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Impact of Covid-19 on human and environmental health including wild animals in India

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Abstract
The Coronavirus (COVID-19) pandemic, caused by the SARS-CoV-2 virus, has had a profound impact on human health, society, and the global environment. The lockdowns imposed during the pandemic resulted in a significant decline in pollution levels across many parts of the world. Restrictions on transportation, industrial activities, and economic operations led to a reduction in greenhouse gas emissions and improved environmental quality. Ecologically sensitive areas, which are normally subjected to intense human activity, experienced reduced disturbance, allowing wildlife and other living organisms to thrive more effectively. Cleaner air, improved water quality, and increased wildlife activity were observed in several regions. These developments suggest that, despite its severe social and economic consequences, the COVID-19 pandemic provided valuable insights into environmental management and highlighted the positive effects of reduced human pressure on natural ecosystems.

Keywords: COVID-19, coronavirus, symptoms, environment, wildlife

Introduction

Coronaviruses are a large family of viruses that can cause illnesses ranging from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). In late 2019, a novel coronavirus was identified as the cause of an outbreak that originated in a seafood market in Wuhan, China (Xu *et al*., 2020). The virus was subsequently named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and the disease caused by it was designated Coronavirus Disease 2019 (COVID-19). Owing to its rapid transmission, widespread impact, and significant mortality rate, the World Health Organization (WHO) declared COVID-19 a global pandemic (Rothan & Byrareddy, 2020) [2]. The pandemic spread across countries and continents, affecting millions of people worldwide, making COVID-19 one of the most significant public health crises in modern history.

Impact of COVID-19 on Human Health

The origin of COVID-19 is widely believed to be zoonotic, meaning that the virus was transmitted from animals to humans (Bassetti *et al*., 2020; Ji *et al*., 2020) [3]. Genetic analyses have shown that the genomic sequence of SARS-CoV-2 shares approximately 80–96% similarity with Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and about 50% similarity with Middle East Respiratory Syndrome Coronavirus (MERS-CoV), both of which are believed to have originated in bats (Cui *et al*., 2019; Rothan & Byrareddy, 2020) [2]. Among the various coronavirus subtypes, beta coronaviruses are known to cause severe respiratory illnesses and higher mortality rates, whereas alpha coronaviruses generally result in mild or asymptomatic infections.

The incubation period of SARS-CoV-2, which refers to the time between exposure to the virus and the onset of symptoms, is estimated to be approximately 5.2 days. Studies have reported that, in severe cases, death may occur between 6 and 41 days after infection, with an average duration of about 14 days from the onset of symptoms (Li *et al*., 2020; Wang *et al*., 2020a) [4, 9]. These characteristics contributed to the rapid spread and significant global impact of the disease.

Symptoms of Coronavirus Infection

COVID-19 primarily affects the upper and lower respiratory tract. The most commonly reported symptoms include dry cough, runny nose, sore throat, fever, headache, and shortness of breath (dyspnea). Some patients also experience gastrointestinal symptoms such as diarrhoea, while others may remain asymptomatic or exhibit only mild symptoms. In severe cases, COVID-19 can lead to serious health complications, including acute respiratory distress, kidney failure, and cardiac injury, which have been identified as major causes of mortality among infected individuals (Zhou *et al*., 2020) [8].

Scientific evidence indicates that the virus is transmitted mainly through direct or close contact with infected persons (Wang *et al*., 2020b) [4, 9]. Transmission can also occur indirectly through contaminated surfaces and respiratory droplets released during coughing, sneezing, or speaking. Furthermore, airborne transmission through virus-laden aerosols that remain suspended in the air for extended periods has been well documented (Ghinai *et al*., 2020; Yu *et al*., 2020) [10].

The risk of severe illness and death from COVID-19 is significantly higher among older adults, largely due to weakened immune responses. Individuals with pre-existing non-communicable diseases such as diabetes, cardiovascular disorders, chronic respiratory diseases, hypertension, and cancer are also more vulnerable to severe infection and adverse outcomes (Fang *et al*., 2020; Zhou *et al*., 2020) [8, 12]. In addition to physical health impacts, the pandemic has been associated with various psychological, behavioural, and social challenges, including anxiety, depression, stress, and social isolation across populations worldwide (Saladino *et al*., 2020) [13].

Preventive Measures for COVID-19

In the initial stages of the pandemic, no specific medication had been conclusively proven through controlled clinical studies to effectively treat COVID-19. Consequently, preventive measures became the primary strategy for limiting the spread of the virus. Early screening, timely diagnosis, isolation of infected individuals, and appropriate medical treatment were considered essential for controlling transmission.

Public health authorities recommended several preventive measures, including wearing face masks, maintaining hand hygiene through regular washing or the use of hand sanitizers, and practicing physical distancing. These infection-control measures played a crucial role in reducing person-to-person transmission and protecting both healthcare workers and the general public.

National Strategies Adopted to Control COVID-19 Pandemic

To mitigate the rapid spread of COVID-19, governments across the world implemented a variety of public health interventions. One of the most widely adopted strategies was the imposition of lockdowns, which restricted movement and encouraged people to remain at home. Italy was among the first countries to implement a nationwide lockdown after experiencing a severe outbreak. Other heavily affected countries, including the United States, the United Kingdom, France, Germany, and India, also introduced strict containment measures to curb the spread of the virus. Many countries adopted either complete or partial lockdowns depending on the severity of local outbreaks. Nations such as the United Kingdom, Canada, Nigeria, Ghana, South Africa, China, Singapore, and India implemented extensive restrictions on public movement and economic activities. In some cases, lockdowns were applied only to regions with high infection rates.

These measures resulted in the temporary closure of transportation services, industries, educational institutions, workplaces, shopping centres, and public gathering spaces. Although lockdowns significantly disrupted the daily lives and livelihoods of millions of people, they were considered one of the most effective strategies for slowing the transmission of the virus and preventing healthcare systems from becoming overwhelmed.

Impact of Pandemic on Environmental Health

The pandemic had significant and often unexpected effects on environmental sustainability. Restrictions on social and economic activities, including lockdowns, travel bans, and reduced industrial operations, resulted in noticeable environmental improvements across many regions of the world. Reduced transportation and commercial activities contributed to lower greenhouse gas emissions, improved air and water quality, and decreased noise pollution. Ecologically sensitive areas also benefited from reduced human interference, allowing wildlife and natural ecosystems to recover temporarily.

However, the pandemic also generated several environmental challenges. One of the most significant concerns was the large-scale generation of biomedical waste, including personal protective equipment (PPE), face masks, gloves, and other medical supplies. Improper disposal of these materials posed risks to both human health and the environment. Furthermore, the increased production and consumption of protective equipment contributed to plastic pollution and environmental degradation.

The implementation of lockdown measures during the pandemic substantially reduced human mobility worldwide. Travel restrictions, the cancellation of public events, and the decline in tourism and industrial activities produced notable environmental changes. Although COVID-19 created severe social and economic challenges, it also demonstrated the extent to which human activities influence environmental quality.

One of the most visible environmental benefits was the reduction in air pollution. The decline in industrial production and transportation activities significantly lowered emissions of greenhouse gases and air pollutants (Baldasano, 2020; Lian *et al*., 2020) [14]. Satellite observations by agencies such as NASA and the European Space Agency's Copernicus Atmosphere Monitoring Service reported considerable reductions in air pollution levels across major cities in Asia, Europe, and North America. Concentrations of nitrogen dioxide (NO_2), particulate matter (PM2.5), and black carbon decreased substantially during lockdown periods (Tobias *et al*., 2020) [16].

In India, metropolitan cities such as Delhi, Mumbai, Bengaluru, and Pune recorded reductions of approximately 40–50% in NO_2 concentrations following the implementation of lockdown measures (Lokhandwala & Gautam, 2020) [17]. Since NO_2 is associated with respiratory illnesses, including asthma and chronic respiratory disorders, its reduction contributed to improved air quality. Satellite imagery also revealed a noticeable decline in smog levels over several major Indian cities (Sharma, 2020) [18]. Some studies further suggested temporary improvements in atmospheric ozone conditions during this period (Tobias *et al*., 2020) [16].

The pandemic also had a positive impact on water quality. Reduced industrial discharge and lower levels of human activity improved the condition of several rivers and coastal ecosystems. Many beaches around the world experienced cleaner environments due to the sharp decline in tourism. In India, the water quality of the Ganga River improved considerably during the lockdown period. Studies reported increased dissolved oxygen levels and a reduction in concentrations of chloride, calcium, and magnesium ions (Bundelkhandi *et al*., 2020) [19]. Similarly, the Delhi Pollution Control Committee observed improvements in the water quality of the Yamuna River during the pandemic (Sharma, 2020) [18].

Noise pollution also declined significantly due to reduced transportation, industrial operations, and commercial activities. Studies reported reductions of approximately 20–30% in noise levels across various regions of the Himalayas (Negi & Tripathi, 2020) [20], while the West Bengal Pollution Control Board recorded reductions of 50–70% in Kolkata. Residents in many urban areas reported experiencing quieter surroundings, cleaner air, and increased bird activity. The Central Pollution Control Board also documented substantial declines in noise levels across residential and commercial zones in Delhi (Sharma, 2020) [18].

Impact of COVID-19 on Wild Animals

The COVID-19 lockdowns provided temporary relief to many wildlife habitats and conservation areas. National

parks, wildlife sanctuaries, and protected regions that typically receive large numbers of tourists experienced a significant reduction in human disturbance. As a result, ecological stress on these areas was reduced, allowing wildlife populations greater freedom and habitat utilization (Saadat *et al*., 2020) [21].

Several reports indicated increased wildlife activity during the lockdown period. According to media reports, numerous bird species extended their stay at the Therthangal Bird Sanctuary in Tamil Nadu. Increased sightings of spotted deer and peacocks were also reported in the Vellore district, which was attributed to reduced human presence and disturbance.

In various parts of India, animals were observed venturing into urban and residential areas more frequently than usual. News reports documented herds of wild elephants moving through towns in Kerala's Wayanad district, while a civet cat was spotted on roads in Kozhikode. Additionally, dolphins were reportedly observed near the coast of Kolkata after several decades, highlighting the positive impact of reduced human activity on aquatic ecosystems (Negi & Tripathi, 2020) [20].

A remarkable increase in nesting activity by Olive Ridley turtles was recorded on Odisha's Rushikulya Beach. Conservationists attributed this phenomenon to reduced tourism and human interference, allowing a successful nesting season after several years. Similarly, large numbers of migratory flamingos were observed in Navi Mumbai during the lockdown period, as reduced human activity created a more favourable environment for these birds.

Overall, the COVID-19 pandemic demonstrated how reduced human pressure can positively influence ecosystems and wildlife. Although the pandemic brought severe challenges for humanity, it also provided valuable insights into the resilience of nature and highlighted the importance of sustainable environmental management. The temporary recovery of environmental quality and increased wildlife activity during the lockdown period underscore the need for long-term conservation strategies that balance human development with ecological sustainability.

Conclusion

The COVID-19 pandemic had profound impacts on human health, society, the environment, and wildlife across the globe. From a public health perspective, the pandemic exposed the vulnerabilities of healthcare systems worldwide and highlighted the challenges associated with managing a newly emerging infectious disease. The rapid spread of the virus, coupled with limited initial knowledge about its transmission, treatment, and long-term effects, resulted in significant morbidity, mortality, and social disruption.

In contrast, the pandemic and the associated lockdown measures produced several temporary positive effects on the environment and wildlife. Reduced industrial activities, transportation, and human interference led to improvements in air and water quality, decreased noise pollution, and enhanced opportunities for wild animal's movement and habitat utilization. These observations demonstrated the strong relationship between human activities and environmental health. However, such improvements were largely temporary and cannot be considered a sustainable solution for environmental conservation.

The pandemic provided an important lesson that environmental protection and human well-being are closely interconnected. It emphasized the need for sustainable development practices that balance economic growth with environmental conservation. Although vaccination has played a crucial role in reducing the severity and spread of COVID-19, continued scientific research is essential for the development of more effective treatments and preparedness strategies for future pandemics.

Furthermore, maintaining a clean and healthy environment remains vital for the well-being of all living organisms. The experiences gained during the COVID-19 crisis should encourage policymakers, researchers, and citizens to adopt environmentally responsible practices and strengthen efforts toward sustainable environmental management and biodiversity conservation.

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