

Corona Virus: A Novel Outbreak

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In December 2019, a new pneumonia case emerged in the Wuhan, Hubei province of China which had an association with the novel CoronaVirus (2019-nCoV). Most of the diagnosed cases had exposure to the Huanan seafood market. The present case is the successor of three earlier similar cases of Coronavirus known as SARS-Corona (Severe Acute Respiratory Syndrome) Virus and MERS-Corona Virus (Middle Eastern Respiratory Syndrome). The origin of the epidemic is still unknown and a lot of other uncertainties hinders the development of vaccines for the virus. As studies suggest that this virus is an evolution of SARS virus concerns are growing around the world as death toll has already surpassed that of SARS virus. This paper explores about the coronavirus, its relation to the similar SARS and MERS virus, its outreach and global impact according to the current scenario.

Keywords: Corona Virus; Gammacoronavirus; Deltacoronavirus.

In December 2019, an epidemic was witnessed in Wuhan, Hubei province of China. As the spread and the death toll is increasing day by day in China, the reports of spread and deaths by this virus in other countries remain very low due to quick and early restriction imposed on travelling. Due to such measures the scale of the outbreak has been contained. It is being predicted that this virus is less infectious than Severe Acute Respiratory Syndrome (SARS) virus which also appeared in China in 2002 but the death toll due to corona virus has already surpassed the SARS virus^{1,2,3}. All the parameters deciding outreach, spread and fatality of

the 2019-nCoV virus are almost similar to those of SARS virus. 2019-nCoV virus has a transmission rate of 3-4 person from a newly infected person. The current fatality rate is less than 3 percent but is alarming, considering the population of the area where the outbreak happened. The incubation period lies between 2 to 14 days and since it is a novel virus, some of its properties are unknown which also hinders the development of a vaccine in near future. According to recent reports as much as 28 countries are affected by this virus and numerous efforts are being made by every country to contain the virus by developing separate

quarantined regions for infected people and cutting off their contact to the outside world fully. Although, this virus is currently being associated with China, there are two special cases from Japan and Germany in which the person infected never visited China. The W.H.O, on 31st, January, 2020, declared Public Health Emergency of international Concern (PHEIC). Prior to this, five major PHEICs were declared in 2009 for H1N1 flu (Swine flu), in 2014 for Polio and Ebola, in 2016 for Zika and in 2018 for Kivu Ebola virus outbreak⁵.

What is the 2019-nCoV virus?

Corona is a Latin word which means "crown". This name is given to the virus because of crown like spikes present on the surface of the virus (as seen under the microscope) which encloses some genetic material. The earliest encounter of this virus with humans was recorded in mid-1960s. It is generally known to be found in animals like bats, camels, cats etc. From animals this virus can "spillover" (transmitted) to humans. It is an RNA virus which infects both animals and humans. There are seven categories which are known to affect human beings. These categories can be listed as follows²:

- a) Alphacoronavirus (229E and NL63).
- b) Betacoronavirus (OC43, HKU1, MERS, SARS)

There are two additional categories namely Gammacoronavirus and Deltacoronavirus. It is a positive-sense virus as it can be translated into a viral protein. It means that this virus can evolve throughout the transmission and become

a new coronavirus. The perfect example of this evolution is (from (a) to (c))³:

a) SARS-CoV (Severe Acute Respiratory Syndrome - CoronaVirus): Emerged in China in 2002 with total of 8098 registered cases and 774 reported deaths. No known cases emerged since 2004. It was known to be spread from cats¹¹.

b) MERS-CoV (Middle East Respiratory Syndrome - CoronaVirus): It emerged in Saudi Arabia in 2012. It was known to be spread from camels. It was mainly limited to gulf countries but affected people in other countries also. Till date the reported cases and the death toll stood at 2506 and 862 respectively. Recently, on 19th and 20th January, 2020, two fresh cases of MERS-CoV were reported in UAE¹⁵.

c) 2019-nCoV: This virus is the part of the ongoing epidemic which emerged from Wuhan, Hubei province in China. It started in December 2019. The origin of this virus is still unknown. The reported number of cases and the death toll has already surpassed the SARS and MERS numbers. Till date, the reported number of cases are nearly 524,007 and the death toll has reached at 23,670 deaths. More than 123,000 people have been recovered and continuous efforts are being made to ensure no further spread by constantly monitoring the unusual patterns².

So, as these viruses come from the same Coronaviridae family of viruses which is also the part of the higher order called nidovirales, the symptoms caused are almost same. Corona Virus

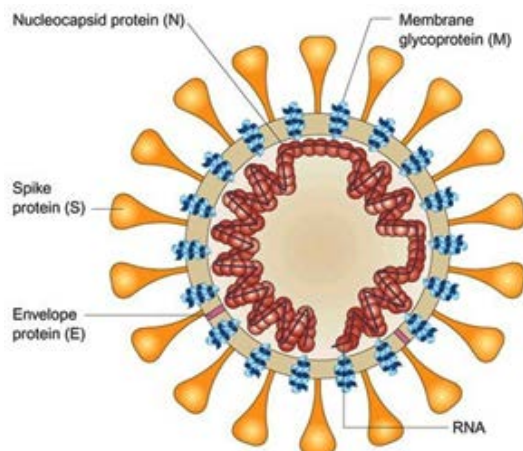


Fig. 1. The Crown shaped Coronavirus^{3, 20}



Fig. 2. CT scan of lungs of an infected person showing affected region of the lungs⁹

can be detected using PCR (Polymerase Chain Reaction). PCR can detect this virus based on its genetic fingerprint which is known. A recent study has found that the phylogentic tree of Coronavirus relates it closely to the SARS virus. However, some inserts of the glycoprotein of 2019-nCoV were aligned with gp120 and Gag proteins present in HIV virus. This observation plays a key role in Human Virus interaction. So, this study suggested that there is a change in preference of host for interaction as compared to other coronaviruses⁸. The rest of part of the viruses are same. So, this also suggests that the 2019-nCoV is an evolution of the SARS-CoV virus^{4,5,6,7,8}.

Symptoms and modes of transmission

As stated earlier the symptoms caused by this virus are very similar to its earlier versions such as SARS and MERS so, there are mild to

severe consequences of coming in contact with this virus. We can divide these consequences or symptoms into two categories as the most common and the least common symptoms. According to the study conducted on a number of patients the most common symptoms include fever, cough, shortness of breath and bilateral pneumonia and the less common symptoms are headache, sore throat, chest pain, rhinorrhea, diarrhea, nausea and vomiting. This virus has profound effect on patients with history of chronic diseases such as diabetes, asthma or any cardiovascular disease. Some recent CT scans of the thorax of the infected patient revealed ground glass lesion in the lower areas of the lungs as shown in Figure 2. These lesions are common to other respiratory syndromes as well⁹.

Corona Virus is transmitted through respiratory droplets, contact with any infected

Table 1. Similarities or differences between SARS-CoV, MERS-CoV and 2019-nCoV Viruses^{15,19}

	SARS-CoV (Severe Acute Respiratory Syndrome)	MERS-CoV (Middle Eastern Respiratory Syndrome)	2019-nCoV (2019- Novel Coronavirus)
Region of Origin	Guangdong, China, 2002	Saudi Arabia, 2012	Wuhan, Hubei, China, 2019
Origin	Rabid Cats, Bats, Civets	Camels	Still unknown
Reported cases (till now)	8098	2506	524,007 and still increasing
Deaths (till now)	774	862	23,670 and still increasing with 123,322 recoveries till now.
Fatality rate	9.6%	34.4%	3.4% and increasing.
Incubation period	2-14 days	2-14 days	2-14 days
Symptoms	Fever, Nausea, Vomiting, Shortness of breath, Cough, Diarrhea etc.	Fever, Nausea, Vomiting, Shortness of breath, Cough, Diarrhea etc.	Fever, Nausea, Vomiting, Shortness of breath, Cough, Diarrhea etc.
Methods of detection (Out of all PCR was proved to be the fastest method to detect live virus)	quantitative Reverse-Transcription Polymerase Chain Reaction (qRT-PCR) and (Molecular test), Enzyme-Linked Immunosorbent Assay (ELISA), Immuno-fluorescence Assay (IF) (Serology tests) and Cell culture inoculation	Real-time Reverse-Transcription Polymerase Chain Reaction (rRT-PCR) (Molecular test), Enzyme-Linked Immunosorbent Assay (ELISA) and Microneutralization assay (MA) (Serology test)	Polymerase Chain Reaction (PCR)
Countries affected mostly	China	Suadi Arabia, UAE and few other middle-eastern nations.	China, Italy, USA and Spain

person or contact with any infected animal. After leaving infected person's body, coronavirus can travel up to six feet and can survive on the surfaces depending on their tolerances. As compared to other viruses like measles or chickenpox they can travel very less. Currently, it is being assumed that a newly infected person can infect 1.5 to 3.5 other persons which is high in comparison to the seasonal flu in which each new patient can infect 1-1.5 other persons. So, if we assume that each new patient of coronavirus can infect 2.6 other persons and each new patient of seasonal flu can infect 1.3 other persons then 5 persons infected with coronavirus

and seasonal flu can infect 368 and 45 people after 5 cycles respectively.

Precautions, cure and Safety

If any of the symptoms appear, first and foremost step should be to isolate the infected person and transfer him/her immediately to hospital. As the outbreak is novel there is no vaccine developed yet to tackle the virus. However, some reports came out that Hong-Kong has developed a vaccine for the virus but is yet to be tested. Later on, it was also claimed that drugs named chloroquine and Hydroxychloroquine which were developed during world war II for the

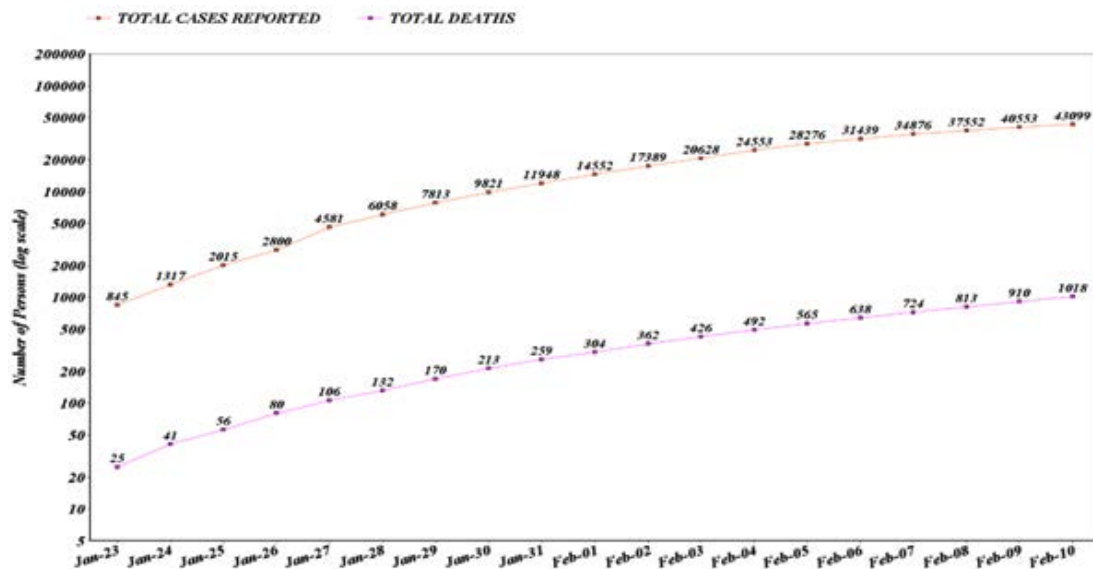


Fig. 3. Timeline of the outbreak with Total number of persons infected and total number of deaths^{12-14, 17-18}.

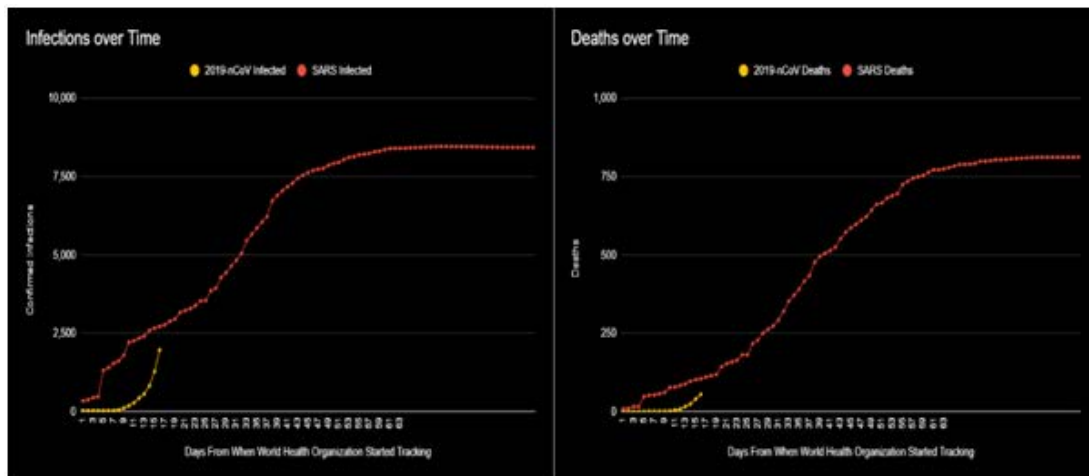


Fig. 4. Comparison of corona outbreak with SARS outbreak¹⁶.

treatment of malaria can be used for the treatment of 2019-nCoV. But, due to lack of evidence and its possible side-effects these options were sidelined, but are still under consideration. WHO launched a global mega trial of two other possible, earlier used treatments along with above mentioned drugs, which seemed most promising option for now. The two other options include the medication used for HIV (ritonavir and lopinavir) and an antiviral compound named as remdesivir which was an experimental compound for Ebola virus. Even if a possible cure is developed, it would take some time after successful trial and mass production, to reach general population. For normal persons the general precautions are to avoid crowded areas, meat markets. Avoid physical contact (social distancing) like handshaking with any person, washing hands regularly with hand wash, wear masks if going out. To assess and address any unusual and unknown consequence with immediate effect is the key to contain the virus. As the virus is contagious, the scale of outbreak can only be contained by isolating the patients from normal population¹⁵.

Corona Virus (Outbreak in China)

There are many websites developed by many government organizations of China and many other countries including WHO which are constantly updating the general population about the outbreak. Many websites are giving the live information about various statistics of the outbreak like Total infected persons reported, Total deaths, Regions or countries affected¹²⁻¹⁸. However, the situation is very critical in USA, China and Italy where 247,523 cases are being reported till now. Right now, the top three countries affected by the outbreak are USA, China and Italy. USA has surpassed China to become the new epicenter of the outbreak. Total death toll has risen to 24,090 and nearly 124,000 patients have been recovered from the virus. New cases are emerging with each passing day within the affected regions. Quarantined facilities have been created by various countries where people are being treated. WHO is constantly monitoring the outbreak along with its major member states to modify existing protocols of investigation as well as introducing new protocols according to the emerging situations. In addition, blueprints for R&D facilities have been activated by collaborating with the expert network around the world to expedite the process

from diagnosis to cure and develop vaccines. Online courses have been developed to create awareness and educate people about the general coronavirus. Figure 3 shows the timeline of Total number of persons infected along with total number of deaths till February 10 on a logarithmic scale because number of infected persons is very high in comparison to number of deaths. Some resources for the live tracking of the situation will be provided in the references.

Figure 4 shows charts of comparison between the 2019-nCoV and the SARS outbreak. It is quite evident that 2019-nCoV virus has surged quickly on both scales (number of infected persons and death toll) in comparison to SARS virus¹²⁻¹⁸.

CONCLUSION

It is well known that the current outbreak is very closely related to the two similar earlier outbreaks named SARS and MERS. It is evident that the evolution of this virus is manifesting itself through different ways. The current scenario clearly indicates that the crisis is growing as number of infected persons and death toll is rising day by day but numerous efforts are being made by the global medical fraternity to deal with the crisis. As the many properties of the virus are still unknown, development of a vaccine will be a challenging problem.

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