

The outbreak of Corona Virus (2019-nCoV) in India: A Statistical case study

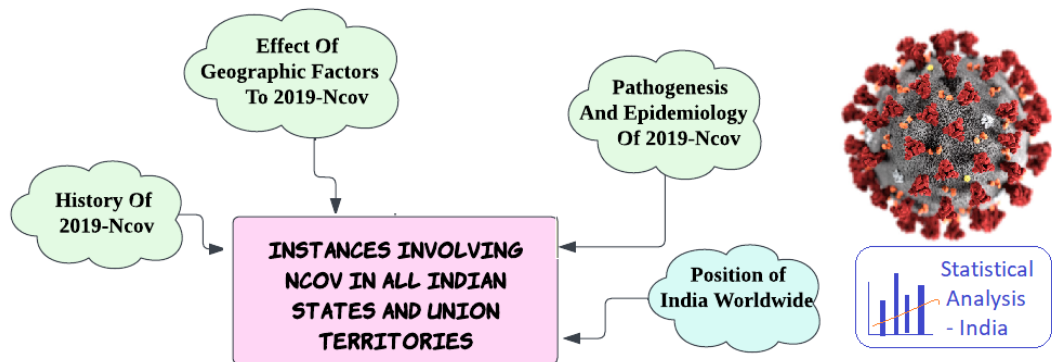
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ABSTRACT

The coronavirus disease's introduction in 2019 impacted India in 2020. A large population was confined indoors due to the blowout of this illness. People's lives were drastically impacted and broken financially, morally, and health-wise. This study concentrates on impact of Covid-19 on the people of



India and covers the occurrence of the covid outbreak in India date-wise. The 2019-nCov has produced an international health catastrophe with a substantial spike in cases and fatalities since the first covid case was detected in Wuhan, China, in December 2019. Close contact with those with the 2019 new coronavirus disease, which has a quarantine period of 2–14 days, is currently the main epidemiological risk factor. The mortality rate of 2019-nCov is predicted to be between two and three per cent. This paper highlights statistical data from February 15th, 2020, to December 16th, 2022 and discusses the history, epidemiology and pathogenesis, diagnosis procedures, India's position worldwide, and history, vaccination statistics, therapeutics target and early treatment of corona virus followed by perspective on the practice point of 2019-nCov, majorly in India.

Keywords: Corona, 2019-nCov, SARS-Cov-2, statistics in India, pandemic.

INTRODUCTION

The novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the new name for the novel coronavirus-2019 (2019-nCov).¹ Till December 28th, 2022, around 44,678,763 corona cases and 530,696 deaths have been reported.² Every age group has significantly suffered from covid-19. People over 60 and those with underlying medical disorders, including diabetes, heart disease, lung disease, or hypertension, are among those who are more likely to experience a severe or critical illness if exposed to the virus.^{1,3-5}

Figure 1 explains the total number of infected cases found in India from February 15th, 2020, to December 04th, 2022.² The trend in India from April 2021 has sudden increase, and word is known

that the variant of 2019-nCov is Delta. In the case of delta number of deaths increases very rapidly. India lacks an oxygen supply as the delta virus is lethal for the lungs, so a lot of respiratory problems.³⁻⁶ According to scientific research that has so far come to light, Coronavirus can survive on a dead body for up to nine days and in bodily fluids, secretions, and wet body cells, considering every case/human body is different regarding medical viability.

HISTORY OF 2019-nCOV

Positive sense RNA viruses that are contained and have spike-like surface projections that, when studied under an electron microscope, give them the appearance of a crown are called "corona-viruses". Their sizes range from 60 nanometers to 140 nanometers in diameter. The four coronavirus types the human body is susceptible to are NL63, HKU1, OC43, and 229E. Frequently, these viruses cause a slight respiratory infection.^{1,4,5,7}

History suggests that human infections with animal beta-corona viruses have caused severe illness twice in the past twenty years. In the Guangdong province of China in 2002–2003, a new coronavirus of the family, with origins in bats, infected humans for the first-time

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using palm civet cats as an intermediary host. SARS-CoV-2 was eventually eradicated after predominantly infecting 8422 people in China and Hong Kong, but not before it claimed 916 lives (11 per cent fatality rate). Second, more than ten years later, in 2012, the middle east respiratory syndrome coronavirus (MERS-Cov), which similarly has a bat origin and has killed 858 people (fatality rate), emerged.

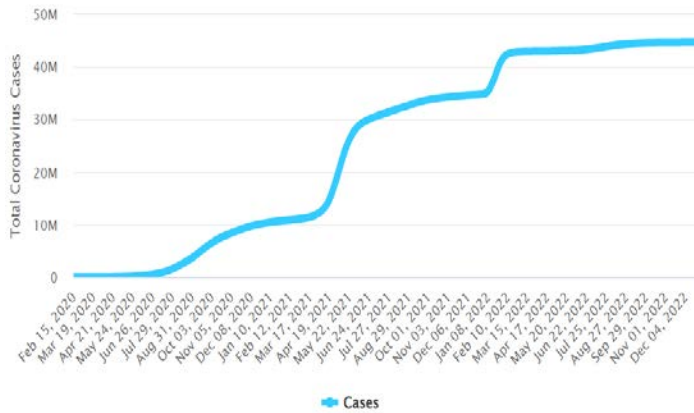


Figure 1. Total corona cases in India from February 15th, 2020, to December 04th, 2022.¹¹

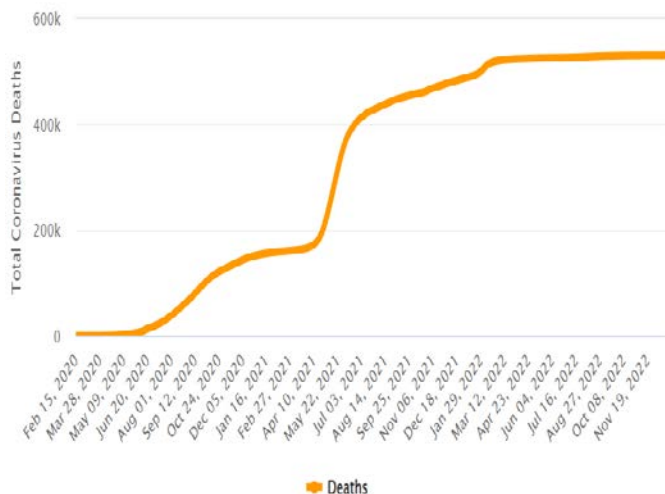


Figure 2. Total Coronavirus Deaths in India.¹¹

In India, Kerala reports its first incidence of COVID-19 infection. On January 27th, 2020, a 20-year-old lady who had a dry cough and sore throat for one day prior went to the emergency room at the general hospital in Thrissur, Kerala, India. The person had no history of shorth breath ness, fever, or rhinitis.⁸ It is improbable that food or its packaging might expose humans to COVID-19. It causes respiratory sickness, mainly transferred by direct physical contact between people.^{9,10} It can also spread through respiratory droplets created during coughs or sneezes and end up in the other person's mouth, nose, or eyes. Several researchers have tried to identify the correlation among various geographic factors with the pathogenesis and epidemiology of 2019-nCov.¹¹ Figure 3 shows flow of current study and discussion included in this article.

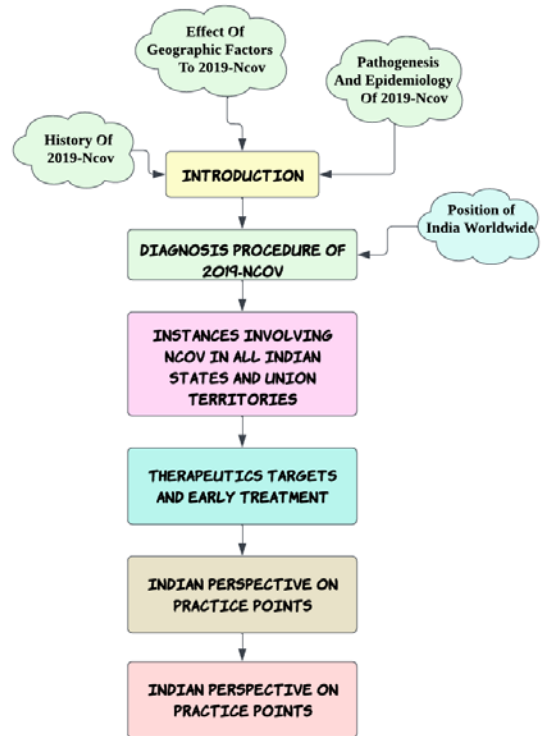


Figure 3. Study covered in the present article

EFFECT OF GEOGRAPHIC FACTORS TO 2019-NCOV

In the previous studies, various research discusses the correlation among different geographic factors like Temperature (T), percentage of rainfall (R), solar radiation (SR), actual evapotranspiration (AET), specific humidity (SH), population density (PD), and wind speed (WD). As Figure 7 suggests, most cases are near the sea (Maharashtra, kerala). The environmental stability is considerably altered by these current geographic factors, which may impact the perseverance of viruses and the transmission cycle. Gupta et al.⁴¹ discovered a positive link between long-term climatic records of temperature, SR (significant), PD, and WS with the number of diseases. This study examined the spatial relationships between long-term climate, topography, societal characteristics and the number of 2019-nCov cases officially confirmed in India.

PATHOGENESIS AND EPIDEMIOLOGY OF 2019-NCOV

People of all ages are at menace with 2019-nCov; people over 65+ had an adverse effect, while the age group under 15 years seems to have comparatively lesser effect from covid.¹² However, this can also happen in those asymptomatic people, and even before any of the symptoms are visible, large droplets created by symptomatic patients' sneezing and coughing are the most significant carrier and help to disseminate the virus. According to studies revealing greater viral loads in the nasal cavity than the throat, there is no difference in viral burden between asymptomatic and symptomatic persons. Patients may still be contagious even after their symptoms have subsided after returning to the UK from a conference in Singapore, a UK resident who had been there

infected eleven additional people while staying at a resort in the French Alps. Other people may behave as super spreaders. These diseased droplets can deposit on surfaces and propagate 1-2 meters. The virus can persist on surfaces for days in favourable climatic conditions, but easy disinfectants like hydrogen peroxide and sodium hypochlorite kill it in only a minute. Inhaling these droplets or touching surfaces exposed to them before touching the mouth, nose, or eyes might result in infection.^{3,5,13} Water supply contamination is anticipated to increase oral aerosolisation transmission because the virus is also detected in stools. As far as we know, there are no cases of pregnant women transmitting the infection to their fetuses across the placenta. However, post-natal transmission-related neonatal illness is discussed. The incubation time spans 2 to 14 days. The receptor the virus uses to enter the respiratory mucosa has been identified as angiotensin receptor 2.¹³ In India, the trends of the spread and control of disease are described in Figure 4.

Figure 5 describes new daily cases in India for 2019-nCov from February 15th, 2020, to December 01st, 2022. From the figure, it can be inferred that India suffered three 2019-nCov waves. The first wave starts in May 2020 and seems to reach a plateau in February-March 2021. WHO labelled them as Alpha (B.1.1.7), Beta (B.1.351), and Gamma (B.1.617.2), with the date of designation starting from 18-Dec-2020 to 11-Jan-2021. The second wave started late in March 2021. WHO labelled it as Delta designated from April 04th, 2021.¹⁴ This strain is one of the lethal nCov stains.

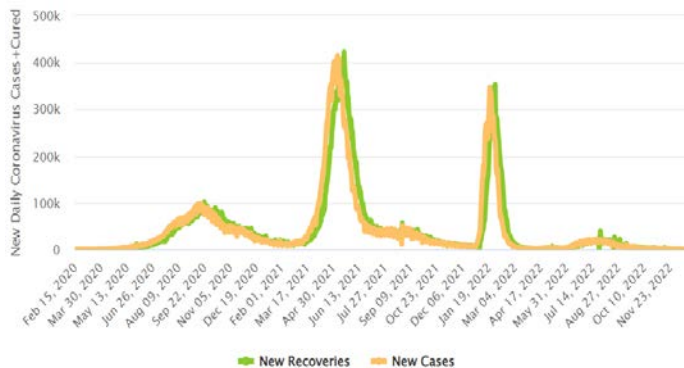


Figure 4. Newly Infected vs Newly Recovered Covid cases in India and discharged patient is each day

A lot many people lost their lives in this stain. Delta variant subsided late in January 2022. The third wave is due to a variant known as Omicron. The third wave in India has less effect due to herd immunity and the proactiveness of the government for very large-scale vaccination.^{1,3,13}

Figure 5 explains the daily death in India officials says that due to 2019-nCov death count by the end of June 2021 was near about 0.4 million, but the reality can be catastrophically worse.

DIAGNOSIS PROCEDURE OF 2019-NCOV

A case is considered questionable if it has a cough, fever, and sore throat, a history of travel to places where local transmission of covid-19 is a spreader (like China, USA), as well as contact with other persons who have had these things in the present or who have been diagnosed with COVID-19.¹⁶ On the other hand, some patients

might not even experience any symptoms or a temperature. A confirmed case is one who found positive in a molecular test.¹⁷

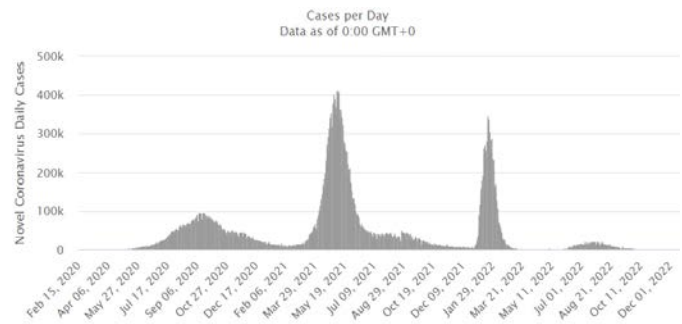


Figure 5. Daily New 2019-nCov Cases in India ¹⁵

The diagnosis uses particular molecular assays on respiratory samples (like swabs, nasopharyngeal, endotracheal aspirates, throat swabs, bronchoalveolar lavage, and sputum). A virus may also be extant in the stool and, in extreme cases, found in the blood. Furthermore, there is currently no available commercial testing (except antigen). In an unlikely situation, the necessary sample must be sent to the National Institute of Virology in Pune or reputed reference labs in India. As the disease spreads, commercial testing will become more accessible. The antigen testing results are not promising in deciding whether a patient suffers from Coronavirus. There are many false positives reported.^{3,13}

Usually, other laboratory tests are not validated. No specific relationship is identified. The white cell count is often low or normal in the case of covid. A lymphocyte count of fewer than 1000 has been associated with significant sickness. Therefore, there may be lymphopenia. The platelet count is often normal or just slightly low. Even though the ESR and CRP are frequently elevated, procalcitonin levels are typically normal. A high procalcitonin level might be a sign of bacterial co-infection. The severe disease is linked to high levels of LDH, CPK, ALT/AST, creatinine, prothrombin time, and D-dimer.³

Bilateral infiltrates can often be seen on the chest x-ray, even though early illness may leave it normal. High-resolution computed tomography (HRCT) offers greater accuracy and sensitivity.¹⁷ CT imaging frequently reveals ground glass opacities, infiltrates, and sub-segmental consolidation. HRCT also calculated the percentage of lung parenchyma. The percentage of lung involvement (all five lobes) in the disease is also recorded. Patients with no symptoms or clinical signs of lower respiratory tract involvement also exhibit it abnormally. Several of these patients eventually underwent repeat testing, which yielded positive molecular results. Abnormal HRCT becomes a practice to identify a person suffering from 2019-nCov having negative blood vitals. However, some medical practitioners advise not to go for HRCT every now and then. Some severe cases should only go for HRCT.^{3,17}

POSITION OF INDIA WORLDWIDE

Figure 6 explains the total number of cases till January 04th, 2023. The graph is plotted in coherent with the population of that country. In a country like the USA, one in three people is infected with 2019-nCov. While in India, out of 100, only three persons are

infected with 2019-nCov. In the graph, only those countries with several 2019-nCov cases are more than 11 million.²

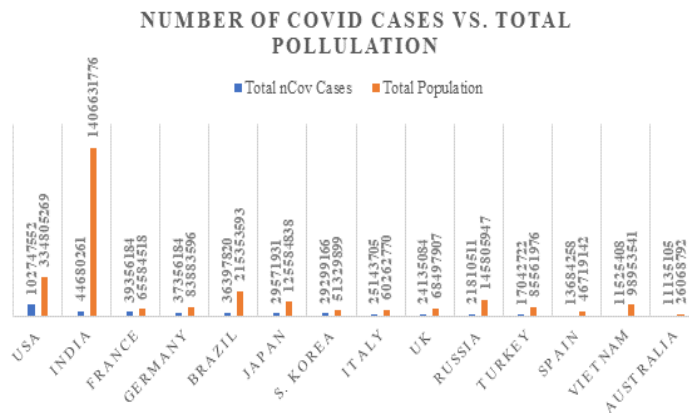


Figure 6. Number of 2019-nCov cases and the population of the respective country

INSTANCES INVOLVING nCOV IN ALL INDIAN STATES AND UNION TERRITORIES

Figure 7 considers the top 10 states based on the number of cases discovered. According to the state government of Kerala, which has a population of 33.4 million (as of the 2011 Census), had a cumulative caseload of 6,755,943 as of September 01st, 2022, since the start of the pandemic, Maharashtra, a much larger state with 112.3 million residents, has had roughly 81,00,338 cases.

According to the Indian Council of Medical Research's fourth nationwide serosurvey of 11 states conducted between June 14th and July 06th, 2021, up to 44.4% of the population in Kerala and 58% in Maharashtra were seropositive.¹⁴ According to Kerala's third phase of a serosurvey carried out in September 2021 by the state government, 70% of people have innate immunity. The majority of Maharashtra's cases (1,765 of the 2,701 new infections in the state on Wednesday were reported from Mumbai), which had a 90% seroprevalence, according to the sixth serosurvey carried out by the Brihanmumbai Municipal Corporation (BMC) in August and early September 2021.¹⁴

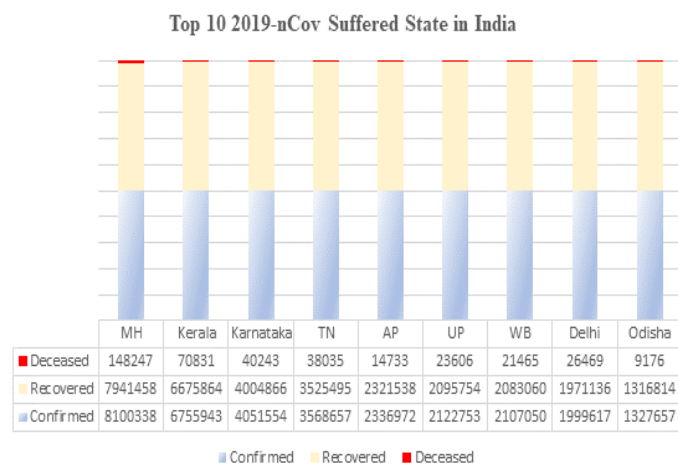


Figure 7. Statistical analysis of the Top 10 states in India based on confirmed vs deceased cases.

Regional experts concur that frequent foreign travel from the two states contributes significantly. "Cases in Kerala begin to rise a few weeks following every outbreak in the Middle East or Europe. Another explanation specialists cite for the continued high number of infections is the high population density in Mumbai and parts of Kerala. Kerala has had a different COVID-19 epidemiology than other regions of the nation. Kerala's test positivity rate, or the proportion of those who test positive out of all the tests taken, has never been lower than 1%.

Mass vaccination was the government's primary strategy for ensuring immunity and protection in the general population. 13,18,72,71,76,623 doses had been given to eligible people in India as of March 07th, 2023. Out of it, 48% of the population—1,52,34,47,39,203 people—received a single dosage, and 74.22% of the population—2,36,57,27,96,474 people—were fully immunised. Figure 8 shows the vaccination status as of March 03rd, 2023, and Table 1 lists the vaccinations that have been licensed in India.¹⁸

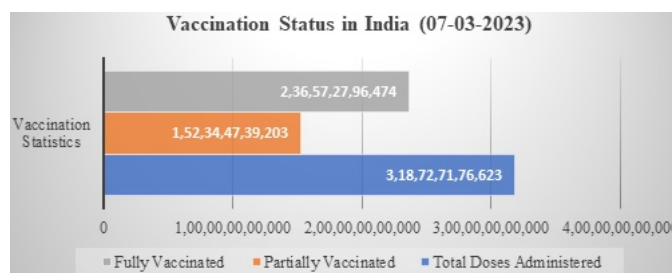


Figure 8. Vaccination Status in India

In India, a few of the widely used and government-approved vaccines have been listed as follows:

Covaxin (BBV152) is the first locally produced SARS-CoV-2 vaccine in India. Bharat Biotech, a pioneering biotechnology business based in Hyderabad, created and produced this vaccine in collaboration with the National Institute of Virology, Pune. The domestically produced vaccine from India demonstrated 64% efficacy against asymptomatic cases, 93% against severe SARS-CoV-2 infection, 78% against symptomatic patients, and 65% against the recently emerging Delta variant.¹⁹ This vaccine is the type of whole virus vaccine in which an inactive virus is injected into the human body to build immunity.

Covishield is another one, created by Oxford University, a brand name for the Oxford-AstraZeneca COVID-19 vaccine (ChAdOx1 nCoV-19, codenamed AZD1222), and Serum Institute of India, Pune manufactured it.²⁰ The primary vaccine used in India's mass vaccination initiative was Covishield, an in-country variation of AZD1222 that was the first vaccine to gain emergency use authorisation approval by DCGI in early January 2021.²¹ According to a study from 2020, Covishield was initially 76% effective at preventing symptomatic Coronavirus at 22 days after the first treatment and 81.3% effective at this point after the second dosage.²²

The Gamaleya Research Institute of Epidemiology and Microbiology in Russia created Sputnik V, also known as Gam-COVID-Vac, the first licenced viral vector vaccine in history. Sputnik-V in India received emergency use approval from DCGI

on April 12th, 2021, and the first dose was given at Hyderabad on May 14th, 2021.²³ Gam-COVID-Vac contains two Ad26 and Ad5 human adenoviruses that have undergone genetic modification to become replication-defective and E1 gene-deficient. Sputnik V has a 91.6% efficacy rate, according to the interim analysis of a clinical phase-III experiment done on 19,866 Russian volunteers.²³

Table 1. List of Vaccine available in India

Name of Vaccine	Manufactured By	Vaccine Platforms designed to train immune system	Approval Date in India
COVOVAX	Serum Institute of India	Protein Subunit	December 28, 2021
Corbevax	Biological E Limited	Protein Subunit	December 28, 2021
ZyCoV-D	Zydus Cadila	DNA	August 20, 2021
GEMCOVAC-19	Gennova Biopharmaceuticals Limited	RNA	June, 2022
Spikevax	Moderna	RNA	June 29, 2021
INCOVACC	Bharat Biotech	Non-Replicating Viral Vector	January 26, 2023
Sputnik Light	Gamaleya	Non-Replicating Viral Vector	February 06, 2022
Sputnik V	Gamaleya	Non-Replicating Viral Vector	April 12, 2021
Jcovden	Janssen (Johnson & Johnson)	Non-Replicating Viral Vector	August 07, 2021
Vaxzevria	Oxford/AstraZeneca	Non-Replicating Viral Vector	January 29, 2021
Covishield (Oxford/AstraZeneca formulation)	Serum Institute of India	Non-Replicating Viral Vector	January 01, 2021
Covaxin	Bharat Biotech	Inactivated	January 03, 2021

For the marketing and distribution of Sputnik V in India, the original producer teamed up with pharmaceutical behemoth Dr Reddy's Laboratories, India.²³ 3.15 million doses of the first component and 450,000 doses of the second component were given to Dr Reddy's Laboratories.²³

Figure 9. explains the percentage of vaccination given to different age groups.²⁴

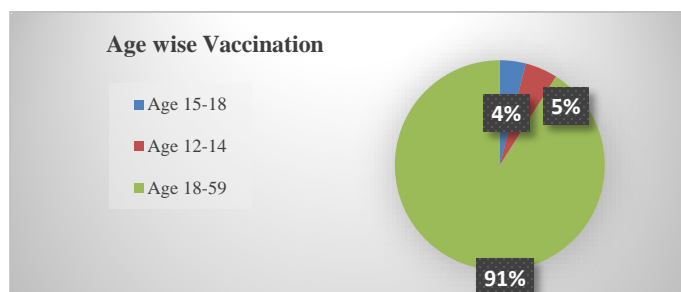


Figure 9. Different Age-wise Vaccination till March 07th, 2023

THERAPEUTICS TARGETS AND EARLY TREATMENT

The progression of the SARS-CoV-2 infection may be divided into four stages, each characterised by a unique set of clinical signs and symptoms that worsen as the disease progresses.²⁵⁻³⁰ At *stage 0*, which comes before SARS-CoV-2

infection and exposure, the optimal time to administer prophylactic doses of vaccines, neutralising antibodies, or antivirals with an acceptable safety profile is before infection and exposure. Antibody and antiviral medications given intravenously or orally during *Stage 1* will also have an effect because viral replication begins during this stage.³¹ There was a degree of uncertainty regarding the duration of this stage when the epidemic first started. An acute viral illness similar to influenza is first caused by SARS-CoV-2.³² To be effective, treatment with antiviral drugs for influenza must be started within the first 48 hours after the onset of symptoms. As a result of clinical research, we know that COVID-19 treatment with antibodies can be given up to ten days after the onset of symptoms.³³ Patients who have reached Stage 2 of the disease develop viral pneumonia, characterised by coughing and fever. Prominent lung inflammation also causes hypoxia and shortness of breath, which may or may not require oxygen supplementation. Chest imaging reveals lung anomalies that diagnose the condition, such as ground glass opacities or bilateral infiltrates. Stage 3, the most severe form of the disease, is a hyperinflammatory state characterised by acute respiratory distress syndrome (ARDS), systemic inflammatory response syndrome (SIRS)/shock, coagulation problems, and heart failure, and an extremely high death rate. Stage 3 is the most severe form of the disease. In addition to antivirals, patients in Stages 2 and 3 need medications that target the host's inflammatory response, and immunomodulatory therapy is frequently necessary in Stage 3. Figure 10 is explaining different stages along with their clinical symptoms is described.

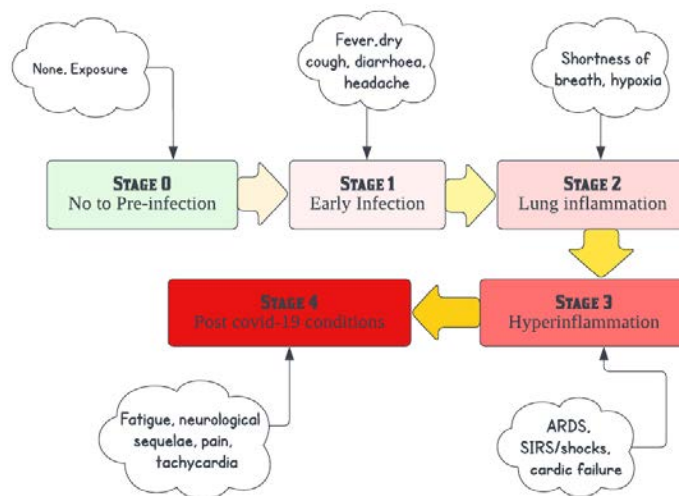


Figure 10. Life cycle of corona viruses along with clinical symptoms

In terms of the therapy of Coronavirus, azithromycin or hydroxychloroquine were given to hospitalised patients as a possible treatment for COVID-19, and antibiotics were used for suspected bacterial co-infections in hospitalised patients, even though their effectiveness had not been demonstrated. Seventy-two per cent of hospitalised patients with COVID-19 were empirically treated with antimicrobials. However, only eight per cent were diagnosed with a bacterial or fungal co-infection, according to a literature review that included nine studies published by the

beginning of 2020. It has been demonstrated that hydroxychloroquine has antiviral action against SARS-CoV-2 in vitro and blocks viral entry. At the same time, azithromycin has been found to have antiviral activity against SARS-CoV-2 in vitro and might restrict viral reproduction. When these two antivirals were combined in vitro, it was observed that they had a synergistic effect on SARS-CoV-2 infection. However, hydroxychloroquine and azithromycin were not successful in treating COVID-19 in clinical studies. As a result, the National Institutes of Health (NIH) Treatment Guidelines Panel does not suggest medication for the treatment or prevention of COVID-19. In the early stages of the epidemic, these combinations were frequently utilised. In light of subsequent findings indicating that these regimens do not result in any clinical benefit, this is a cautionary example of how restricted in vitro results might be misunderstood. Like the previous point, the NIH COVID-19 Treatment Guidelines Panel does not support any specific recommendations for empiric antimicrobials because there is insufficient data. During the early stages of the pandemic, research was also conducted on dietary supplements consisting of vitamins and minerals. One of these was zinc, which, when present in high doses, is known to inhibit the reproduction of certain RNA viruses. Zinc is not currently recommended for use in treating patients who have COVID-19 based on the findings of a multicenter retrospective cohort research that investigated the addition of zinc to hydroxychloroquine in hospitalised patients. The study evaluated the combination of zinc and hydroxychloroquine.

As doctors gained a better understanding of the clinical signs, aetiology, and repercussions of COVID-19 infection, they focused their attention on triaging and monitoring patients at high risk for progressing respiratory symptoms. The NIH COVID-19 Treatment Guidelines Panel recommends providing timely supplemental oxygenation. The high-flow nasal cannula is also preferred over non-invasive positive pressure ventilation in patients with acute hypoxemic respiratory failure due to better outcomes, including a reduced intubation rate. Prophylactic anticoagulation was recommended for COVID-19 patients who were hospitalised after it was shown that there was a significant incidence of venous thromboembolic events. These patients are now required to get it. In the lack of therapies that were proven to be effective, clinical recommendations continued to develop as more evidence was collected on what was successful.³⁴⁻³⁶

INDIAN PERSPECTIVE ON PRACTICE POINTS

The coronavirus risk in India has been varying with time and currently, the infection rate is incredibly minimal, however, the situation might change. Consequently, it is advised that:³⁷⁻⁴⁰

- All patients with respiratory symptoms should have their travel history, recent international travel, and contact with sick people who have travelled overseas recorded by their healthcare professionals.
- Patients with respiratory illnesses should have a system of triage established in the outpatient department and be given a straightforward surgical mask to wear. When evaluating such patients, they should do so while wearing surgical masks and periodically washing their hands.

- Suspected cases ought to be reported to locations designated by the government for investigation and isolation. In India, there are still no commercial test kits available.
- Before being placed in contact and droplet isolation, patients admitted with acute respiratory distress syndrome and severe pneumonia should have their travel history evaluated. Decontamination of surfaces must be performed often. If logistical feasibility allows, the samples should be sent for SARS-CoV-2 testing after being checked for etiology using multiplex PCR panels.
- The global expansion of the disease and other recent developments should be shared with all practitioners.
- International travel that is not necessary should be avoided.
- Stop propagating misconceptions and misleading information regarding the condition, and work to calm the public's fear and terror.

CONCLUSION AND DISCUSSION

India's medical, economic, and public health infrastructure, as well as that of certain other nations, most notably its neighbours, have all been put to the test by the current 2019-nCov virus outbreak. Life in India after 2019-nCov changed very much. People still suffer from post covid complications, and the situation will become more evident with time. Furthermore, zoonotic virus and disease outbreaks are expected to persist. Therefore, efforts should be made to develop holistic plans to tackle the current situation and prevent future zoonotic outbreaks. In addition to managing the current outbreak, efforts should be taken to create comprehensive plans to stop future zoonotic outbreaks - figure 11 explains recent active cases in India.

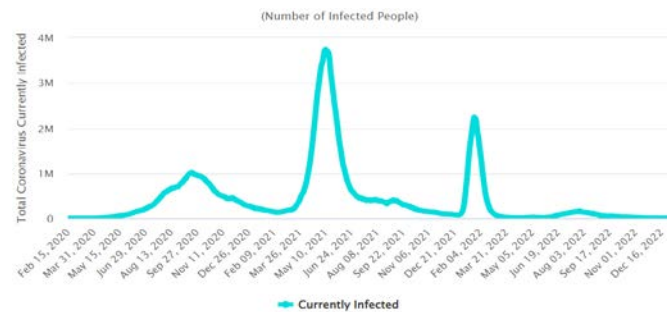


Figure 11. 2019-nCov active cases in India¹⁵

In the recent statistics, India has approx. 3k active cases with approx. 170+ daily corona cases with a similar number of recoveries daily recorded. Sooner and later, with the advance in clinical medicine, every individual thinking of the pandemic will be over soon. Many medicine/vaccines are in the testing phase, and some vaccines are already on the market to save humanity. However, the variant of 2019-nCov is changing rapidly, so each of us should be on alert mode, follow the government's advisory, and follow all the protocols.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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