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# The unfurl of the coronavirus and its thwack on humans and the environment: a review

R. Sivaranjane<sup>1</sup> and P. Senthil Kumar<sup>2,3</sup>

## Abstract

The new coronavirus disease 2019 (COVID-19) severe acute respiratory syndrome coronavirus 2 was first discovered in Wuhan (China) in December 2019 and belongs to the same family as that of the severe acute respiratory syndrome coronavirus 1. On January 30, 2020, the World Health Organization announced the outbreak as a Public Health Emergency of International Concern. Diagnosis of this disease is carried out by using special molecular tests. It is mandatory to identify the individual with COVID-19 symptoms, and isolation is necessary to prevent further transmission of this virus. This review highlights the formation, prodrome, transmission and survival mechanism of COVID-19 and shows that the pandemic circumstance fundamentally improves the air quality in various urban areas across the globe, decreases water contamination and commotion and diminishes the tension on the traveller objections, which may facilitate the reclamation of the natural framework. The worldwide effect of this new outbreak is still dubious.

## Addresses

<sup>1</sup> Department of Chemical Engineering, St. Joseph's College of Engineering, Chennai 600119, India

<sup>2</sup> Department of Chemical Engineering, Sri Sivasubramaniya Nadar College of Engineering, Chennai 603110, India

<sup>3</sup> Centre of Excellence in Water Research (CEWAR), Sri Sivasubramaniya Nadar College of Engineering, Chennai 603110, India

Corresponding author: Kumar, P. Senthil ([senthilkumar@ssn.edu.in](mailto:senthilkumar@ssn.edu.in))

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## Keywords

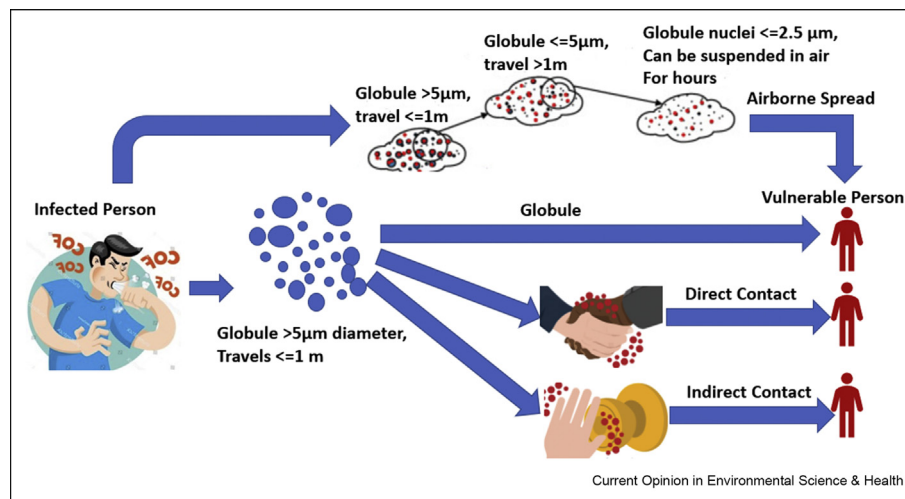
Coronavirus, Global pandemic, Pollution, SARS-CoV-2.

## Introduction

Coronavirus disease 2019 (COVID 19) is a highly communicable respiratory viral infection, which initially originated in Wuhan, China, and eventually spread across the world. COVID-19 has been officially labelled

as a pandemic by the World Health Organization. Coronavirus cases were first recorded on 17 November 2019 in Wuhan, China, potentially because of a change in an infection transferred by bats. Starting from 31 December 2019 and until 13 January 2021, 92,097,048 instances of COVID-19, including 1,972,382 deaths, have been reported in 217 nations and domains [1]. As of January 30, 7736 confirmed and 12,167 speculated cases had been reported in China and 82 affirmed cases had been reported in 18 different nations [2]. On January 12, 2020, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first confined and distinguished by the Chinese Center for Disease Control and Prevention [3]. The Center for Disease Control and Prevention is reacting to an outbreak of respiratory illness brought about by another Covid virus that was first distinguished in China and has now been recognized in excess of 70 areas universally. The infection has been named 'SARS-CoV-2' and the disease it causes has been named as 'Covid disease 2019'. The International Committee on Taxonomy of Viruses termed it as the SARS-CoV-2 virus. The size range of this SARS-CoV-2 virus is approximately 60–140 nm. The coronavirus was named so because it contained crown-like spikes on the outer surface. Coronaviruses are members of the Coronaviridae family (order Nidovirales). Coronaviruses are minute in size and contain a solitary abandoned RNA as a nucleic material, with their size ranging from 26 to 32 kb in length. The alpha coronavirus ( $\alpha$ ), the beta coronavirus ( $\beta$ ), the gamma coronavirus ( $\gamma$ ) and the delta coronavirus ( $\delta$ ) are the subgroups of the coronavirus. Putative etiopathogenic factors related to zoonotic viral transmission pathways are responsible for respiratory and gastro-intestinal diseases leading to multi-organ failure in infected individuals or patients having co-morbidities [4]. The extremely intense respiratory disorder coronavirus Severe Acute Respiratory Syndrome CoronaVirus (SARS-CoV), H5N1 flu A, H1N1 2009 and Middle East respiratory syndrome coronavirus cause intense lung injury and intense respiratory distress, which prompt pneumonic illnesses and result in casualty [5]. Coronavirus infection has been reported in a few avian species as well as in various warm-blooded animals, including cats, dogs, mice, bats and camels. Novel mammalian coronaviruses are currently being recognized. For instance, a HKU2-related coronavirus caused by bats was accountable for loose bowel disorder in pigs in 2018 [6] (Figure 1).

Figure 1



Transmission of the coronavirus.

The genomes of the virus contain a variable number of open reading frames (ORFs) coding for accessory proteins that are not essential for virus replication, but appear to have a role in pathogenesis (Pathogenesis is the process by which a disease or disorder develops). Further examination demonstrates that a portion of the 2019 novel coronavirus shared under 80% nucleotide grouping to SARS-CoV. The grouping is similar to that of the severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV), with both variants sharing 79.6% of their genetic characteristics [7]. Towards the end of 2019, Wuhan, a rising business centre point of China, witnessed the advent of the novel coronavirus, with more than eighteen hundred individuals killed and more than seventy thousand people infected within the initial fifty days of the pestilence. The infection was named as Wuhan coronavirus or 2019 novel coronavirus by the Chinese specialists [5]. According to history, SARS-CoV (2003) infected 8098 people with a mortality rate of 9%, across 26 countries; then again, the novel corona infection (2019) infected 120,000 individuals with a mortality rate of 2.9%, across 109 nations. It shows that the transmission rate of SARS-CoV-2 is higher than that of SARS-CoV, and this is attributed to the genetic recombination phenomenon at the S protein in the RBD region of SARS-CoV-2, which may have upgraded its transmission capacity [5].

SARS-CoV-2 infection has been named COVID-19 and patients with COVID-19 exhibit influenza-like symptoms with a high fever, sore throat, dry hack and respiratory problems. Nearly, 2.2 million individuals have been infected, with more than 0.15 million individuals killed worldwide. USA is the most infected nation with the highest number of patients at around 0.7 million. In

spite of incredible endeavours, there is no treatment of this ailment. This infection was found to have 86.9% similarity to that of bat coronavirus, and henceforth, it is suspected to have originated from bats [8]. SARS-CoV is capable of existing for a prolonged period of time in water, and transmission through fecally contaminated droplets of water might be more probable. Information on the endurance and perseverance of SARS-CoV in water and sewage is required to overcome the dangers associated with this novel pathway [9]. Ecological surfaces have been perceived as the possible transmission routes of nosocomial viral contamination. Clinical surfaces play an important role in the overall spread of nosocomial viral contamination during the SARS outbreak. During outburst in medical care offices, surface testing for SARS COVID-19 (SARS-CoV) revealed SARS-CoV nucleic acids on the surface of inanimate objects. This indicates that surfaces could definitely be a strong source of infection transmission [10].

Without a prophylactic antibody and successful treatment, general well-being estimates, for example, social distancing, quarantine, contact tracing and hand cleanliness are the best way to prevent the local transmission of SARS-CoV-2. The usage of these measures relies upon the man force and the level of pandemic wave in each country. During the main pandemic wave, numerous nations received exacting measures including lockdown, stay-at-home suggestions, mass social affair revocation and shutdown of schools and insignificant shops [11].

The formation, prodrome, transmission, epidemiology and evolutionary dynamics of the coronavirus infection is investigated in detail in this review. This survey also

highlights the current information on the evolutionary ability of COVID-19 within humans.

### Structure of the coronavirus

The Middle East respiratory syndrome coronavirus comprises primarily of four protein structures, namely spike or S protein, envelope or E protein, membrane or M protein and nucleocapsid or N protein. The spike protein is present at the surface of the viral envelope in a three-molecule form, and this spike protein belongs to type I transmembrane glycoprotein. It comprises of two subunits namely S1 and S2 subunits, and these subunits are responsible for fusion, binding and viral entry. The E protein or the envelope protein is located in the intracellular membranes of the virus, and the function of E protein includes intracellular trafficking, budding and viral assembly. In general, E proteins are made up of 76–109 amino acids. The M protein is a portion of the viral envelope, which takes part in viral morphogenesis by connecting with other viral proteins. The S, M and E proteins are embedded into the membrane of the endoplasmic reticulum and are carried into the region of the endoplasmic reticulum–Golgi zone in which they are linked with the N proteins to create particles [12].

### Symptoms of COVID-19

COVID-19 infection may occur through the mucous films, particularly oral mucosa and nasal mucosa, and then, it penetrates through the respiratory tract into the lungs [13]. People with COVID-19 symptoms typically have a fever and respiratory tract indication, and the approximate incubation period of COVID-19 is 14 days [14]. COVID-19 can either be analysed by chest CT radiography or it can be tested in a laboratory [15]. In the research centre, a genomic sequencing process using reverse transcription quantitative polymerase chain reaction is a specific identification method for detection of COVID-19 infection [16]. The lower respiratory tract is the main target of the SARS-CoV-2 inflammation [17]. The coronavirus is also believed to infect the upper gastrointestinal and respiratory tracts of warm-blooded animals. Coronavirus infection usually ranges from mild to severe on the basis of the immune system. The propagation of SARS-CoV-2 occurs through the replication of RNA by using RNA-dependent and RNA polymerase enzyme. Signs of COVID-19 may appear within 2–14 days after contracting the disease. Furthermore, the ailments can be felt for the next 27 days [8].

COVID 19 is more prominent in individuals, kids and especially in patients having other medical issues such as lung ailments, heart disease, diabetes and other diseases. The possibility of contracting COVID-19 is extremely high in cases of dry cough, shortness of breath and contact with a COVID-19 patient or travel to

COVID-19-affected areas. Under such a circumstance, clinical testing for COVID-19 is an unquestionable requirement. The basic indication of this disease includes respiratory problems, fever, dry hack, sore throat, sneezing, muscle pain and fatigue and, in some extreme cases, kidney failure, pneumonia, acute respiratory syndrome and death [18].

### Transmission of the coronavirus

It is confirmed that the coronavirus can spread from one individual to another individual. It is not known whether the novel COVID-19 can be transmitted by blood transfusion. SARS-CoV-2 infection can be transmitted by transfer of blood because of the fact that numerous people might be asymptomatic bearers and may give blood. SARS-CoV-2 RNA is identified in the serum or plasma of contaminated patients; there is no information available that is related to the dangers of transmission of SARS-CoV-2 by means of blood transfusion [19]. Three potential courses of transmission of respiratory infections are known at present: short-range bead transmission, contact with contaminated surfaces and aerosol transmission [20]. Transmission of SARS-CoV-2 can occur through immediate, indirect or close contact with infected individuals through infected discharges, for example, salivation and respiratory emissions or their respiratory beads, which are ousted when an infected individual sings, snuffles or talks and hacks [21]. It is important to consider SARS-CoV-2 transmission through routes other than droplets. Surfaces touched by infected individuals, water and sewage, trash or soil are additional probable routes of infection transmission. The incubation period of COVID-19 keeps changing from 2 to 12 days, with a mean of 5.1 days [1]. With regard to its effect on pregnancy, an investigation of nine pregnant ladies who experienced COVID-19 in late pregnancy claimed that COVID-19 did not cause side effects compared to non-pregnant individuals and there is no evidence of intrauterine contamination caused by vertical transmission [22].

In aerosolized structures, SARS-CoV-2 was found to be stable for about 3 h, and on tempered steel and plastic surfaces, it was found to be active for about 72 h [23]. Droplet nuclei or aerosols in general refer to droplets with a diameter of less than or equal to 5  $\mu\text{m}$ , and the size of respiratory droplets is usually greater than 5  $\mu\text{m}$  in diameter [24]. Airborne transmission of SARS-CoV-2 can occur during clinical practice, which gives rise to aerosols [25]. As soon as the droplets break, the fluids begin to vaporize and a few droplets become so small that transport via air. Such small droplets are allowed to move in air and they have a potential to transmit the viral substances several metres from where they originated [26].

As indicated by Wells, isolated droplets are released upon exhalation. Large droplets settle more quickly

than they dissipate and small beads vanish more quickly than they settle. In this model, as small droplets progress from the warm and moist state of the respiratory framework to the colder and drier external environment, they vaporize and create residual particles made of the dried material from the first drops [27]. The recent ongoing model test found that the droplets from the infected person has the capability to spread the virus to person within close proximity [28]. Waterborne transmission has never been observed in people; however, identification of Human CoronaVirus (HCoV) in the faecal matter of infected patients has led to the recommendation the faecal–oral route, which is responsible for HCoV transmission [29]. It has been proved that that viral respiratory diseases spread by direct contact, for example, coming into contact with an infected individual or surface and through fomites that the individual has either touched or on which large infection-containing droplets exhaled by the individual have landed and the infection can sustain stably for quite a long time [30].

### Clinical tests for detection of the coronavirus

#### Real-time reverse transcriptase-polymerase chain reaction

Real-time reverse transcriptase-polymerase chain reaction is the most well-known and fast indicative test for diagnosing SARS-CoV-2, as it targets the virus DNA and identifies its presence within a person's sample, subsequently showing a high detection rate [31].

#### Nucleic acid tests

Real Time reverse transcriptase-polymerase chain reaction is as of now the best quality level test to detect SARS-CoV-2 infection. It utilizes reverse transcription polymerase chain reaction to identify the viral RNA from tests acquired through the specimen site. The PCR step uses special chemicals and enzymes and a PCR machine called a thermal cycler. Each heating and cooling cycle increases (amplifies) the amount of the targeted genetic material in the test tube. After many cycles, millions of copies of a small portion of the SARS-CoV-2 virus's genetic material are present in the test tube. One of the chemicals in the tube produces a fluorescent light if SARS-CoV-2 is present in the sample. Once amplified enough, the PCR machine can detect this signal. Scientists use special software to interpret the signal as a positive test result. The significant limit is that the test can examine just a single sample at a time [31].

#### Antibody test

Antibody testing identifies the explicit antibodies (IgG and IgM) created against SARS-CoV-2 in the serum, plasma or entire blood of the host in light of the viral disease. It plays a major role in detecting the infection

during the later stages and distinguishing individuals with invulnerability against the infection [31].

#### Antigen test

This test identifies the presence of SARS-CoV-2 nucleocapsid protein antigens on viral surfaces from nasopharyngeal and oropharyngeal swabs. This test depends on indicated monoclonal antibodies which will be made to tie up with explicit viral antigens in liquid samples [31].

### Survival mechanism of the coronavirus

Viral passage depends on a fine transaction between the virion and the host cell. Disease is started by association of the viral molecule with explicit proteins on the cell surface. After preliminary attachment of the receptor, wrapped infections need to meld their envelope with the host cell layer to convey their nucleocapsid to the objective cell. The spike protein assumes a double part in passage by interfering receptor binding and fusion of the membrane. The process of fusion includes enormous conformational changes of the spike protein. COVID-19 virus can use an assortment of receptors and triggers to enact combination, anyway basic viewpoints that empower this underlying advance of the viral life cycle are moderated [32].

### Impact of COVID-19 on human health

In general, viruses strike by seizing cells in our body. They enter host cells and multiply and subsequently develop rapidly. They are then able to spread to new cells in the body. COVID-19 generally affects the respiratory framework, which is a group of organs and tissues that allow the body to relax. Respiratory infections affect various pieces of this respiratory framework, for example, the lungs. A COVID-19 virus normally contaminate and pollute the coating of the throat, nasal routes and lungs. At times, it can seriously harm the lungs [33].

### Epidemiology of the coronavirus

Numerous human isolates of the corona virus are responsible for causing upper respiratory zone infections in grown-ups and in children. Past epidemiological investigations on HCV respiratory contaminations in youngsters have been founded on serological proof of disease on the grounds that the troubles in developing HCVs in traditional tissue and organ societies makes the removal of virus from the affected organs difficult [34]. The accessibility of SARS-CoV-2 genomes empowered us to distinguish a rapidly forming variety, indicating that genomic epidemiology is a groundbreaking approach for analysing the outbreak. Genomic epidemiology depends on phylogenetic analysis and has empowered scientists across the world to identify SARS-CoV-2 increase in people, to uncover the importation



and nearby transmission chains not recognized by movement history and conventional contact-tracing procedures and to follow the geographical spread and predominance of strains bearing explicit transformations of epidemiological relevance [35].

### Evolutionary ability of the coronavirus

AFLA part from having pathogenic properties, COVID-19 viruses pose another danger for the human population as they have the capacity to spread across interspecies. This is suspected for the HCoV OC43 that may have advanced from the cow-like COVID-19, which is responsible for gastrointestinal diseases in cows. Essentially, the SARS-CoV virus is a zoonotic agent that crossed species barriers. Phylogenetic analyses of SARS-CoV isolates from humans and animals firmly propose that the infection started from creatures, in all likelihood bats, was intensified in palm civets and transmitted to the human population through live creature markets. This ability of the COVID-19 virus might be the reason for the shocking increase in new infected cases and subsequently ought to be remembered [32]. Towards the start of the SARS outbreak, the virus was seen to be originated from animals prior it got spreaded to humans. After the causative agent of SARS was determined, SARS-CoV or anti-SARS-CoV antibodies were found in masked palm civets and creature controllers in a commercial centre. In 2005, two groups autonomously announced the discovery of the novel COVID-19 virus identified with human SARS-CoV, which were named SARS-CoV-related infections or SARS-like COVID-19 in horseshoe bats. These disclosures recommended that bats might be the common hosts for SARS-CoV and that civets were just middle hosts. Numerous COVID-19 viruses phylogenetically identified with SARS-CoV (SARSr-CoVs) were found in bats from various areas in China and furthermore from European, African and Southeast Asian nations [36]. The first COVID-19 virus was segregated in chicken embryos in 1937, as a result of viral seclusions in rodents, home-grown creatures and humans [37]. The replication number of the infection is assessed to be a normal of 3.28 (mean  $R_0 = 3.28$ ), demonstrating that each infected individual is likely to transmit infection to 3 individuals [38].

### Impact of COVID-19 on the environment

The worldwide disruption brought about by COVID-19 has resulted in a positive impact on the environment. Because of movement limitations, there has been a significant decline in social and monetary activities, and the air quality has improved in numerous urban areas due to a decrease in water contamination in various parts of the globe [48]. Because of COVID-19, governments have enforced limitations on the motion of vehicles and individuals and stopped industrial activities [49]. The COVID-19 episode/pandemic has limited the everyday dynamics of life for individuals

with its increasing impact around the world, leading to the shutdown of factories and also putting a halt to academic and training institutions. The other categories that were disturbed as a result of this outbreak include tourism, hospitality, manufacturing, sports, entertainment and international travel [39]. Because of the COVID-19 pandemic in the Middle East and North Africa, there has been unexpected decline in oil costs [40]. The economy of numerous nations is currently confronted with the dangers of high inflation, and due to shortage of production, unemployment has shot up. The lockdown will legitimately influence the Gross Domestic Product (GDP) of every nation [41]. The European Environment Agency believes that road transport adds to unnecessary convergences of about 70% of nitrogen dioxide ( $\text{NO}_2$ ) and about 30% of particulate matter [42]. COVID-19 outbreak has a very positive impact on the environment. COVID-19 has led to a significant decline in nitrogen dioxide concentration and particulate matter. China has imposed severe traffic limitations and self-quarantine procedures to limit the spread of the coronavirus disease. These activities have led to changes in air pollution levels. Sea shores are one of the most significant regular capital resources found in seaside territories. The absence of sightseers because of the social distancing due to the new coronavirus pandemic has caused a remarkable change in many sea shores across the globe. The impact of the coronavirus has also helped to bring down the noise level in the environment. With the government imposing quarantine procedures, many people are encouraged to stay indoors, and the use of government transportation facilities has in turn reduced to a great extent. Business activities have also come to a halt. All these factors have contributed to the significant decrease in noise level in all the major cities across the globe. The quarantine measures in most of the countries has made people to buy the required products over online, and as a result, the amount of waste produced by households has increased [43]. However, these positive effects on the environment are not permanent, and hence, people and the government should learn from this lockdown on how to bring down the pollution level on a large-scale basis [44]. Social distancing is one of the major negative aspects of COVID-19, which induces tension and dissatisfaction among individuals [45].

### Impact of climatic change associated with the coronavirus

An in vitro study occurs in a controlled environment, such as a test tube or petri dish. The in vitro security of SARS-CoV-2 investigations has demonstrated that the infection is exceptionally steady at 4 °C but it is sensitive to heat and SARS-CoV-2 loses infectivity at an ordinary temperature of 37 °C. Notwithstanding this, slight decrease in temperatures near 37 °C may considerably build the spreading capacity of the virus [4].

### How to prevent the spread of the virus

At present, there is no specific drug to curtail the spread of the coronavirus. The one possible way to limit the spread of the virus is by drastically reducing the viral reproduction number ( $R_0$ ) to less than 1. As indicated by the World Health Organization, it is advisable to maintain distance from people experiencing breathing problems, cold and fever. In addition, the utilization of masks prevented the transmission of droplets from infected individuals to other people. Furthermore, it is advised to wash hands on a regular basis to avoid getting infected at the earliest, and it is important to maintain social distancing to prevent the transmission of the disease to a large extent [46].

### Handling the second wave

As nations all over the globe have begun manoeuvring down the recently enforced limitations like starting up organizations and shops and recompense for movement, there is an increased threat for the spread of second wave, which would be hard to control, particularly during the winter season of the year. Untimely lifting of containment measures might actually prompt a second influx of contamination. A study showed that easing up the lockdown too soon would make the  $R_0$  surpass 1 and spread across China. Epidemiologic studies measure the potential exposures before the disease has occurred and therefore has the capability to predict the disease rate. Some modern technology, for example, artificial intelligence (AI), could be used to manage a lot of information and produce better models. Antibody-based serological tests ought to be conducted as they show the number of individuals evidently insusceptible to the infection. These kinds of identifying the individuals who are likely to be affected and who are not likely to be affected by the virus might actually reduce the dramatic increase in infection cases [47].

### Future scope

COVID-19 has made the vast majority of us hypermindful of each accessible surface that could transmit the infection; therefore, in a post-COVID-19 world, it is normal that we will have less touch screens and more voice interfaces and machine vision interfaces. To reduce traffic at medical clinics and other healthcare facilities such as laboratories, many hospitals have started video consultations, and it is expected to continue in the future. Shop owners who do not have online selling option for their products as of now will have to move on to sell their products online in order to sustain in the industry. Increased reliance on robots is expected; robots will be deployed worldwide to deliver groceries. Scientists aim to ensure that the natural language processing framework that they created can be utilized later to identify and address the loopholes in research on

emerging microorganisms before even the new microorganisms reaches the pandemic state by analyzing the spreading capability report of the new microbe with that of recently investigated microorganisms.

### Conclusion

Coronavirus disease is a highly infectious disease caused by the novel SARS-CoV-2. The COVID-19 pandemic is spreading across the globe at a rapid rate. It has caused more infections and deaths than SARS or Middle East respiratory syndrome (MERS). On comparing the  $R_0$  values, it is observed that SARS-CoV-2 is more infectious than SARS or MERS. This infection is profoundly contagious and can be spread through droplets and close contact. A few cases are dangerous, and thus, COVID-19 represents an extraordinary danger to safety and global health. This study presents a basic survey of the current investigations on the ecological causes and results of COVID-19. Rapid control of the spread of COVID-19 infection and reducing the mortality rate are urgent issues that need to be addressed. The mechanism of the infection stays obscure, and no particular antiviral medications have been developed. This new infection outbreak has tested the economic, clinical and general well-being framework of China and, to some extent, of various other nations, particularly its neighbours. Time alone will tell what the infection will mean for our lives here in India. There is a high probability of future outbreak of infection of zoonotic origin.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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