



COVID-19: A GLOBAL PANDEMIC

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The novel corona virus-2 (n-CoV-2) identified in the December 2019 which then spread worldwide has become pandemic in the form of Corona virus disease 2019 (COVID-19) and affected the health, economy and the medical system to a significant extent. As on date, around 8.20 million confirmed cases including death of around 443,815 have been reported. The present review deals with the history and origin of the COVID-19, its worldwide pandemic spread, symptoms and preventive measures as an attempt to create awareness of the fatal disease.

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outbreak. The International Committee on Taxonomy of Viruses renamed the virus SARS-CoV-2.⁴ Coronavirus disease COVID-19 is an ongoing global health emergency.

SARS-CoV-2 is a rapid pandemic due to its highly contagious nature. As the number of cases continues to rise, there is no confirmed medication or vaccine available as on today. Hence the virus poses a threat to the public health. The COVID-19 pandemic is spreading across the globe at an alarming rate. It is more infectious and severe; hence the number of deaths as compared with SARS or MERS is very high.⁵ Only isolation protocols to prevent further transmission can reduce its impact.

INTRODUCTION

Corona viruses belong to a large family of viruses. Several types of corona viruses are known to cause respiratory infections like Severe Acute Respiratory Syndrome (SARS). Some of them cause the common cold in people; others infect animals, including bats, camels, and cattle. The past few decades have seen endemic outbreaks in the form of respiratory syndrome coronavirus (MERSCoV) and severe acute respiratory syndrome related coronavirus (SARS-CoV)^{1,2} and now another the outbreak comes due to a new strain called the SARS-CoV-2 virus. The virus was firstly detected in Wuhan city of China, in December 2019 and has set off a global pandemic.³

The most recently discovered coronavirus causes coronavirus disease COVID-19 which is affecting people in different ways. Most of the infected people can develop mild to moderate illness and recover without hospitalization. The disease was named as COVID-19 after recommended by the World Health Organization (WHO). Crowded conditions can let viruses an easy spread. Sometimes the virus changes much faster and can start to infect and spread among people. As SARS-CoV-2 has spread both inside and outside China, it has infected people who had no direct contact with animals i.e. the virus is transmitted from human to human contact. It is now spreading worst in the U.S. and around the globe.

As on 16th June 2020, more than 8.20 million confirmed cases resulting in more than 443,815 deaths worldwide have been reported including at least 213 countries. The WHO has declared it a global health emergency at the end of January 2020.

The medical science, public health, economics and infrastructure of whole world have been challenged by the novel corona virus-2 (n-CoV or (COVID-19) pandemic

HISTORY AND ORIGIN

Corona viruses were firstly discovered in the 1930s when an acute respiratory infection of chickens caused by infectious bronchitis virus (IBV) was observed.⁶ Arthur Schalk and M.C. Hawn described a new respiratory infection of chickens in 1931. In 1940s mouse hepatitis virus (MHV) and transmissible gastroenteritis virus (TGEV) were isolated.⁷ Common cold virus B814 was discovered in the 1960s as Human corona viruses,⁸⁻¹¹ as it caused a common cold.

Later on, researchers found a group of similar human and animal viruses and named them after their crown-like appearance. The name "corona virus" was derived from Latin word "*corona*", meaning "crown" by June Almeida and David Tyrrell who firstly observed and studied human coronaviruses.¹²⁻¹⁵ In the same year research group at the National Institute of Health was able to isolate another member of this group of viruses using organ culture which was named as virus strain C43¹⁶ and observed distinctive club-like spikes such as B814, 229E, and IBV with the electron microscope.^{17,18} A new group of IBV-like viruses came to be known as corona viruses after its distinctive morphological appearance related to the mouse hepatitis virus.¹⁹ A large number of animal corona viruses were identified since 1960s.²⁰

Till 2002; corona virus was treated as simple non-fatal virus. Several cases of SARS caused by corona and their mortally found to be more than 1000 patient as reported in 2003. Four corona viruses namely HKU1, NL63, 229E and

OC43 have been in circulation in humans, and generally cause mild respiratory disease. In 2002-2003 when a β genera new corona virus origin in bats crossed over to humans *via* the intermediary host of palm civet cats in China. This β -genera new corona virus affected 8422 people mostly in China and Hong Kong as SARS and caused 916 deaths. World health organization (WHO) and centers for disease control and prevention declared as state emergency in 2004. In 2012, several infected patients and deaths were found in Saudi Arabian reports.²¹⁻²⁵ In 2012, due to the Middle East respiratory syndrome coronavirus (MERS-CoV), which was also of bat origin emerged with dromedary camels as the intermediate host; affected 2494 people and caused 858 deaths. A novel SARS coronaviruses in 2003²⁶ resulting in the detection of number of novel corona viruses in humans, animals and wildlife.²⁷⁻²⁹

Chu DK *et. al* described that animals are the natural reservoirs of the viruses as corona viruses found in bat and avian species.^{30,31} Other human corona viruses have since been identified, including SARS-CoV in 2003, HCoV NL63 in 2004, HCoV HKU1 in 2005, MERS-CoV in 2012, and SARS-CoV-2 in 2019.^{32,33} COVID-19 was first identified and isolated from pneumonia patient in the Wuhan city of China.^{34,35}

Experts say SARS-CoV-2 originated in bats like that the corona viruses behind MERS and SARS started through animals. The epicenter of this ongoing outbreak is in the city of Wuhan in Hubei Province of central China and the Huanan seafood wholesale market was thought to be at least one of the places where SARS-CoV-2 from an unknown animal source might have crossed the species barrier to infect human. In the Wuhan's wet seafood market, a few customers buying fresh meat and fish, including animals were killed on the spot. The first concrete evidence for human-to-human transmission of SARS-CoV-2 was reported by a group of clinicians and scientists from the University of Hong Kong.³⁶

MICROBIOLOGY OF SARS-COV-2

Coronaviruses (family *Coronaviridae*, subfamily *Coronavirinae*) are important pathogens of bird and mammal origin. Corona viruses are positive-sense RNA viruses and are currently classified into four genera:³⁷

- 1) α -coronavirus
- 2) β -coronavirus
- 3) γ -coronavirus and
- 4) δ -coronavirus

α -coronaviruses and β -coronaviruses are found exclusively in mammals, whereas γ -coronaviruses and δ -corona viruses primarily infect the birds.

SARS-CoV-2 is a spherical or pleomorphic enveloped particles containing single-stranded positive-sense. Virus of zoonotic origin is ranging from 60 to 140 nm in diameter associated with a nucleoprotein within a capsid comprised of matrix protein. Spike like projections on its surface afford it a crown like appearance under the electron microscope; hence named as corona-virus. SARS CoV-2 contains four

structural proteins, namely envelope (E), spike (S), membrane (M), and nucleocapsid (N). S, M, and E proteins together form the envelope of the virus and are involved in replication of genetic material. N proteins remain associated with the RNA forming a nucleocapsid inside the envelope. Polymers of S proteins remain embedded in the envelope giving it a crown-like appearance.³⁸⁻⁴¹

These viruses are intracellular parasites with lack of their own metabolism and require a host to replicate i.e it is not living. Viruses are nanostructures, typically comprised of proteins, genetic material, and often lipid membrane. Their outer lipid membranes are stable and comprised of fatty acids with hydrophobic interactions between chains.

SPREAD OF COVID-19

In December 2019, adults in Wuhan, capital city of Hubei province local hospitals with sever pneumonia of unknown cause emerged. On December 31st 2019, China notified the outbreak to the WHO and the virus was identified as a Corona-virus.

However, there is no evidence so far that the origin of SARS-CoV-2 was from the seafood market or anywhere else. Rather, bats are the natural reservoirs of a wide variety of CoVs, including SARS-CoV-like and MERS CoV viruses.⁴²⁻⁴⁴ Environmental samples from the Huanan sea food market were also tested positive, signifying that the virus originated from this place.⁴⁵ The number of cases started increasing exponentially, that human-to-human transmission was occurring and the disease went on spreading.^{46,47}

COVID-19 was analyzed by virus genome sequencing throughout the genome to Bat CoV RaTG13 and showed 96.2 % overall genome sequence identity,⁴⁸ suggesting that bat SARS-CoV-2 might share the same ancestor. Similar residues of receptor were observed in many species by phylogenetic analysis⁴⁹ suggesting the possibility of alternative intermediate hosts, such as turtles, pangolin and snakes.

Large droplets generated during coughing and sneezing by symptomatic patients are transmitted rapidly from person to person. It becomes more dangerous as in the form of transmission through asymptomatic people before onset of symptoms.⁵⁰ The virus can remain viable on surfaces for several days in favorable atmospheric conditions. Infection is acquired either by inhalation of these droplets or touching surfaces contaminated by them or then touching the nose, mouth and eyes. Transmission of SARS-CoV-2 occurs mainly between family members, relatives and friends who comes in contact with patients or incubation carriers.

SYMPTOMS, TRANSMISSION AND PREVENTATION

Close contact between individuals can also result in transmission.⁵¹ This also indicates possible transmission in closed spaces due to elevated aerosol concentrations has a basic multiplying number of SARS-CoV-2 is 2.2. This

suggests that a patient can transmit the infection to two other individuals. Current data suggests that the virus has an incubation period of three to seven days.⁵² COVID-19 virus can survive for up to 72 hours on plastic and stainless steel, less than 4 hours on copper and less than 24 hours on cardboard.

Symptoms of COVID-19 may appear in few days i.e. in 2 days or as long as 14 days. The most common symptoms of COVID-19 are fever or chills, dry cough, shortness of breath or difficulty in breathing, loss of taste or smell, sore throat and tiredness. Other symptoms those are less common and may affect some patients include nasal congestion, headache, conjunctivitis, diarrhea, nausea or vomiting, rashes on skin or discoloration of fingers or toes. People associated with difficulty in breathing/shortness of breath, chest pain/pressure, or loss of speech or movement should seek medical attention immediately and self-isolation and monitoring of their symptoms.

Two kinds of tests are available for COVID-19:

A viral test for current infection: It includes analysis of swabs of the inside of the nose to check the possible infection with SARS-CoV-2, or not that causes COVID-19.

An antibody test for previous infection: It includes blood check by looking for antibodies, which indicate that, is there was a past infection with the virus. For current infection, antibody test was not be used because it can take 1-3 weeks after infection to make antibodies.

The disease spreads primarily from person to person through small droplets from the nose or mouth, which are expelled when a person with COVID-19 coughs, sneezes, or speaks. These droplets are relatively heavy, do not travel far and quickly sink to the ground. People can catch COVID-19 if they breathe in these droplets from a person infected with the virus. This is why it is important to stay at least 1 meter away from others. These droplets can land on objects and surfaces around the person such as tables, doorknobs and handrails. People can become infected by touching these objects or surfaces, followed by touching their eyes, nose or mouth. Thus it is important to wash your hands regularly with soap and water or clean with alcohol-based hand rub. When we wash our hands with soap these hydrophobic interactions are disrupted and the lipid membrane is dissolved, destroying or deactivating the virus. It is not possible to use soap as an internal treatment because it also destroy our own cells. Following precautions have been suggested for protection from COVID-19.....

Clean your hands regularly and thoroughly with soap and water for at least 30 seconds. Use a hand sanitizer that contains at least 70 % ethyl or isopropyl alcohol which kills viruses (\log_{10} is ~ 4.0 for various corona virus strains)^{60,61} Various household or medical disinfectant/cleaning agents including povidone iodide, dimethyldidecylammonium salts, and polyhexanide and their combinations or oxidative/lipid-dissolving agents like hydrogen peroxide, sodium hypochlorite or household washing up agents containing alkyldimethylamine N-oxides and other surfactants were found to effective against enveloped viruses, but the resistivity of various types of corona viruses are different and the contact time needs for reaching completeness of the

disinfection process varies in a wide range, the details can be found in the refs.^{60,61}

Practicing hand and respiratory hygiene is important at all times. Maintain at least a two meter (2 m) distance between yourself and others, so as to prevent from small liquid droplets from nose or mouth which may contain virus. Avoid touching your eyes, nose, and mouth with unwashed hands because contaminated hands can transfer the virus to your eyes, nose or mouth.

Cover your mouth and nose with a cloth face cover, wear a mask if possible. Cover your mouth and nose with a tissue paper when you cough or sneeze.

Avoid going to crowded places. Stay home and self-isolate.

Clean and disinfect frequently touched surfaces daily.

Avoid public transportation.

Take your temperature if symptoms develop. Be in touch with your doctors.

STATISTICS OF COVID-19

The **COVID-19** a worldwide pandemic of corona virus disease 2019 caused by the SARS-CoV-2 virus. The Epidemic Diseases Act, 1897 invoked in many countries declared it an epidemic due to significant outbreak of COVID-19. Educational institutions and many commercial establishments have been shut down worldwide. As on 16th Jun 2020, more than **8,207,780** confirmed cases including more than **443,815** deaths have been reported worldwide, affecting at least 213 countries (Figure 1 and 2). The WHO has declared this a global health emergency at the end of January 2020.

India currently has the fourth largest number of confirmed cases in Asia with the number of cases 354,161 on 16th June 2020 including more than 11,921 deaths. India observed a 24-hour voluntary public curfew on 22 March 2020 at the instance of the Prime Minister Narendra Modi. Further, the government ordered a nationwide lockdown for 21 days, extended the ongoing nationwide lockdown till 3 May. 1 May, lockdown across the country was further extended till 30 May and afterward till 30 June 2020 with some conditions. Oxford COVID-19 Government Response Tracker (OxCGRT), in its report based on data from 73 countries, reports that the Indian Government has responded more stringently than other countries in tackling the pandemic. The death rate is highest in US and that of India is 2.80% is quit less than other countries.

VACCINE AND TREATMENT

Currently, no vaccine is available to prevent COVID-19. Antibiotics only work on bacterial infections and do not work against viruses.

Use of antibiotics only prevents or treats secondary bacterial infections in severely ill COVID-19 patients. Current treatment strategies are aimed at symptomatic care and oxygen therapy. Prophylactic vaccination is required for the future prevention of CoV-related epidemic or pandemic.^{53,54}

Intense global R&D activity has been forced to develop a vaccine against the disease after the genetic sequence of SARS-CoV-2. COVID-19 pandemic is driving evaluation of next generation vaccine. The humanitarian and economic impact of the COVID-19 accelerates the development of vaccine. The first COVID-19 vaccine entered human clinical testing on 16th March 2020 and multiple platforms are under development. Vaccine development is a lengthy and expensive process. Attrition is high, and it typically takes multiple candidates and many years to produce a licensed vaccine. Coronavirus vaccine developed by Oxford University began human safety trials and at the same time an Indian company Serum Institute of India has started to work on making the vaccine locally so as to be ready in case the trial succeeds. This is the sixth coronavirus vaccine to enter the first phase of clinical trials. In this vaccine a gene may be inserted for an important protein of the virus which can lead to build immunity in patients.

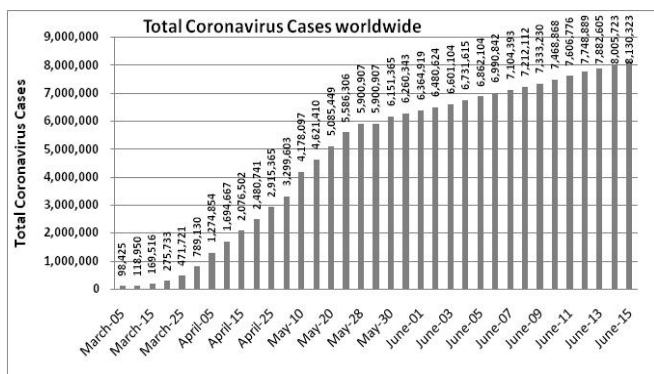


Figure 1. Total coronavirus cases in worldwide

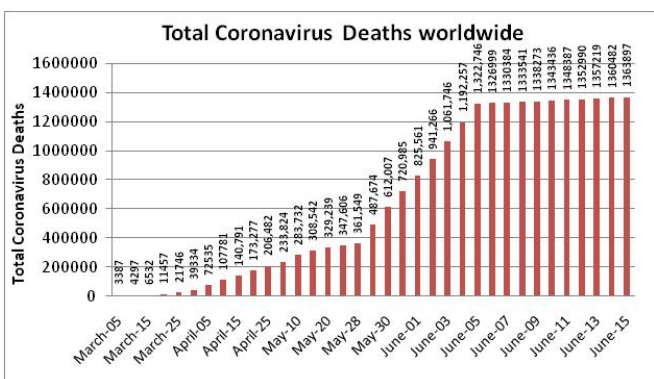


Figure-2. Total coronavirus death in worldwide

Chen from the Beijing Institute of Biotechnology describes that virus which infects human cells delivers genetic material those codes for the SARS-CoV-2 spike protein into the cells. These cells then produce the spike protein and travel to the lymph nodes where they create antibodies by immune system. Antibodies recognize the spike protein and fight off the coronavirus. Vaccine produces virus-specific antibodies and T cells within 14 days.⁵⁵

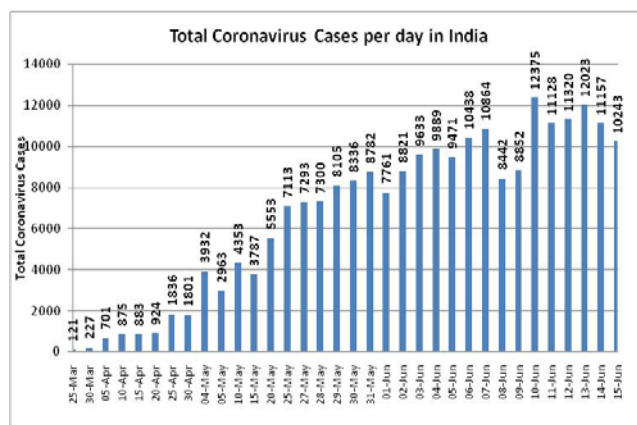


Figure 3. Total coronavirus cases in India /day

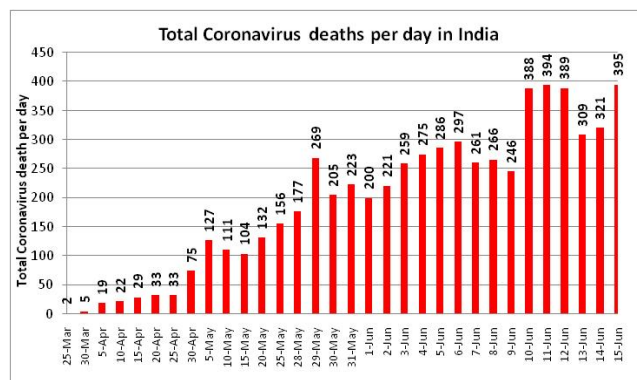


Figure 4. Total coronavirus death in India/day

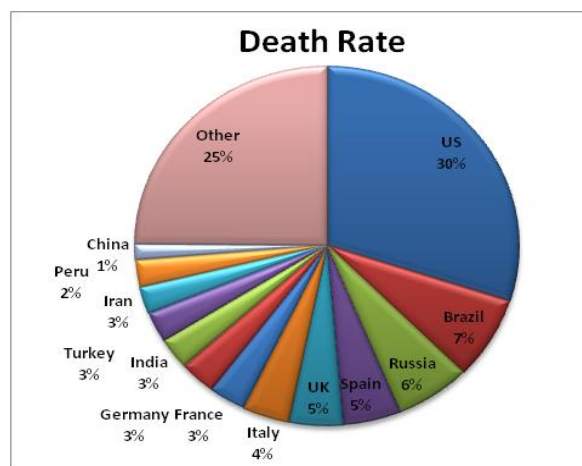


Figure 5. Death rate due to COVID-19

Vaccine of Moderna has already entered clinical trials in the US with mRNA platform. A similar technology is being used for vaccination of other infectious diseases. Promising immune response to the coronavirus in animals, clinical trials for its anti-COVID-19 vaccine by US-based vaccine maker Inovio is also under progress. US drug giant Pfizer has made a funding to vaccine maker BioNTech for developing its mRNA vaccine, expected to go on human trials.

Drug maker J&J, and USA's Biomedical Advanced Research and Development Authority (BARDA) are also started to develop the vaccine, will work on the same platform and technology which was used for developing the vaccine for Ebola.

The Department of Biotechnology, Council of Scientific and Industrial Research and ICMR are working on developing a vaccine for COVID-19. The vaccine development is being supported by three Indian industries. Research on therapeutic and drug development has started. Rising Pharma, the US partner of Hyderabad-based Laurus Labs, in collaborative agreement with the Division of Infectious Disease and International Medicine at the University of Minnesota on a clinical trial exploring hydroxychloroquine as a preventive treatment. France is expecting preliminary results in two weeks from a clinical test of hydroxychloroquine and three other drugs remdesivir, lopinavir and ritonavir in combination.

A broad-spectrum antiviral, similar to broadspectrum antibiotics, would rapidly treat newly emerging viral outbreaks [56]. There are two main approaches for treatment of viruses to antivirals, intracellular and extracellular. Intracellular antivirals are drugs which designed to inhibit the intracellular replication of viruses. Remdesivir is a promising candidate for treating SARS-CoV-2, which was originally developed for Ebola⁵⁷ and for HIV^{58,59} in ritonavir and lopinavir combination.

CONCLUSION

In summary, COVID-19 has turned a fatal disease worldwide. The number of active cases and deaths due to the disease are continuously increasing day by day across the entire world. To face the pandemic, the world has utilized a range of measures and although each country has their own approach, included periods of self-isolation or quarantine and lockdown for control the spread of virus. Many crossovers with chemistry and materials are ready to be exploited problem of viruses, but no perfect drug or vaccine exists as on today. Taking own precaution seems to be a better solution in the present scenario.

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