20 | | | | | | Hunan(69),Zhejiang(62), | g(5) | Singa |
| 20 | | | | | | Anhui(60), | , | pore(3 |
| [5, | | | | | | Chongqing(57), | Tai |), |
| 24] | | | | | | Beijing(51), | wan(| Malay |
| | | | | | | Shanghai(40), | 3), | sia(3), |
| | | | | | | Shandong(39),Jiangxi(36 | Mac | Franc |
| | | | | | |),Guangxi(33), | au(2 | e(3), |
| | | | | | | Sichuan(28), |) | Unite |
| | | | | | | Hainan(19),Jiangsu(18), | | d |
| | | | | | | Fujian(18),Liaoning(17), | | States |
| | | | | | | Shaanxi(15), | | (2), |
| | | | | | | Yunnan(11),Tianjin(10), | | Japan(|
| | | | | | | Shanxi(9),Heilongjiang(| | 2), |
| | | | | | | 9), Hebei(8), | | South |
| | | | | | | Guizhou(5), Gansu(4), | | Korea |
| | | | | | | Jilin(4),Xinjiang(3), | | (2), |
| | | | | | | Ningxia(3),Inner | | |
| | | | | | | Mongolia(2),Qinghai(1) | | |
| | | | | | | The rest cases unlocated | | Vietna |
| | | | | | | | | m(2) |
| | | | | | | | | , |
| | | | | | | | | Nepal |
| | | | | | | | | (1), |
| | | | | | | | | Austra |
| | | | | | | | | lia(1) |

@Data from the date were calculated as of 24 pm on that day (Beijing time) unless otherwise indicated.

#Data were firstly official announced on this day without a specific calculated deadline timepoint.

* Data from the date were calculated as of 18 pm on this day.

Reference 19, 21, 23 and 24 were used to demonstrate the distribution of infection nationwide on the respective date.

Reference 1, 5, 15, 16, 17, 18, 20 and 22 were responsible for the rest information presented on the respective date.

Table 2. Presentation of the first seventeen deaths of 2019-nCov cases up to 22 Jan 2020 24 pm at 24 pm (Beijing time)

| Case | Gender | Age, years | First symptom | Comorbidity | Surgery history | First symptom to death#, days |
|------|--------|------------|--|----------------------------|-----------------|-------------------------------|
| 1 | Male | 61 | Fever, cough and fatigue for 7 days | Liver cirrhosis, kyllonema | NA | 20 |
| 2 | Male | 69 | Fever, cough and anhelation for 4 days | Aortosclerosis | NA | 16 |

| | | | | | | |
|---|------|----|---|---|---|----|
| 3 | Male | 89 | Somnolence and obnubilation | Hypertension, cerebral infarction, encephalomalacia | NA | 10 |
| 4 | Male | 89 | Anhelation for 4 hours | Hypertension, diabetes mellitus, coronary heart disease, frequent ventricular premature beat | Coronary stent implantation | 6 |
| 5 | Male | 66 | Fever, cough, headache and fatigue for 6 days | Chronic obstructive pulmonary disease, hypertension, type 2 diabetes mellitus, chronic renal insufficiency, | Ascending aorta artificial aortic replacement, abdominal aortic stent implantation, cholecystectomy | 10 |
| 6 | Male | 75 | Fever, cough, expectorati | Hypertension | Hip replacement | 14 |

| | | | | | | |
|----|--------|----|--|--|----|----|
| | | | on for 5 days | | | |
| 7 | female | 48 | Fever, muscular soreness, fatigue, cough and expectoration | Diabetes mellitus, cerebral infarction | NA | 41 |
| 8 | Male | 82 | Chilly, muscular soreness for 5 days | NA | NA | 12 |
| 9 | Male | 66 | Dry cough for 9 days | NA | NA | 30 |
| 10 | Male | 81 | Fever for 3 days | NA | NA | 7 |
| 11 | Female | 82 | Fever, cough, chest tightness and fatigue for 3 days | Parkinson's disease | NA | 19 |

| | | | | | | |
|----|--------|----|---|---|-----------------------------------|----|
| 12 | Male | 65 | Anhelation and fatigue for 3 days | NA | NA | 13 |
| 13 | Female | 80 | Fever and cough for 9 days | Hypertension, diabetes mellitus, Parkinson's disease | NA | 11 |
| 14 | Male | 53 | Fever | NA | NA | 20 |
| 15 | Male | 86 | Fatigue for 7 days | Hypertension, diabetes mellitus, colon cancer | Colon cancer surgery | 19 |
| 16 | Female | 70 | Continuous high fever | NA | NA | 8 |
| 17 | Male | 84 | Fever, cough and anhelation for 3 days | Chronic bronchitis, unstable angina pectoris, hypertension, gastrointestina l bleeding, renal insufficiency, | Coronary stent implantation | 16 |

| | | | | | | |
|---------|---------------------|-------------------|---|--|------------------------------------|-------------------|
| | | | | hyperlipidemia, hyperuricemia, lacunar cerebral infarction | | |
| Summary | Male:13 Female:4 | *75(range, 48-89) | Top 2 symptoms Fever: 11(64.7%) Cough: 9(52.9%) | Eleven patients had comorbidities | Five patients had surgery history. | *14 (range, 6-41) |

#This was estimated and calculated from first symptom to death.

* Variables were expressed as median and range.

NA Not available