



# Approaches for prevention and environmental management of novel COVID-19

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## Abstract

The World Health Organization (WHO) recognized a novel coronavirus as the causative agent of a new form of pneumonia. It was subsequently named COVID-19 and reported as the source of a respiratory disease occurrence starting in December 2019 in Wuhan, Hubei Province, China. It has been affirmed a public health emergency of international significance by the World Health Organization. It is regarded as a subset of the severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS); COVID-19 is triggered by a betacoronavirus called SARS-CoV-2, which affects the lower respiratory tract and occurs in humans as pneumonia. A variety of drugs, such as remdesivir and favipiravir, are currently undergoing clinical trials to evaluate for the management of COVID-19. The effect of the pandemic as well as the epidemic that follows through the life cycles of various recycled plastic is evaluated, particularly those required for personal safety and health care. In response to the growth in COVID-19 cases worldwide, the energy and environmental impacts of these lifecycle management have risen rapidly. However, significant hazardous waste management concerns arise due to the need to assure the elimination of residual pathogens in household and medical wastes. This review article summarizes the preventive and environmental management of COVID-19.

**Keywords** Severe acute respiratory syndrome · Environment · Waste management · Novel coronavirus · COVID-19

## Introduction

Coronavirus belongs to a family of viruses that might cause various complications like pneumonia, fever, breathing

problems, and inflammation of the lungs. These viruses are prevalent worldwide in animals, but very few cases have been known to affect humans. The term novel coronavirus 2019 was coined by the World Health Organization (WHO). It

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refers to a coronavirus that affected the lower respiratory tract of pneumonia patients in Wuhan, China, on 29 December 2019 (Hui et al. 2020). The WHO declared that the 2019 novel coronavirus is recognized internationally as coronavirus disease 2019 (COVID-19) (Lai et al., 2020). The official reference name for the virus is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). A group of patients with pneumonia of unknown cause was reportedly related in December 2019 to a local Huanan South China Seafood Market in Wuhan, Hubei Province, China (Zhu et al. 2020). COVID-19 is the third-largest in two decades of coronavirus infection identified initially in Asia, after extreme acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS) (Morens and Taubenberger 2018). Several significant clinical features of COVID-19 were reported. First, an attack rate of 83% is surprisingly high even within family context, suggesting the strong transmissibility of SARS-CoV-2. Second, with much more frequent signs and more extreme radiological abnormalities seen around elderly patients, the clinical manifestations of COVID-19 in this family vary from mild to moderate. In general, it appears that COVID-19 is less serious than SARS. Third, it was observed that an asymptomatic kid has ground-glass opacification in his lung and SARS-CoV-2 RNA in the sputum sample. This observation of asymptomatic virus shedding brings about the possibility of SARS-CoV-2 transfer from asymptomatic carriers to someone else, which is later confirmed by others (Bai et al. 2020).

When the COVID-19 pandemic spreads around the globe, the intensive care unit (ICU) staff, medical administrators, states, policymakers, and researchers need to brace for a rise in patients severely ill. Many lessons can be gained from Asian ICUs' combined experience with COVID-19 outbreaks, SARS, and MERS. The dense population of Wuhan and accessibility to the marketplace that sell live animals enabled it the epicenter for the interaction between humans and animals. Besides, the lack of early containment due to the failure to track the exposure history accurately in first patient cases led to the rapid rate of spread in Wuhan. It finally instigated the declaration of this viral pneumonia as an epidemic by the WHO on 30 January 2020. On 11 March 2020, the COVID-19 was declared a pandemic by the WHO due to the global logarithmic growth of the outbreaks.

## Mode of transmission

Droplets of various sizes could spread respiratory infections. When the size of droplet particles is more than 5–10  $\mu\text{m}$  in diameter, they are referred to as respiratory droplets and are then referred to as droplet nuclei if they are less than 5  $\mu\text{m}$  in diameter (WHO, 2014). According to available data, the COVID-19 virus is transmitted primarily between humans

via respiratory droplets and contact routes (Burke, 2020; Chan et al. 2020; Huang et al., 2020; Liu et al. 2020; Mission, 2020; Thompson, 2020). A study of 75,465 cases of COVID-19 in China showed no airborne transmission (Ong et al. 2020). Droplet transmission occurs when a person is in close contact (within 1-m range) with someone who has respiratory symptoms (like coughing or sneezing), thus are at risk of exposure to potentially infectious respiratory droplets through his/her mucosa (mouth and nose) or conjunctiva (eyes). The transmission may also occur in surroundings around the infected person via fomites (Ong et al. 2020).

Consequently, COVID-19 virus transmission may occur through direct contact with infected people or by indirect contact with surfaces in the immediate environment or with items used on the infected person (e.g., stethoscope or thermometer). Airborne transmission is distinct from droplet transmission as it corresponds to the existence of microbes within droplet nuclei. They are usually called particles having a size less than 5  $\mu\text{m}$  in diameter that can remain in the atmosphere for more extended periods and can be transmitted to others over distances greater than 1 m. There is specific evidence that infection with COVID-19 can lead to bowel infection and can be found in feces. To date, however, only one study has evidence that the COVID-19 virus may be present in feces (Zhang et al. 2020). Presently, there have been no records of fecal-oral COVID-19 virus transmission. According to the World Health Organization (WHO), 25 March 2020, 414,179 cases and 18,440 deaths from COVID-19, triggered by the novel SARS-CoV-2, were reported globally. On 26 February 2020, however, the rate of case rise in the rest of the world became higher than that in China. Significant outbreaks occur in Italy (69,176 cases), the USA (51,914 cases), and Iran (24,811 cases), and the outbreak keeps expanding geographically (Verity et al. 2020). As per the WHO report 19 July 2020, the total number of confirmed cases 14,043,611 and 597,583 deaths (Coronavirus WHO 2020) across the globe is summarized in Table 1 (Organization WH 2020a) (Fig. 1).

## Ensuring a healthy workspace—personnel security and sustainability

### Management of infectious diseases

The essential mechanism of shielding health care staff is to monitor exposure to COVID-19. A control hierarchy can depict that. Engineering controls are programmed until it comes into contact with the worker to eliminate the danger at source. Administrative controls and personal protection equipment (PPE) are also used in current systems where hazards are not regulated very well.

**Table 1** List of confirmed total cases and death of COVID-19 globally (Coronavirus 2020)

Country	Total confirmed cases	Total deaths
United States of America	3,544,143	137,674
Brazil	2,046,328	77,851
India	1,077,618	26,816
Russian Federation	771,546	12,342
South Africa	350,879	4,948
Peru	345,537	12,799
Mexico	331,298	38,310
Chile	328,846	8,445
The United Kingdom	294,070	45,273
Iran (Islamic Republic of)	271,606	13,979

**Engineering controls**

Engineering controls are intended to reduce the source threat before the worker comes into contact. Patients are put in control areas of higher order for engineering before utilizing lower order areas. Those areas of patient care consist of the following:

**Class N rooms** They are used for negative pressure insulation to separate patients who may transmit the infection, which is present in the atmosphere or is airborne. A negative pressure chamber has a working PPE dressing and doffing anteroom. Precautions on airborne PPE are still needed. Doffing is done in the antechamber.

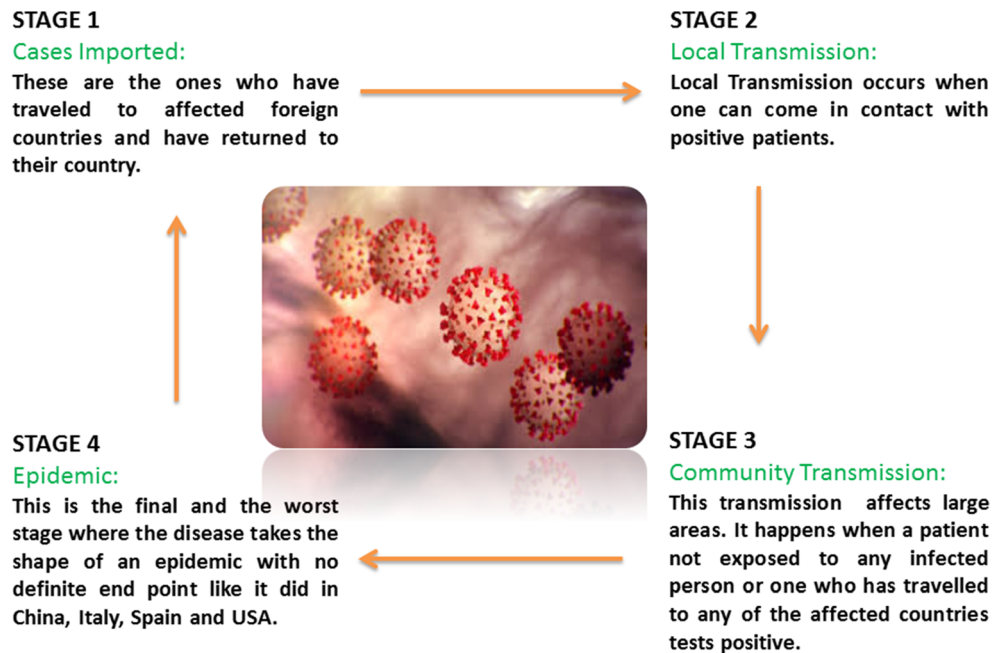
**Class S rooms** They are standardized rooms that can be used to separate patients who can spread infections by droplets or touch paths. Class S rooms do not have negative pressure.

**Open cohort areas** There is no negative pressure on open cohort areas, as well as no engineering controls. Ideally, it is advised for the treatment of COVID-19 patients to take place in a single room with a Class N negative pressure. When Class N rooms are not possible, then the option ought to be single Class S rooms with specific areas demarcated for PPE dressing and doffing. Upon depletion in all single rooms in Class N and Class S, patients may need to be coordinated in the regions that are physically isolated from non-COVID-19 patient areas. When one or more COVID-19 patients are there in an open ICU area, precautions for airborne PPE should be required throughout the region.

**Administrative controls**

Protecting the individual health care worker and maintaining a sustainable workforce for the duration of the pandemic is essential to staff protection. In a pandemic, we suggest moving patient care in the ICU to attending intensive care specialist to reduce the need for attendance inside the ICU by other medical staff. It is recommended that all patients should be tested for possible infection with COVID-19. The patient screening will be consistent with the current national COVID-19 case concept guidelines, which must include clinical history, contact history, and travel history. Patients found to be at risk should be isolated and COVID-19-tested. It is advised that almost all hospitals maintain a record of

**Fig. 1** Stages of transmission of COVID-19



staff training in accordance and competency with the PPE; only staff qualified in the use of the PPE can care for COVID-19 patients.

**Personal protection equipment**

With the existence of the critical disease, much viral load, and the efficiency of aerosol-generating procedures, there is an increased risk of dispersion of aerosolized virus into the health care environment in ICU. But then we all highly endorse that airborne PPE safety precautions be used in intensive care for all COVID-19 patients. In non-ICU conditions, this requires the use of high flow nasal oxygen.

We advise against the use of homemade, nonstandard PPE as poorly structured PPE poses a possible risk for using it. It is suggested to avoid coughing and aerosol-generating procedures in orthodontics so as to minimize the generation of aerosol procedures. If required, they must be concluded in a negative pressure room (Class N room). But if this is not possible, then you can use a single room (Class S). Procedures for processing aerosols are presented in (Fig. 2b).

**Training in PPE**

It is strongly suggested for all intensive care staff (medical, nursing, allied health, cleaning, and ward assistants) the awareness in infection control and personal safety equipment. Environmental cross-contamination should be avoided (Fig. 3). All workers should receive an individual N95 mask fitting check. If possible, we suggest N95 fit testing to consider that the evidence for fit testing efficacy is limited and that the variability and availability of N95 mask types would make it difficult to enforce any guideline on appropriate testing from a realistic perspective Group AC-19 W (2020).

**Guidelines related to intensive care interventions**

The below principle instructions apply for the given time where resource depletion exists and rationing decisions must

be made. These are appropriate for all types of patients. The same conditions apply to patients with COVID-19 as well as other patients needing intensive care.

The guidelines support the SAMS Guidelines “Intensive care treatments.” They, therefore, involve only a limited proportion of coronavirus-infected patients, perhaps even the group of critically ill patients needing intensive care.

**Primary ethical principles** Particularly critical under resource shortage conditions are the four generally accepted principles of medical ethics (benefit, non-maleficence, respect for autonomy, and equity). The desires of the patient about emergency treatment and intensive care must be decided at an early stage, particularly for individuals belonging to a risk category.

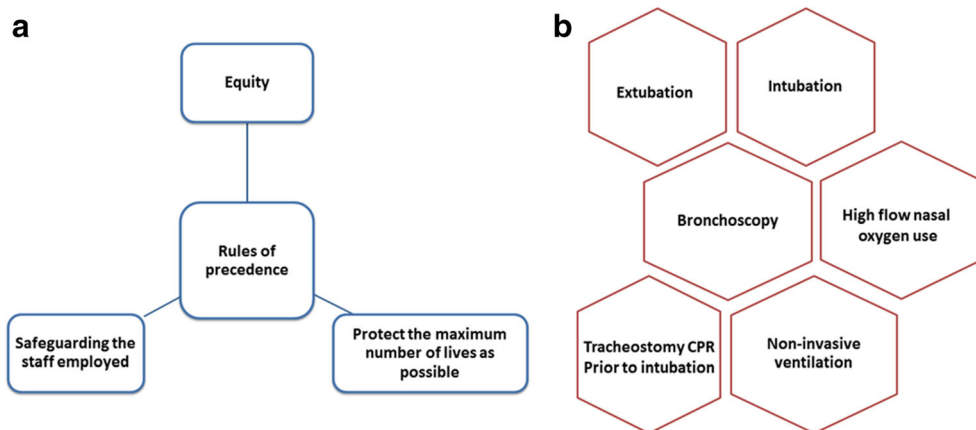
There is no need to use scarce resources for care that a patient does not want to obtain. If the available resources are inadequate to allow all patients to receive the treatment they need, these fundamental principles must be implemented in compliance with the rules of precedence (Fig. 2a).

**Equity** Without prejudice, i.e., without unjustified discriminatory treatment based on gender, age, citizenship, national origins, religious preference, public or insurance background, or persistent disability, the available resources must be allocated. The assignment process has to be rational, impartial, and transparent. Unreasonable decisions could be prevented with a sensible allocation process.

**Protect the maximum number of lives as possible** All interventions are driven under circumstances of acute scarcity to reduce the number of fatalities. The decisions are being made to allow only those people to work who do not fall sick frequently. Elderly persons are avoided as they may fall sick frequently due to weak body.

**Safeguarding the staff employed** Such individuals would be at high risk for coronavirus infection. If they cannot function due to illness, there will be more fatalities under circumstances

**Fig. 2** a Rule of precedence for the care of patients. b The process involved in the generation of aerosols



**Fig. 3** Methods to avoid cross-contamination



Avoiding environment cross contamination

- Preferably only single-use equipment should be used
- Refrain of using equipment/resources in ICU
- No personal devices in COVID-19 areas
- Stethoscope use should be minimized
- Minimize personal effects in workplace

of acute scarcity. Hence, they must be secured from infection as much as possible but also against undue psychological and physical stress. Experts whose wellbeing is at higher risk in the case of coronavirus infection need to be specifically covered and must not be employed in the treatment of COVID-19 patients (Swiss 2020).

**Intensive patient care with COVID-19**

Preliminary reports indicate that COVID-19 is correlated with severe illness seeking intensive care in around 5% of confirmed infections. Despite however severe the disease is, as in recent world outbreaks of extreme acute respiratory infections including MERS and influenza A(H1N1) pdm09, avian influenza A(H7N9), and SARS (severe acute respiratory syndrome), the critical treatment should be primarily a product of the global response to this evolving infectious disease. The dramatic rise in COVID-19 incidents in Wuhan, China, in late 2019 demonstrated too rapidly that health services could be contested to include sufficient treatment. The instance at least-fatality rates was seven times higher among people in the region of Hubei relative to those outside the province, 2.9% vs. 0.4%, highlighting the significance of the ability of the health care system in the treatment of patients with COVID-19 who are critically ill (Wu and McGoogan 2020). The emergency treatment required for every individual and alternative methods required for intensive care patients are presented in Fig. 4 a and b, respectively.

**Factors related to the need for intensive care**

Appreciation of typical clinical characteristics and course of the disease is critical both in planning for a growing number of patients and in deciding how important to treat infected persons. Patients receiving intensive care appeared to be elderly (median age up to 60 years), and 40% had comorbid circumstances, typically diabetes and heart disease (Wang et al.

2020a). Older people and individuals with serious, severe medical conditions such as diabetes and pulmonary or cardiovascular disease tend to have a higher chance of undergoing more severe complications from COVID-19. Currently, up to date, there is no vaccine for the prevention of COVID-19. The only most excellent way to prevent/avoid illness is to avoid being exposed to this virus (Fig. 5). Young people have been usually shown to develop a milder illness, while perinatal exposure can be linked with severe risk. The low number of pregnant females affected has had a mild course to date (Chan et al. 2020), but rare cases make predictions of the class of disease uncertain; however, a serious condition in expectant mothers has been a serious concern with influenza A(H1N1) pdm2009. The median time between symptom onset and

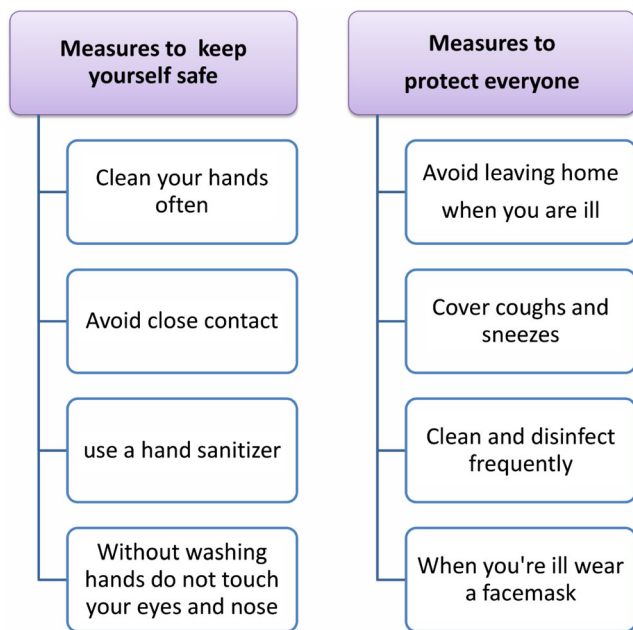
**Emergency treatment essential for everyone**

- Conservative approaches regarding intravenous fluids.
- Evidential treatment using antibiotics for suspected bacterial pneumonia.
- Taking into account the early intrusive mode of ventilation.
- Protective pulmonary ventilation approaches.
- Assessment of the oxygenation of extracorporeal membranes.

**Alteration of conventional emergency treatment**

- Patients of the suspected disease are admitted to private rooms where possible
- Usage of medical masks in the diagnosis and transfer of symptomatic individuals
- Maintain a gap between patients of at minimum 1 or 2 meters
- Use of N95 masks and eye protection

**Fig. 4 a** Emergency treatment required for every individual. **b** Alternative methods required for intensive care patients



**Fig. 5** Protective measures to be followed to avoid the spread of COVID-19

admittance to ICU was 9 to 10 days, indicating a progressive decline in most cases (Yang et al. 2020). The first and most reported cause for intensive care was respiratory assistance, of which two thirds in patients met acute respiratory distress syndrome (ARDS) requirements (Wang et al. 2020a). Some essential steps for shielding against current coronavirus is presented in (Fig. 6).

## Differentiation from other causes

Because of the presence of several circulating respiratory viruses, it is essential to distinguish COVID-19 from other pathogens, particularly influenza, and mainly to use upper (nasopharyngeal) or lower (induced sputum, endotracheal aspirates, broncho-alveolar lavage) respiratory tract samples for reverse transcriptase-polymerase chain reaction and bacterial crops. There are indicative but nonspecific radiographic improvements, such as ground-glass opacity on computed tomography. Quick access to diagnostic test results is public health and clinical priority, allowing effective patient triage and infection management procedures to be enforced (Bai et al. 2020; Cascella et al. 2020).

## Clinical management of COVID-19

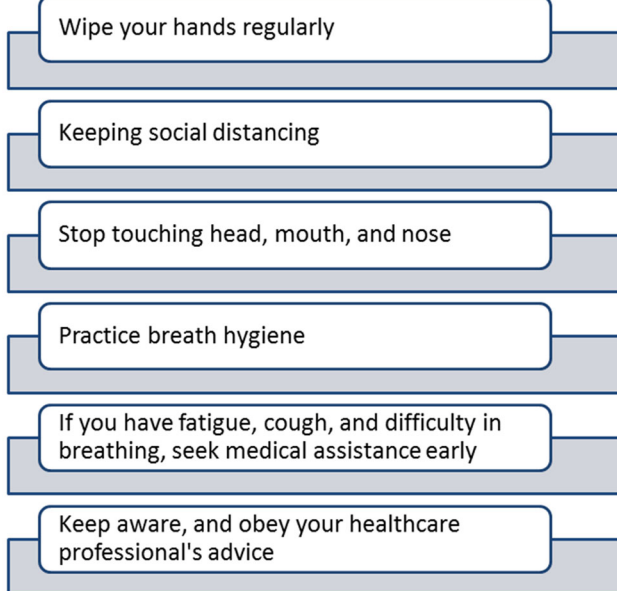
With the emerging problems posed by this emergency in public health, there is a growing need for the timely detection and creation of drugs that can be used to treat COVID-19 infections. A broad variety of drugs previously approved for

additional indications and some investigational drugs are being tested in COVID-19 through clinical trials for profit (Prevention 2020). While the COVID-19 pandemic evolves, ever more research findings have been brought to light that support different prevention and treatment strategies. Before incorporating various pharmaceutical agents into clinical practice, however, it is of paramount importance for the treating physician to exercise caution and critically assess available data.

COVID-19 is the third in two decades of widely identified coronavirus infection in Asia. It consists of SARS and MERS (Morens, 2018). A group of researchers led by Dr. Josef Penninger, University of British Columbia, has found a drug that effectively blocks SARS-CoV-2 cell door, which infects its hosts. It gives a new insight into critical aspects of SARS-CoV-2, the COVID-19-causing virus, at its cellular-level interactions, as well as how the virus can affect blood vessels as well as kidneys. In this outbreak, ACE2—a protein on the cell membrane surface—is the center stage as the primary receptor for the SARS-CoV-2 spike glycoprotein. Since the COVID-19 outbreak persists globally, there is a lack of a clinically validated antiviral medication or a drug directly targeting the essential SARS-CoV-2 receptor ACE2 at a molecular level for treatment of severe COVID-19 cases (Monteil et al., 2020).

A team of scientists led by infection biologists from the German Primate Center, including researchers from the Charité, the University of Veterinary Medicine Hannover Foundation, the BG-UnfallklinikMurnau, the LMU Munich, the Robert Koch Institute, and the German Center for Infection Research, wanted to find out how the new SARS-CoV-2 coronavirus reaches host cells and how this process

## Essential steps for shielding against current coronavirus



**Fig. 6** Essential steps for shielding against current coronavirus

can be prevented. The scientists recognized a cellular protein essential for SARS-CoV-2 entry into the lung cells. They identified a cellular enzyme that is necessary for viral entry into lung cells: the TMPRSS2 protease. “This protease constitutes a possible therapeutic intervention target.”

Neuraminidase inhibitor oseltamivir is a key drug in influenza management. Due to lack of neuraminidase, it has never been shown to have activity for CoVs and is therefore unlikely to be of benefit. While it has been used in the earlier part of the Chinese epidemic, most recommendations no longer prescribe it (Organization WH 2020b).

In Vero cell studies, favipiravir, an RNA polymerase inhibitor, demonstrated moderate activity against SARS-CoV-2 virus with marked cytopathy (Wang et al. 2020b). The drug was used in China for COVID-19 diagnosis and is being tested in a clinical trial for mild SARS-CoV-2 disease and as an alternative in moderate and extreme diseases (Cai et al. 2020).

The drug camostat mesilate is known to inhibit the transmembrane protease, serine 2 (TMPRSS2). It was earlier approved in Japan for the treatment of chronic pancreatitis. The scientists are focusing on whether this drug can also prevent SARS-CoV-2 infections. According to Markus Hoffmann, the isolated SARS-CoV-2 from patients was tested against this drug molecule and found that it prevents the virus entry into the lung cells. Thus, it may be used for the treatment of COVID-19 after clinical trials (Hoffmann et al., 2020).

Coronaviruses cause respiratory infections, primarily in humans. People with SARS-CoV-2 that remain asymptomatic 2 to 14 days following infection and certain people are likely to expose the virus without acquiring disease symptoms. Remdesivir is a nucleotide-like prodrug that is intracellularly metabolized to an adenosine triphosphate analogue that inhibits viral RNA polymerases. Remdesivir has extensive activity toward members of several families of viruses such as filoviruses and coronaviruses, and in nonclinical models of these coronaviruses, remdesivir has also shown prophylactic as well as therapeutic effectiveness (de Wit et al. 2020; Sheahan et al. 2020; Wang et al. 2020b). The antiviral, remdesivir, is the most active compound for treating COVID-19 so far. Presently, it is in clinical trials to treat infections with the Ebola virus (Martinez 2020).

Recent work has revealed that antiparasitic medicines presently available across the globe will eradicate the virus within 48 h. Researchers have found that single dose of ivermectin might halt the development of the SARS-CoV-2 virus in cell culture. Further, the dose translation is done so that it may be given to humans to treat the infection successfully. An antiparasitic drug molecule, ivermectin approved by the FDA, is shown to be effective against this virus *in vitro*. It also works against some viral diseases, including HIV, dengue, influenza, and Zika.

According to Dr. Kylie Wagstaff, who led the research at the Monash Biomedicine Discovery Center, ivermectin,

within 48 h, halts the SARS-CoV-2 virus from developing in cell culture. It was established that even a single dose could eliminate all viral RNA by 48 h, and there was a significant reduction in it even at 24 h.

“Ivermectin is commonly used and used as a safe medication. We need to find out now if the dose you would use in humans is going to be successful, this is the next step,” Wagstaff said. Still, the mechanism is not known that how ivermectin acts on the virus, on the basis of its activity in other viruses; it is likely to work by inhibiting the virus from “dampening down” the host cell ability.

Dr. Leon Caly, Scientist, Victorian Infectious Diseases Research Laboratory (VIDRL), Doherty Institute, from the Royal Melbourne Hospital, stated: “As a virologist who was part of the team which first isolated and shared SARS-CoV-2 outside of China in January 2020, I am interested in the possibility of using Ivermectin as a possible COVID-19 drug” (Caly et al., 2020).

## COVID-19 waste management

According to the 2008 Medical Waste (Management and Processing) Rules, medical wastes could not at any stage be mixed with other wastes generated in-clinics, collecting from clinics, transporting them, and storing them separately based on classification. The current COVID-19 pandemic has already turned safe places all over the world into a living hell with huge death tolls due to its rapid spread culture and contributing to constant lockdowns in almost every part of the country. Amid all the issues it has generated so far, one big problem that can cause severe havoc in an already destructive and infectious environment in a densely populated city is not correctly handling of medical waste. China’s Wuhan is home to 11 million people, the first city to be viciously brutalized by the pandemic. According to the emergency office of China’s Ministry of Ecology and Environment, its hospitals created more than 240 tons of medical waste daily during the outbreak peak compared to 40 tons before the epidemic occurred. The central government has deployed 46 mobile medical devices to tackle this tremendous amount of medical waste treatment that supports the town of Wuhan, and in March, a new plant with a capacity of 30 tons was installed within 15 days. Biomedical waste is toxic as it includes possible virus particles that may be concealed beneath human skin: objects that are contaminated with blood bags, needles, syringes or some other sharp objects, and body fluids as well as dressings, plaster casts, cotton swabs, and blood or body fluid-contaminated bedding. Experts claim that waste medicinal products are not like other waste as in the case of household or industrial waste. It can infect one directly through the skin or ingestion and inhalation of items such as inhalers or ventilation pipes. Microbes and viruses that are immune to antibiotics (including

COVID-19 at this point) could spread quickly from medical waste. Biomedical waste is harmful because it contains possible virus particles, which can be hidden underneath human bodies: blood-contaminated objects, needles, syringes or any other sharp object, and body fluids as well as dressings, plaster casts, cotton swabs, and blood or body fluid–contaminated bedding. Covid W (19AD); (MacKenzie 2020).

During the COVID-19 emergency, safe management of household waste will also likely be critical. Medical waste such as contaminated masks, gloves, medicines used or expired, and other items can easily be mixed with household garbage. Still, it should be treated as hazardous waste and disposed of separately. Plastic products used are often pathogen-contaminated and should be treated as hazardous waste. Just before the start of the COVID-19 pandemic, plastic waste management was considered a major environmental problem because of rising concerns about contamination in terrestrial and marine ecosystems (Rajmohan et al. 2019). These should be stored separately from other fluxes of household waste and collected by municipal specialists or waste management operators. Medical waste from health care facilities is especially problematic since any remaining pathogens must be eliminated (Windfeld and Brooks 2015). Health centers will continue to treat infectious waste according to guidelines for handling medical waste. Treatment facilities are usually built to manage safe environments where a consistent average flow rate and composition of medical waste is treated. Specific treatment technology choices are based on thermal processes such as incineration, steam treatment (autoclaving), plasma treatment, and treatment with microwave. Treatment selection process is governed by a multitude of economic, technical, environmental, and social acceptability (Liu et al. 2015). There seems to be no indication at this time that the presence of the coronavirus in a health care facility will create new infectious waste streams that require special handling. Hospital waste, such as disinfecting pads, personal protection devices, or disposable food ware, may be disposed of in the garbage as solid waste. All nonrecyclable waste from households and hospitals should be bagged and tied before putting it in a trash receptacle. All this waste must be disposed of in an unbroken waste wasteland approved by municipal solid waste approval.

### The pandemic effect on plastic waste

The pandemic has resulted in substantial difficulties in the treatment of solid municipal waste (MSW) and harmful medical waste. China's got the most data on that topic. According to the 11 March press releases of the Joint Prevention and Control System of the State Council in China, however, during disease outbreak, the quantity of MSW was decreased by 30% in large and medium cities (Prevention 2020).

Nevertheless, medical waste production in Hubei Province increased sharply (+ 370%), with a high plastics proportion. From 20 January to 31 March, there was an estimated 207 kilotons of accumulated medical waste in all of China. In Wuhan, medical waste increased from the usual level of 40 tons/day to around 240 tons/day, reaching the full capacity of 49 tons/day for incineration (Klemeš et al. 2020). Under normal conditions, treatment systems designed for waste quality and quantity have to deal with drastic changes that cause irregular operations. Research of engineering is essential if these structures are to be able to cope with the complex and changing existence of the pandemic. Another problem is that much of the virus itself remains unknown, as it is still uncertain which products and processes will be required to handle the epidemic. The COVID-19 crisis illustrates the vital role of plastic in everyday life. Managing the virus needs single-use plastic, although in many other applications, disposability is generally seen as an environmental liability (Klemeš et al. 2020). Specific prevention or reduction steps being placed in various countries increase both the amount and nature of plastic waste. Consumers see single-use plastics as a convenient option for specific uses. Survival of the virus was observed on various surfaces like plastics (Van Doremalen et al. 2020). While plastics in terms of virus persistence are no better than other products, disposability is seen as a significant benefit by consumers who prioritize hygiene. That has resulted in increased use and recycling of plastic products, also for non-medical purposes. On the other hand, in the expected global economic slowdown, plastic demand in the different sectors (e.g., automotive and aviation applications) is declining. Lockdown initiatives have resulted in a rise in the quantity of packaging used to distribute food and produce to residences. Such changes will intensify environmental issues with plastics that already existed before the pandemic took place. While this rise is inevitable, efforts should be continued to protect the environment. Metrics, in particular, should be created and wholly exploited to promote device design and comparison of alternatives, footprints.

### Socio-economic and environmental implications of COVID-19

COVID-19 has no equal effect on all. There are many reasons why this pandemic is affecting various socio-economic classes in different ways. Knowing the consequences and understanding how this pandemic impacts diverse socioeconomic classes differently is not easy, and useful data is the key to it. These socioeconomic factors include population density, urban and rural settings, level of education, lifestyle, household size, and household owners and tenants. Often just a single block away from neighborhood households across the socio-economic continuum can make a big difference in one's life



(demonstrate from the USA on the US longevity map of Club Vita). It is therefore sometimes regrettable that individuals who think the effects of COVID-19 are likely to be in your neighbors (Messner 2020). Many countries are now using various strategies to avoid the disease spreading and attempting to restrict only a subset of people who will contract the disease. It has been proposed that groups with lower socioeconomic status may be more at risk from the COVID-19 spread, based on New York's research finding that more impoverished communities were strongly affected. COVID-19 spreads by droplets from the respiratory system by someone with the virus, meaning it would cover with more excellent human proximity, more extensive contact networks, and lower hygiene levels. Some variables contribute to the occurrence of COVID-19, but different socio-economic groups possibly experience them differently (Lipsitch et al. 2020).

## Other environmental impacts of COVID-19

Beaches are amongst the most significant natural assets, mainly in the coastal areas (Zambrano-Monserrate et al. 2018). They offer resources (land, sand, leisure, and tourism) that are vital to coastal communities' survival and have intrinsic values that must be protected against over-exploitation (Lucrezi et al. 2016). Nevertheless, unaccountable use by people has caused many beaches in the world to pose problems with pollution (Partelow et al. 2015). As a result of the social distancing steps due to the latest coronavirus pandemic, the shortage of visitors has caused a significant shift in the appearance of many beaches worldwide. Beaches like Acapulco (Mexico), Barcelona (Spain), or Salinas (Ecuador), for example, now look cleaner and with crystal clear waters.

Environmental noise is characterized as an ambient noise that could be produced by high-volume anthropogenic activity (for example, industrial or commercial activity), engine vehicle transit, and melodies. Environmental noise is one of the primary sources of discomfort for the population and the environment, which causes health problems and changes the ecosystem's natural conditions (Zambrano-Monserrate and Ruano 2019). Some governments have enacted quarantine measures that have caused people to remain at home. Despite this, the use of public and private transportation has dramatically decreased. Commercial activities have almost wholly stopped too. Both these developments have led to a significant decrease in noise levels in most cities around the world.

Organic and inorganic waste generation is indirectly followed by a wide range of environmental problems, such as soil degradation, deforestation, air pollution, and water pollution (Mourad 2016; Schanes et al. 2018). The quarantine policies that have been established in several countries have led consumers to increase their demand for

home delivery online shopping. Hence, household-generated organic waste has increased. Food purchased online is also shipped packed so inorganic waste has increased as well.

Waste recycling has always been a significant environmental issue of interest in all countries (Liu et al. 2020). Recycling is a growing and efficient means of pollution control, energy conservation, and conserving natural resources (Varotto and Spagnoli 2017; Ma et al. 2019). Countries like the USA have suspended recycling systems in some of their cities as a result of the pandemic because officials were worried about the risk of COVID-19 spreading in recycling centers. Waste management has been restricted in particularly affected European countries. Italy has, for example, prohibited contaminated people to sort their waste. The industry has also taken the opportunity to repeal disposable bag prohibitions, while single-use plastic can still contain viruses and bacteria.

## Conclusion

In a nutshell, this epidemic disease, COVID-19, is being transmitted from individual to individual. The health care professionals are facing a challenge in the control of this epidemic disease. As to date, there is particular treatment available for the cure, and the scientists and researchers are actively involved in the exploration of drugs/vaccines to combat this epidemic disease. Therefore, the frontline to combat the spread of this disease is to take precautions, maintain social distancing, and spread knowledge among people to ensure the safety of people.

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**Data availability** The data generated or analyzed in this article are online and publicly available without request.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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