



REVIEW ARTICLE

Journal home page: www.jpadr.com

COVID pandemic: its impact on human health, environment, and potential strategies for sustainability

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ARTICLE INFO ABSTRACT



Received 04 June 2023;
Revised 22 July 2023;
Accepted 21 August 2023.

Keywords:

Coronavirus, COVID-19,
Environment, Economy,
Pandemic, Impact

Despite the advised measures, worries concerning the pathways of transmission for this pandemic disease have been raised because to the fast increase of COVID-19 symptoms and fatalities over the world. Inhaling tiny airborne droplets, in addition to the more generally documented transmission routes of larger respiratory droplets and direct contact with sick persons or contaminated surfaces, is a likely third route of infection. While there are still some questions about the proportional contributions of the various transmission channels, we believe the data is robust enough to justify developing interventions that target airborne transmission as part of a larger effort to reduce infection risk inside. Sufficient and adequate ventilation, potentially augmented by particle filtering and air disinfection, avoidance of air recirculation, and avoidance of overcrowding are all examples of appropriate building engineering controls. Such procedures are often simple to adopt and low in cost, but only if they are recognized as important in achieving infection control objectives. We believe that, in addition to effective application of other controls (such as isolation and quarantine, social distancing, and hand hygiene), the use of engineering controls in public buildings, such as hospitals, shops, offices, schools, kindergartens, libraries, restaurants, cruise ships, elevators, conference rooms, or public transportation, would be an additional important measure globally.

An official publication of the Global Pharmacovigilance Society.

Introduction

In 2020, governments worldwide implemented strong lockdowns in an attempt to contain the corona virus's spread. Confinement in houses around the globe resulted in a sharp drop in the numbers of persons working in transportation and industrial capacities (Staista, 2022). While the COVID-19 epidemic spread rapidly over the world, endangering lives and disrupting cities and countries' economies, it also had a significant effect on the environment. In a couple of months, the world's way of life has shifted dramatically. As work-from-home becomes the new standard, 23% of worldwide carbon emissions have been reduced only as a result of reduced commuting (Mehta R., 2020). SARS-CoV-2, a new RNA

coronavirus from the same family as SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV), was discovered in early January 2020 as the source of a pneumonia outbreak in Wuhan, Hubei province's capital, from whence it quickly spread throughout China. After infecting and killing thousands of people in China, the virus has moved to Italy, other European nations, and the United States, with the number of verified new cases growing by the day. Because of the extensive infectivity and high contagion rate, the World Health Organization designated the illness coronavirus disease 2019 (COVID-19) and designated it a pandemic. Coronaviruses infect humans most often in the respiratory and gastrointestinal systems. COVID-19, a novel coronavirus, has become a global health threat: it has killed 26 495 people and



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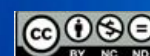
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Available online 1 September 2023

infected more than 570,000 others as of March 28, 2020. Similar to other coronaviruses, SARS-CoV-2 infection causes flu-like symptoms such as fever, cough, and asthenia. Although severe lung injury has been reported in people of all ages, the virus is more likely to cause severe interstitial pneumonia, acute respiratory distress syndrome (ARDS), and subsequent multiorgan failure in some high-risk people, such as the elderly or those with multiple comorbidities, resulting in severe acute respiratory failure and high death rates. Affected people usually have varying degrees of dyspnoea and radiological findings (Pascarella et al., 2020).

The Pandemic Beneficial Effects On The Environment And Understanding Covid

As the Globe Health Organization (WHO) proclaimed the epidemic on March 11, 2020, governments throughout the world developed more or less appropriate reactions, including announcements of statewide lockdowns. COVID-19 has exacerbated pre-existing inequities and generated several strange juxtapositions in this environment. Here are a few examples. So-called “advanced economies” that possess some of the world's strongest health security capabilities are unable, or unwilling, to adequately protect their citizens during the recent global outbreak. In contrast, several countries in the Global South have done a better job at keeping the pandemic under control (Stevano et al., 2021).

The unequal capacity of various socioeconomic groups to adopt social distancing measures, as well as their unequal underlying health and living situations, influence the class implications of coronavirus. Employment is a critical issue during pandemic. The pandemic has varying consequences on employees' incomes, their chances of being jobless, their ability to work from home, and their exposure to the illness, depending on their employment type, with those in informal, insecure, and front-line labor being the most severely impacted. With a significant degree of informality in the Global South's labor markets, employment vulnerability is especially acute during the COVID-19 crisis. There are also substantial interconnections between class, ethnicity, gender, and migrant status, with racial inequities contributing to pandemic's disproportionate impacts on ethnic minorities in countries like as Brazil, the United Kingdom, and the United States. Young employees, women, migrants, and racialized minorities who work in services and informal professions are more likely to lose their employment and not be able to replace their income. People that have to keep working because they have been considered vital, such as nurses, paramedic and doctors, suffer heightened health risk (Akram-Lodhi A.H., 2020).

COVID-19's worldwide disruption has triggered various environmental and climatic changes. Air quality has improved in many cities, and water pollution has

decreased in several regions of the globe, as a result of mobility restrictions and a considerable slowdown in social and economic activity. Furthermore, increasing usage of personal protective equipment (e.g., face masks, hand gloves), their haphazard disposal, and the development of a large volume of hospital trash have significant environmental consequences. Both good and bad environmental repercussions are being seen by COVID-19 (Rume et al., 2020).

Environmental Effects

Reduction of air pollution and green house gas

The global climate is changing as a result of carbon dioxide (CO₂) emissions. Global warming has reached dangerously high levels that can no longer be ignored. Greenhouse gas emissions have suggested an increase in temperature and global warming (GHGs). There is a dynamic relationship between GHGs and air pollution, which is directly linked to detrimental health effects. According to the Annual State of the Global Air Report, 95 percent of the world's population breathes contaminated air, according to the Health Effects Institute (HEI) (2019). Despite the fact that the COVID-19 problem has caused extensive human suffering throughout the globe, air pollution is decreasing as a consequence of ongoing virus-fighting efforts, demonstrating what can be accomplished if we convert to clean energy. Policymakers may go forward with green grids and transportation system regulations to attain low levels of air pollution throughout the globe if all obstacles are eliminated. COVID-19 has posed a serious concern to people with chronic obstructive lung illness, cardiovascular illness, or high blood pressure, all of which have been linked to long-term exposure to PM_{2.5}. It has been shown that there is a clear link between the chance of developing problems if infected with COVID-19 and long-term air pollution exposure. The findings of a research showed the importance of increasing air quality in terms of health benefits and the mildness of infection symptoms. Furthermore, it was discovered that the presence of nitrogen dioxide leads to COVID-19's death. In England, links between air pollution and COVID-19 have also been discovered. They looked studied the link between the primary air pollutants produced by burning fossil fuels and SARS-CoV-2 mortality rates in England. They matched the most recent SARS-CoV-2 cases and fatality statistics from public databases with air quality data collected at more than 120 locations throughout the country. The authors discovered that levels of specific indicators related with poor air quality, ozone, and nitrogen oxides are linked to COVID-19 mortality in different English areas. Furthermore, the influence of air pollution on SARS-CoV-2 lethality in Northern Italy was explored, and it was shown that a high

level of pollution in a region is a co-factor of the area's high degree of lethality (Carraturo et al., 2020).

Increase of biomedical COVID waste generation

Healthcare trash includes waste from biomedical research organizations, health facilities, medical labs, and garbage from sporadic or small sources. Despite the fact that hospitals create a substantial amount of medical waste, they only account for a tiny percentage of overall waste sources. The COVID-19 dilemma is having an increasingly negative environmental effect as a result of increased plastic usage and waste, but the danger has been further amplified by the growing number of significant health issues. The unanticipated spike in plastic item needs in terms of healthcare use to safeguard the general community, impacted individuals, medical and service staff is one of the most visible environmental challenges during this pandemic. The widespread use of safety equipment has resulted in significant supply chain disruptions and waste processing concerns throughout the world. Because of the increasing demand for several plastic items, such as individual safety appliances, gloves and masks for medical employees, disposable plastic items for life-support tools, respirators, and common plastic items involving medical needles, the emerging need direction is expected to meet the universal crisis curve. In the medical field, old plastic products are often contaminated with germs and should be treated as hazardous waste. Because of the rising issues of possible contamination in the earth and ocean ecosystems, the processing of plastic disposals was viewed as a vital environment-related concern even before the start of the COVID-19 disaster. Universal disposal processing methods are currently unable to govern existing plastic disposals properly, and the upcoming wave of disposals during the COVID-19 crisis threatens to overwhelm present disposal processing processes as well as the potentials of medical organizations. Due to the need to destroy any lingering infections, healthcare disposal from various healthcare institutions is exceedingly complicated. As a consequence of contact to infectious organisms by health personnel, garbage pickers, garbage-cite employees, patients, and the general public, where medical waste is disposed of, improper treatment of medical waste creates a major risk of secondary disease transmission. When evaluating health-related waste management, it's helpful to have a common measuring ground so that signs from different places may be compared. Creating less contaminated trash is the best way to assess the impact of healthcare-related disposals. One of the most effective ways to do this is to ensure that only infectious healthcare waste is shipped for special processing, and that all other safe healthcare waste is handled in the same manner as household waste. This might be accomplished by training medical personnel and

implementing standardized healthcare waste flows and wastebasket colors (Mofijur et al., 2020).

Municipal solid waste generation and reduction of recycling

COVID-19 has had a substantial impact on garbage recycling already. As the epidemic expanded and lockdowns were enacted in various nations, both public authorities and municipal waste management officials had to immediately adapt to the situation. Waste disposal has also been a huge environmental issue for all technologically sophisticated countries, since there was no clear knowledge regarding the SARS-CoV-2 retention duration. Recycling is an increasingly popular and effective method of reducing pollution, preserving energy, and preserving natural resources. Due of the pandemic, recycling efforts in a number of cities have been halted, with authorities concerned that COVID-19 might spread to recycling centers. In the impacted European nations, waste management has been inadequate. Infected persons in Italy, for example, are barred from sorting rubbish. Because of the dispersed nature of the cases and the persons afflicted, extensive waste management during the pandemic is very challenging. At this time, the need of establishing best management practices for waste handling and hygiene in order to reduce employee exposure to potentially hazardous trash should be emphasized. Given the potential significance of the environment in the transmission of SARS-CoV-2, waste processing at both homes and quarantine facilities is a critical control point. The Association of Cities and Regions for Sustainable Resource Management (ACR+) has reported on the provision of separate collection services to COVID-19 contaminated homes and quarantine facilities in Europe to safeguard frontline garbage workers. ACR+ also predicts a 72-hour delay in waste disposal (because to COVID-19's potential lifetime in the environment). Furthermore, the collected garbage should be transferred without segregation to waste incinerators or sites as soon as possible (Morawska et al., 2020).

Potential Strategy For Sustainability

The situation we are tackling has significant influence on not only the physical care of millions of residents, but also on sustainability, as shown in several studies. Sustainability takes into account three components that are economy, society, and environment. When combined with the rapid spread of COVID-19, economic results have deteriorated significantly, social issues such as family violence have increased, and many animal species have suffered due to a lack of protective forces provided by conservationists trapped in their houses (Klemes et al., 2020).

Sustainable industrialization

Industrialization is necessary for economic development; nevertheless, it is now time to consider long-term sustainability. A transition away from less energy-intensive sectors, the adoption of cleaner fuels and technology, and strong energy-efficient regulations are critical to long-term industrial sustainability. Additionally, industries should be located in designated zones, with the understanding that waste from one sector may be utilized as raw materials in another. After a certain amount of time, industrial zones should have been shut down in a cyclical pattern to minimize emissions while minimizing the impact on the national economy. Other sectors such as ready-made garments (RMG) and others where a large number of workers are employed, as well as sufficient distance and a hygienic atmosphere should be made to help minimize the spread of contagious communicable diseases (Pan J., 2016).

Use of green and public transport

To minimize emissions, individuals must be encouraged to use public transportation rather than private automobiles. Besides, encouraging people to ride their bikes for short distances should be paired with a public bike-sharing system, which is not only good for the environment but also is good for health (Ellabban et al., 2014).

Use of renewable energy

Renewable energy may help reduce demand for fossil fuels such as coal, oil, and natural gas, which may contribute significantly to decreasing green house gas (GHG) emissions. Global energy consumption is lowered as a consequence of the COVID-19 pandemic, resulting in emission reductions and improved ambient air quality in a variety of places. However, it is impossible to cut down on the energy consumption like a pandemic condition in order to sustain everyday necessities and global economic development. As a result, the utilization of renewable energy sources such as solar, wind, hydropower, geothermal heat, and biomass helps fulfill energy demand while reducing GHG emissions (Somani et al., 2020).

Waste recycling and reuse

To minimize waste disposal burdens, industrial and municipal trash should be recycled and utilized. In order to limit the consumption of raw materials and waste production, circular or circulatory systems should thus be used in the manufacturing process. In addition to the rules, risky and infectious medical waste should be handled carefully. It is now known that most individuals (particularly in poorer nations) do not know about trash segregation and disposal problems 2020. Thus, government should conduct an intensive campaign of

awareness of correct waste, management and disposal ways via diverse public media (Hysa et al., 2020; WHO, 2020).

Ecological resoration and ecotourism

Tourist places should shut down for ecological rehabilitation occasionally. In addition, the practice of ecotourism is needed for sustainable livelihoods, protection of culture and the preservation of biodiversity (Islam et al., 2018).

International cooperation

Combined international efforts are needed to achieve sustainable environmental objectives and to conserve global environmental resources, such as global climate and biological variety. Accordingly, responsible international authorities such as the United Nations Environment Program (UNEP) must play an effective role in preparing timely policies, establish international agreements and coordinate global leaders in an efficient implementation process (Islam et al., 2018).

Conclusions

The global health and economic consequences of the SARS-CoV-2 pandemic are severe. Although many therapies have been suggested, at present there are no specific options capable of treating COVID-19 disease or preventing SARS-CoV-2 infection. The only intervention currently viable and proven to decrease the contagion rate seems to be strict quarantine measures for the general population. Specifically designed randomized clinical trials are urgently needed to determine the most appropriate evidence-based treatment modality to reduce the spread of this disease and prevent the burden of any future outbreak. COVID-19 pandemic has imposed a huge financial and social burden to the world. With regard to its continuously evolving nature, it remains a challenging task to restrict the transmission of infection among the population. One of the prominent approaches for preventing SARS-CoV-2 infection is the development of vaccines against COVID-19. A great deal of work has done so far and till now 33 vaccine candidates have entered into a clinical trial and 143 are in the preclinical phase. Despite the extraordinary efforts of the firms and researchers across the globe for developing the COVID-19 vaccines, there is still a lot more to explore that could be helpful in developing more specific vaccine. Gathering of important information like immunization route, finding more target antigen(s) apart from targeting S protein as antigen only, can be helpful in eradicating the infection. The immunopathological basis of COVID-19 need to be explored more so that its immune evasion mechanism can be targeted and it will also provide deeper insights into vaccine designing strategies. The three main criteria which should be taken into consideration while developing a vaccine are: speed, scale up manufacturing

and global access. The astonishing efforts by researchers across the globe in terms of scale and speed of vaccine development have fastened the vaccines development journey from bench to bedside within a few months only.

Conflict of Interest

No conflict of interest declared by the authors.

Acknowledgment

None acknowledged.

Funding Information

No agency provided any funding.

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