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Impact of COVID-19 on Environment and Diagnosis in India

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Abstract: Covid-19 is the term for Corona Virus Diseasethat started invading Wuhan, China in December 2019. It has normal flu-like symptoms at the beginning but soon gets accompanied by severe acute respiratory problems. Till now finding suggests that early identification of symptoms, isolating the infected from others, and treating them is the solution. Ground glass opacity is identified in the early stages of Radiological Images soon fibrous stripes appear and resolution occurs in the lungs. Every disorder can be characterized by the specific nature of the tissue which can be examined through existing modalities. The first cases of coronavirus disease (COVID-19) were reported in Wuhan, China at the end of 2019. Soon, the number of infected people increased rapidly, and within a few months, the outbreak turned into a pandemic, with infected individuals diagnosed all over the world. Business travel was curtailed, closed down schools, colleges, and universities were in order to reduce, the spread of the disease, and established numerous quarantine cases across nations. The study objective is to contemplate the effectiveness of COVID-19 on the environment and healthcare of the Indian Territory from March 2020 and April 2020. This paper describes the impact of COVID-19 on the environment and healthcare, have the possible ways out have also been discussed therein.

Keywords*:* COVID-19, AQI, Radiological Images, Computer-aided diagnosis

I. INTRODUCTION

Coronavirus disease 2019, has claimed the life of 541, 24 actuals, and effecting 11,764,563 globally since its discovery in Wuhan, China. Since then, the disease rapidly circled the globe and has eventually affected every continent except Antarctica. It has been categorized as a pandemic by the World Health Organization [1]. International Committee on Taxonomy of Viruses (ICTV) virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2]. According to WHO, from 2002–2003, more than 8000 people suffered and 774 died of a coronavirus, called SARS. In 2012, the MERS-CoV pandemic broke out infecting more than 2494 persons and killing over 858 lives worldwide [3,4]. Coronaviruses belong to a large diverse family of viruses. These can be categorized into four genera namely, α-, β-, γ-, and δ.

All the previously discussed coronaviruses responsible for the worldwide spread of the pandemic, namely SARS, MERS-CoV, and SARS-CoV-2 are β-coronaviruses.The early investigations have observed the image of this virus shows it has a diameter of 60-140 mm and an envelope of protein spikes with a single-stranded positive RNA genome. Molecular techniques can be used to get a more accurate result for diagnosing COVID-19 compared to nucleic acid testing and radiological images. But it requires an understanding of the proteomic and genomic composition of the virus or changes in the expression of proteins in the host (human/animals) during infection. More than 1000 genome sequence of SARS-CoV-2 has been recorded by researchers in the Global Initiative on Sharing All Influenza Data (GISAID) and GenBank. This sequencing is important to probe sequences for PCR and other nucleic acid tests. This virus is highly infectious and can be transmitted through droplets and close contact.

The hunnnnnnnnnnnn spreading of the virus occurs due to close contact with an infected person exposed to coughing, sneezing, and respiratory droplets. The presenting features of COVID-19 disease in adults are prominent. It is a matter of great importance to clarify the correlation between COVID-19 and immune-rheumatologic patients. Taking into consideration the quick and frantic spread of the epidemic, the health of rheumatic patients is a matter of prime concern. COVID-19 is a respiratory disease, damage to the tissues of the Lungs is quite obvious, but there is a report that other organs and tissues may also be affected. Since viral shedding in plasma or serum is common in respiratory tract infections, there is a possibility of transmission of coronaviruses through the transfusion of labile blood products. COVID-19 is a major public health concern for the world's population and is a leading cause of hospitalization and death, particularly for middle and old-age people in the affected countries.

II. COVID-19 AND ENVIRONMENT

The first case of the coronavirus outbreak in India was reported on 30 January 2020 in Kerala's Thrissur district when a student had returned home from Wuhan University in China [5].

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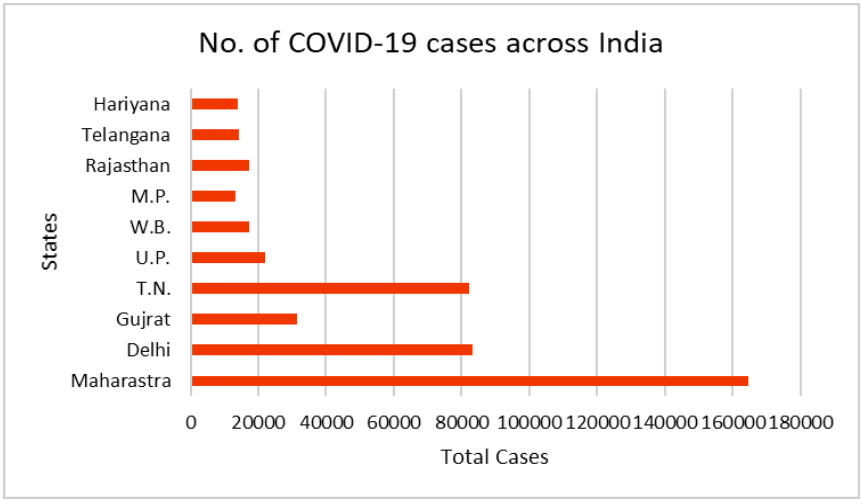

Fig. 1 A comparative study of COVID-19 cases in Indian states.
(Source: covid-19india.org , Accessed Data on 07th July 2020)

In a hypothetical scenario in which the impact of air pollution on mortality was underestimated using the aforementioned models, and in which we considered a time period of two months with a decrease in NO2 air pollution, macabre predictions could postulate a 6% reduction in mortality due to air. Similar calculations could be applied to other countries. Considering the huge decrease in air pollution following the quarantine the COVID-19 pandemic might paradoxically have decreased the total number of deaths during this period, by drastically decreasing the number of fatalities due to air pollution. Moreover, the reduction in air pollution itself could also have positive benefits in reducing preventable non-communicable diseases [6]. CO2 emissions, another common tracer of air pollution [7], decreased by 25% in China and by 6% worldwide [8]. Air pollution is responsible for many deaths and increased incidences of respiratory disease [9]. According to the World Health Organization, 4.6 million individuals die annually from diseases and illnesses directly related to poor air quality than motor vehicle accidents [10].

Air pollution associated deaths include but are not limited to aggravated asthma, bronchitis, emphysema, lung and heart diseases, and respiratory allergies. According to the World Health Organization (WHO), 13 of the world's 20 cities with the highest annual levels of air pollution are in India, with New Delhi [11]. The pollution caused by the industrial waste is the major contributor followed by vehicles and crop burning. In rural areas, much of the pollution results from biomass burning for cooking and keeping warm; in autumn and winter months, large scale crop residue burning in agriculture fields is a major source of air pollution [12]. On March 25th, 2020 the prime minister of India imposed a lockdown on 1.3 billion citizens of India to control the spread of Coronavirus disease. There is literally a ban on free movement of citizens outside their home in order to avoid community transmission.

The various religious, cultural, social, scientific, sport, and political mass gathering events are cancelled. Various types of industries are not functioning, all types of travels are cancelled. Meanwhile, efforts to restrict transmission of the SARS-CoV-2, by restricting the movement have had an outstanding environmental effect. Due to non-functioning of industries, industrial waste emission has decreased to a large extent. Vehicles are hardly found on the roads resulting almost zero emission of green-house gases and toxic tiny suspended particles to the environment.

Due to lesser demand of power in industries, use of fossil fuels or conventional energy sources have been lowered considerably. Ecosystems are being greatly recovered. In many big cities the inhabitants are experiencing a clear sky for the first time in their lives. The pollution level in tourist spots such as forests, sea beaches, hill areas etc. is also shrinking largely. Ozone layer has been found to have revived to some extent. The pandemic has executed worldwide destruction on mankind, but created a very positive impact on the world environment.

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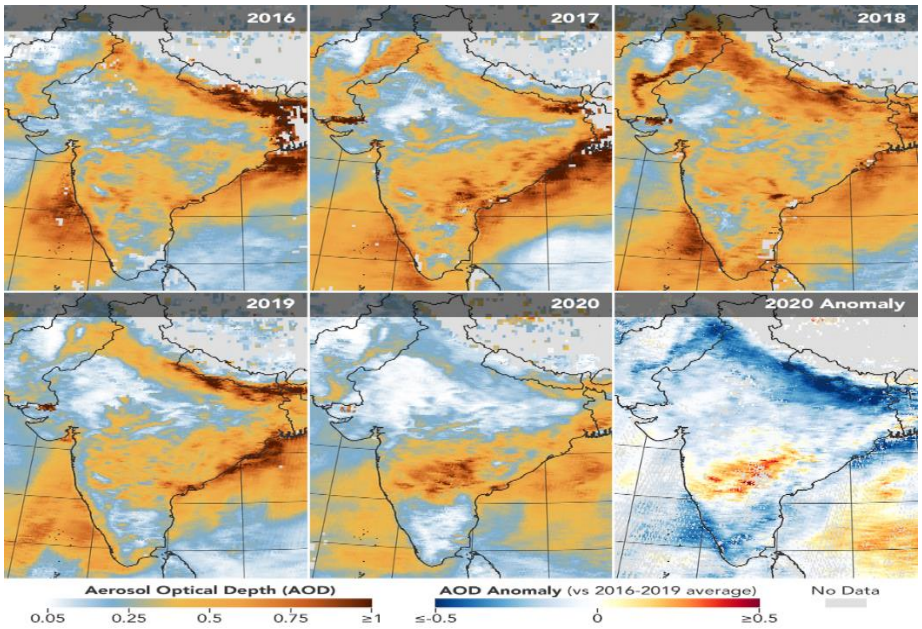

Fig 2 Airborne Particle Levels Plummet in Northern India. This image is taken from NASA, 2020[13]

III. COVID-19 AND HEALTHCARE

❖ Reverse transcriptase-polymerase chain reaction (RT–PCR) test is routinely used for the diagnosis of COVID-19.

❖ Nucleic Acid Testing: To detect COVID-19 reverse transcription-polymerase chain reaction (RT-PCR) kits have been designed. It involves the reverse transcription of viral RNA into cDNA (complementary DNA) strands, specific regions of cDNA are amplified. RT-PCR is the most predominantly used method for diagnosing COVID-19, the swab is taken from the patient's nasopharynges, the upper and lower respiratory tracts, and tested.

❖ Protein Testing: Serological tests i.e., blood tests are useful for surveillance of viral protein antigens and antibodies generated in response to SARS-CoV-2 infection particularly. Pool Testing is a new strategy adopted by India in April 2020 to test COVID-19 positives. According to the Indian Council of Medical Research testing people in a group in areas least affected (COVID-19 positive rate < 5%) helps to reduce the usage of testing-kits by 1/4th times. Pool Testing involves testing samples of a group of people together using the RT-PCR kit. Depending on the reports of the test further testing is conducted. If it comes positive then individual tests will be conducted if it is negative then it will stheave testing of a group.

❖ Problems faced with these diagnostic strategies are a time-consuming approach. RT-PCR test can take up to 2 days to complete. Infrastructure is required to store specimens. Special biosafety lab is required to store a PCR machine which each cost about USD 15,000 to USD 90,000. Testing-kits are less available in the market. The cost of an RT-PCR kit is about USD 120-130. Out of 905 patients, RT–PCR, 419 (46.3%) tested positive for SARS-CoV-2. The phlebotomist is getting exposed to invasive swab for testing. Prone to human-error and bias.

Computer-Aided Diagnosis from radiological diagnosis: The challenges of shortage of kits and a false negative rate of RT-PCR, was addressed by a computer-aided diagnosis of COVID-19 from radiological images thereby helping communities without laboratory infrastructure to the diagnosis of positive patients. A machine learning algorithm is trained with infected patients X-Ray data such that it can classify between healthy and infected individuals. The computer-aided systems have improved the detection of patients who were positive for COVID-19 via RT–PCR who presented with normal CT scans, correctly identifying 68% patients, whereas radiologists classified all of these patients as COVID-19 negative. Computer Aided Diagnosis has proved successful in medical imaging and diagnosis of lung diseases as extensive testing and diagnostics are of great importance in order to effectively contain the pandemic. The insufficient testing capacity in most countries has therefore spurred the need and search for alternative methods that enable diagnosis of COVID-19.

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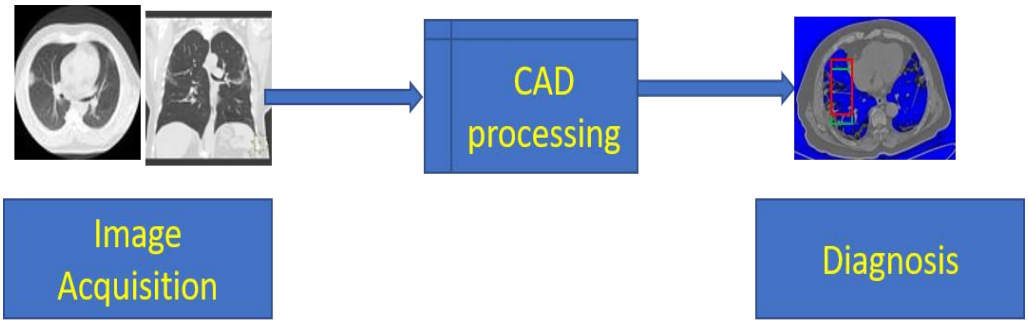

Fig. 3 Computer-Aided Diagnosis in Radiological Image.

COVID-19 pneumonia can rapidly progress into a very critical condition. Examination of radiological images of over 1,000 COVID-19 patients showed much acute respiratory distress syndrome (ARDS)-like characteristics, such as bilateral, and multi-lobar glass ground opacifications (mainly posteriorly and/or peripherally distributed) [15, 16]. As such, chest computed tomography (CT) has been coined as a potential alternative for diagnosing COVID-19 patients [15]. While RTPCR may take up to 24 hours and requires multiple tests for definitive results, diagnosis using CT can be much quicker. However, use of chest CT comes with significant drawbacks: it is costly, exposes patients to radiation, requires extensive cleaning after scans, and relies on radiologist interpretability.

IV. RESULTS AND DISCUSSION

While RT-PCR may take up to 24 hours and requires multiple tests for definitive results, diagnosis using CT can be much quicker. However, use of chest CT comes with significant drawbacks: it is costly, exposes patients to radiation, requires extensive cleaning after scans, and relies on radiologist interpretability. According to the World Health Organisation the most accurate test is nucleic acid testing collecting swab from thoracic part of the body using RT-PCR kit. There are various limitations of using a chest radiological image as it can be useful in providing rapid diagnosis but is not as accurate as nucleic acid tests. As for patients with mild symptoms, CT Scan images do not show any abnormalities.

The relation of COVID-19 on the air pollution of Indian territory from March 2020 to April 2020 on air quality data from the Sentinel – 5 P satellite images elucidate that the Air quality of Indian Territory has been improved significantly during COVID-19. Mumbai and Delhi are one of the most populated cities. There is a drop of major pollutant concentrations for the before and after lockdown. NO2 shows a drop of 52% from these Sentinels – 5 P satellite images. However, SO2 shows 17.9% drop in 2020 compared to 2019 as shown in the images.

V. CONCLUSION

Governments all over the world have been forced to declare lock-down, compelling billions of people to stay at home. Many people, being both idle as well as bored, have resorted to social networking as a form of time pass. In a time of crisis and desperation, it is a common psychology that man will tend to believe what he prefers to believe. Hence, false rumors are running wild through social media, and even many elite people are in partial belief with these rumors. A common perception in social media (at least in India) is that, unlike the high-income countries such as Italy, UK, France, and the USA, the economically poor countries such as India and many African countries will be somewhat less affected by COVID-19. Various reasons have been put forward in support of such a claim. Hot humid weather conditions, cross-protection from malaria, mutation in the virus making it weaker, etc., were some of the reasons cited. One such interesting reason raised is that the common people living in low-income countries are commonly exposed to lesser hygienic conditions and receive lesser medical attention throughout their lifetime than the people living in high-income countries. As such, these people from economically poor countries, such as India and the African countries, have inherently acquired a stronger immunity and higher resistance against different diseases. The economic growth of the industry is getting hampered while others may show promising growth due to this pandemic world-wide. The health-care industry is having a positive growth and the market forecast says that it will have a healthy growth in the next 4 years. The scarcity of health care facilities rises higher demand which leads to higher revenue generation of the medical industry. Products to manage the spread of the virus and services for the treatment of COVID-19 are expected to grow in the coming time. Due to the pandemic, there is a change in customer behaviours which is impacting supply chain operation. New product is getting launched, vaccines and rapid diagnosis of COVID-19 are also the need of this hour. Diagnosis of various diseases like cardiac diseases, pulmonary diseases, neurological diseases have increased demand for medical image diagnosis. Studies have shown that a computer-aided system can provide more accurate results compared to a radiologist. Investments are made in state-of-art systems and market forecasts are expecting exponential growth of the healthcare industry. Emerging technologies are expected to provide patients with advanced system which are widely available. After the COVID-19 pandemic, there is a high preference for minimal human intervention treatment and diagnosis procedure.

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