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COVID-19 and the Environment

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Abstract

This paper reviews the pandemic caused by SARS-Cov-2 virus. It covers the beginning of the spread, the devastating effects on health and wellbeing, the environment and measures taken to prevent further spread by developing coping strategies and control. It also examines the global impact of the pandemic on the short- and long-term as well as the gains and pains. Travel and social distancing have contributed to faster transmission across the continents. The main points emerged from the reports to date which re-emphasized the importance of Water, Sanitation and Hygiene (WASH) and the use of soap and sanitizers for hand hygiene, air pollution through aerosols, and contact as the major determinants in the widespread of the infection. The causative agent, the non-living virus has no life but needs a host to replicate as it is short lived in the environment. Lockdown, closure of schools and institutions, social distancing and quarantine protocols generated a variety of wastes; the significant component is more plastics in the form of face masks, face shields, gloves, Personal Protective Equipment (PPE) and other packaging materials. They need to be properly managed through innovative methods and recycling. Due to travel bans and movement restrictions, air pollution considerably reduced impacting a positive gain for climate change. Lessons learnt from the developed countries should guide the low income countries in effectively coping with the pandemic through increased environmental consciousness, ecosystem balance and attitudinal change in our way of thinking and living. COVID-19 pandemic is indeed a wakeup call to improve our environment through ecological balance.

COVID-19 et l'environnement

Abstrait

Cet article passe en revue la pandémie COVID-19 causée par le virus SRAS-Cov-2 tout en considerant ses débuts, sa propagation, ses effets dévastateurs sur la santé, le bien-être et l'environnement et les mesures prises pour empêcher la propagation, ainsi bien que l'adaptation et le contrôle. Il examine l'impact de la pandémie à l'échelle mondiale sur les gains et les difficultés à court et à long terme. Les voyages et les distances sociales ont contribué à une transmission plus rapide à travers les continents. Les principaux points ressortis des rapports à ce jour

soulignaient à nouveau l'importance de l'eau, de l'assainissement et de l'hygiène et l'utilisation de savon et d'assainissants pour l'hygiène des mains, la pollution de l'air par les aérosols et le contact comme les principaux déterminants de la propagation de l'infection. L'agent causal, le virus non vivant, n'a pas de vie mais il a besoin d'un hôte pour se répliquer est de courte durée dans l'environnement. Le verrouillage, la fermeture d'écoles et d'institutions, les activités de distanciation sociale et de quarantaine génèrent une variété de déchets; la composante importante est davantage de plastiques sous forme de masques faciaux, d'écrans faciaux, de gants, d'équipement de protection individuelle et d'autres matériaux d'emballage. Ils doivent être correctement gérés grâce à des méthodes innovantes et au recyclage. En raison des interdictions de voyager et des restrictions de circulation, la pollution de l'air a considérablement diminué, ce qui constitue un gain positif pour le changement climatique. Les leçons tirées des pays avancés devraient aider les pays à faible, faire face efficacement à la pandémie grâce à une conscience environnementale accrue, à l'équilibre des écosystèmes et à un changement d'attitude dans notre façon de penser et de vivre. La pandémie de COVID-19 est en effet un appel au réveil pour améliorer notre environnement grâce à l'équilibre écologique.

The Pandemic

The Year 2020 is unique and will stand out in the pages of history. COVID-19 which emerged as a simple flu-type local health problem in Wuhan, China, has turned into a pandemic. In a short period it rapidly spread to over 188 countries (out of the UN recognized 193 countries) and devastated the entire planet. Only 12 countries which included Kiribati, Marshall Islands, Micronesia, Nauru, North Korea, Palau, Samoa, Solomon Islands, Tonga, Turkmenistan, Tuvalu, and Vanuatu (Al Jazeera, 2020) have not reported any case. It should be noted that not reporting global pandemic cases does not certify that the pandemic is totally absent. As at 4 November 2020 (4.00 PM CET), there have been 47,362,304 confirmed cases of COVID-19, including 1,211,986 deaths globally (WHO, 2020).

Looking at the figures from African region, - "it took 98 days to reach 100,000 cases and only 18 days to move to 200,000 cases. Ten out of 54 countries are currently driving the rise in numbers, accounting for nearly 80% of all the cases. More than 70% of deaths took place in only five countries: Algeria, Egypt, Nigeria, South Africa and Sudan" (WHO, 2020a). The pandemic specifically affects the elderly more than others and those with pre-existing medical conditions (such as high blood pressure, heart problems or diabetes).

The Origin

Pandemics and epidemics have been affecting humanity over the centuries. They are as old as human race. After the Spanish Flu of 1918, COVID-19 is perhaps the most devastating infection, affecting the entire globe notwithstanding Ebola, Lassa fever and several others. All these infections have their origin from wild life. The suspected ecological reservoirs for SARS-CoV-2 are bats. However, it is believed that the virus jumped the species barrier to humans from another intermediate animal host which has not been confirmed. This intermediate host could be a domestic food animal, a wild animal, or a domesticated wild animal which has not yet been identified. The virus also mutates frequently thereby making it complex in understanding its science and molecular structure.

COVID-19 and its Severity

The median time for COVID-19 from onset of infection to clinical recovery for mild cases is approximately 2 weeks and is 3-6 weeks for patients with severe or critical disease. For

effective infection, the virus dose should be at least 1000 particles. While breathing releases 20 virus particles per minute, speaking releases 200 and coughing or sneezing releases 200 million particles. Naturally, the virus is fast spreading in the environment. The non-living virus, once it enters the human host, attacks the heart, and weakens its muscles thereby disrupting its rhythm. It savages kidneys requiring dialysis equipment for support. It also attacks the nervous system, affecting taste and smell and occasionally reaches the brain. It creates blood clots that can kill with sudden efficiency and inflames blood vessels throughout the body. It can begin with a few or no symptoms.

Treatment and Cure

A lot of speculations were proposed for possible treatment. These included use of malaria drug Chloroquine, flu drugs, and several country specific herbal remedies. The herbal remedies included use of concoctions by using ginger, cloves, cinnamon, pepper, neem, bitter leaf, garlic, black pepper among others. There are personal experiences of relieving symptoms or cure but no proof of evidence exists. The possible drugs suggested awaiting human trials are Favipiravir and Remdesivir. Some British, Indian, American, Chinese and Russian companies have developed vaccines which are being tested with human subjects. There is need for more time to conclude before making them available to public. We are therefore caught up in a helpless situation. The proven preventive and control measures are those practised during the Spanish Flu period: wearing a face mask, or a face mask and a face shield, keeping a 1.6m social distancing, frequent washing of hands with soap or sanitizers, and avoiding hand contact with face (eyes, nose, mouth, etc.), quarantine, lockdown and closure of schools, offices and institutions, closure of inter-city and inter-country borders, as well as travel restrictions and total ban on travel by air and other means. These interventions are non-pharmaceutical in nature. The COVID-19 infection and the prevention and control measures being practiced have significant impacts on local and global environment. These observations collected from various reports emanated from December 2019 to date (November 2020) are summarized in this paper. Figure 1 shows the COVID-19 impact on several aspects of quality of life in general. Table 1 shows itemized COVID-19 control activities being adopted as standard operating procedures by various countries and their impact on environment.

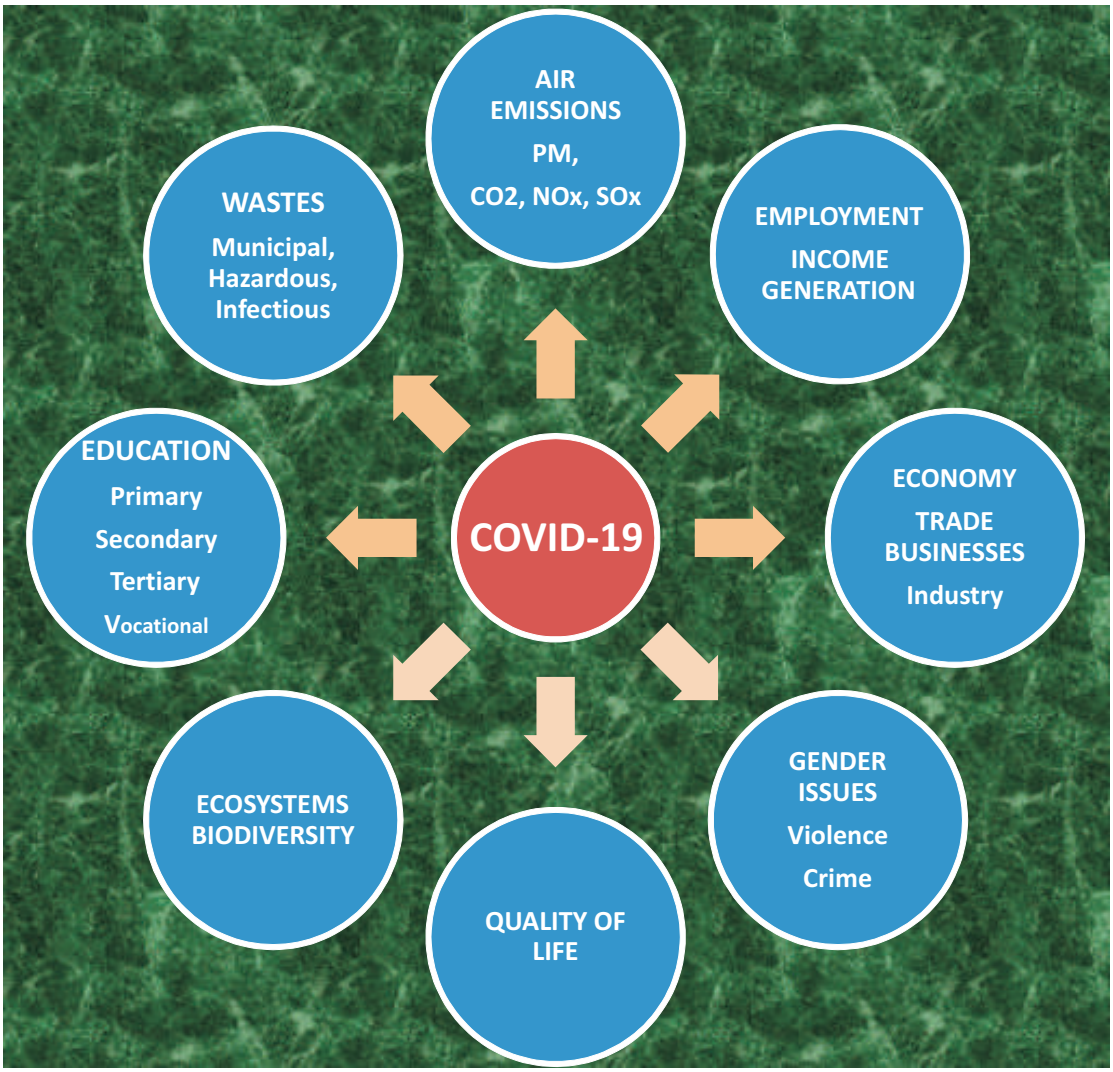

Figure 1: Impact of COVID-19

The Survival of Viral Particles outside the Host

The COVID-19 virus is an enveloped virus, with a fragile outer membrane. Therefore, such viruses are less stable in the environment and are more susceptible to oxidants, such as chlorine and other disinfectants. At 4^0C, the infectious virus persists for up to 28 days; the lowest level of inactivation occurs at 20% Relative Humidity (RH). Inactivation is more rapid at 20^0C and the slowest inactivation occurs at low RH.

Inactivation is more rapid at 40^0C. There is greater survival (protective effect) at low RH of 20% and high RH (80%) than at moderate RH (50%).

The COVID-19 preventive and control measures recommended from past experience are frequent hand washing with soap and sanitizers, use of face masks, face shield or gloves, social distancing, isolation and quarantine, lockdown and control or ban of travel. These control or preventive measures have their impact on environment and ecosystems.

Global Impacts on Environment and Quality of Life

- There are fewer vehicles on the road, pollution levels reduced as most people stayed indoors.
- There are increasing volumes of waste arising from households due to life indoors

– thus recycling and resource recovery is grinding to a halt.

- In the UK, refuse workers were granted key worker status, as they play key roles in keeping communities operating. Existing household waste recycling centres have remained closed, thus encouraging fly-tipping (quadrupled) in some parts of the country.
- In the USA, collection challenges have increased and the waste evacuators complained of risks to collections, which has resulted in disrupting recycling activities.
- In the UK, food stockpiling was a significant issue. Similar experiences were reported in various cities worldwide, e.g., Maghreb, Manila etc.
- In Australia, where waste is a resource for compost and accounted for 80-100 million tonnes, and used in fertilizing degraded soils, is now being banned for organics to landfill; several recycling activities are springing up using wastes as feedstock.
- USA is moving towards sustainable waste management through thermal technologies which destroy all pathogens.
- Digital transformation has overtaken the world resulting in total shut down of industrial activities or massively disrupting their productivity.

Table 1: Impact of COVID-19 and related preventive and control activities on the environment

COVID-19 Activity	Source	Environmental Consequences
SARS-CoV-2 Viral particles	Discharges from infected patients (droplets from cough, sneeze, talking or shouting); Contact (Hands and body) from confirmed patients; contact from asymptomatic carriers; waste handling activities	▪ Not transmitted through water, wastewater or faeces; only one study has cultured the COVID-19 virus from a single stool specimen . ▪ Survive in aerosols 3h; on copper 4h; cardboard 24h; currency, phone screens; glass, plastic and stainless steel 2 - 3 days; (van Doremalen *et al* , 2020). ▪ Cross contamination of raw food possible; ▪ UV radiation, soaps, detergents and laundry destroy the virus
Pharmaceutical interventions	Diagnosis, Treatment, ICU admission, Ventilator facility, Vaccine related wastes, toilet rolls usage	▪ Surface contamination ▪ Healthcare and infectious wastes (combined) ▪ Municipal wastes arising from care givers ▪ Plastics and packaging wastes
Quarantine and Isolation	Facility-based and maintenance related, toilet rolls; meat processing and cold storage facilities.	▪ Infrastructure needs and related impacts, land use and degradation ▪ Reduction of environmental pollution - air pollution including particulate matter, carbon, nitrogen and sulphur emissions ▪ Water demand ▪ Various wastes needing treatment and disposal - municipal, healthcare; liquid wastes, food wastes
- Lockdown - Curfew, - Closures, - Reduced industrial activities, - -Travel restrictions	Roads, Check points, Automobile based, Airports, Train stations	▪ Significant reduction in all types of wastes (except increase in household wastes) and air emissions ▪ Reduction in hydrocarbons and heavy metals discharges/emissions ▪ Reduction in noise ▪ Clearer skies and improved visibility in major cities (Satellite pictures show tremendous reduction in haze and air pollution).

Cont'd

COVID-19 Activity	Source	Environmental Consequences
Super spreaders	Hotels, Restaurants, Bars, Eateries, Entertainment places, Religious congregations, Meeting halls, Sports, Local markets, Super markets, Schools, Institutions, workers handling cold storage facilities (among infection high risk group).	▪ Increased municipal wastes ▪ Increased resource consumption and demand ▪ Increased emissions and noise
Non-Pharmaceutical Interventions - **Hand hygiene** - **Face Mask, Face shield** - **Gloves**	Soaps, detergents, disinfectants, sanitizers, plastics and packaging, cloth based gadgets, chemicals used in decontamination,	▪ High water demand ▪ High Sanitation and hygiene needs (Toilet rolls shortage in Western countries) ▪ Increased waste generation (biodegradable and non-biodegradable); ▪ Increased plastic waste (Significant) ▪ Wastes from Non -functional or overused equipment / tools used in sanitation activities
Ecosystems and Biodiversity	Less human activities and movements reducing population pressures	▪ More freedom to wildlife as they find more open and less congested spaces for their habitat due to low human activities and reduced pollution.

Source: Mynepalli Sridhar *et al,* 2020

UN Secretary-General declared COVID-19 as a global health crisis in the 75-year history of the United Nations. This has resulted in undue human suffering, global economic downturn and upending people's lives.

A) Water, Sanitation and Hygiene: The spread of COVID-19 is closely related to water and sanitation. Cleaning of hands reduces the transmission and help people stay healthy. Appropriate use and provision of Personal Protective Equipment (PPE) to front line healthcare personnel still deserve more attention as many governments in developing countries have been negligent on these due to inadequate funding and other problems.

B) Zoonotic Infections: Humans have been destroying wildlife habitats for their selfish gains. In recent years, there is rise in diseases transmitted from animals to humans.

C) Waste Management: As COVID-19 pandemic continues to spread, medical, household and other hazardous wastes are on the increase. They need proper collection, handling and management. A conspicuous impact of waste is in the form of plastics. Various governments are developing policies to reduce plastics. COVID-19 pandemic has introduced more plastics usage in the form of face masks, face shields, gloves, packaging, PPE, etc. Experts are proposing to bring back the "bring-your-own-cup scheme".

D) Use of Chemicals: Certain chemical usage has increased. COVID-19 has made it mandatory for migrants at international borders to be disinfected with bleach which is exposing the common man to hazardous substances. It is considered a ghastly and inhumane practice and needs to be addressed in a better way so as to combat COVID-19.

E) Air Quality: COVID-19 has some beneficial impacts on air quality. The World Health Organization estimates that there are more than six million deaths annually because of outdoor and indoor air pollution. According to the 2019 report on the State of Global Air, air pollution contributed to the loss of

147 million years of healthy life in 2017 alone. By obeying stay-at-home directives during the pandemic, people in Canada and beyond have contributed to the reduction of pollutants such as nitrogen dioxide, as well as particulate matter in major cities, including Toronto, Montreal and Calgary, which have experienced reductions in nitrogen dioxide levels of between 30 and 40 percent. Researchers found that air pollution has intensified the pandemic. But the lockdown and related measures implemented by countries to stop the spread of COVID-19 have also led to a decrease in economic activities and drop in road transport, temporarily cleaning skies and decreasing levels of certain air pollutants and reduction in haze. Some experts argue that the drop in air pollution is short-term. Once the global economy recovers, pollution will return to pre-pandemic levels.This should be safeguarded. Cleaner and smog-free skylines are shown in Figure 2.

Lockdown has brought back the blue moon. Blue Moon is the second full moon of a calendar month. Thus we had a blue moon on 31 July 2015; 31 January 2018; 31 March 2018 and of recent 31 October 2020. In 2020, people across all time zones can see the moon for the first time since 1944 (The frequency of a blue moon can be calculated as follows: It is the period of time it would take for an extra synodic orbit of the moon to occur in a year. Given that a year is approximately 365.2425 days and a synodic orbit is 29.5309 days, then there are about 12.368 synodic months in a year. For this to add up to another full month would take 1/0.368 years. Thus it would take about 2.716 years, or 2 years, 8 months, and 18 days for another blue moon to occur).

F) Biodiversity Loss: Seven species of Great apes are already threatened by extinction, and are potentially vulnerable to the COVID-19 virus. Wild life destruction is on the rise as some of them are useful either in the production of COVID-19 vaccines or a threat of its infection to humans. Half a million sharks are being killed for vaccine development; Tigers tested positive at Bronx Zoo, New York. Coronavirus lockdowns increased poaching in Asia and Africa. The invisible trade of wild plants has been on the increase during the pandemic.

Denmark's Institute of Infectious Diseases found mutations of the virus, five antibody-resistant cases of COVID-19 in the mink farms and 12 in humans. This will result in future vaccine been less effective. Therefore, the Government planned to kill all of its up to 17 million mink (Rosane, 2020).

G) Travel Bans and Restrictions: The major decline in commercial traffic began during the third week of January and accelerated in February before making a modest recovery toward the end of the month into the first week of March as China restarted some flights. In the second week of March, governments around the world began implementing restrictions on travel that have led to a further — and continuing —decrease in the number of flights operated globally (Petchenik, 2020). To limit the spread of the coronavirus disease, a total of 217 countries and territories worldwide have imposed travel restrictions. It has also caused USD 314 billion losses of revenue (United Nations' World Tourism Organization, 2020).

H) Ecotourism and Wildlife Tourism: Lockdowns and the loss of tourism revenue is creating challenges for protecting wildlife. The cost of COVID-19 to zoos is estimated to be enormous in terms of extinction for the 77 species of plants

Figure 2: Cleaner skies and visibility of blue moon as a result of reduced air pollution during COVID-19 control period

Source: Top- www.google.com;
Bottom-**Chris Robertson,** skynews, https://www.google.com, Accessed 7, November, 2020

and animals (an estimate). Ecotourism in several countries has been adversely affected which has an effect on their economies and developmental programmes.

I) **Food Security and Hygiene:** Wild meat which was a favoured food of many has gone out of market; forest dwelling populations have a serious survival problem.

J) **Oceans, Seas and Climate Change**: The global lockdown measures have led to a decrease in fishing, tourism and maritime transport activities. Carbon dioxide remains in the atmosphere and oceans for centuries. This is linked with climate change. Any temporary fall in emissions due to the Coronavirus epidemic, should not be taken lightly. The lockdowns have affected some of the environmental laws and regulations as many governments are looking for liberal laws; if these are granted, climate change impact will not reduce and we are bound face the problems.

K) **International Meetings:** Several international meetings dealing with the environment have been postponed thereby delaying any anticipated decisions. The UN Climate Change Conference COP26 set to take place in Glasgow in November is being rescheduled for 2021.

Conclusion

Any pandemic or calamity has negative impact on humanity and the environment in general. But in the case of COVID-19, it is believed that

"Nature is sending us a message on the ongoing climate crisis" as a result of excesses of human beings in the name of development and economic growth. We have been suppressing the wildlife for selfish gains at a cost. The major issues we face due to COVID-19 are climate change, air pollution and waste management. As reported by Geneva Environment Network (2020), emissions are projected to be 7% lower in 2020 than in 2019, though the cost has been very high. Some innovative solutions are needed. Partnerships such as Adidas and Parley who recycled the plastic waste obtained from oceans into sports material, or several multinational companies (Unilever, Mastercard, Microsoft, Deloitte etc.) who have initiated joint programmes of partnership should be taken as good models if we have to cope with pandemics like COVID-19. We should learn to live with COVID-19 without antagonizing Nature.

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