



## Review Article



# Epidemiology and Clinical Characteristics of COVID-19

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## Abstract

Since December 2019, there has been an outbreak of a novel coronavirus (COVID-19) infection in Wuhan, China. Meanwhile, the outbreak also drew attention and concern from the World Health Organization (WHO). COVID-19 is another human infectious disease caused by coronavirus. The transmission of COVID-19 is potent and the infection rate is fast. Since there is no specific drug for COVID-19, the treatment is mainly symptomatic supportive therapy. In addition, it should be pointed out that patients with severe illness need more aggressive treatment and meticulous care. Recently, accurate RNA detection has been decisive for the diagnosis of COVID-19. The development of highly sensitive RT-PCR has facilitated epidemiological studies that provide insight into the prevalence, seasonality, clinical manifestations and course of COVID-19 infection. In this review, we summarize the epidemiology and characteristics of COVID-19.

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## Introduction

In early December 2019, an outbreak of unexplained pneumonia occurred in Wuhan, Hubei Province.<sup>1-2</sup> Since the outbreak of the new coronavirus pneumonia, with the rapid spread in the country and even the world, the number of infected cases has grown exponentially. The rapid spread of COVID-19 has attracted worldwide attention, and the World Health Organization (WHO)<sup>1, 3</sup> has identified it as a public health emergency of international concern. The incubation period for this disease is generally 1–14 days.<sup>4</sup> The disease usually begins with simple respiratory symptoms described as fever and cough for 2–3 days. Human challenge studies confirmed that COVID-19 causes upper respiratory disease and immune responses. Recent developments in RT-PCR for COVID-19 detection have given rise to a greater understanding of the clinical characteristics and molecular epidemiology of COVID-19.<sup>5</sup> Since most of the patients with the earliest onset had been exposed to the south China seafood market in Wuhan, it was widely believed that COVID-19 originated from wild animals sold in the market. Shi et al<sup>6</sup> reported that the natural host of COVID-19 might be bats; the team found that the full genome sequence of the COVID-19 obtained from the confirmed patient was 96% similar to the bat coronavirus, and it was also demonstrated that COVID-19 acts on the receptor angiotensin-converting enzyme 2 through the same cells as severe acute respiratory syndrome coronavirus (SARS-CoV). However, the relevant research on COVID-19 is not

complete yet. In this review, we review the epidemiology and clinical characteristics of COVID-19.

## Virus Forms and Structure

The coronavirus is a single-stranded RNA virus with a diameter of 80 ~120 nm. It consists of four types, namely  $\alpha$ -CoV,  $\beta$ -CoV,  $\delta$ -CoV and  $\gamma$ -CoV.<sup>7</sup> Bats are the most important natural hosts. About 35% of the viruses they carry are coronaviruses, from which at least a dozen different coronaviruses have been identified so far.<sup>8</sup> The COVID-19 was a novel class coronavirus with a circular or elliptical shape and a diameter of 60-140 nm.<sup>7-9</sup> The typical coronavirus particle structure was observed under electron microscopy. Current studies have shown a 96.3% homology with the bat SARS-like coronavirus (BatCoV RaTG13), suggesting that bats may be the natural host for COVID-19.

## Epidemiological and Clinical Characteristics

### Methods of Detection

Seropositive studies provide key insight into the epidemiology of COVID-19, but there are limitations including the limited ability to determine the time of infection. This makes it difficult to identify and count mild and asymptomatic infections.<sup>10</sup>

### Seroepidemiology

Previous studies have shown that viral RNA can be found in the plasma or serum of patients with SARS-

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COV, MERS-COV or SARS-COV-2 at different periods after the onset of disease.<sup>11</sup> However, polymerase chain reaction (PCR) detection of viral RNA is not equivalent to detection of a complete infectious virus.<sup>12</sup> As more and more asymptomatic infections are found in COVID-19 cases, blood safety should be considered. At the same time, current studies suggest that people are generally susceptible to COVID-19, and the severity of COVID-19 is positively correlated with age and underlying diseases (hypertension, diabetes, cardiovascular disease, etc.), which is similar to the situation with SARS and Middle East respiratory syndrome (MERS) infection. To sum up, COVID-19 has strong transmission capacity and a large base of susceptible population. So, it is necessary to take actions as soon as possible to avoid larger scale spread. The final cause of death for many patients may be acute respiratory distress syndrome, according to the chief export of the acute respiratory care department at Zhongnan hospital of Wuhan university.<sup>3</sup> For COVID-19, people of all ages, with or without immunity, may progress to the critical stage of acute respiratory distress syndrome. Admittedly, the mechanics of ARDS are unclear. Since there is no specific drug for COVID-19, treatment is concentrated on symptomatic support. In addition, it is important to emphasize that severe patients need more aggressive treatment and meticulous care.

#### COVID-19 in Adults

At the same time, current studies suggest that the population is generally susceptible to COVID-19, and the severity of the disease is positively correlated with age and underlying diseases (hypertension, diabetes, cardiovascular disease, etc.) This is similar to what happened with SARS and MERS. Huang et al<sup>1</sup> reported the first 41 cases of COVID-19 diagnosed in Wuhan, among which 27 cases (66%) had a history of exposure to the seafood market in southern China, and one case had familial clustering. This report first mentioned that COVID-19 may have human-to-human transmission characteristics. Subsequently, Chen et al<sup>12</sup> observed 99 patients with COVID-19 in the same hospital, and found that elderly men with close contacts and underlying diseases were more likely to be infected, which could rapidly progress to severe respiratory diseases such as acute respiratory distress syndrome (ARDS) and even become life-threatening.

#### COVID-19 in Children

A number of studies have focused on pediatric populations. As children's immune function is not mature, they are susceptible to respiratory system infections, and their symptoms are more diversified, so the formation of antibodies and cross-immunity and other problems is easy to be missed. With the spread of the epidemic, the number of children gradually increased. The infection affected premature infants and infants, and now there are severe

cases of children.<sup>14</sup> At present, most of the confirmed cases of children are declared to be cluster disease, i.e. "second-generation" infection, and no clear reports of children as the source of adult infection have been found. Beijing, Guangdong and other places have seen a number of cases of children infected with the new coronavirus, especially on January 26, 2020, when a 9-month-old infant in Beijing was infected through close family contact.<sup>14</sup> The transmission route in children is, similar to adults, mainly by contact and respiratory droplets. Finding that most of the infected children have aggregation, aerogel transmission may also play a significant role in transmission. Careful monitoring of the developmental stages of mothers who become pregnant due to COVID-19 infection is needed, as adverse maternal and child outcomes of COVID-19 pregnancies persist, and public health system surveillance of the impact on infants and children is critical.

#### Seasonality

Although outbreaks and familial sexual transmission cases have been described, little is known about the seasonality of COVID-19.<sup>15</sup> The scientists report that the new coronavirus is most likely to become a seasonal respiratory disease based on its current infectivity and lethality. McGraw, a professor of infectious diseases at Penn state university, believes that COVID-19 is more seasonal.<sup>16</sup> It becomes more active in winter, when it enters people's bodies by droplets, and it spreads faster in cold and dry air. Normal seasonal viruses usually cannot withstand high temperatures, so once summer arrives, the virus has basically zero infectivity when taken. On the other hand, infectious disease expert Amesh Adalja disagrees with McGraw, arguing that the evidence suggests it is not seasonal because we have not seen the time of spring and summer, and although its symptoms are somewhat similar to seasonal flu that does not mean that it is really a seasonal virus. Admittedly, the seasons can affect it, but they do not necessarily make it disappear. As we all know, our country is in the northern hemisphere; spring temperatures are mild, which helps spread virus. However, there have also been confirmed cases across the ocean in the southern hemisphere, suggesting that the virus is resistant. However, as the seasons change, it is possible that the epidemic situation in China may weaken and the crisis in the countries of the southern hemisphere may intensify, although we do not know yet. Therefore, it is too early to say whether the new coronavirus is seasonal. We do not know much about it, there is no data to carry out a comprehensive analysis, and everything should be rigorous.

#### Clinical Characteristics

COVID-19 is usually associated with respiratory disease. The most common symptoms associated with COVID-19 infection are fever, stuffy nose, and cough; However, the

**Table 1.** Summary of Clinical Characteristics of Patients Infected with COVID-19

Author	Study Location	Age Range	Median Age (y)	No. Patients	Fever (%)	Rhinorrhea (%)	Cough (%)	Fatigue (%)	Headache (%)	Diarrhea (%)	Chest Tightness /Dyspnea (%)
Zhao et al, 2020 <sup>17</sup>	Guangxi, China	11–68	45	28	18 (64)	2 (7)	12 (43)	7 (25)	4 (14)	NA	3 (11)
Yu et al, 2020 <sup>18</sup>	Guangzhou, China	33–62	50	91	70 (77)	NA	57 (63)	19 (21)	11 (12)	5 (5)	5 (5)
Chen et al, 2020 <sup>19</sup>	Wuhan, China	26–79	56	29	28 (97)	NA	21 (72)	12 (41)	2 (7)	4 (14)	17 (59)
Liu et al, 2020 <sup>20</sup>	Shenzhen, China	10–72	63	12	10 (83)	NA	11 (92)	NA	0 (0)	2 (17)	NA
Tian et al, 2020 <sup>21</sup>	Beijing, China	1–94	48	262	215 (82)	NA	120 (46)	69 (26)	17 (6)	NA	18 (7)
Wang et al, 2020 <sup>22</sup>	Wuhan, China	42–68	56	138	136 (99)	NA	82 (59)	96 (70)	9 (7)	14 (10)	43 (31)
Liu et al, 2020 <sup>23</sup>	Wuhan, China	43–66	55	109	90 (83)	NA	67 (61)	62 (57)	NA	12 (11)	NA
Xu et al, 2020 <sup>24</sup>	Zhejiang, China	32–52	41	62	48 (77)	NA	50 (81)	32 (52)	21 (34)	3 (5)	NA
Chen et al, 2020 <sup>12</sup>	Wuhan, China	21–82	56	99	82 (83)	4 (4)	81 (82)	NA	8 (8)	2 (2)	2 (2)
Yang et al, 2020 <sup>4</sup>	Wuhan, China	NA	60	52	51 (98)	3 (6)	40 (77)	NA	3 (6)	NA	1 (2)

virus has been associated with pneumonia.<sup>14</sup> Symptoms of clinical characteristics in patients infected with COVID-19 are frequently reported (Table 1).

Currently, it is believed that people are generally susceptible to COVID-19, including pregnant women and children. Most studies suggest that older middle-aged people are more predisposed to COVID-19 (median age of onset is about 55 years).<sup>24</sup> Adults with COVID-19 infection most commonly manifest fever, cough and fatigue, which in some patients can be accompanied by runny nose, headache and other symptoms. Additional symptoms such as diarrhea are less common. Respiratory viruses can interact with each other and some bacteria may affect susceptibility to acute respiratory diseases, especially in patients with underlying immune deficiencies or chronic respiratory diseases, such as chronic obstructive pulmonary disease or cystic fibrosis.

In conclusions, the recent COVID-19 outbreak has been deemed a global health emergency. Internationally, the number of confirmed reports continue to rise.<sup>25</sup> At present, China has listed COVID-19 as a class b infectious disease stipulated by the law on prevention and treatment of infectious diseases, and adopted an infectious disease prevention. The basic strategy for controlling the epidemic is early detection, early isolation, early diagnosis and early treatment. COVID-19 cases are insidious and transmissible in the incubation period, and multiple clusters have been reported in China. The causal role of COVID-19 in these cases is therefore uncertain and larger studies are needed in the future to describe the prevalence, clinical characteristics and course of the disease.<sup>26</sup>

#### Authors' Contribution

All authors contributed significantly to both the study and the

manuscript. XH contributed to the data collection, data analysis and wrote the draft of the manuscript. LH and LW prepared this manuscript for publication. FW and KC took responsibility for the integrity of the data analysis, and KC reviewed the manuscript. All authors read and approved the final manuscript.

#### Conflict of Interest Disclosures

The authors declare that they have no competing interests.

#### Ethical Statement

The study was conducted as per the ethical principles of the Helsinki Declaration.

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#### References

- Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5.
- Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*. 2020 Feb 28. doi: 10.1056/NEJMoa2002032.
- Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. *J Med Virol*. 2020;92(4):441-447. doi: 10.1002/jmv.25689.
- Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respir Med*. 2020 Feb 24. pii: S2213-2600(20)30079-5. doi: 10.1016/S2213-2600(20)30079-5.
- Sederdahl BK, Williams JV. Epidemiology and Clinical Characteristics of Influenza C Virus. *Viruses*. 2020;12(1):E89. doi: 10.3390/v12010089.
- Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020;579(7798):270-273. doi: 10.1038/s41586-020-2012-7.

7. Su S, Li X, Hao H, Wang XY, Zhang MM, Geng H, et al. Advances in research on SARS-CoV-2. *Journal of Xi'an Jiaotong University*. 2020. Available from: <http://kns.cnki.net/kcms/detail/61.1339.R.20200224.0944.010.html>.
8. Yang X, Miao C, Jin M, Jin M, Zhou D, Zhuang J, et al. Current status and progress of 2019 novel coronavirus pneumonia. *Chinese Crit Care Med*. 2020; 32(2):2095-4352. doi: 10.3760/cma.j.issn.2095-4352.2020.02.000.
9. Chang L, Yan Y, Wang L. Coronavirus Disease 2019: Coronaviruses and Blood Safety. *Transfus Med Rev*. 21 February 2020. doi: 10.1016/j.tmr.2020.02.003
10. Ling L, Joynt GM, Lipman J, Constantin JM, Joannes-Boyau O. COVID-19: a critical care perspective informed by lessons learnt from other viral epidemics. *Anaesth Crit Care Pain Med*. 2020. doi: 10.1016/j.accpm.2020.02.002.
11. Wang Y, Kang H, Liu X, Tong Z. Combination of RT-qPCR Testing and Clinical Features For Diagnosis of COVID-19 facilitates management of SARS-CoV-2 Outbreak. *J Med Virol*. 2020 Feb 25. doi: 10.1002/jmv.25721.
12. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020;395(10223):507-513. doi: 10.1016/S0140-6736(20)30211-7.
13. Rasmussen SA, Smulian JC, Lednický JA, Wen TS, Jamieson DJ. Coronavirus Disease 2019 (COVID-19) and Pregnancy: What obstetricians need to know. *Am J Obstet Gynecol*. 2020 Feb 24. pii: S0002-9378(20)30197-6. doi: 10.1016/j.ajog.2020.02.017.
14. Fang F, Luo X. Facing a major outbreak of new coronavirus infections in 2019: thoughts of pediatricians [J]. *Chinese Journal of Pediatrics*. 2020;58(2):81-85. doi: 10.3760/cma.j.issn.0578-1310. 2020.02.001.
15. Rodriguez-Morales AJ, MacGregor K, Kanagarajah S, Patel D, Schlagenhauf P. Going global - Travel and the 2019 novel coronavirus. *Travel Med Infect Dis*. 2020;33:101578.
16. Khan S, Ali A, Siddique R, Nabi G. Novel coronavirus is putting the whole world on alert. *J Hosp Infect*. 2020. doi: 10.1016/j.jhin.2020.01.019.
17. Zhao R, Liang Y, Lin Y, Lu N, Li Q, Li Y, et al. Clinical characteristics of 28 patients with novel coronavirus pneumonia. *Chinese J Infect Dis*. doi: 10.3760/cma.j.issn.1000-6680.2020.02.000.
18. Yu C, Zhai J, Zhang L, Jiang S, Chen B, Guan W, et al. High resolution CT findings and clinical features of novel coronavirus pneumonia in Guangzhou. *Chinese Journal of Radiology*. doi: 10.3760/cma.j.issn.1005-1201.2020.0010.
19. Chen L, Liu H., Liu W, Liu J, Liu K. Analysis of clinical features of 29 patients with 2019 novel coronavirus pneumonia. *Chinese Journal of Tuberculosis and Respiratory Diseases*. 2020. doi: 10.3760/cma.j.issn.1001-0939.2020.0005.
20. Liu Y, Yang Y, Zhang C, Huang F, Wang F. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. *Sci China Life Sci*. 2020. doi: 10.1007/s11427-020-1643-8.
21. Tian S, Hu N, Lou J, Chen K, Kang X, Xiang Z, et al. Characteristics of COVID-19 infection in Beijing. *J Infect*. 2020. doi: 10.1016/j.jinf.2020.02.018.
22. 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. doi: 10.1001/jama.2020.1585.
23. Liu Y, Sun W, Li J, Chen L, Wang Y, Zhang L, et al. Clinical features and progression of acute respiratory distress syndrome in coronavirus disease 2019. *MedRxiv*. 2020. doi: 10.1101/2020.02.17.20024166.
24. Xu XW, Wu XX, Jiang XG, Xu KJ, Ling 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. doi: 10.1136/bmj.m606
25. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir a, et al. World Health Organization declares Global Emergency: A review of the 2019 Novel Coronavirus (COVID-19). *Int J Surg*. 2020. doi: 10.1016/j.ijsu.2020.02.034.
26. Noori A, Shokoohi M, Moazen B, Moradi Gh, Naderimagham Sh, Hajizadeh Sh, et al. National and sub-national burden of infectious diseases in Iran, 1990 to 2013: The study protocol. *Arch Iran Med*. 2014;17(3):169-175.