

COVID 19: A CALL TO ONE HEALTH ACTION

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ABSTRACT

In an ever changing 21st century world, pandemics such as the Severe Acute Respiratory Syndrome (SARS-CoV-2) virus also known as COVID-19 have come to stay, especially as the world is gradually becoming a global village. The disease has caused a lot of economic and social disruptions globally. The relationship between animals, the environment and humans as hosts of the virus needs to be understood as a way to break the chain of the spread of the virus. This calls for more concerted efforts in preventive measures at the human, environmental and animal interfaces. The synergy between the various health sector (environmental, animal and human) practitioners will help curb the pandemic and also make our world a better and more environmentally-friendly place. This paper aims to elucidate the linkages between man and his environment; the implication of these infections and pandemics on public health and furthermore lends a voice to the call for a One Health approach to curbing the current COVID-19 pandemic ravaging the world.

Keywords: COVID-19 Pandemic; Infectious diseases; One health; Global health; Public health; Inter-sectoral collaborations

INTRODUCTION

The world today is facing many multi-faceted problems which will need an international and multi-disciplinary approach to subdue. Emerging and re-emerging diseases have ravaged the world with various outcomes and most of these diseases are of zoonotic (animal) origin. One of such outcomes is the respiratory diseases of the *Coronaviridae* family of which the recent coronavirus (COVID-19) pandemic belongs. These respiratory infections represent a constant pandemic danger, of which coronaviruses and especially the *Betacoronavirus* in the family *Coronaviridae* is a subset. The human respiratory framework is helpless against such respiratory diseases because of the contact-based inoculation of these infectious materials as droplets through the eyes, nose, or mouth. Airborne transmission is viable as observed, for example, in the variety of viral respiratory ailments influencing people of all ages.^{1,2} In the recent past decades, communities have been faced with various emerging and novel viral respiratory infections with pandemic potential including the Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) which occurred in China in 2002³; swine origin pandemic (H1N1) flu- a virus that

rose in Mexico in 2009⁴; and the Middle East Respiratory Syndrome coronavirus (MERS-CoV) which developed in Saudi Arabia in 2012.^{1,5,6}

History of Coronavirus and COVID-19

Coronaviruses are a wide group of viruses that cause many infections resulting in sickness with a wide range of symptoms which could progress from mild to severe.^{7,8} Coronaviruses are ubiquitous i.e. can be discovered everywhere throughout the world and are implicated in around 10-15% of normal colds, generally during the rainy, stormy season. There are four genera of coronaviruses (CoV) which are α , β , γ and δ . α - and β -CoV can affect warm blooded animals, while γ - and δ -CoV cause infections in birds. Before the SARS-CoV-2, prevalently known as COVID-19, six CoVs have been recognized as human-susceptible infections. These are α -CoVs HCoV-229E and HCoV-NL63, β -CoVs HCoV-HKU1 and HCoV-OC43. These four have low pathogenicity with accompanying mild symptoms which mostly manifest as regular cold. The other two known β -CoVs, SARS-CoV and MERS-CoV cause serious and possibly

deadly respiratory tract diseases.⁹ These infections were treated as basic and non-lethal conditions prior to 2003, however since this time, there has been an unexpected change with the identification of the Severe Acute Respiratory Syndrome (SARS) which caused a mortality of about 1000 patients from several nations.⁵ These nations include the United State of America, Hong-Kong, Singapore, Thailand, Vietnam and Taiwan. In 2004, a strain of the coronaviruses known as NL63 was identified in a child experiencing bronchiolitis (a lower respiratory tract disease) in the Netherlands. Scarcely a year later, another coronavirus was found in an old patient in Hong Kong. It was later named HKU1 and has been identified in populaces around the globe.⁷

SARS-CoV, which was first identified in November 2002, was genomically identified and confirmed in 2003 and has caused mortality of as much as 774 people from that point till the last known epidemic outbreak in 2014.¹⁰ This coronavirus is the nearest comparative with the SARS-CoV-2 (COVID-19) which at present has attained pandemic status globally.¹⁰ In 2012, another coronavirus episode prompted the identification of the novel infection named MERS-CoV. The first instance of the Middle East Respiratory Syndrome (MERS) occurred in Saudi Arabia. There were two different outbreaks in South Korea and Saudi Arabia in 2015 and 2016 respectively.^{11,12} Likewise, Africa has also experienced the effect of this infection with practically all the nations affected.¹³ COVID-19

has been reported as zoonotic, i.e., having the ability to be transmitted from human to animals and animals to man.¹⁴ The animal involvement in the transmission of SARS-CoV-2 has been reported either as reservoir or intermediate hosts (Fig. 1), hence, frequent washing of hands, non-contact with animal faeces or wild life is highly recommended as this will tend to reduce the zoonotic import of the disease.

Understanding the SARS-CoV-2

The SARS-CoV-2 is a β -coronavirus, which is an enveloped non-segmented positive-sense RNA infection of the *coronaviridae* family. It is the seventh of the coronaviruses that has caused episodes of epidemics on the planet. A transitory name was at first given to this coronavirus as 2019-novel coronavirus (2019-nCoV) and it was later assigned as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the Coronaviridae - Study Group of the International Committee on Taxonomy of Viruses (ICTV). The infection was named COVID-19 (Coronavirus disease-2019) by the World Health Organization (WHO).⁸

The COVID-19 outbreak emanated from Wuhan, China in December, 2019 and has spread to practically all the countries of the world necessitating the elevation of its status to a pandemic challenge by the WHO.¹⁶ As at January 9, 2021, there has been 87,273,380 cases and 1,899,440 mortalities of COVID-19 globally.¹⁷ The epidemic was at first connected to a fish/seafood

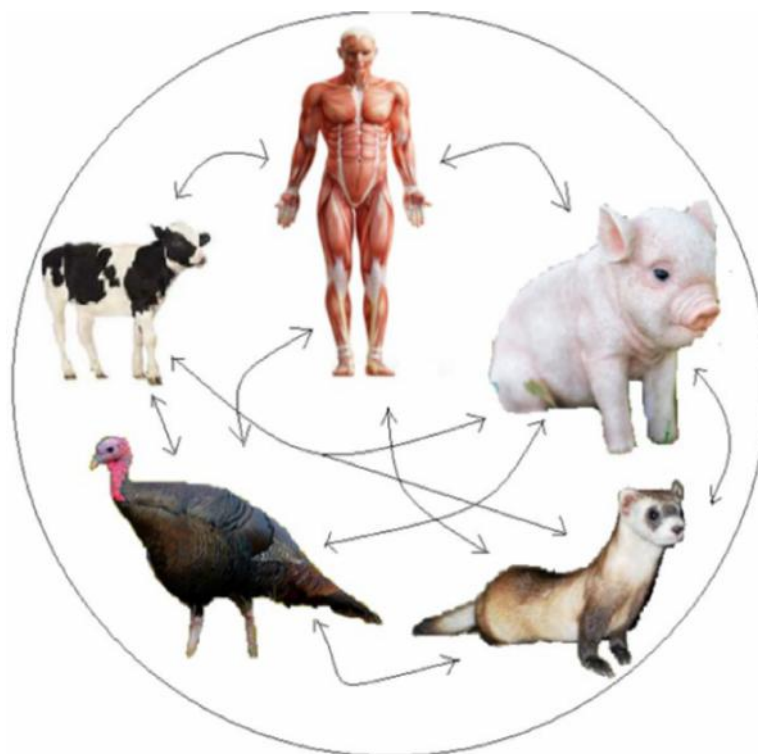


Fig. 1: Corona virus hosts and transmission modes. Source: Kumar *et al.*¹⁵

market and was linked to Bat CoV RaTG13 to which it demonstrated 96.2% comparability.^{4,18} However, there is no concrete proof yet that the root of SARS-CoV-2 was from the fish market. It is also probable that bats are the characteristic reservoir of a wide assortment of CoVs, including SARS-CoV-like and MERS-CoV-like infections.^{3,19} Findings have shown that the virus replicates poorly in pigs, chicken and ducks though replication in dogs has been suspected.^{18,20} Direct contact with animals that are intermediates of these viruses or consumption of wild animals has been implicated as the main route of SARS-CoV-2 transmission.²¹

One of the primary difficulties in containing the COVID-19 episode is that its symptoms and side effects can be exceptionally mild. In some cases some individuals may not exhibit any side effects whatsoever while still being able to infect others. COVID-19 isn't

the contamination site. The viral transmission pathways are described below (Fig. 2 and 3). The three main ways of transmission are through droplets, aerosols and fomites (Fig. 2). Transmission through droplets is the most reported and well established means of infection with the virus. The other means (aerosol and fomites) are still being investigated though there have been some reports of their being involved in the transmission process. Since the virus is a relatively large one, contact with infected persons especially those with a cough, is the easiest and one of the highest known risk factors for the infection. To prevent transmission therefore, keeping of a social distance of about six feet will help reduce the chances of contracting the infection.

Infected persons, especially those with respiratory clinical signs, release airborne droplets of the virus. These droplets may fall on surfaces and stay on them,

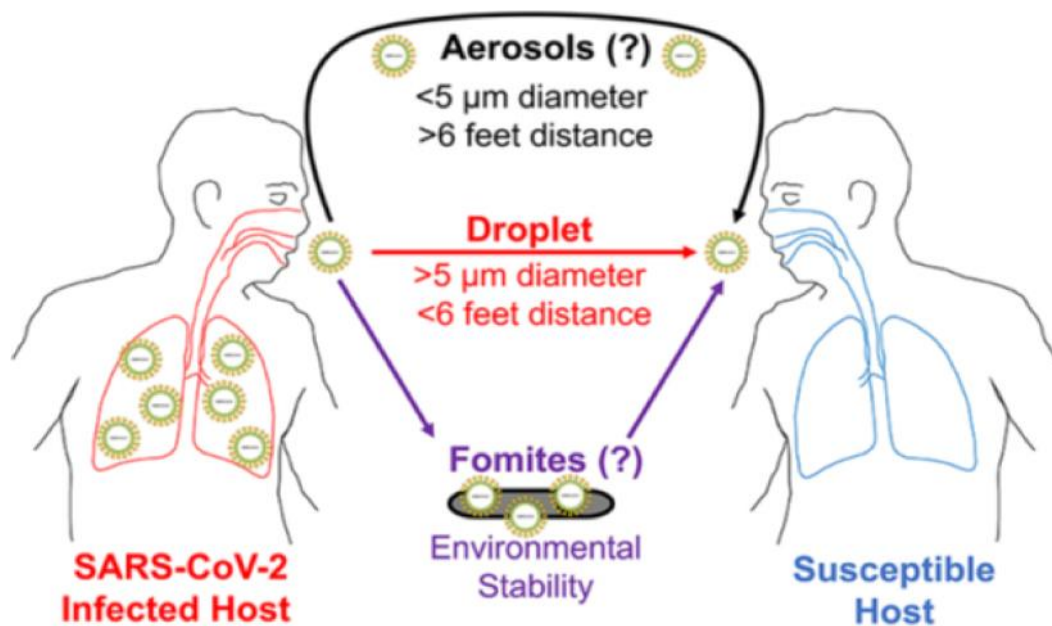


Fig 2: The routes of entry of COVID-19 virus in human to human transmissions. (Source: Kumar *et al.*¹⁵)

as fatal as either SARS or MERS, but since it can spread undetected, the population of individuals it will affect and the numbers of mortality will perhaps be higher than any coronavirus we have ever experienced.

Routes of transmission of SARS-CoV-2

Individuals can get infected with SARS-CoV-2 through close contact with people who have symptoms and side effects from the infection. These symptoms include coughing, wheezing and sneezing. The coronavirus is spread by means of airborne zoonotic droplets. Infection is then multiplied and repeated in ciliated epithelium that causes cell harm and disease at

then they become sources of formite infection or hang on in the air and become source of infection for people exposed to such infected air (Fig.3). Subsequently, these droplets get into the respiratory system and lodge in the organs of the individual. This is the reason why the use of face masks or face shields are highly recommended especially when individuals are in public places or densely populated spaces. In addition, one of the ways, also highly recommended to stop the spread of the disease is for individuals to reduce public appearances to instances when this is extremely necessary, this helps to limit individuals' exposure to sources of infection.

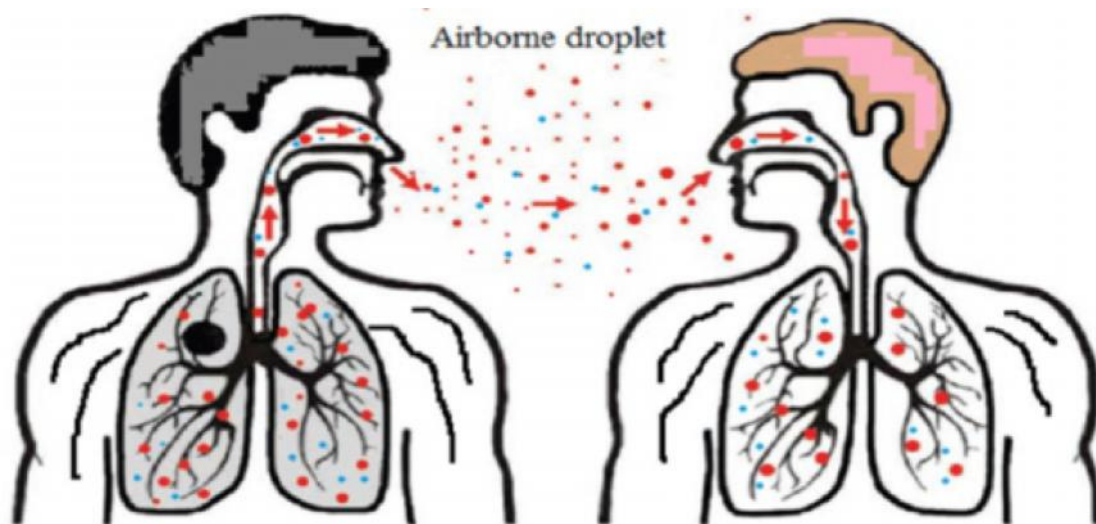


Fig 3: Transmission of crown infection by means of airborne beads. (Source: Kumar *et al.*¹⁵).

Community/Network transmission of COVID-19

The covid-19 infection was believed to have been primarily transmitted from animals especially bats, however once the epidemic was established transmission became more of person-to-person (Fig. 2 & 3). This mechanism linked to human-to-human transmission, is an active process that is facilitated through respiratory droplets when an infected person cough or sneezes; hence leading to community transmission of the disease.^{1,5} Community transmission happens essentially between close relatives and companions who have been in close contact with either symptomatic or asymptomatic patients. Globalization and migration including travels can explain the rate of mobility of infectious zoonotic diseases.

In the case of the COVID-19 outbreak, globalization was probably a main factor that drove the ascendancy of the disease to the level of a pandemic⁸, resulting in partial and complete lockdown of states and nations. Healthcare providers and social insurance laborers are at higher dangers due to their proximity to infected persons in their line of duty. Other factors included social activities such as celebrations, public events involving mass movement and gathering of people.⁸ Spill over outbreaks are common and significant phenomena in previously recorded zoonotic diseases outbreaks.²² This is also an issue that should be taken into consideration in the understanding and management of the current COVID-19 pandemic as its spill over can be very significant.

Environmental/ecological impact of COVID-19

With the cross-cutting nature of the COVID-19 pandemic, there has been an increase in the volume of medical waste generated in communities daily. For instance, in Wuhan, China, tons of medical waste have

been generated since the onset of the pandemic.²² This is more than multiple times the sum that the incinerator in the territory can deal with per day. Failure to dispose of this refuse appropriately will prompt contamination which could result in another pestilence if care is not taken, especially as coronavirus has spread rapidly to different parts of the world. Thus, clinical waste administration and management could become a major issue.²³ COVID-19-associated wastes such as discarded face covers, hand sanitizer bottles alongside disposed used tissue papers will accumulate on the land and if they eventually get into aquatic bodies, will most likely clog water bodies and become an extraordinary ecological danger (Fig.4). For example, with the increasing usage of disposable facemasks and shields globally comes the consequent increase in waste generation; this is with resultant deleterious effects on the ecological characteristic of animals' natural terrestrial and aquatic surroundings.²⁴ These may also result in the loss of animal lives.²⁵ In addition, sharp objects indiscriminately dumped on land sites can be a source of harm to humans and animals who come to the sites to scavenge and may directly or indirectly lead to infections, morbidities and loss of lives. Improper waste disposal of COVID-19 associated wastes can thus be described as a secondary cause of death during the pandemic. The information in Figure 4, depicts the environmental and ecological contamination issues related with the COVID-19 pandemic (Fig. 4).

Forestalling zoonotic infection episodes

There is currently no straight forward solution to preventing zoonotic disease outbreaks. However, some researchers have suggested that the reinforcement or fortification of certain lines of defenses could help to prevent zoonotic infection episodes or epidemics.

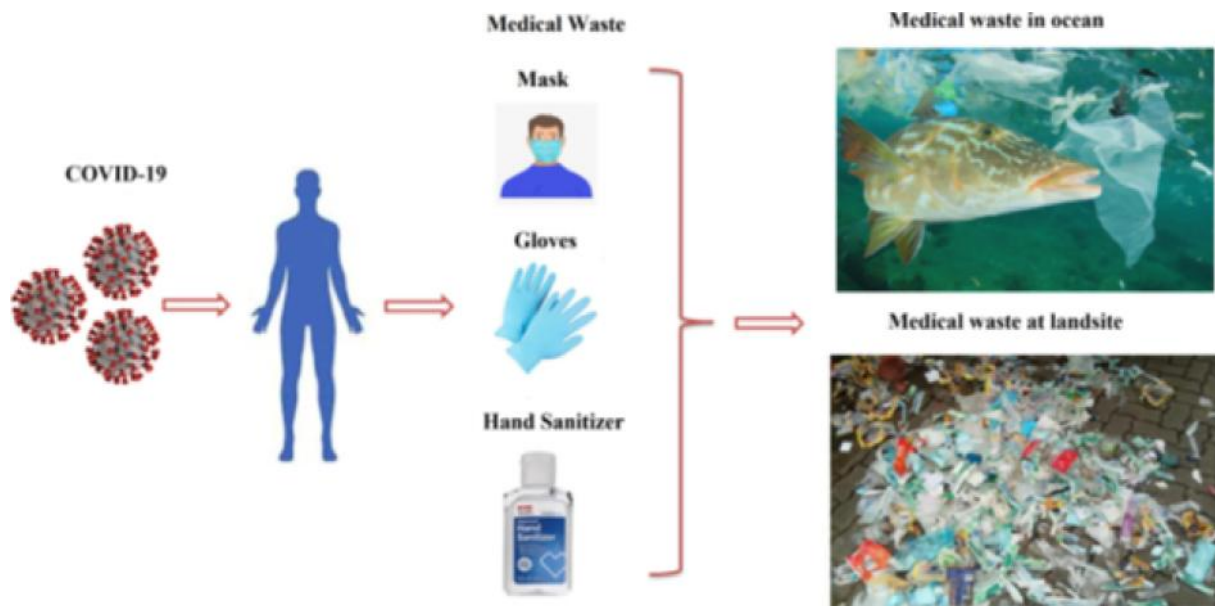


Fig. 4. Diagrammatic presentation of waste from COVID-19 pandemic in nature. (Saadat *et al.*,²⁶)

These lines of defense are:

1. Preserving and safeguarding biological systems (ecosystems) and reestablishing characteristic natural surroundings (habitats) can guarantee that the animal-human distance is maintained and animals don't have to scrounge close to where people live.
2. Elimination or reduction of unsafe practices that predispose individuals to pathogens – through community education and engagement with respect for individual or community livelihood and socio-cultural practices.
3. Governments' investment in public health and routine surveillance in areas prone to leading such infectious diseases outbreak.

The containment and control of COVID-19, animal-to-human control of the disease can be faster when compared to the human-to-human modes of transmission.²² However, it is important to note that its zoonotic origin similar to other coronaviruses such as SARS-CoV and MERS-CoV, makes it imperative to have a clear understanding of the interaction between humans and animals. This is important if future emergence or entirely new epidemics are to be forestalled either locally or globally.

One health approach to handling COVID-19

The One Health concept acknowledges the interconnectedness of Human, animal and environmental health and wellbeing. The approach focuses on these relationships and interconnectedness

in infectious and zoonotic disease management. The WHO defines the One Health strategy as “an integrated approach in the designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes”.²⁶ The COVID-19 challenge has human, animal and environmental interface and this has brought to fore the relevance of the One Health principle in the management of the disease. A pivotal strategy in the One Health approach will be the intentional composition of a multi-disciplinary team (drawing expertise from medical, environmental health, public health team, physicians, veterinarians and allied researchers) with a multi-pronged mandate to tackle the pandemic.

Although, the one health concept is not new, however, the case of the COVID-19 pandemic, may require a more coordinated One Health response at the global level with involvement of stakeholders at the regional and country levels in relation to interdisciplinary surveillance and monitoring of the disease; synergy in the coordination and integration of animal and human disease diagnoses; and collaborative community efforts at addressing community transmission and other COVID-19-associated issues such as waste management challenges etc. There is an urgent need for stakeholders to take the front seat in developing meaningful, and efficient collaborations and partnerships with the goal to understand the disease better, respond to further spikes and challenges posed by the disease and ultimately prevent future major

outbreaks. This will aid in reducing capital costs accrued in the control of the pandemic especially in resource-limited countries.^{27,28}

Way forward and call to action

The One Health approach offers a concrete avenue for stakeholders' involvement in addressing not only the COVID-19 pandemic but other emerging infectious diseases especially those with zoonotic linkages. Globally, 60 % of all infectious diseases are of zoonotic origin²⁸ and there are still several emerging and re-emerging diseases at the human-animal interface. The human – animal distance has reduced drastically over the years, due to man's increasing advance into animal spaces for game and economic pursuits. These unnatural intermingling at the human-animal interfaces has increased the probability of zoonotic disease transmission. A One Health paradigm shift would prevent devastating morbidity and mortality associated with zoonotic infectious diseases. The current COVID-19 pandemic offers yet another opportunity to fully integrate the One Health approach into infectious disease control.

It is very pertinent to put into considerations such issues as the effect of climate change, human activities, population and urbanization and how they interplay to affect the emergence and re-emergence of these infectious diseases including the COVID-19 infection in the environment. Furthermore, the ecological, demographic, behavioral and socioeconomic drivers of these infections should be studied. Evidence from these studies should be used to guide public health prevention and intervention programs.

At the community level, stakeholders' engagement is important to re-orientate community perceptions and practice and limit community transmission of these infections when they occur.

Given the foregoing, it is important to begin to consider public education as a key aspect of control of these emerging diseases. It is imperative to also begin to take the human-animal interface seriously especially in the planning, surveillance and management of infectious diseases.

In summary, the COVID-19 challenge has again brought to the fore the fact that prevention is more cost effective than management of ensuing infections. Prevention also limits the occurrence of mortalities and the attendant disruptions associated with outbreaks. It is therefore of utmost importance that all stakeholders including environmental health professionals, Public health practitioners (both human

and animal health), community and social organizations embrace the One Health concept to enhance the chance of a better and healthier world for all.

Ethical Approval

The work did not involve the use of human subjects or animal experiments.

Declaration of interests

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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Author contributions

CO: Conceptualization; CO and EU: Writing- Original draft preparation, Writing- Reviewing and Editing.

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