



The Epoch of Covid-19 Pandemic: An Indian Frame of Reference

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ABSTRACT

The outbreak of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has posed greater challenges to the world. This ongoing pandemic has put all the public health systems under immense pressure. It is associated with considerable morbidity and mortality. The second wave is even worse than the first and has taken so many lives. India with the second highest population in the world is suffering immensely from the inhumanity of Covid-19 disease. After Spanish Flu of 1918-1919, COVID-19 is the first to effect the health system, economy, and psychology of India to such a large extent. People in every nook and corner are terrified and are struggling to save lives. The present review aims at understanding the coronavirus in general, its virology, global epidemiology, clinical presentation, diagnosis, treatment and control of COVID-19 with emphasis on vaccines, its types and administration with the reference to India.

Key Words: Covid-19, Coronavirus, Pandemic, Vaccines, Indian

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INTRODUCTION

Novel Corona virus has caused such a highly contagious respiratory disease, which soon after its emergence became a global public health emergency of International concern (PHEIC) on January 30, 2020. And in no time on March 11 2020, it was proclaimed a pandemic. This widespread disease has created a havoc in every sector including social and economic one [1].

Covid-19 and SARS-COV-2 were officially named by World Health Organisation on February 11, 2020. Coronavirus disease 2019 (COVID-19) produced by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a communicable condition and has generated considerable infections all over the globe in more than one year [2]. Not only this 3,404,925 lost their life worldwide soon after its emergence in December 2019 [3].

Novel coronavirus is actually a new strain that has not infected humans before. Because it is new, very little is known about how it acts and is thus named 'NOVEL' corona virus. Also because of its novelty there is no natural immunity amongst human population against the virus and no specific drug treatment is there.

BACKGROUND

The precise start of the virus remains still unknown⁴ but the upsurge of acute pneumonia like disease was earliest noticed in Wuhan, China back in December 2019 which was the epicentre⁵. Wuhan Central Hospital and the Chinese CDC were informed by Vision medicals in December that the results of the tests have shown a new coronavirus. The pathogenic organism causing disease was then named coronavirus disease 2019 (COVID-19) and was recognized as a new coronavirus. This was further given the name of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [6].

Report published by World health organisation (WHO) in March 2020 stressed upon the probable animal source for the virus and came to the conclusion that as bats and humans increasingly cross paths human spill over via bats could be the most likely explanation for the spread of virus [7].

2019-nCoV was denominated as SARS-CoV-2 by the International Committee on Taxonomy of Viruses. Beyond 80,000 confirmed cases with larger than 2,700 deaths were announced globally by February 2020. The infection had spread to at least 37 countries by then [8]. Then this was announced as a worldwide health emergency by WHO [9].

Till May 20, 2021 more than 164,996,243 of COVID-19 cases were charted worldwide, having more than 3,419,946 deaths, along with global social and economic disruption [3]. Talking specifically about India, the pioneer instance of Covid-19 was confirmed on January 30, 2020 [10]. And nationwide lockdown started on March 24, 2020 for the entire population. On May 30, 2020 reported cases in India were 182,143 with 5164 total death as reported in WHO situation Report¹¹. In September 2020, India had the biggest number of proved cases amongst all the Asian nations [12].

Soon India exceeded the magnitude of 10,000,000 confirmed cases. The pace was a little slow giving a little relief to the people and health care workers with the hope of improvement in the situation. Placing healthcare workers in strain again, the INDIA was hit by the second wave in April 2021 like a tsunami and India reported horrific surge of cases over 300,000 fresh infections and 2,000 deaths in a day, with distress of under-enumeration in the late April and there was acute shortage of oxygen beds and oxygen gas in the country [13].

An Overview of SARS-CoV-2 virus

SARS-CoV-2 comes under the family of group of viruses called as corona viruses. It belongs to the subgenus Sarbecovirus (beta coronavirus lineage B). It is known that seven members of this virus family infect humans and three of them have the great potential to cause respiratory infections together with SARS virus and Middle East respiratory syndrome coronavirus. The genetic makeup of SARS-CoV-2 is of size 29.8–29.9 kb. The virion is almost spherical with a diameter of 60–140 nm. On the surface of the virus the typical spike length of 9–12 nm is confirmed. This spike length is formed of four structural and non-structural proteins (NSPs) (**Fig1**). During infection, they attach to permissive cells via receptor-binding domain (RBD) in the S1 subunit of the spike protein. The S2 subunit of the spike protein then mediates the union between the virus and the cell membrane [14].

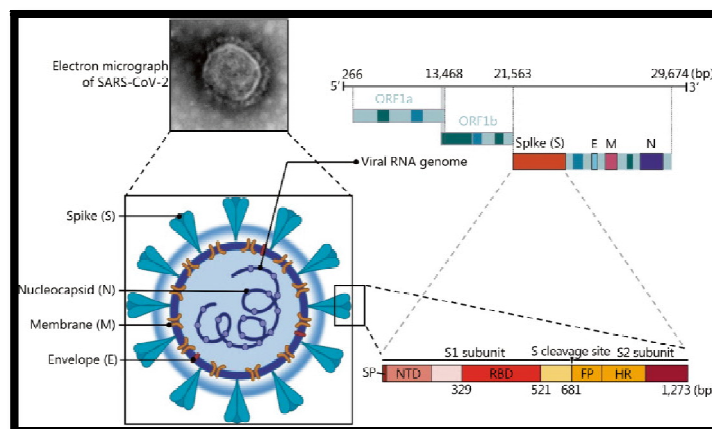


Fig 1: electron micrograph picture of SARS-CoV-2 spike glycoprotein. S, M, N and E the structural proteins and the Whole SARS-CoV-2 virion can be seen. Details of RNA genome and spike gene can also be seen [14].

Signs and Symptoms

On May 10, CDC stated that transmission of COVID-19 occurs on the inhalation of droplets or airborne particles respired by the affected person. Though the chances are less but the contaminated droplets or fluids which by mistake land on mouth, eyes, and nose can also transmit the infection¹⁵. The contagious disease Covid-19 can cause numerous symptoms varying from one individual to the other. These can range from being asymptomatic individuals to mildly affected to severely affected ones. And is capable of causing such serious illnesses which can lead to death. Usual onset has been assumed to vary between 2-14 days of exposure. And thus those infected are recommended to quarantine for 14 days [16].

According to WHO, [17], The most common clinical presentations of COVID-19 patients are found to be high temperature (Fever), cough (usually dry), tiredness (Fatigue).

Relatively less persistent symptoms seen in some patients include:

- Dysgeusia, Aguesia, Hypogeusia, Congested nose, Red eyes, Sore throat, migraine, swollen Muscles or joints leading to pain. A few individuals have also experienced skin eruptions. Nauseatic feeling has also disturbed many. Diarrhea has been the first symptom in many especially in the second wave. Chills have been seen in number of infected individuals. Some have also complained of dizziness.

Symptoms of severe COVID-19 disease include:

- Fall in sPO₂ leading to shortness of breath and difficulty in breathing requiring sudden hospitalization.
- Reduced appetite has also been found in many.
- Persistent pain or pressure in the chest have been reported in many and for prolonged duration
- Persistent High temperature (above 38 °C) for more than 7 days have also been the matter of concern

Even other more severe and rare neurological complications have also been reported including strokes, inflammation in the brain, delirium and nerve damage. It might cause complications of respiratory, cardiovascular, neurological and other longer-term effects including multisystem inflammatory syndrome in children and long covid [16]. Researchers have shown that 81% of the infected individuals develop only mild to moderate disease, while others (14%) may develop moderate to severe symptoms which may be accompanied with dyspnoea, hypoxia on HRCT Imaging with more than 15 CT Score. But a little percentage of patients (5%) may land up with sudden respiratory failure, shock, or multiorgan dysfunction [18].

It has been seen in studies that elderly are more likely to require hospitalization after COVID-19 than young adults. But in the second wave this has not been seen in all cases. Many youngsters in early 20s, 30s or 40s without any co-morbidities have lost their lives with sudden onset of severe symptoms (Fig 2).

The results interpreted were then compared with 5-17-year-olds and it was found that the death rate is 45 times higher in 30–39-year-olds. Also it was 8,700 times higher in 85+-year-olds. But the scene in April and May 2021 has brought new data into the limelight where more deaths were reported in young age group (Fig 2).

Some fundamental medical conditions can also increase the risk for severe illness. According to ICMR (Indian council of Medical Research) death due to Covid and ICU admissions have been 15-20 times higher in patients with comorbidities such as Hypertension, diabetes, or lung- or heart-related diseases, as compared to those with no comorbidities, and so people with comorbidities would benefit most with vaccination (Fig 2) [19].

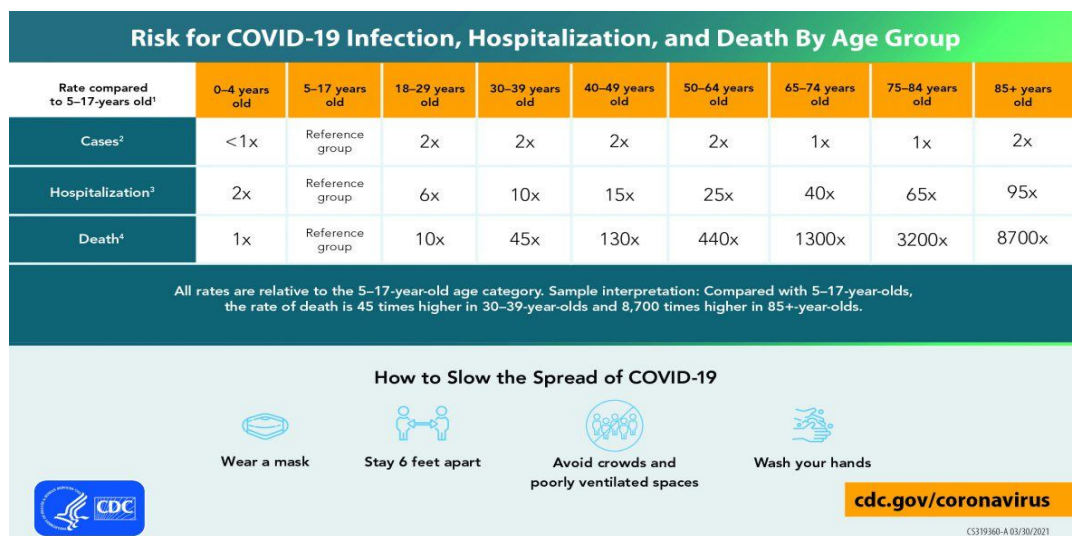


Fig2: The Figure shows the summary of the associated risk for Covid infected patients, their hospitalization and frequency of deaths in different age groups issued by CDC issued on March 30, 2021 [19]

It has been seen that Indiscriminate use of the steroids in the patients with Covid 19 and high blood sugar levels are potentially responsible for rising in a rare fungal infection-Mucormycosis among vulnerable COVID-19 patients. And generally, any Mucormycosis has a mortality rate of 54% [20]. The ICMR issued guidelines for recognizing and treating black fungus in May 2021. The Diagnostic test for the covid-19 includes rRT-PCR Testing, CT scan.²⁰ICMR has published Advisory for COVID-19 testing which was revised on 4 May 2021.

Treatment

Till now no fix anti-covid drug treatment is available. Only symptomatic and supportive therapy is done to relieve the symptoms.

Fortunately most cases of COVID-19 are light. Patients exhibiting light symptoms are cured at home with supportive care including medication such as paracetamol or NSAIDS, adequate fluid intake, plenty of rest, and nasal breathing [21].

When the disease is new experimental drugs are meant to be used as we have no other option to try upon patients to save their lives. Here in this pandemic also several experimental drugs have been actively studied and tried. Some are still being used and some have been declared ineffective as lopinavir. In February 2021, in the United States, Remdesevir received FDA approval for certain COVID-19 patients, and then for Baricitinib, Bamlanivimab, and Casirivimab¹⁶. Similarly various studies and researches have been done since its emergence and granted permission for various treatments modalities like convalescent plasma therapy, use of dexamethasone. Though the Government of India has now disapproved the plasma therapy as this is bringing no good and is not able to save the lives [16].

Cardiac patients on ACE inhibitors and angiotensin receptor blockers were asked to stop the drugs on contracting Covid but these concerns were later found to be irrational.²² Similarly NSAIDS such as ibuprofen can alleviate symptoms of COVID-19 and can be continued for other conditions in the period of Covid infection [23].

Corticosteroids have been proven to be the life saving drug in this pandemic. So the ones who are asthmatic or have COPD can continue taking their topical or systemic corticosteroids even if they get Covid-19 infection [24].

For mild cases self isolation is recommended to lessen the load on health care facilities. The latest guidelines were released on 28th April 2021 for the people in self isolation.

PREVENTION AND VACCINATION

Headgears, seclusion, distant socializing, ventilating rooms, hand cleaning, and most importantly the vaccination will remain mainstay for the prevention of Covid spread .

MoHFW have issued guidelines for infection control at office and other places in the Covid 19 pandemic. Further spread of infection can be prevented by following proper measures of cleaning, disinfection and waste disposal. Adequate ventilation has also proven to be beneficial. Apart from these the best measure to prevent the infection is to get vaccinated.

Additionally, as the more are being home and feel distressed with quarantine, travel restrictions or fear of infection or side effects of vaccines and various guidelines have been published by ICMR for psychological crisis. Before the vaccine emergence human trials were started and many such preventive measures came into being which boost the immunity [25].

Aarogya Setu, a mobile application developed by National Informatic Centre under the Ministry of Electronics and Information Technology, India helps in Covid-19 contract tracing, syndromic mapping. It was a great help for all the citizens of the nation as it recognized and notified the positive patients in the surroundings.

Whatever has been done and is being done, the only way to protect yourself against virus is to take utmost precautions. While working in healthcare settings performing procedures like intubation or hand ventilation can generate aerosols. All necessary precautions must be taken without fail. Guidelines issued by CDC for healthcare professionals are life saving and they should be followed at any cost. Use of personal protective equipment including PPE gown, respirator, eye cover and medical gloves as recommended by CDC Guidelines should be worn everytime you see or operate infected patient.

Vaccination

Pandemic has caused huge loss to the life and created havoc in the various sectors. But a relief of sigh has been there with the emergence of vaccine and its appreciable outcomes. Addressing the associated issues would definitely improve COVID-19 vaccines in coming times and could thus become the most rapidly used vaccines in the history of human-fighting-pandemic.

There are undoubtedly many dares which are to be accepted while vaccine research and development. Nations, scientists, researchers, doctors, technicians have come together and joined hands to produce life saving Covid-19 vaccines and save human civilization. And now there are numerous vaccines available. The only major task now is to produce them in adequate numbers so that large population can be vaccinated soon to prevent further severe infections.

As of April 2021, 14 vaccines have been public use. They are two RNA vaccines, five conventional inactivate vaccines, five viral vector vaccines and two protein subunit vaccines [26].

Vaccination drive in India

India began its first vaccination drive for COVID-19 vaccine on January 16, 2021 with the world's largest vaccination programme [27].

India and Indians were appreciated everywhere to run an efficient vaccination drive. This would have been a huge success if our nation was not hit by the second wave in the month of April 2021. Unfortunately we lost many lives which brought so much fear and negativity all around.

There are two vaccines which have received the approval and are being used efficiently i.e. Covishield (product of the Serum Institute of India) and Covaxin (manufactured by Bharat Biotech).

COVAXIN, is the India's aboriginal vaccine for Covid-19 manufactured by Bharat Biotech in alliance with ICMR - NIV. The hypothesis based on which the vaccine has been developed is based on the fact that the deactivated vaccines fail to reproduce and so very rarely revert to cause the disease. They are less capable of infecting people but still are able to command the immune system for the defensive reaction against an infecting agent.

India under its large vaccination drive plan started with vaccinating frontline workers in the first phase [34]. In the following episode of the vaccine drive, all citizens who were above 60 years of age, and those between the ages of 45 and 60 with comorbidities were the targets. Also any health care professionals or the frontline workers who were left during the first phase were also allowed to get vaccination. Online registration was started on March 1, 2021 via the AarogyaSetu app and the Co-WIN website. And From April 1, 2021 there was a change and now all the citizens above the age of 45 were allowed to take the dose of vaccine.

In April, there came another storm with a major second wave of covid infections in the country. With the end of Teeka Utsav (Vaccine Festival) initiated by PM Modi, India had reached a total of over 111 million vaccine doses [28].(Fig 3)

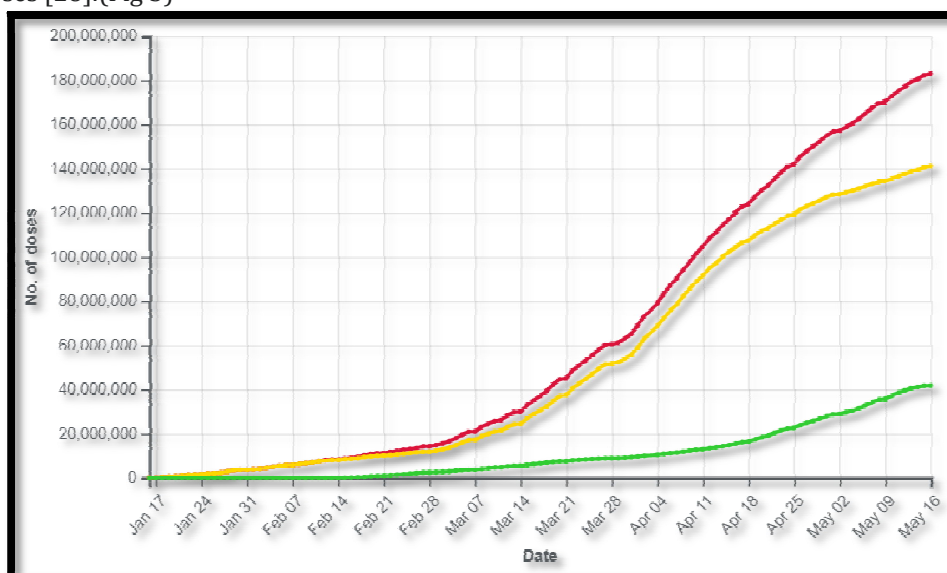


Fig 3: The Graph depicts the cumulative doses of Covid-19 vaccines dispensed over the country²⁹

And on May 16 2021, the statistical data of administration of vaccines in India reached 182,926,460 doses overall [29]. (Fig 4)

Vaccinations in India Gender wise as of May 16, 2021		
Gender		Figures
Male		74,695,200
Female		67,052,235
Others		19,970

Fig: 4 The Table showing the Vaccine distribution based on Gender²⁹

In April 2021, another vaccine that got approved for administration was Sputnik V along with other Covishield and Covaxin, with its deployment which is expected to begin by late May 2021.³¹

As on May 15, 2021, the total count of 182,220,164 doses have been administered in India including first and second doses of the currently approved vaccines; thus vaccinating 3% of the Indian population. And the data also shows that 10% of the total Indian population has received at least one dose. Now in May 2021 looking at the scenario where more youngsters are getting severe disease vaccination drive for people 18 years and above have also started.

Older people and individuals with comorbidities like cardiovascular disease, diabetes, respiratory diseases are more prone to infection and it has been reported that the severity of infection and the risk of

dying is also more in these individuals. Not only vaccines developed against SARS-CoV-2 but also the routine vaccinations against pneumococcal, influenza and hepatitis are recommended to protect against respiratory and other illness in patients with co morbid conditions. Either covaxin and covidshield can be used in co-morbid conditions [32]. (Fig 5&6)

Vaccination by age group as of 16 May 2021	
Age group	Population
18-30	7,677,562
30-45	13,695,677
45-60	64,205,648
over 60	56,178,737

Fig 5: The Table showing Vaccine administration by age group [29]

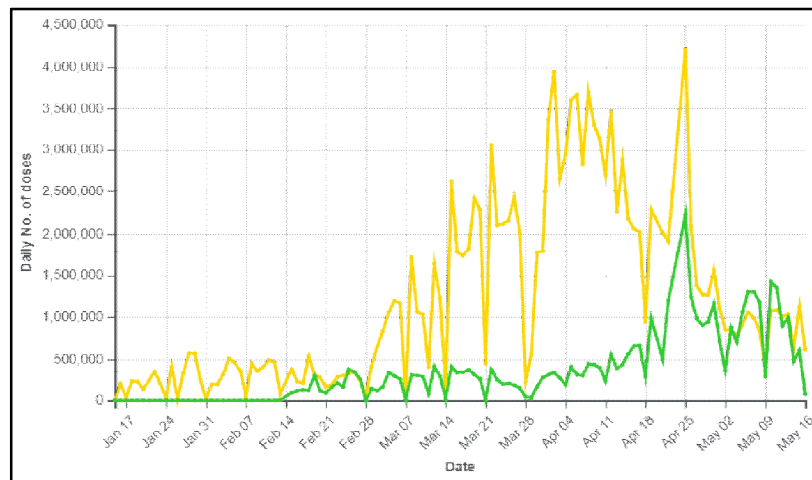


Fig 6: The Graph showing the data of daily doses which were dispensed over the country [31]
Green Shows those given 1st Dose Only, Yellow shows those given 2nd dose only

The common side effects seen with COVID-19 vaccination were lethargy, hyperthermia, localized pain and firmness at the site of injection which existed for many days³³.

An agreement across the exercise immunology literature suggested that meditation, breathing exercises, physical activity also act as an immunomodulator and can thus reduce the risk of communicable diseases [34].

Recent Research and Guidelines for Vaccines in India

There was a big sigh of relief post vaccination. The infection rate after taking vaccine has reduced to 0.04% as per the data shared by ICMR on April 2021. Even if an individual is getting infected after taking vaccination, the infection is usually not severe.

Phase 3 results in March 2021 of the COVAXIN, developed by Indian Council of Medical Research (ICMR) in collaboration with Bharat Biotech International Limited (BBIL), showed 81% efficacy with the interim vaccine to prevent the infection with Covid-19.^{35,36} It is important for the people to vaccinate them who have had Covid-19 in the past as it has been seen that one third of population with Covid-19 are not developing neutralising antibodies with no significant answer to how long these antibodies can last among Indians. Thus, it is important for every citizen to take the vaccine for preventing the spread of the disease.

CONCLUSION

Covid-19 Pandemic era will always be remembered for its cruelty towards human civilization. One and a half year has passed but the fear, anxiety is still the same. The first wave, the second wave, the third wave; how many such waves will come and go and how many of us will be losing our lives is unpredictable. But in such a period of negativity vaccines have given a ray of hope. Vaccination has proven to be the toughest weapon in a fight against covid-19 alongwith masking, social distancing, cleaning and disinfection. Humans should realise that they can not play inadvertently with the nature. All sciences all nations all humans are equal and thus fighting against the virus is not the war of an individual but is the war of the

Nation which we have to fight altogether and win. The nation will again smile one day but definitely those who have gone will never come back. Let's pray and hope for better India, Safe India.

REFERENCES

1. Faghy MA, Arena R, Stoner L, Haraf RH, Josephson R, Hills AP, Dixit S, Popovic D, Smith A, Myers J, Bacon SL, Niebauer J, Dourado VZ, Babu AS, Maden-Wilkinson TM, Copeland RJ, Gough LA, Bond S, Stuart K, Bewick T, Ashton REM; HL-PIVOT Network. The need for exercise sciences and an integrated response to COVID-19: A position statement from the international HL-PIVOT network. *Prog Cardiovasc Dis.* 2021 Jul-Aug;67:2-10.
2. CDC (11 February 2020). "Coronavirus Disease 2019 (Covid-19)". Centers for Disease Control and Prevention.
3. Covid-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at JohnsHopkinsUniversity(JHU).(<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>)
4. To KK, Sridhar S, Chiu KH, Hung DL, Li X, Hung IF, Tam AR, Chung TW, Chan JF, Zhang AJ, Cheng VC, Yuen KY. Lessons learned 1 year after SARS-CoV-2 emergence leading to COVID-19 pandemic. *Emerg Microbes Infect.* 2021 Dec;10 (1):507-535.
5. Yuen KS, Ye ZW, Fung SY, Chan CP, Jin DY. SARS-CoV-2 and COVID-19: The most important research questions. *Cell Biosci.* 2020 Mar 16;10:40.
6. Outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): increased transmission beyond China-fourth update" (PDF). European Centre for Disease Prevention and Control. 14 February 2020.
7. Keni R, Alexander A, Nayak PG, Mudgal J, Nandakumar K. COVID-19: Emergence, Spread, Possible Treatments, and Global Burden. *Front Public Health* 2020; 28 (8):216.
8. Coronavirus disease 2019 (COVID-19) Situation Report – 76 (https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200405-sitrep-76-covid-19.pdf?sfvrsn=6ecf0977_4)
9. COVID-19 Public Health Emergency of International Concern (PHEIC) Global research and innovation forum. ([https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-\(pheic\)-global-research-and-innovation-forum](https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-(pheic)-global-research-and-innovation-forum))
10. "COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)". ArcGIS. Johns Hopkins University (JHU).
11. [werehttps://www.who.int/docs/default-source/coronaviruse/situation-reports/20200531-covid-19-sitrep-132.pdf?sfvrsn=d9c2eaef_2](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200531-covid-19-sitrep-132.pdf?sfvrsn=d9c2eaef_2)
12. "India most infected by Covid-19 among Asian countries, leaves Turkey behind." *Hindustan Times*. UPDATED ON MAY 29, 2020 08:27 AM IST
13. Gettleman J, Yasir S, Kumar H, Raj S. "As Covid-19 devastates India, Deaths go undercounted". *The New York Times*. Retrieved 26 April 2021.
14. Li, DD., Li, QH. SARS-CoV-2: vaccines in the pandemic era. *Military Med Res* 2021; **8**: 1.
15. CDS (11 February 2020). Scientific Brief: SARS-CoV-2 Transmission." *Ceners for Disease Control and Prevention*.
16. Azer SA. COVID-19: pathophysiology, diagnosis, complications and investigational therapeutics. *New Microbes New Infect* 2020 Sep; 37: 100738.
17. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19>
18. "Interim Clinical Guidance for Management of Patients with confirmed Coronavirus Disease (COVID-19)". U.S. Centers for Disease Control and Prevention (CDC). 6 April 2020.
19. Centres for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html>
20. Garg E, Saluja P, Dave A, Khurana C, Arora M, Rai R. Mucormycosis: The Black Fungus –An Insidious Killer. *Annals of R.S.C.B* 2021; . 25 (6): 12978-12992
21. "Clinical Management of COVID-19." *World Health Organizatin (WHO)*. 2020-05-27.
22. Semenzato L, Botton J, Drouin J, Baricault B, Vabre C, Cuenot F, Penso L, Herlemont P, Sbidian E, Weill A, Dray-Spira R, Zureik M. Antihypertensive Drugs and COVID-19 Risk: A Cohort Study of 2 Million Hypertensive Patients. *Hypertension.* 2021 Mar 3;77(3):833-842.
23. Are nonsteroidal anti-inflammatory drugs (NSAIDs) safe in persons with coronavirus disease 2019 (COVID-19)? <https://www.medscape.com/answers/2500114-197680/are-nonsteroidal-anti-inflammatory-drugs-nsaids-safe-in-persons-with-coronavirus-disease-2019-covid-19>.
24. https://www.icmr.gov.in/pdf/covid/techdoc/COVID_Management_Algorithm_17052021.pdf
25. Gautam S, Gautam A, Chhetri S, Bhattarai U. Immunity Against COVID-19: Potential Role of AyushKwath. *J Ayurveda Integr Med* 2020.
26. "COVID-19 vaccine development pipeline (Refresh URL to update)." *Vaccine Centre, London School of Hygeine and Tropical Medicine* 2021.
27. <https://www.thehindu.com/news/national/coronavirus-worlds-largest-vaccination-programme-begins-in-india-on-january-16/article33582069.ec> PM Modi calls for Vaccine Utsav.
28. PM Modi calls for Vaccine Utsav.<https://www.indiatoday.in/programme/news-today/video/vaccine-utsav-pm-modi-aghadi-vaccine-stock-1788840-2021-04-08>
29. Ministry of Health and Family Welfare Government of India. <https://www.mohfw.gov.in/>
30. National Co-win statistics. <https://dashboard.cowin.gov.in/>

31. The Hindu. <https://www.thehindu.com/news/national/india-gets-first-consignment-of-sputnik-v-vaccine-from-russia/article34458233.ece>
32. Choi WS, Cheong HJ. COVID-19 Vaccination for People with Comorbidities. *Infect Chemother.* 2021 Mar;53(1):155-8.
33. Kaur RJ, Dutta S, Bhardwaj P, Charan J, Dhingra S, Mitra P, Singh K, Yadav D, Sharma P, Misra S. Adverse Events Reported From COVID-19 Vaccine Trials: A Systematic Review. *Indian J ClinBiochem.* 2021 Mar 27:1-13.
34. Ghram A, Moalla W, Lavie CJ. Vaccine and physical activity in the era of COVID-19 pandemic. *Prog Cardiovasc Dis.* 2021 Mar 12:S0033-0620(21)00029-3. doi: 10.1016/j.pcad.2021.03.001. Epub ahead of print. PMID: 33716015; PMCID: PMC7952126.
35. Covaxin showed 81% efficacy in third phase trials, says Bharat Biotech <https://scroll.in/latest/988469/covaxin-showed-81-efficacy-in-third-phase-trials-says-bharat-biotech>
36. Kadire SR, Wachter RM, Lurie N. Delayed second dose versus standard regimen for Covid-19 vaccination. *N Engl J Med.* 2021.

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