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The COVID-19 Pandemic: Why It Won't Be the Last

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ABSTRACT In the last two decades, the world has witnessed disease outbreaks that have resulted in massive loss of lives and economic disruptions.[1] The current pandemic of the novel coronavirus or SARS-CoV-2, which causes COVID-19, might still not be the last of the pandemics that the world will suffer in the years to come—as long as human activities that use natural resources beyond their capacities, resulting in the spread of viruses, continue unabated. This brief explores how these human activities have paved the way for the outbreak of epidemics and pandemics like the one caused by SARS-CoV-2. It reviews the causal linkages, particularly the zoonotic links, to frequent epidemics. The brief highlights climate change as a factor that has contributed to these disease outbreaks.

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INTRODUCTION

The impact that human activities have had on planet Earth has made scientists refer to the current geological era as 'Anthropocene' – the age of humans.[2] Indeed, human beings have significantly altered 83 percent of the world's land and two-thirds of its oceans, and have impacted ecosystems, geochemistry, and the composition of the atmosphere.[3] These alterations have brought wildlife, livestock and humans in closer proximity with each other, which in turn has increased the chances for the spread of diseases, including those caused by new strains of bacteria and viruses. In the current era of climate change, there has been higher probability of new diseases emerging.[4]

According to 'Project Predict', part of the United States Agency for International Development's Emerging Pandemic Threats programme led by the University of California, Davis One Health Institute, "emerging diseases have quadrupled in the last half-century."[5] A study in Brazil published in the *Journal of Emerging Infectious Diseases* concluded that with a four-percent increase in deforestation in the Amazon region between 1997 and 2000 alone, there was a 50-percent increase in cases of malaria. This is because the mosquitoes that transmit the disease, thrive in the clear areas.[6] As the habitat of wild animals contracts, they come in closer proximity to humans, creating more potential for the emergence and transmission of pathogens.

In the last two decades, many viruses like coronaviruses and the Ebola have emerged globally, killing tens of thousands of people.[7] One such coronavirus is SARS-CoV-2, which causes the COVID-19 disease. Researchers have found that SARS-CoV-2 has similarities with SARS, the virus that exploded in 2002 in China.[8] SARS-CoV-2 is found in some species of bats and has been transmitted to humans as a result of their close proximity.[9] Within a span of seven months, more than 14 million people have been infected and more than 600,000 have died due to COVID-19.[10]

This brief builds on a review of literature to study and explore the causative factors that have triggered epidemics and pandemics in the last two decades. The brief explores the interconnection between virus outbreaks on one hand, and changing human activities, loss of biodiversity, and climate change, on the other. It gives attention to evidence of zoonotic factors in the emergence of new viruses like SARS-CoV-2.

DISEASE OUTBREAKS: A BRIEF TIMELINE

The World Health Organization (WHO) defines a pandemic as a "worldwide spread of a new disease."[11] For instance, the Justinian Plague, which broke out in the sixth century in Egypt, killed as many as 30 million to 50 million people.[12] The Black Death, which hit Europe and Asia in the mid-1300s, killed almost one-third of Europe's population at that time.[13] In 1918, the world experienced history's worst known infectious disease outbreak—the Spanish Flu, which infected over 500 million and killed over 20-50 million people globally.[14]

In the last two decades, around 60 percent of the pathogens that have resulted in these diseases have been zoonotic—meaning that they spread from animals to humans.[15]

1. **Ebola virus** was first discovered in 1976. It appeared in two simultaneous outbreaks—one in South Sudan, and the other in Yambuku, Democratic Republic of Congo (DRC). Ebola virus is a deadly disease with occasional outbreaks. It is thought that fruit bats of the Pteropodidae family are hosts of Ebola virus. The Ebola virus re-emerged in 2014-16. That time, the outbreak started in Guinea and killed five times more than all other known Ebola outbreaks combined.[16]

2. **Severe Acute Respiratory Syndrome (SARS),** a respiratory illness, was identified in 2003. SARS is a virus from bats that spread to other animals and first infected humans in the Guangdong province of Southern China in 2002. The outbreak spread to a total 26 countries and became a global pandemic. It infected over 8,000 people.[17]

3. **Swine Flu (H1N1) of 2009** fueled the fear of a global pandemic. It appeared to have originated from animal influenza viruses.[18] The US Centers for Disease Control (CDC) estimated that around 151,700 - 575,400 people died globally from the swine flu 2009 virus.[19]

4. Another viral respiratory disease emerged in 2012 in Saudi Arabia, named **Middle East respiratory syndrome (MERS)**. The virus, also belonging to the coronavirus family of viruses, infected more than 2,000 people and killed some 866. According to WHO, dromedary camels are a large reservoir host for MERS and an animal source of MERS infection in humans.[20]

5. A new strain of coronavirus that has never affected humans before is responsible for the current pandemic. The virus is called **SARS-CoV-2**, and the disease it causes is COVID-19. This virus that causes the disease is genetically related to the coronavirus responsible for the SARS outbreak.[21] It is still uncertain which animal species acted as intermediate host in the case of SARS-CoV-2. However, similarities have been found between SARS-CoV-2 and coronaviruses found in some species of bats belonging to the genus *Rhinolophus*, which could have been the natural reservoir for the virus.[22] While the source of the virus is not known, it is likely that it is linked to the trade of live wild animals and their body parts.[23]

FREQUENT VIRUS OUTBREAKS: CAUSES

Most of these viruses have close links to human activities. As humans strive to fulfill the needs of their growing populations, unsustainable activities are creating greater possibilities for high risks of viruses than ever before.[24] This section outlines the key factors for the disease outbreaks that plague the world.

Burgeoning Population

Over the last two centuries, the world population has been experiencing rapid growth. According to a United Nations (UN) report, the world population is expected to increase by two billion in the next 30 years, from the current 7.7 billion to 9.7 billion in 2050.[25] As populations grow, increasing numbers of people move to urban areas, making those spaces more highly dense. Indeed, the number of megacities with

populations greater than 10 million has grown from 10 in 1990 to 33 in 2018.[26]

With more than 55 percent of the world population living in urban areas, there have been associated changes in the environment.[27] To begin with, people dwelling in urban areas have different consumption patterns than those in rural areas.[28] Consequently, the environment in these urban agglomerations changes through people's consumption of food, energy, water, and land. Studies have found that urban populations consume higher amounts of food, energy, and durable goods than rural populations.[29] Unrestrained population densities in urban settings put extreme pressure on public resources and services. They also undermine public health systems during medical emergencies.[30]

Further, as people move from rural areas to urban, the constant flow of populations increases the risk of infection. In India, for example, an average of 90 million people migrated annually through railways between Indian states during the last five years.[31] Furthermore, the size of population growth has brought about unsustainable densities per square kilometer. For instance, in Mumbai, about 2,000 people occupied one square kilometer in 1901; this ratio increased to over 28,000 people per square kilometer by 2011.[32] The growing urban population forces people to live in closer proximity with each other, resulting in the fast spread of infections.[33]

Zoonotic factors

Six of every ten diseases that have been discovered and studied by scientists have originated from wildlife, and found their way to human populations.[34] As the population grows, the need for land also increases. To fulfill the need of growing population and urbanisation, forest areas are encroached, leading to habitat clearing, degradation and fragmentation of the landscape. The exploitation of wildlife populations and degradation of habitats are the ecological drivers of the zoonotic emergence of viruses. SARS, MERS, Ebola are examples of viruses that have resulted from zoonosis.[35] The zoonotic origin of viruses is considered the most significant, growing threat to global health.[36]

The increase in the zoonotic origin of viruses has a relationship with deforestation, land-use change, expansion and the intensification of agriculture and animal production, and the utilisation of high-risk wildlife.[37] To fulfill the demands of the growing population on earth, the forest ecosystem is massively exploited. It further causes behavioural changes in animals as it increases their interaction with humans and domestic animals, clearing a path for inter-species spillover. For instance, the obliteration of their natural habitat urged the wild fruit bats to move to human habitats. This resulted in the increase in their interactions with livestock, which has led to the inter-species spillover of Nipah infection in Malaysia and Hendra infections in Australia.[38] According to disease ecologist Peter Daszak, "Any emerging disease in the last 30 or 40 years has come about as a result of encroachment into wild lands and changes in demography."[39] Diseases have quadrupled in the last 50 years, because of increase in habitat encroachment by human beings, especially in disease "hot spots" around the globe, mostly in the tropical regions.[40]

Loss of Ecological Biodiversity and rising zoonosis

Natural ecosystems are key to supporting and nourishing life. Rapid and drastic changes in these ecosystems can bolster the emergence and spread of infectious diseases.[41] The loss of habitats, the changes in the natural environments, and the decline in biodiversity are factors that are responsible for the spread of emerging infectious diseases.

According to the UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), three-fourths of land and two-thirds of the water environment have been changed, and around one million animal and plant species are at risk of extinction.[42] According to the *Living Planet Report 2018*, "the average decline of vertebrate populations across the globe in the past 40 years has been 60 percent. Greenhouse-gas emissions has led to the rise in average global temperatures by 1°C, when compared to pre-industrial times."[43]

In the woodlands of West Africa, the movement of people into the remote regions has brought them into closer contact with bats that carry the Ebola virus. Indeed, scientists have traced the origin of HIV from chimps in the woods of Central Africa, before spreading through human-human transmission.[44] The HIV/AIDS pandemic have claimed over 33 million lives.[45]

Table 1 shows the emerging diseases and their human drivers related to ecological changes.

Table 1. Emerging diseases and their human drivers related to ecological changes

Disease	Emergence Mechanism	Anthropogenic Drivers
Malaria	Niche invasion; vector expansion	Deforestation
Schistosomiasis	Intermediate host expansion	Dam building; irrigation
Dengue Fever	Vector expansion	Urbanization; poor housing condition
Rabies	Biodiversity loss, altered host selection	Deforestation and mining
Lyme Disease	Depletion of predators; biodiversity loss; reservoir expansion	Habitat fragmentation
West Nile virus and other encephalitides	Niche invasion	International travel; climate variability
Ebola	Forest encroachment, bushmeat hunting	Forest encroachment

Source: World Wildlife Fund[46]

Globalisation

The spread of COVID-19 from Wuhan to the rest of the world within weeks in early 2020 reveals the relationship between globalisation and the spread of the virus. In contemporary times, people are easily exposed to viruses because of the increase in global travels. Data shows that 4.233 billion people travelled in 2018 alone, as compared to 3.974 billion people in 2017.[47] With increase in travel by people as well as inter-country trade, the chances of spreading the virus to different parts of the world are also rising. For example, ground-zero for the SARS pandemic of 2003 has been identified as Guangdong Province in China: a medical professor from Guangdong who had developed symptoms, went to visit Hong Kong and infected many people there. In less than four months, 4,000 cases were recorded and 550 people died. More than 8,000 other people became infected across more than 30 countries worldwide.

A virus does not only spread through humans but also via food, animals, and others that are traded. For example, Guinea rats shipped as pets in the United States in 2003 harbored infections with monkey pox, which then entered prairie dogs, and eventually humans.[48]

Climate Change

WHO estimates that between 2030 and 2050, climate change will cause around 250,000 additional deaths per year from heat stress, malnutrition, and the spread of infectious diseases; 38,000 due to heat exposure, 48,000 due to diarrhoea, 60,000 due to malaria, and 95,000 due to childhood malnourishment.[49]

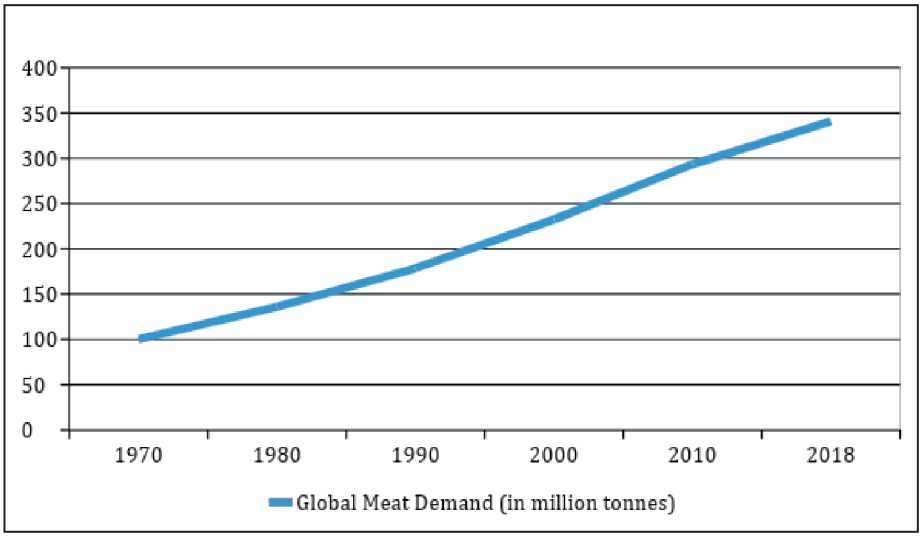
Rising global temperatures, combined with the increasing recurrence of extreme weather conditions, is projected to increase the severity of disease outbreaks. For example, climatic conditions influence water-borne diseases and those transmitted through insects or other cold-blooded animals. Furthermore, high heat waves and increasing water levels result in frequent floods, which increases the spread of infectious agents like bacteria and viruses.[50] Malaria, for one, is influenced by climate; it kills over 400,000 people every year. The Aedesmosquito vector of dengue is highly sensitive to climatic conditions. According to a WHO report, climate change is likely to increase exposure to dengue.[51] Increasing temperature and humidity also affect the development, survival and spread of pathogens and their hosts.[52]

Similarly, glaciers are in retreat and plants have been displaced to higher altitudes. Further, the alterations in animal life have increased the chances of infectious diseases. For instance, malaria is now prevalent even in elevated regions where it did not previously exist, such as the rural highlands of Papua New Guinea.[53]

Growing Meat Consumption

Throughout history, humans have hunted and eaten wild animals. With rapid growth of global population in the last two centuries, the demand for meat also increased. Global meat production has quadrupled in the last 50 years (see Figure 1). The high demand for meat has put severe pressure on land. Further, farmed animals are pumped with antibiotics to hasten their growth and meet demand. Due to the increased use of antibiotics, bacteria have

Figure 1. Global Meat Production (1970-2018)



Source: UN Food and Agriculture Organization[54]

become resistant, leading to the emergence of "superbugs" which are pathogens that are resistant to antibiotics.[55]

The increase in demand for meat has resulted in encroachment of land meant for wild habitats, which has opened doors for pathogens to jump to domesticated animals and humans. Viruses and other pathogens also move from animals to humans through markets that provide meat to fast-growing urban populations around the world.

THE CASE FOR HEALTH SERVICES AS A PUBLIC GOOD

India's health infrastructure is woefully placed to fight the COVID-19 pandemic. There is less than one doctor for every 1,000 citizens and only 0.55 beds for every 100,000 patients.[56] In 2019, India spent only 1.28 percent of its gross domestic product on health.[57]

The country's current healthcare system is stressed to the maximum while tackling the spread of the pandemic. According to the 2019 Global Health Security Index that measures the pandemic preparedness of countries, India was ranked at 57 out of 195, indicating that it is more vulnerable than China (at 51) and Italy (at 31).[58]

Yet India is not alone in its vulnerabilities to COVID-19. As illustrated in the earlier sections of this brief, the world in the last two decades has witnessed a number of epidemics and pandemics emerging from diverse and mostly known human activities. It is imperative for countries across the globe to seriously address the drivers of these disease outbreaks.

The world must concentrate on policies that promote sustainable land-use planning, reduce deforestation, protect biodiversity, to in turn provide auxiliary benefits by reducing human contact with wildlife. These policies should reconcile agricultural activities with biodiversity conservation, while reducing the interaction of humans and livestock with wildlife.[59] Further, protecting the forest landscapes can likewise benefit biodiversity

conservation and worldwide carbon storage. It will also prevent the risk of disease transmission to humans.[60] Intact ecosystems will also play a significant role in disease regulation by maintaining natural disease dynamics in wildlife communities and reducing the chances of contact and pathogen transmission among humans, domesticated animals, and wildlife.[61] Policies should aim to lessen the rate at which consumption of animal protein is increasing in developed countries.[62]

To unravel the global security issues such as that of biological health hazards, developing technologies to control the infectious diseases and strengthen the governance of global health systems is essential. [63] With the increase in impact of globalisation and easy cross-border disease transmission, economists argue that financial and political institutions need to put in place policies that will allow countries to gain full advantage of globalisation and minimise the risk of infectious diseases.[64]

COVID-19 has revealed the need for the world to consider financing and delivering health as global public good. To battle diseases, especially pandemics, it is important to shift the focus from healthcare being a national approach, to making it a global public good. If healthcare were to be treated as a global public good, a global surveillance network can be developed which will help detect viruses at an early stage.

Amidst the COVID-19 outbreak, a step forward to making health a global good is access to COVID-19 tools accelerator, which is a global collaboration to quicken the development, production, and fair access to COVID-19 tests, treatments, and vaccines.[65] Furthermore, to prevent the devastation that the world is facing today requires global investment in health research projects, and infrastructure and insurance fund, in order to minimise perils of this level in future.

A specialised agency can be set up to invest in and look after the development of pandemic-related infrastructure like testing equipment, isolation and quarantine facilities, and basic life support systems across all nations. This agency can pool assets from philanthropy, multilateral organisations, civil society organisations, and corporations as well. These ventures would be responsible for guaranteeing prompt action against the spread of a disease once the infection is detected and testing methods are set up in the future.

CONCLUSION

The world in the last two decades has witnessed a number of disease outbreaks emerging from diverse and mostly known human activities. It is crucial to address the main drivers of these crises to prevent a recurrence of a pandemic like the ongoing COVID-19. The interaction of human beings and livestock with wildlife opens the danger of spillover of pathogens. For many zoonoses, domesticated animals serve as an epidemiological bridge among wildlife and human contaminations. Further, human-incited ecological changes alter the wildlife population structure and diminish biodiversity, bringing about new ecological conditions that favour specific hosts, vectors, and pathogens. In this regard, the world needs to concentrate on policies that promote sustainable land-use planning, reduce deforestation, and strengthen biodiversity protection.

The current outbreak of SARS-CoV-2 should also increase people's awareness about climate change. Coronaviruses and climate change are the result of exponential growth that is beyond the earth's capacity to cope. The vulnerabilities of ecological change can add to those of the pandemic and make the crisis more serious and difficult to deal with.[66]

As stated by the UN Environment Chief, Inger Anderson, "Our continued erosion of wild space has brought us uncomfortably close to animals and plants that harbor diseases that can jump to humans. If we don't take care of nature, we can't take care of ourselves uncomfortably close to animals and plants that harbor diseases that can jump to humans."[67] Sustainable development and collaboration among nations will be key to saving the world from future health and humanitarian crises. ORF

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