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Epidemiology for covid -19: : literature of Review

A report
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By
Mariam H. Saleh
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Supervisor
Dr. Ayad Q. Mahdi
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Abstract

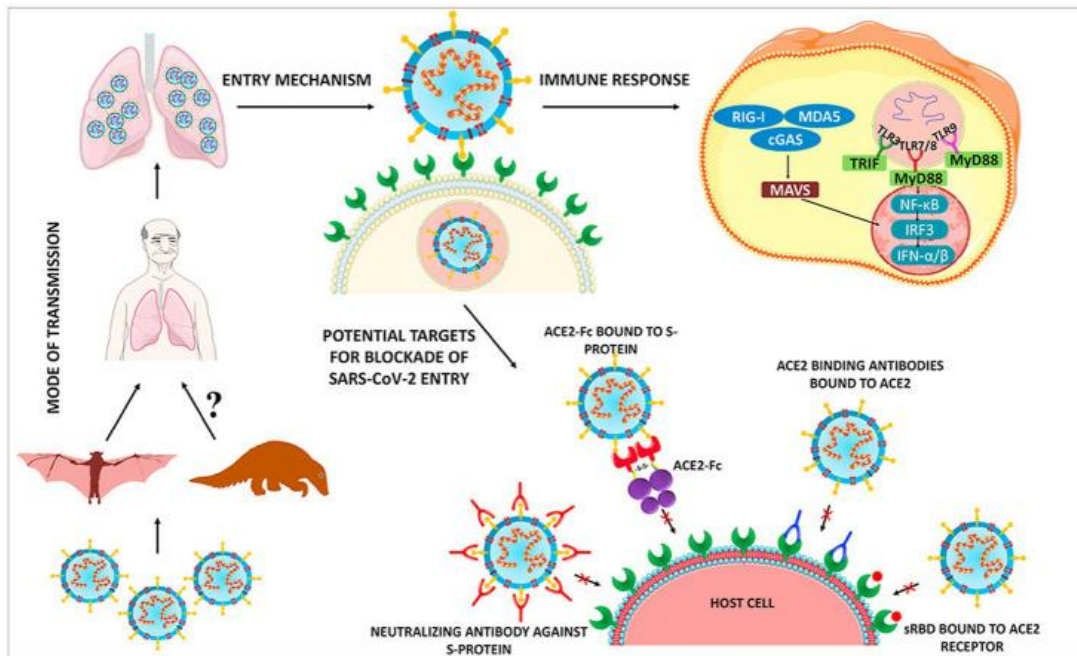
A Coronavirus disease 2019 (COVID-19) causing serious respiratory illness such as pneumonia and lung failure was firstly reported in Wuhan city, the capital of Hubei, China.

The etiological agent of COVID-19 has been confirmed as a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is most likely transmitted from zoonotic coronaviruses, similar to SARS-CoV previously emerged in 2002. Within a few months of the first report, SARS-CoV-2 has spread across China and worldwide, reaching a pandemic level.

As COVID-19 has triggered enormous human casualties and serious economic loss posing global threats, it is urgent to understand the ongoing situation and to build strategies to contain the viral spread. Currently, various diagnostic kits for testing COVID-19 are available and several repurposing therapeutics for COVID-19 have shown to be clinically effective. In addition, global institutions and

companies have begun to develop vaccines for the prevention of COVID-19. Here, we review current status of epidemiology, diagnosis, treatment, and vaccine development for the COVID-19.

Graphical abstract



Introduction

In **December 2019**, cases of serious illness causing pneumonia and death were first reported in Wuhan, the capital of Hubei, China. Soon after, the number of cases soared dramatically, spreading across China and worldwide. As of **March 25**, more than 400,000 cases of the disease have been confirmed with over 18,000 deaths.

The causative agent of the disease has been confirmed as a novel coronavirus (CoV). The World Health Organization (WHO) announced the official name of the disease as “coronavirus disease 2019 (COVID-19)” and now publicly refers to the

virus as “the COVID-19 virus” (formerly known as “2019-nCoV”, or “Wuhan Coronavirus”). Analysis of the viral genome has revealed that the new coronavirus is phylogenetically close to severe acute respiratory syndrome coronavirus (SARS-CoV) [Lu R, et al.2020], the causative agent of a viral outbreak in 2002.

Thus, the new coronavirus has been named “SARS-CoV-2” by the International Committee on Taxonomy of Viruses (ICTV) and other virologists [Gorbalenya AE et al.2020].

Coronaviruses are enveloped, positive-sense single-stranded viruses ((+)ssRNA virus) belonging to the family Coronaviridae. Most coronaviruses have 8-10 open reading frames (ORFs). ORF1a and ORF1b are translated into polyprotein 1a (pp1a) and pp1ab, which are processed by viral proteases to produce 16 non-structural proteins containing RNA-dependent RNA polymerase enzyme (RdRp).

The viral RNA is replicated through transcription of a minus-strand template by RdRp. During replication, coronaviruses generate 6-9 subgenomic mRNAs (sgmRNAs), which lead to translation of accessory and structural proteins from downstream ORFs [Sola I 2015]. Spike (S), envelope (E), membrane (M), and nucleocapsid (N) proteins, necessary for completion of a viral replication cycle, are translated from sgmRNAs [Fehr AR 2015]

Many coronaviruses are known to infect humans and various animals. In general, 15-30% of common colds are caused by human coronaviruses (HCoVs) including HCoV-229E, HCoV-NL63, HCoV-OC43, and HCoV-HKU1 [Fung TS 2019]. However, some coronaviruses from animal reservoirs can be transmitted to humans causing outbreaks in the human population.

The SARS-CoV outbreak in 2002 originated from bats in China [Li W et al. 2005] and the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2012 from dromedary camels, though also likely transmitted from bats, in the Middle East [Corman VM et al. 2014]. Although the origin of the SARS-CoV-2 outbreak has not yet been identified, it has been reported that SARS-CoV-2 might be transmitted by bats [Zhou P et al. 2020], snakes [Ji W 2020], or pangolins [Liu P

2019]. Unlike HCoVs, these zoonotic viruses infect both humans and various animals and cause severe respiratory illnesses such as acute respiratory distress syndrome (ARDS) and pneumonia, leading to death [*GrahamRI 2013,PierisJS et al 20030*]. The symptoms of COVID-19 are more severe in older age groups with comorbidities, while allergic diseases, asthma, and chronic obstructive pulmonary disease (COPD) are also risk factors [*Yang X et al2020,ZhangJJ*].

Since 2000, various zoonotic coronaviruses have been circulating in the animal reservoir [*Liu P2019,WongACP 2019*]. Particularly, MERS became endemic in Saudi Arabia and other Middle Eastern countries [*WillmanM2019,Reusken CB et al2016*]. At this point, we cannot exclude the possibility of other coronavirus outbreaks in the future. The following is a review of the current status of epidemiology, diagnosis, therapeutics, and vaccines against COVID-19 and related coronaviruses.

Epidemiology

The number of COVID-19 cases reported to the WHO has been growing since the first report of COVID-19 in December 2019 from the WHO China Country Office(*Accessed 28 Feb. 2020*.)The infection began to spread from the Huanan seafood wholesale market in Wuhan, China, while the exact infection route of the first case remains unclear.

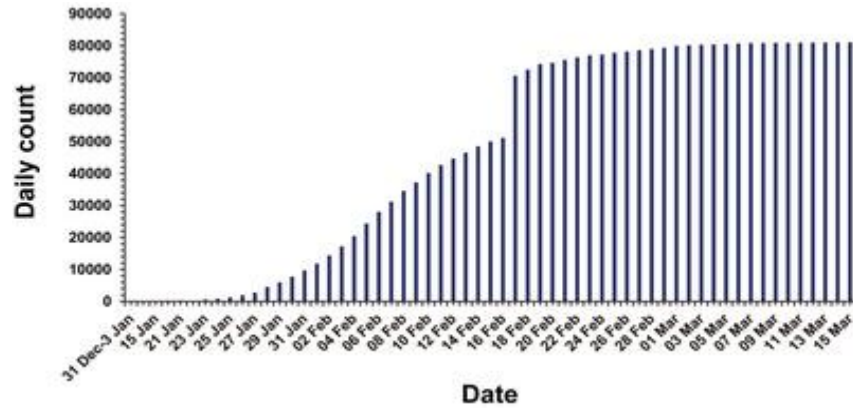
- The number of confirmed cases in China grew until mid-*February 2020*.
- Then, the number of daily new cases in China started to decrease from late-*February 2020* (**Fig. 1**).

A sudden increase of the cases in China on *February 17* is due to the change in COVID-19 diagnostic criteria.

At the time of writing (*March 19, 2020*), COVID-19 cases continue to be reported globally from over 170 countries. As of *March 15, 2020*, 153,517 laboratory-confirmed COVID-19 cases with 5,735 deaths (*approximately 3.8% mortality*) have

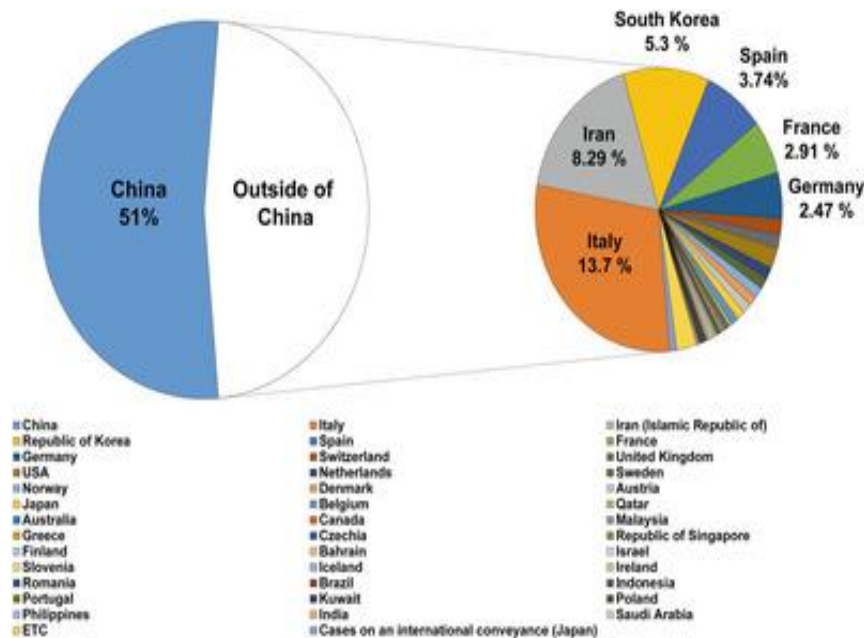
been reported according to WHO. (Accessed 02 Mar. 2020., Accessed 19 Mar. 2020) (Fig. 2).

Fig.1.Cumulative confirmed cases of COVID-19 in China, as of 15 March, 2020. Sudden increase of the cases in China on February 17 is due to the change in COVID-



19 diagnostic criteria.

Fig.2. Global distribution of COVID-19 confirmed cases, as of 15 March, 2020. Distribution of the confirmed cases of COVID-19 in each country is presented in the diagram.



In the early stages of the global COVID-19 spread, the cases identified outside of China were mostly travelers who were infected in China and then traveled to

areas outside of China. Countries outside of China that reported travel-associated COVID-19 cases were Singapore, Japan, Republic of Korea, Malaysia, Vietnam, Australia, United States of America, Germany, etc. [In the early stages of the global COVID-19 spread, the cases identified outside of China were mostly travelers who were infected in China and then traveled to areas outside of China. Countries outside of China that reported travel-associated COVID-19 cases were Singapore, Japan, Republic of Korea, Malaysia, Vietnam, Australia, United States of America, Germany, etc. [(Accessed 02 Mar 2020)].

Unfortunately, COVID-19 has begun to spread domestically in South Korea, Italy, Iran, and Japan from mid-*February 2020* [(Accessed 28 Feb. 2020)](*Fig.3*).

Particularly, in the Republic of Korea, the spread of COVID-19 had been well managed until mid-February.

The number of confirmed cases in South Korea was 31 on *February 18, 2020* [(Accessed 28 Feb. 2020.)] and most of these cases were travelers the event as of *February* from China or their close contacts. However, COVID-19 infections among a religious group in the Daegu metropolitan area and a nearby hospital triggered a sudden spread to other major domestic cities in South Korea in mid-February (*Fig.4*).

As a result, a week later, the confirmed cases soared to 763 and 74.6% of those cases were tied to *24, 2020*) [(24 Feb 2020)].

On *March 1*, the total number of confirmed cases reached 3,526, among which 59.5% belonged to the religious group-related cases [01 Mar 2020).

Fig.3.cumulative confirmed cases of COVID-19 outside of China, as of 15 *March, 2020*.

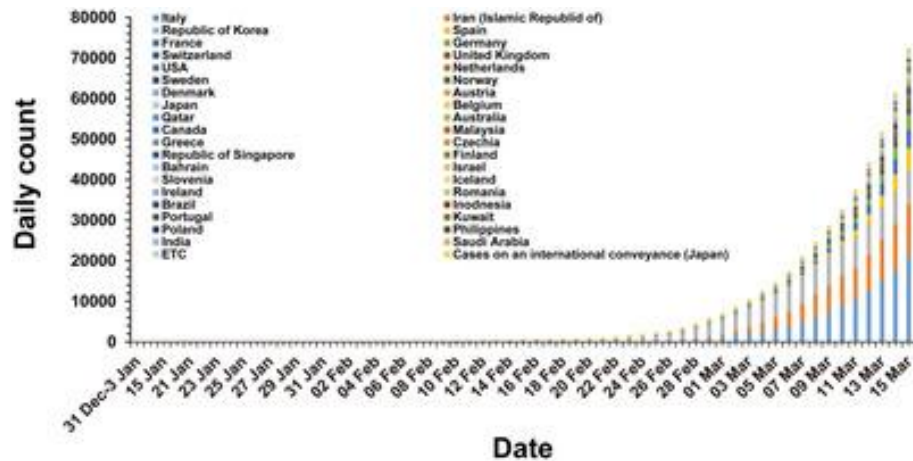
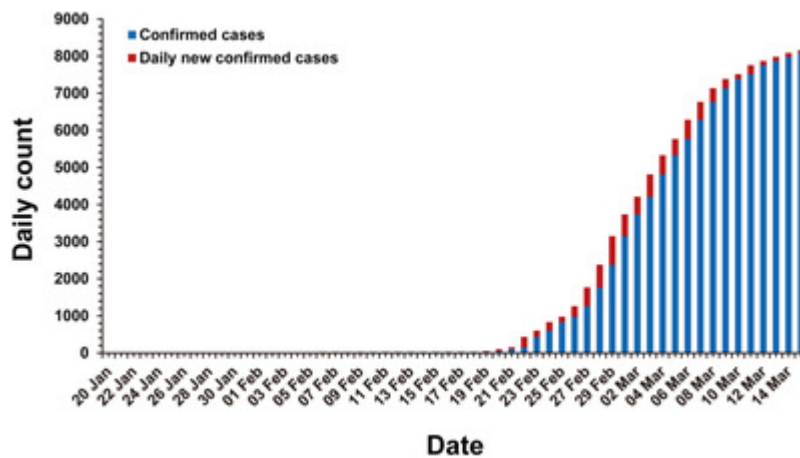


Fig.4. Cumulative confirmed cases of COVID-19 in South Korea, as of 15 March, 2020. Blue bar represents the cumulative confirmed cases before the indicated date. Red bar represents the newly confirmed cases at the indicated date.



The mortality rate of SARS-CoV-2 (3.8%) [COVID-19] is lower than that of SARS-CoV (10%) [Accessed 28 Feb. 2020.] or MERS-CoV (37.1%) [(MERS-CoV), November 2019], but the number of relative infection cases is more than 10 times higher.

Accumulating reports revealed that SARS-CoV-2 can be transmitted from people who are asymptomatic or have mild infections [Pan X2020- Rothe C2020].

These features may explain the sudden epidemic spreading of the virus.

References

- **Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, et al. 2020. Presumed Asymptomatic Carrier Transmission of COVID-19. JAMA. doi: 10.1001/jama.2020.2565. [Epub ahead of print].**
- **Corman VM, Ithete NL, Richards LR, Schoeman MC, Preiser W, Drosten C, et al. 2014. Rooting the phylogenetic tree of middle East respiratory syndrome coronavirus by characterization of a conspecific virus from an African bat. J. Virol. 88: 11297-11303**
- **Did pangolins spread the China coronavirus to people? Available from <https://www.nature.com/articles/d41586-020-00364-2#ref-CR1>. Accessed 28 Feb 2020**
- **Fehr AR, Perlman S. 2015. Coronaviruses: an overview of their replication and pathogenesis. Methods Mol. Biol. 1282: 1-23**
- **Fung TS, Liu DX. 2019. Human coronavirus: host-pathogen interaction. Annu. Rev. Microbiol. 73: 529-557.**
- **Graham RL, Donaldson EF, Baric RS. 2013. A decade after SARS: strategies for controlling emerging coronaviruses. Nat. Rev. Microbiol. 11: 836-848.**
- **Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et al. 2020. Severe acute respiratory syndrome-related coronavirus: the species and its viruses -a statement of the coronavirus study group. BioRxiv. 20200207: 937862.**
- **Ji W, Wang W, Zhao X, Zai J, Li X. 2020. Cross-species transmission of the newly identified coronavirus 2019-nCoV. J. Med. Virol. 92: 433-440.**
- **KCDC COVID-19 situation reports in South Korea (24 Feb 2020). Available from https://www.cdc.go.kr/board/board.es?mid=a20501000000&bid=0015&act=view&list_no=366324&tag=&nPage=1. Accessed 28 Feb. 2020.**
- **KCDC COVID-19 situation reports in South Korea (18 Feb 2020). Available from https://www.cdc.go.kr/board/board.es?mid=a20501000000&bid=0015&act=view&list_no=366228&tag=&nPage=3. Accessed 28 Feb. 2020.**
- **KCDC COVID-19 situation reports in South Korea (01 Mar 2020). Available from https://www.cdc.go.kr/board/board.es?mid=a20501000000&bid=0015&act=view&list_no=366410&tag=&nPage=1. Accessed 02 Mar. 2020.**
- **Liu P, Chen W, Chen JP. 2019. Viral Metagenomics Revealed Sendai Virus and Coronavirus Infection of Malayan Pangolins (*Manis javanica*). Viruses 11. pii: E979.**

- **Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. 2020. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet* 395: 565-574.**
- **Peiris JS, Lai ST, Poon LL, Guan Y, Yam LY, Lim W, et al. 2003. Coronavirus as a possible cause of severe acute respiratory syndrome. *Lancet* 361: 1319-1325.**
- **Reusken CB, Schilp C, Raj VS, De Bruin E, Kohl RH, Farag EA, et al. 2016. MERS-CoV infection of alpaca in a region where MERS-CoV is endemic. *Emerg. Infect. Dis.* 22: 1129-1131.**
- **Rothe C, Schunk M, Sothmann P, Bretzel G, Froeschl G, Wallrauch C, et al. 2020. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *N. Engl. J. Med.* 382: 970-971.**
- **Pan X, Chen D, Xia Y, Wu X, Li T, Ou X, et al. 2020. Asymptomatic cases in a family cluster with SARS-CoV-2 infection. *Lancet Infect. Dis.* pii: S1473-3099.**
- **Peiris JS, Lai ST, Poon LL, Guan Y, Yam LY, Lim W, et al. 2003. Coronavirus as a possible cause of severe acute respiratory syndrome. *Lancet* 361: 1319-13.**
- **Sola I, Almazan F, Zuniga S, Enjuanes L. 2015. Continuous and discontinuous RNA synthesis in coronaviruses. *Annu. Rev. Virol.* 2: 265-288.**
- **WHO Novel Coronavirus (2019-nCoV) SITUATION REPORT - 1 21 JANUARY 2020. Available from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4. Accessed 28 Feb. 2020.**
- **WHO Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Available from <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>. Accessed 02 Mar. 2020.**
- **WHO Coronavirus disease 2019 (COVID-19) Situation Report - 55 (15 Mar 2020). Available from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200315-sitrep-55-covid-19.pdf?sfvrsn=33daa5cb_8. Accessed 19 Mar. 2020.**
- **WHO Coronavirus disease 2019 (COVID-19) Situation Report - 26 (15 Feb 2020). Available from https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200215-sitrep-26-covid-19.pdf?sfvrsn=a4cc6787_2. Accessed 02 Mar 2020.**
- **WHO Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. Available from https://www.who.int/csr/sars/country/table2004_04_21/en/. Accessed 28 Feb. 2020.**
- **WHO Middle East respiratory syndrome coronavirus (MERS-CoV) monthly summary, November 2019. Available from <https://www.who.int/emergencies/mers-cov/en/>. Accessed 28 Feb. 2020**

- **Willman M, Kobasa D, Kindrachuk J. 2019. A comparative analysis of factors influencing two outbreaks of Middle Eastern respiratory syndrome (MERS) in Saudi Arabia and South Korea. *Viruses* 11. pii: E1119.**
- **Wong ACP, Li X, Lau SKP, Woo PCY. 2019. Global epidemiology of bat coronaviruses. *Viruse* 11.**
- **Yang X, Yu Y, Xu J, Shu H, Xia Ja, Liu H, et al. 2020. 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.* pii: S2213-2600(20)30079-5.**
- **Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, et al. 2020. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy*. doi: 10.1111/all.14238. [Epub ahead of print].**

