

COVID-19 pandemic—Environmental perspective of COVID-19 and a primer for all of us

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ABSTRACT

Coronavirus Disease (COVID-19) spread worldwide has created a global pandemic. To reduce the transmission of the virus, the Indian government had imposed a countrywide lockdown on 24 Mar 2020 by suspending all public transport and industries temporarily resulting in loss of jobs in multiple sectors and looming threats to the nation economy. Lockdown on the opposite hand has removed pollutants from the air and thus improved air quality in many cities across the globe. The near-total shutdown of all economic activities except related to essential commodities like medicine and food was only allowed which resulted in the lowering of carbon emission and improvement in global warming and air pollution. This review article intended to bring important features of how the COVID-19 pandemic affects human civilization and the global environment. However, its epidemiology, symptom, possible prevention, and management will briefly describe. Authors have collected data from, PubMed, Embase, Scopus, WHO, and CDC (USA). Severe Acute Respiratory Syndrome is a result of COVID-19 infection. This virus is transmitted through close contact by respiratory droplets from one person to another. The majority of symptoms of COVID-19 are very much similar to any viral upper respiratory tract infection (Common Coryza). Any person with the slightest suspicion or has respiratory symptoms related to COVID-19 infection should wear a facemask, keep safe social distancing, observe cough/sneeze etiquettes. The COVID-19 pandemic has taught us a lesson to introspect the way humans are destroying the environment for their benefit. Whatever be the origin or cause, the occurrence of COVID-19 has made a foreground for us to improve the symbiotic relationship between humans, wildlife, and nature.

Keywords: Coronavirus disease, COVID-19, droplet infection, environment, pollution, wildlife

Introduction

An outbreak of novel coronavirus has been declared by The WHO on 30 Jan 2020, as a “public health emergency of international concern.” Later on it was designated as pandemic on 11 Mar 2020.^[1,2] SARS-CoV-2 (severe acute respiratory syndrome), also known as 2019-nCoV, which was responsible for COVID-19.^[3-7] The said infection has originated from a seafood and live animal market in Wuhan, China where animal

were slaughtered. Initially, only 27 unusual pneumonia cases were reported in mid Dec 2019 and in no time converted into a pandemic.^[7-11] Initially it was thought that it was caused by an innocuous virus, as most patients reported fever or difficulty in breathing, a common symptoms of URTIs.^[10,11] Human civilization apart from COVID-19 has seen many pandemics in recent past, for example, H1N1 in 2009, poliomyelitis in 2014, Ebola infection in 2014 in Africa in, Zika virus infection (2016), and Ebola pandemic in DRC (Congo) in 2019.^[12,13]

Apart from above five pandemics, now COVID-19 has been declared pandemic on 30 Jan 2020 by the WHO. These global spread have been responsible for a large number of deaths, morbidities, and loss of economy.

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Received: 02-06-2020

Revised: 09-09-2020

Accepted: 06-10-2020

Published: 30-01-2021

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_1055_20

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How to cite this article: Shaki O, Gupta TP, Rai SK. COVID-19 pandemic—Environmental perspective of COVID-19 and a primer for all of us. J Family Med Prim Care 2021;10:48-55.

COVID-19 pandemic has caused greatest human suffering as compared to other contagious diseases globally. Other environmental changes such as depletion in ozone layer, air pollution, soil pollution, and rapid urbanization create tremendous threat to our mother earth and health of human being. Rapidly urbanization and rapid development of industries with toxic gases release in large amount allow green gas production and global warming. COVID-19 outbreak may be because of indirect global environmental neglect and changes. Apart from effects on human life, COVID-19 virus disease has slowdown the economy worldwide. Now is the high time where healthcare personnel, public, local, and central governments need to be hand in hand for prevention and its spread.

In this study, our objective is to focus on basic virology, epidemiology, clinical presentation, current testing protocols, prevention, and the impacts of Novel Corona on environment and society and measures to be taken to minimize community spread and other the risk factors.

Virology of COVID-19 and Electron microscope image

The SARS-CoV-2 virus belongs to coronavirus family, because of presence of crown-like structure outer wall.^[3,14] SARS-CoV-1 virus and MERS-CoV virus are also belong to coronavirus family, responsible for the common cold^[3,9,14,15], [Figures 1 and 2]. This COVID 19 (SARS-CoV-2) is a betacoronavirus similar to MERS-CoV and SARS-CoV-1, and is closely associated with bats.^[15-17] Till now no animal source has been pin pointed for COVID-19, early cases were thought to be originated from seafood and live animal market in China.^[17-19]

This review of article is pertinent to primary physician in the form of prevention and how this epidemic has changed the world and its economy. Since there is no treatment of COVID-19, but we primary physician can prevent this by spreading awareness among society about its spread.

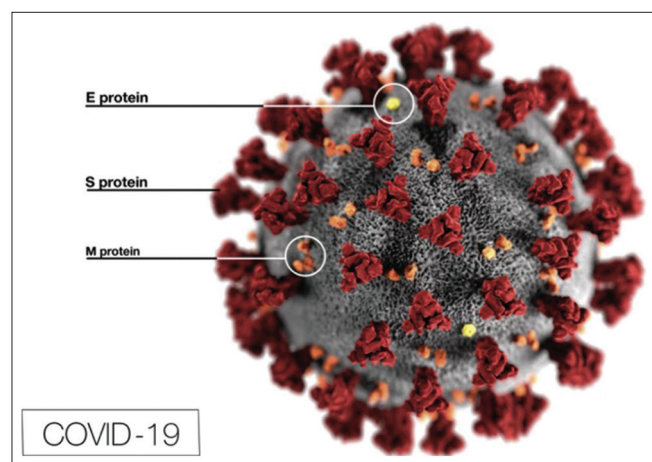


Figure 1: Electronic microscope image of COVID-19. Source - <https://www.cdc.gov/media/subtopic/images.htm>(<https://phil.cdc.gov/Details.aspx?pid = 23354>). Accessed 11 Sep 2020.

Epidemiology

Initially cases of COVID-19 were reported from Hubei, China, and later on, many cases have been reported from China as well from other countries because of inter-person transmission. In the month of Dec 2019, about more than 94% of COVID-19 cases were reported from Hubei Province only, and in Mar 2020, large number of new cases were reported in Germany, Spain, Italy, and the United States of America.^[20-22]

Till now we know that coronaviruses, primarily spreads through close contact (approx. one meter) by cough droplets,^[9,16,17,22,23] COVID-19 virus also gets transmitted through contaminated surfaces with the hand, mouth, nose, and eyes.^[17,24] Patients are at higher risk of spreading the infection when they are most symptomatic.^[21,23] There is no data to support viral shedding in asymptomatic person, whereas it is highest in critically ill patient.^[25-27] Epidemiologic study and its spread in China indicate COVID-19 is highly contagious with sustained spread. In the USA, initially inter-person transmission was limited but has progressed to community transmission in many parts of the USA rapidly.^[24]

From initial exposure, the incubation period for COVID-19 thought to be 14 days. But later, mean incubation period was found to be 5.2 days (95% CI 4.1–7.0) but can vary from 02 to 14 days.^[18,28]

Burden of disease

Till date total number of confirmed cases globally is 27, 417,497, distribution country wise has been shown [Figure 3]. However, infection of COVID-19 has been steadily increasing on daily basis worldwide. For detail, see COVID-19 (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>); last access on 9 Sep 2020.^[29]

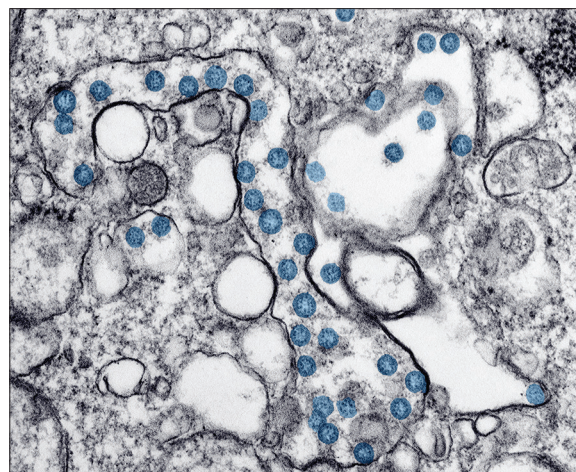


Figure 2: Electron microscope picture showing the spikes on the outer surface of the COVID-19. (source: Eckert A, Higgins D, Centers for Disease Control and Prevention. ID# 23313; 2020. <https://phil.cdc.gov/Details.aspx?pid = 23313>. Accessed February 18, 2020. (<https://phil.cdc.gov/Details.aspx?pid = 23311>))

The worldwide spread of COVID-19 in many countries has created a global pandemic threat [Figure 4].

Symptoms

Most of the clinical features of COVID-19 are very much similar to common Coryza fever, cough, breathlessness, and fatigue.^[15,16,28] Many patients in addition to pulmonary symptoms may present with vague symptoms like myalgias, diarrhea, malaise, headache, nausea vomiting, confusion, chest pain, sore throat, running nose and sneezing, nasal congestion, and nausea. Elderly and immunocompromised persons may not show febrile response. Centers for Disease Control and Prevention (CDC) has place a temperature benchmark of 100.0 F° for early detection of potential COVID-19 patient.^[28]

Approach to suspected COVID-19 in outdoor department

A general approach to COVID-19 should focus on identifying and isolating patients at risk for infection, informing hospital infection prevention policy and involving local public health authorities, engaging preventive and social medicine specialist,

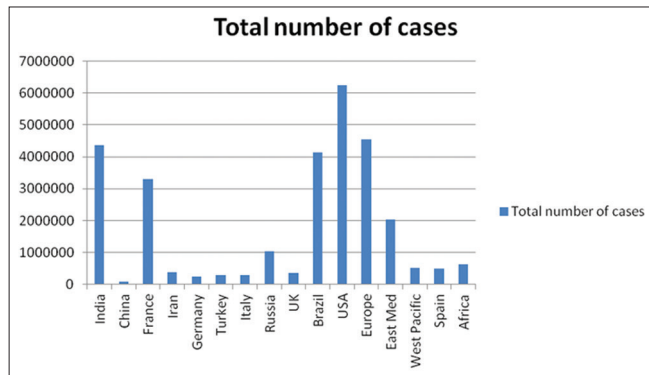


Figure 3: The comparative study of COVID-19 cases of India with other Countries. (Source: WHO, 2020, Accessed date: 9 Sep 2020).

Microbiologist, respiratory medicine physician and critical care medicine specialist in holistic care. The World Health Organization (WHO) has established case and contact definitions for COVID-19 to standardize global surveillance [Table 1].

Simultaneous efforts of local health society and Central health departments is required to control this pandemic. Facemask is made mandatory to wear by all personnels to minimize transmission to others. It is recommended by CDC for identifying and assessing suspected COVID-19 has been shown in Figure 5.^[31]

COVID-19 and its effect on health globally

How disease related with human health is well studied over the period of time and not a new subject. This pandemic caused by COVID-19 originated from China in Dec 2019 is responsible for

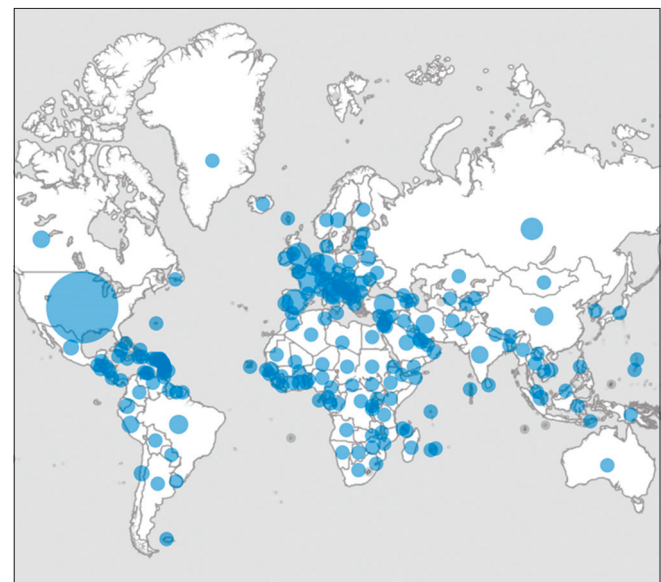


Figure 4: Current distribution of COVID-19 in different countries. (Source: WHO, 2020, Accessed date: 9 Sep 2020)

Table 1: World Health Organization (WHO) case and contact definitions for global surveillance of COVID-19			
Suspected case	Probable case	Confirmed case	Contact
A. Patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days prior to symptom onset; OR B. Patient with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case (see definition of contact) in the last 14 days prior to symptom onset; OR C. Patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath; AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation.	A. Suspect case for whom testing for the COVID-19 virus is inconclusive. OR B. Suspect case for whom testing could not be performed for any reason.	A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms	A contact is a person who experienced any one of the following exposures during the 2 days before and the 14 days after the onset of symptoms of a probable or confirmed case. Face-to-face contact with a probable or confirmed case within 1 m and for >15 min; <ul style="list-style-type: none"> • Direct physical contact with a probable or confirmed case; • Direct care for a patient with probable or confirmed COVID-19 disease without using proper personal protective equipment; OR • Other situations as indicated by local risk assessments.

For confirmed asymptomatic cases, the period of contact is measured as the 2 days before through the 14 days after the date on which the sample was taken which led to confirmation. <https://www.who.int/docs/default-source/coronavirus/situation-reports/20200418-sitrep-89-covid-19.pdf>

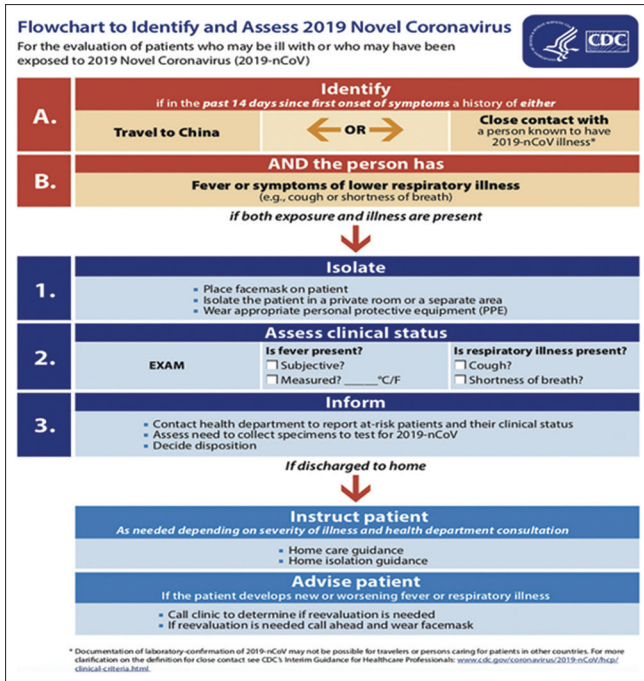


Figure 5: Flowchart to Identify and Assess 2019 Novel Coronavirus from the CDC. (Available at <https://www.cdc.gov/coronavirus/2019-ncov/hcp/2019-nCoV-identify-assess-flowchart-508.pdf>. Accessed 9 Sep 2020.)^[30]

a large global outbreak and put public health at risk. COVID-19 virus is highly contagious and transmitted inter-person through droplets, close contact through sneezing, coughing, respiratory droplets, and aerosols [Figure 6].

COVID-19 and economy loss worldwide

Pandemics always cause tremendous damage to the society and economical loss. COVID-19 has severely affected the economy globally which may takes years to make good of its losses. Government of various countries have imposed partial to total lockdown to prevent free personnel movement, thus reducing transmission of the disease in the community. All passenger transport movement has been stopped including railway, flight, buses, and ships. Only essential commodities like health, food, milk, LPG items movement is allowed through goods train and trucks. All commercial, educational, spiritual, sports, recreational activity, entertainment facility like cinema hall, health club hall, seminars are closed. In this lockdown, industries are suffering much more than anyone because of stopped production and non-availability of workers. Transportation company, tourism company, hospitality industries are also facing economical loss. Factory output and production level has gone all time low. Developing country like India which has strong economy is now facing increased unemployment because of loss of jobs. For the treatment and rehabilitation of the COVID-19 patients and their families there will be increase in financial burden on patients as well as on governments.^[31]

GDP of each country have been affected by Government imposed lockdown. As estimated by Organization for Economic



Figure 6: Pictorial diagram of transmission of COVID 19 infection. (Picture is self explanatory)

Cooperation and Development (OECD) there will be loss of 2% points in annual GDP growth in each month. Worldwide tourism companies noted significantly dip in revenue by 50% to 70%.^[32] After financial emergency in 2008–2009, World Trade Organization and Organization for Economic Cooperation and Development (OECD) have indicated that COVID-19 pandemic is a responsible for decrease in global economy. Media has reported that human civilization and modern society has not seen such a devastating global health emergency and economical slowdown after the World War-II.^[32]

Global environmental effect of COVID-19

As civilization begins, human have started destroying and manipulating the mother nature for its own interest and to meet the undue demand of constantly increasing population. Rapid urbanization, industrialization, deforestation, increased human activity at every level, loss of green fields, and increased carbon emission with greenhouse effect that has detrimental effect on global environment. These increased human activities further pollute water bodies, air, oceans, mountains, depletion of ground water level, depletion of ozone layer, and global warming. This irresponsible human behavior causes tremendous change in biodiversity and ecosystem.^[33] Greenhouse gases like CO₂ CH₄, N₂O are large way causing global warming. To satisfy our desire to achieve more and more, we started destroying the nature in numerous and ruthless ways. But because of COVID-19, outbreak many countries like China, USA, Iran, France, Turkey, Taiwan, Italy, Spain, U.K, Germany, South Korea, Australia, African countries, and India and many more are under lockdown from few weeks to few months. Every effort is being made to restrict

transmission of the COVID-19 by constrain of people from one location to other. All passenger transport means are closed which significantly reduces use of fossil fuels and emission of greenhouse gases and toxic suspended particles in the air. Air pollution has significantly reduced because of shut down of industries. Should we give thanks to Novel Corona pandemic, which significantly recovered our ecosystems, of course it cannot be at the cost of human lives. Many news channels across the country as well as many people observed a clear sky and mountain peaks for the first time.

This COVID-19 pandemic on one hand has shown its devastating effect on human lives and on other hand, it brought a very positive and healthy change in the environment globally.

Prevention and control of COVID-19 pandemic

Pandemic because of COVID-19 is of all time high that created global threat, which requires response from each country. WHO and Governments of all affected countries must furnish facts to help the public to face such devastating global health threats. In order to minimize the damage caused by COVID-19, infection control, public health agencies are to play an important role to limit the global spread of this virus. Few WHO recommended global strategies are as follows to prevention and control COVID-19 disease.

Prevention of community spread and restricting mass gathering

The main objective of public health department and administration was to restrict mass gathering and to prevent COVID-19 transmission from person to person. WHO has recommended some precautionary measures like regular hand washing with soap/sanitizer, use of face mask, avoid gathering, avoid hand shake, and observe cough etiquette. Various social activities like cultural, religious, meeting, has been postponed by Govt. of different countries. Information technology, Television, print media, and social networking are constantly creating awareness regarding its spread, prevention, and current status of COVID-19 across the globe. The thumb rule is to prevent mass gathering to prevent Corona.

Plantation and deforestation

On earth surface approximately 30% area has been covered by the Forests according to World Wildlife Fund. The constantly increasing human population and growths results in deforestation. Ruscio *et al.* in 2015^[34] reported average rise of temperature, disappearing glaciers lead to increased in ocean levels and increased rate of unexpected climate change like flood, draught, and extreme weather events which affect our ecosystem and human health too. Olivero *et al.* in 2017 and Afetl *et al.* in 2018 both has reported different types of diseases in animals and birds because of deforestation.^[16,35] As of today COVID-19 is bat related virus which took many human lives and turned into a pandemic. Many countries are spending billions of dollars to prevent this pandemic by developing diagnostic tools,

vaccines, treatment, and antivirus medicines. By deforestation, we are disturbing wild life habitats and the time has come for the world not to destroy forests, respect wild life, stoppage of deforestation for own benefit and to encourage afforestation in every possible corner of earth.

Effect of World population growth on Environment

Uncontrolled and unrestricted increasing human population across the world is not a good sign for our mother earth. It has adversely affected our environment and has various ill effects on human health. Human activities directly affects environmental change.^[36] China has the greatest population and constant increase in human population results into deforestation and make people consume all kinds of animals like frog, bats, insects, snakes, etc., Fan *et al.*^[37] from China, in Dec 2019, has reported that COVID-19 has originated from bats that created a havoc in public health worldwide. Traveling from one to another place, in crowded trains, buses, on the streets and staying in overcrowded rooms, apartments, and slum makes human exceedingly vulnerable to new virus. Population control is therefore very much required of this present scenario and thereafter too.

Global judicial restriction and ban on wildlife trade and consumption

We should not forget one very important fact that this COVID-19 pandemic has started from seafood market, Wuhan, China. After this outbreak, Govt. of China has imposed temporary suspension on sale of wildlife where animals such as bats, wolf, pangolin, worms, fishes, annelids, some poisonous fish like puffer fish, Fugu fish and varieties of insects etc., are kept alive during sale. In China, the unrestricted wildlife slaughtering and sale might enhance the risks of emerging new viruses. WHO and many scientists have urged many countries to stop and put a permanent ban on wildlife slaughtering and sale. If these measures are implemented in future, it would help to protect human lives from future pandemics with another unknown deadly virus.

Keeping public health, national security, economical loss and biosafety in mind, the time has come to consider the global ban on wildlife markets and trades.

Table 2: COVID-19 therapies under study

Medicine	Dosage
Chloroquine	500 mg PO BID for 10 days
Hydroxychloroquine	400 mg PO BID for 1 day, then 200 mg PO BID for 4 days
Remdesivir	200 mg for 1 day, then 100 mg IV every day for 9 days
Lopinavir/Ritonavir	400-100 mg PO BID for 14 days
Tocilizumab	8 mg/kg in 100 mL of 0.9% NS IV over 60 min
Favipiravir	1600 mg PO BID for one day, then 600 mg PO BID for 6 days
Plasma from COVID-19 survivors	Under evaluation
Vaccine	Under trail

Treatment

After review of present published data, no specific treatments can be found or exist nor can be recommended with confidence. Many countries are trying their best to develop vaccines which are under study, including DNA-based, vector-based, and protein-based vaccines.^[38] Only supportive and symptomatic management is available till date. Clinical trials of antiviral drugs are under consideration, although none are currently approved by the U.S. FDA [Table 2]. More recently, U.S. FDA just approved a clinical trial at Columbia University for plasma from COVID-19 survivors for critically ill patients.

Many published data of non-randomized clinical trials supports the use of convalescent plasma has been shown good results and reduce the mortality rate in patients with COVID-19 infection with respiratory distress who otherwise did not respond to available medication.^[30-41] In other study by Cheng *et al.* on 1775 SARS patients found that 80 patients transfused with SARS convalescent plasma had a much low death rate, compared to non-transfused patients (12.5% *vs.* 17%).^[39] FDA issued an EUA for convalescent plasma on August 23, 2020 with certain guidelines.^[42]

Patients disposal

Critically ill patients, with severe symptoms, require admission and monitoring. Person with mild symptoms with no comorbidities can be discharge with advice for self-quarantine for 2 weeks at home. It is important to prevent transmission of infection to others. Social distancing plays a pivotal role in minimizing the spread of the virus, like limited essential events and small or large gatherings and everyone should maintain at least 02 m distance from each other.^[43-45]

Take home message:

- (a) Prevention is better than cure
- (b) use of triple ply face mask and hand sanitizer
- (c) maintain proper interpersonal distance about 6 feet
- (d) wash hand with soap frequently and don't touch face and mouth frequently
- (e) avoid going in crowded places
- (f) consult primary family physician in case of upper respiratory symptoms, loss of smell/test, skin rashes/or any unexplained symptoms.
- (g) follow Gov/ICMR/WHO guidelines

Conclusion

In 21st century as human are advancing day by day, we moved forward by destroying our environment resulting in rising of so many natural disaster across the globe. We are not taking proper care to restore the mother nature while moving forward rather destroying it more rapidly. Last few months of COVID-19 induced lockdown has very positive effects on environment and has successfully recovered to a great extent that will have definite positive impact on global environment. Whatever be the origin or cause, the occurrence of COVID-19 has made a foreground for us to improve the symbiotic relationship between humans, wildlife,

and nature. In today time of fast growing world and economy, it is essential to know the origin, control the source of disease, reduce its transmission, and use of available medical resources.

Natural disasters and pandemics will come and go as long as humans live on this earth; let's all unite as responsible human beings to make our mother earth free from ill effect of our own activities and trust mother nature, before it is too late.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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