Review of COVID-19 Wave 2 Outbreak in India – Detailed Analysis

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Abstract - *The world is in a big state of emergency that began in China in November 2019 and in no time the complete world was hit with the deadly virus. The virus named the novel coronavirus (nCovid-19) and its spread have been a great threat. COVID-19 is a global epidemic with terrible consequences. The country has faced many problems such as oxygen shortage, availability of hospital beds, people losing their jobs amid crisis. The first step is to find how the second wave accelerated so much. This study offers a brief overview of the spike in cases in India during the second wave and specific events that were super propagators. With the help of the different curve graphs showing the onset and further growth of the COVID19 Wave 2. It also encompasses various steps by the government taken together to curb the transmission of the infection. The efficiency of social distancing and quarantine has been researched, as well as the incubation period. The successful Mumbai Model has been reported to curb the propagation, mainly because of experience with the COVID19 Wave 1 in the past. The study provides fundamental process-the steps for curbing the oxygen shortage, making more beds available at the same time vaccinating as many people as possible.*

Key Words: Cause, Mutation, Indian Government Initiatives, Liquid Medical Oxygen, Vaccination

1.INTRODUCTION

A pandemic is an infectious disease outbreak that has spread across a large area, such as multiple continents or the entire world, and has affected a large number of people. Pandemics are generally illnesses caused by infection transfer from one person to another. [1]. After multiple pandemics, including plague, influenza, and cholera, the worldwide COVID-19 pandemic has emerged. The signs and symptoms were comparable to Pneumonia. The virus's transmission was limitless because it was a contact-based sickness. The onset of second wave was confirmed in India in March 2021The number of cases in India began to rise over time, and distinct modes of transmission across different time periods began to emerge. The paper even discusses about what initiatives were taken by the government of India to fight the shortage of Liquid Medical Oxygen (LMO) and how the production of the same was increased. It also does an analysis of different graphs related to rise in case, number of people vaccinated etc. It has a brief explanation on the Mutation of virus during Wave 2 and it discusses The Mumbai Model.

1.1 Mutation

Mutant variants are proportional to the size of the infection, the more people infected, the more likely it is that variants of concern will emerge [1]. Most mutations damage the virus and therefore the survival of the virus is not enabled by environment while certain mutations facilitate virus survival. Covid-19 mutations and variants are being tracked using genome sequencing and epidemiological studies. The US Centers for Disease Control and Prevention (CDC) classifies variants into three categories such as variant of interest (VOI), variant of concern (VOC) and variant of high consequence. VOI is a variant with a specific genetic marker, which is estimated to influence communication, diagnosis, therapy or immunologic escape. The VOI are B.1.525 labelled as Eta by WHO (United Kingdom/Nigeria – December 2020), B.1.526 labelled as Iota by WHO (United States (New York) – November 2020), B.1.617(India – February 2021), B.1.617.1 labelled as Kappa by WHO (India – December 2020), B.1.617.3(India – October 2020), P.2 labelled as Zeta by WHO (Brazil – April 2020). VOC is a variety in which transmissibility and severity are increased, treatment or vaccine efficacy decreased or diagnostic detection failures increased. The VOC are B.1.1.7 labelled as Alpha by WHO(United Kingdom) , B.1.351 labelled as Beta by WHO(South Africa),B.1.427 and B.1.429 labelled as Epsilon by WHO (United States - (California)), B.1.617.2 labelled as Delta by WHO (India), P.1 labelled as Gamma by WHO (Japan/Brazil).[2] A variant of high consequence where measures of preventive have drastically lowered their effectiveness compared with prior forms. Currently, there are no High consequence variant. The variants bring concerns for further spread and elude from both antibody and natural diseases resistance. [3][4][5]

1.1 Cause of Second Wave

While, India was recouping from the primary wave which took almost a year that's six months rising and six-month falling period, it saw a certain rages in cases once more and causing the second wave. There were certain different trend watched and were distinctive from the primary wave altogether, there are five fundamental reasons for the cause of second wave in India.

1. Stamping of control zone has been less strict: In Cities and distinctive districts, the Government had requested the authorities to actualize micro-containment zone markings, In this the floor of a building or the house is been considered as containment zone. Whereas this was actualized, the tracking and monitoring of the persistent wasn't considered to be compelling and the

spread of the infection wasn't contained appropriately. Prior, a whole building or zone would be made a containment zone, decreasing the chances of transmission of the virus.

2. Huge clusters of undetectable suspect or asymptomatic COVID-19 cases: A large asymptomatic population infected during the second wave, which is much more extreme than the first wave, which crested in September, persists to transmit the infection to those who remain inside. Individuals who have been infected are recovering without creating symptoms, conceivably due to expanded wellness and a stronger immune system. The main challenge is to contain the threat of infection spread by the contaminated, asymptomatic individual.

3. Protocols not executed legitimately: Poor adherence to COVID norms such as mask use and maintaining physical distance. Individuals were careless enough to celebrate festivals and go to active and swarmed markets without masks after the number of active cases began to decline late last year. There were certain gatherings that occurred since the beginning of 2021, such as The Kissan Andolan at the start of the year, and then later on in the end of February, India's election authorities reported key elections, Campaigning had begun in full swing, with no safety conventions and social distancing.

4. Deterioration of the contact tracing system: People mobility, combined with a lack of testing and improper tracing, caused havoc and a spike in cases. The air travel ban was lifted completely, and there was no tracking of the patient, nor was contact tracing kept up to date, and the travellers escaped the quarantine period, resulting in an increase in the rate of transmission.

5. Mutation of virus: Several of these variations could be driving the surge. Because of the various variations seen, the characteristics also vary, resulting in unpredictable effects in the population. Also, because genome studies are critical for epidemic management and India isn't quite self-sufficient in sequencing, it's difficult to track how far the variant has spread and how much the lineage is affecting the population. Amid the first wave, patients were assigned a time of day or two to be conceded to the hospital. During the second wave, be that as it may, they don't have that extravagance. Patients who show up ordinary are losing control few of these variations may well be driving the surge within an hour of creating low oxygen levels, and death occurs rapidly.[6]

1.1 Government of India Initiatives

The government of India did not consider total lockdown as an initial option because the cases and severity differed by region, making it unfair for the regions where the cases were under control. While the number of cases had to be kept low, there was a lot of pressure on the Indian economy, which was in a slump following the severe Covid-19 wave. As a result, the Central Government delegated responsibility to the State Government to mobilize forces to bring cases under control in accordance with the severity of the situation.

During the second wave of the virus, the government took a variety of measures to combat it:

1. Extended vaccine programme: All adults aged 18 and up will be eligible to participate in the country's vaccination campaign. Vaccine doses of Covaxin and Covishield have been given out so far. It was made available for free to anyone over the age of 18 at all government facilities beginning in June. In India, newer vaccines such as Pfizer and Sputnik were eagerly anticipated through government contracts. Later, the central government announced a new vaccine allocation policy under which half of the output of domestic vaccine production will be directed to the central government, with the remainder going to state governments and the open market.

2. Implementation of Curfew measures: According to the Indian government, lockdowns were a final choice in coping with the Covid-19 pandemic it had been foreseen that that Lockdowns were entirely avoidable if a micro-containment strategy was used. However, lockdowns of varied severity were obligatory in bound states to halt the unfold of the infection. For instance, the various state governments imposed a weekend curfew and a nighttime curfew. Many states later considered Total Lockdown as an option when resources were scarce and cases were exponentially increasing day by day. This was done to instil a sense of urgency among individuals and promote COVID-19-appropriate behaviour, or to hasten the spread of the novel coronavirus, with many alternative states considering lockdown.

3. Government Support Measures: As the second wave of the Covid-19 pandemic puts pressure on the reimbursement of business and private loans, and defaults increase, the govt has return up with new monetary relief measures Accordingly, the Pradhan Mantri Garib Kalyan Package Insurance Scheme was launched to cover the families of those who have died as a result of COVID-19 or COVID-19 related duty. In addition, the government has launched the Emergency Credit Line Guarantee Scheme to help businesses.[7]

2. INTRODUCTION O_2

As we know a human body consists of about 65% oxygen which is very vital for respiration and bodily functions.

During COVID-19 Wave 2 there was a huge number of people who suffered from breathlessness i.e., were unable to breathe without a support machine. Hence, they required oxygen therapy which could be supplied via Liquid Medical Oxygen (LMO) which is a highly pure form of oxygen used for medical purposes. It is in liquid form because oxygen being in gaseous state at room temperature as it has low melting and boiling points it would be easier to store in large volumes and transport it when in liquid state.[8]

LMO was in such great demand during the COVID-19 Wave 2 as it was crucial for treating patients diagnosed with covid as the disease affected lung functioning majorly. Shortness of breath or trouble breathing were the most common symptoms, as it hindered the flow of oxygen to various regions of the body.

2.1 Government Initiative to increase production of LMO

- The Centre had increased the production and supply of LMO by 20% while seeking to set up 551 dedicated medical oxygen generation plants in public health facilities across district headquarters by using funds from the Prime Minister Cares.

- Different industries were ordered to restrict the use of liquid oxygen for their manufacturing rather divert it for medical purposes including the existing stocks. It added around 1500 tons to the daily supply.

- They proposed streamlining transportation, converting argon and nitrogen, importing containers, and increasing local manufacture to increase the availability of oxygen tankers.

- Prime Minister Narendra Modi's government has introduced "oxygen express" trains to transport gas from manufacturing units to regions where it is needed across the country.

- Airlifting oxygen from military bases has also been done by the Indian Air Force.

- The government is also utilizing Air Force cargo planes to fly empty tankers to production hubs, in collaboration with industrial gas firm Linde India and others. The oxygen tankers will subsequently return by road, having been refilled.

- 23 mobile oxygen generating plants are being imported from Germany by the military forces.

- Several other companies provide oxygen to hospitals, and Tata Group, a conglomerate that makes everything from salt to software, is importing 24 specialized containers to transport liquid oxygen.[9]

2.2 Foreign Government Aids

Foreign Governments from the countries like USA, UK, Singapore, Australia, Saudi Arabia, UAE, France, Germany, Russia, and China came forward amidst the ongoing crisis related to LMO. They sent rapid diagnostic kits, ventilators, personal protective equipment (PPE) kits, oxygen concentrators, cryogenic oxygen tanks, Remdesivir Injections.

2.2 Shortage

When the country was dealing with the deadly Covid-19 Second Wave, there was a major shortage of Liquid Medical Oxygen. The bureaucracy caused a great delay in making it available to those in need. The sharp increase in India's coronavirus infections during the second wave had swamped the health care system, patients were seen dying in the ambulances and parking lots outside hospitals, and engulfed crematoriums.

This caused an acute drainage supply of medical oxygen, which is vital for those who had been infected. The dire shortage had turned out to be a major challenge faced by the hospitals across major part of the country. Hundreds of hospitals in Indian cities and towns ran short of the oxygen gas, and they had to send the relatives of the suffering patients to find oxygen cylinders so that the patients' life could be saved, which sometimes ended in vain.

2.3 Reasons of Shortage

- No centralized coordination - Oxygen therapy being crucial for patients suffering from hypoxemia where oxygen level in blood were too low. As the industries that were able to produce the most oxygen was mainly based in East Side of the country and the worst hit parts being western and north, the distribution system was completely haphazard and the red tape held back many timely deliveries.

- Inadequate Transport and Storage Capacity - Liquid oxygen needed to be transported at very low temperatures in specially designed cryogenic tankers to distributors, who in turn convert it into gas for filling cylinders. But India was short of cryogenic tankers. As a finite number of oxygen tankers and cylinders were only available so the logistics became difficult as refilling them and bringing back to destination was a holdup. This was a huge problem not only in cities but in small villages also where the healthcare facilities were already extremely weak.

- India had been receiving emergency medical aid from other countries to help alleviate the country's chronic oxygen shortage. The third of six relief shipments, which contained 1,000 oxygen cylinders, was delivered by the US on Sunday. More than 400 oxygen

concentrators were supplied by the United Kingdom, while France sent eight oxygen generators, each capable of serving 250 hospitalized patients. A German military jet carrying 120 ventilators arrived in India on Saturday, and officials said they were planning future flights with extra supplies. Despite all of the emergency resources available to save lives, it appears that they have not reached individuals who are gasping for air after being held at customs for weeks.[10]

3. ANALYSIS[11]

Chart -1: Number of People Tested
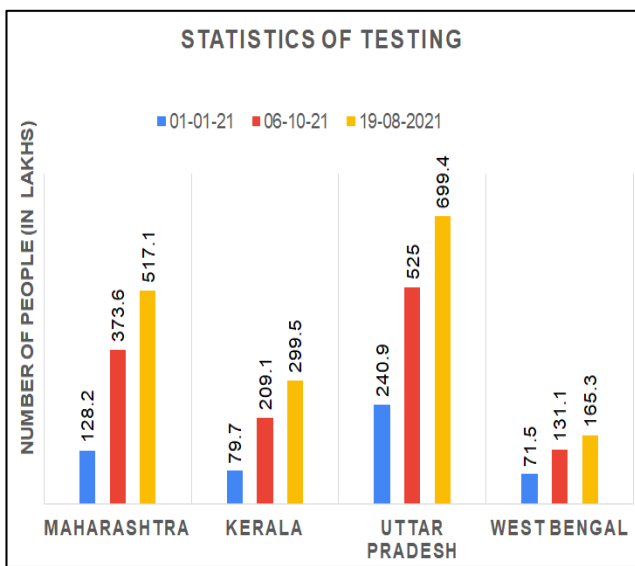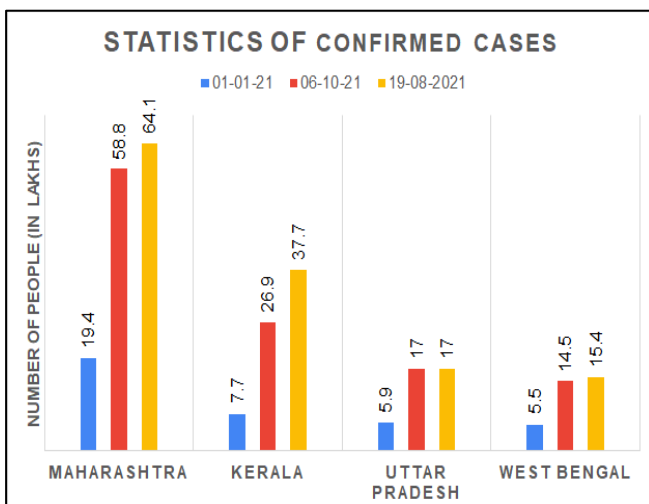

Chart -2: Number of People Tested Positive

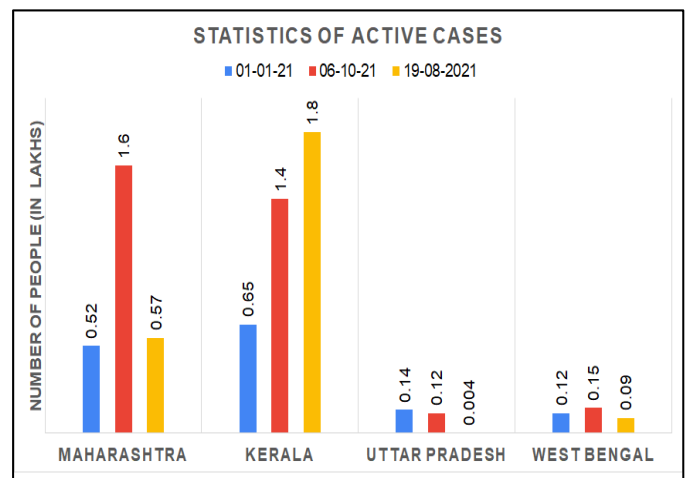**Chart -3**: Number of Active Cases

Chart -4: Number of Recovered People
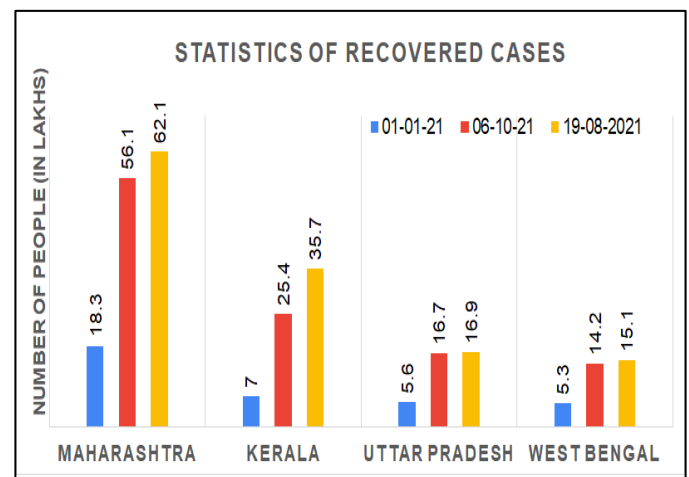

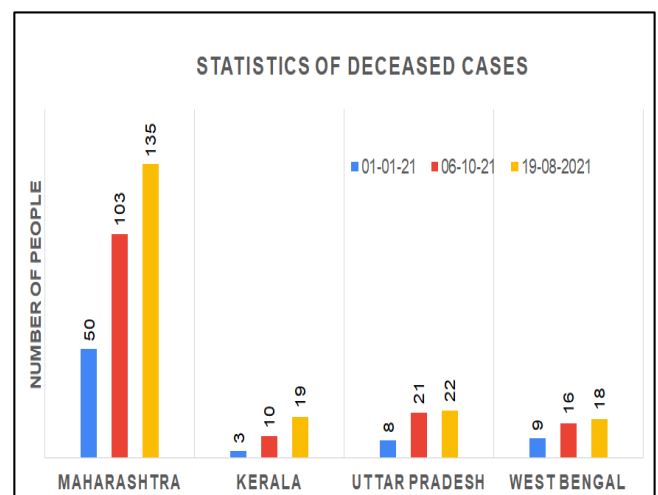**Chart -5**: Number of People Deceased

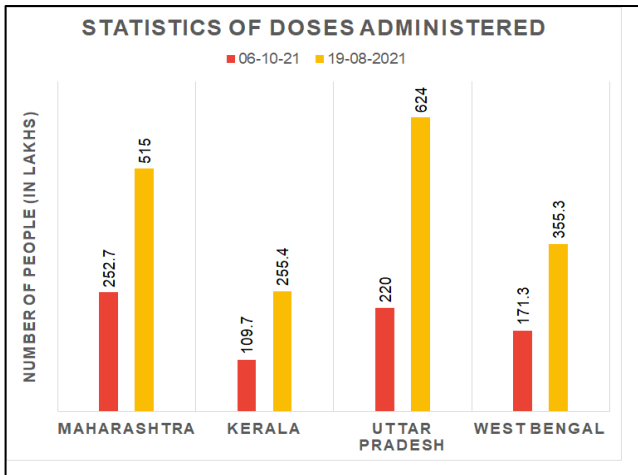**Chart -6**: Number of Total Doses Administered

Chart -7: Number of People Partially Vaccinated
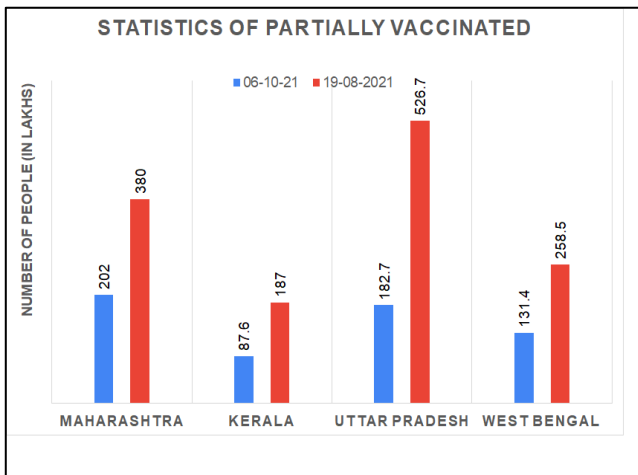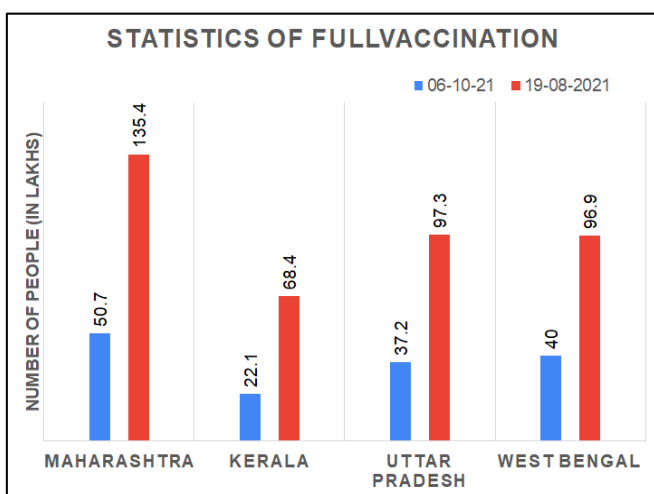

Chart -8: Number of People Fully Vaccinated

4. MUMBAI MODEL

Cases were increasing across the country, and resources were running low to deal with the second wave of Covid-19. Different states had different mechanisms in place to deal with the second-19 wave, but Mumbai has achieved a timely lockdown, aggressive tests, and an excellent triaging system since the second wave of Covid-19 began in February 2021.In order to deal with the second wave, various strategies were implemented under the umbrella of the 'Mumbai Model.'

1. **Decentralized War room:** The citizen engagement control room in Mumbai was decentralised, with one control room in each of the 24 wards. Each war room had multiple public phone lines, a 24x7 team of doctors and trained staff who carefully triaged cases, assigning ICU or oxygen beds only to serious patients, and a dashboard of hospital beds and an ambulance network that ran on Uber's software. The BMC has established 10 inspection teams and arranged ambulances for each ward to facilitate the assessment of people testing positive and requiring hospitalisation for better coordination of bed allotment between the 24 war rooms and jumbo care facilities.The patient was notified by the concerned ward war room after the municipal corporation received a report from the laboratory. Depending on the diagnosis, the individual was either asked to undergo home quarantine or a team was dispatched to the patient's home to transport the patient to a quarantine centre or hospital.

2. **Walk-in Covid care centres :** Patients can get checked at walk-in clinics. Depending on their needs, they will be referred to either the associated Covid Care Center or a hospital. This type of facility determines whether patients require home isolation, stabilisation centres, or hospitalisation, as well as whether oxygen and ventilators are required in their room.

3. **Jumbo facilities and adequate technology:** In comparison to the first wave, the city's hospital bed capacity, including ICU and oxygenated beds, has been increased. The jumbo field hospitals built during the first wave remained operational even after the number of patients and admissions dropped. Through an integrated board integrated into the war chamber, BMC is capable of assigning beds to both public and private hospitals. The BMC has established an online dashboard covering Mumbai's 47 crematorias, which has resulted in long lines for the deceased, with a partnership with the Indian Institute of Technology that allows cremation slots to prevent crowds and privacy is preserved.

4. **Ramping up test facilities and Effective Lockdown:** As the second wave approached, the BMC expanded testing facilities in town. Positive reports could only be given to patients immediately, while negative reports had to travel through war zones. In order to better deal with the second wave, each war room established a doctor's team to visit people and determine whether they needed to be hospitalised in an emergency. If doctors were unavailable, this responsibility was delegated to primary health care workers.

5. **Oxygen Supply Management:** Most hospitals' oxygen storage capacities have increased as a result of the installation of new cryogenic tanks. Even though it was underutilised in the first wave, the increased capacity of the second wave assisted in handling the load very well. While Mumbai's Covid-19 facilities were being expanded, the city also began production on storage tanks for Liquid Medical Oxygen. Six zonal teams were formed by civic entities to tackle oxygen control in four wards. When an oxygen deficiency was detected in a clinic in a specific zone, the zonal group assumed responsibility for coordinating additional oxygen from different offices or moving patients, depending on the situation.

The 'Mumbai Model' is based on vision, planning, decentralisation and delegation, deploying fewer resources, and leadership. The BMC was firmly in control, owing to its network of primary health care centres, civic hospitals, and special jumbo COVID-19 centres, which were supplemented by private health facilities whose beds were authorised for public use.

Mumbai model of localized war room was an efficient methodology for bed allotment and Pune as a case study for successful implementation of strict containment measures, resulting in decline in cases-two necessary aspects of battling infection.

The control room for citizen engagement in Mumbai was decentralised, with one control room for each of the 24 wards. Not only were there telephone operators in these control rooms, but also doctors and medical support staff who communicated with ambulance operators. This group assessed the need for a patient to be admitted to the hospital and aided them in doing so.

Mumbai's central dashboard, which tracked available hospital beds, ambulances, and a mechanism for purchasing beds, guaranteed that residents were not inconvenienced.

The thorough implementation of containment operations in Pune has resulted in a decrease in the positive rate as well as the number of cases. The optimism rate was 41.8 percent before the strict lockdown-like restrictions were implemented, but it has subsequently dropped to 23.4 percent.

Chahal says the BMC's success in keeping the death rate low is a result of its long-term programmes. Contact tracing programmes were used to identify high-risk patients during the first wave. Over the course of five weeks, BMC staff were able to efficiently distribute medical aid to households in over 2,300 containment zones across the city, with approximately 150,000 at-risk persons separated in hotels and Covid care centres. These efforts resulted in a flattening of the curve in July 2020. (of new instances). Simultaneously, the civic authority assumed control of bed distribution at the city's hospitals. "Mumbai is the first and, most likely, the only city where patients are no longer admitted straight to hospitals," adds Chahal. Patients apply for hospitalisation through the BMC system, and a team of BMC doctors analyses each case to determine whether it deserves a bed. The BMC has been able to assure a steady supply of beds for individuals in need thanks to its micromanagement. "There is not a single case where someone who needed an oxygen bed didn't get one," says Chahal.

In late 2020, Chahal chose to decommission the BMC's central Covid command centre. Instead, he used a decentralised strategy, establishing command centres in each of the city's 24 wards, complete with ambulances, physicians, telephone operators, and the necessary infrastructure to take the battle to the streets. This approach efficiently spread the immense logistical load of the all-Mumbai command headquarters, with each ward accountable for around 700,000 people. "We created 24 Mumbais," says Chahal, "each one equipped to fight the battle." It was also a good move to keep extra medical capacity on hand. Mumbai has five large Covid care centres with a total of 10,000 beds, as well as another 40,000 beds in smaller nursing homes and hospitals. Its largest centre, Nesco in Goregaon, had only three patients in 3,000 beds in early January. Despite widespread calls to close the centres, Chahal persisted on keeping them open. This proved wise as the second wave started to arrive May 10, the BMC had 612 ICU beds in Covid care centres with 24x7 oxygen supply, more than any other Maharashtra city..

The BMC began offering walk-in Covid care centres in early 2021 for persons who were sick but had not tested positive for Covid-19. People in these facilities are treated right away and tested for Covid; positive cases are transferred to Covid wards, while negative cases are transferred to non-Covid wards..

For accurate resource maps and demand estimates, the BMC's system relies on meticulous planning and months of data collection. There are presently 15,000-17,000 persons requiring oxygen in Mumbai. Patients in intensive care units (ICUs) require a lot of oxygen—approximately

25 litres per minute—while patients in less urgent instances only require about 10 litres per minute. According to P. Velrasu, auxiliary municipal commissioner of projects, the BMC conducted a capacity audit in May 2020. Engineers went to hospitals to collect information on oxygen storage capacities, piping systems, oxygen delivery methods, and oxygen providers, including supply frequency. "Detailed planning was essential for successful oxygen management in Mumbai," says Velrasu. We discovered that oxygen demand by Covid patients in the ICU jumped to 25 litres per minute, therefore we installed additional cryogenic tankers in most hospitals to boost oxygen storage capacity. Despite the fact that it was underutilised in the first wave, the expanded capacity handled the load very well in the second.

The BMC has put up six temporary jumbo COVID-19 hospitals in a short amount of time for effective treatment of COVID-19 patients.. According to the press release, the six hospitals have a total capacity of 8,915 beds and employ over 4000 people.

Classic managerial themes like as foresight, planning, decentralisation and delegation, marshalling finite resources, and leadership are at the heart of the 'Mumbai Model.' Its strength, however, was in emphasising the importance of the public sector in the COVID-19 response system. Through its network of primary health centres, civic hospitals, and special jumbo COVID-19 centres, the BMC was firmly in authority, backed by commercial hospitals whose beds were mandated for public use.

The key to making this paradigm succeed was decentralisation. Chahal's decision to replace the central control centre in each municipal ward of Mumbai with 24 war rooms provided the assistant municipal commissioner of that ward more autonomy. This ensured that the almost 10,000 RT-PCR reports received every evening during March and April did not overwhelm a single central facility. Instead, each war room dealt with about 415 reports, or about 84 patients every day, based on the average positive rate of 20% in April. At the request of Chief Minister Uddhav Thackeray, data was not deflated or fudged, ensuring that the BMC was aware of the amount of reaction and resources required.

Each war room had a 24x7 team of doctors and trained staff who would meticulously triage cases, allocating ICU or oxygen beds only to serious patients, each had a dashboard of hospital beds and a network of ambulances run on Uber's software, and each had a 24x7 team of doctors and trained staff who would diligently triage cases, allocating ICU or oxygen beds only to serious patients, and each had a 24x7 team of doctors and trained staff who would diligently triage cases.

To eliminate corpse lineups, IIT-Bombay experts were enlisted to build and maintain a dashboard for the city's crematoria. When oxygen supplies became critically short, Chahal collaborated with the Centre and Reliance Industries to make up the difference. For Mumbai residents, every jumbo centre offered walk-in testing and quarantine. Thousands of patients were denied access to restricted resources due to the requirement that all testing labs provide data to the BMC, rather than individual patients.

A timely lockdown, intensive testing, and a good triaging system have been attributed with Mumbai's performance in flattening the curve since the second wave of Covid-19 began in February. Here's how the top court and the Bombay High Court broke down the 'Mumbai Model,' which was recommended to Delhi and other cities by the apex court and the Bombay HC:

1. Retaining Jumbo Facilities

2. War Rooms

3. Effective Lockdown-like Curbs

4. Oxygen Supply Management

Mr Chahal worked on three methods after taking command, visiting hospitals and COVID hotspots like Dharavi: 1) remove fear; 2) decentralise war rooms to reduce response time; and 3) establish necessary infrastructure. Here's how each of these was implemented with care and precision.

Hub-and-spoke operation: The BMC headquarters served as a hub, receiving and sorting almost 10,000 reports every day from 55 testing labs before sending them to 24 wards. Within these wards, the load per ward was lowered to 400, or merely 40 per dashboard.

The focus was on patients who tested positive and required to be admitted to the hospital for a short period of time, usually fewer than five days. By 8 a.m., each ward-war room would be presenting results to patients, while doctors and medical personnel fanned out to individuals who had tested positive. The key to this was having the right people and having the right infrastructure.

Medical Staff: BMC especially asked doctors and medical support professionals (primarily recent graduates from medical colleges and nursing schools across the state) to handle the war rooms and gave them with a large compensation (Rs50,000 per month) and hotel accommodations within walking distance of the hospital. To accompany the ambulances in each ward, it may hire around 900 doctors and 600 nursing students.

Ambulances: Mr Chahal also requisitioned over 800 SUVs and had them rebuilt with a glass barrier separating the driver's section. These became improvised ambulances, capable of transporting patients with minor symptoms to the hospital. He also requested Uber's assistance with its software platform for tracking and managing the 800 ambulances, in order to build a streamlined and technologically advanced system.

Crematoriums: It's worth noting that there were no photographs of long lines to cremate the deceased in Mumbai. When deaths began to rise, this, too, was a result of proper planning. Mr Chahal collaborated with the Indian Institute of Technology to develop an online dashboard for Mumbai's 47 crematoriums that allots cremation times to avoid overcrowding and allows people to say their final goodbyes in dignity and relative solitude.

Future Ready: Aside from establishing new facilities and restoring those that were shut down following the first COVID wave, the BMC is gearing up for a possible third COVID wave in July. Mr Chahal claims to have 5,500 beds available today, including over 3,000 oxygen beds. Nearly 2,000 ICU beds with oxygen and ventilators are among them. Four additional mega centres are being built, increasing patient capacity by 2,000 beds, including 200 ICU beds.

Co-opting Hospitals: Maharashtra chose to cap COVID treatment prices in all hospitals early in the pandemic; after some hitches, this appears to be functioning successfully. Mr Chahal has access to a centralised dashboard with information about the BMC's 172 hospitals and COVID facilities, which comprise a number of massive centres set up in open fields, government and commercial hospitals, and smaller hospitals. They've been told that they can only admit patients through the municipal war rooms (this is not strictly enforceable).

Each ward staff greets patients, assesses their condition, and, if necessary, phones the dashboard to request a bed that is appropriate for their needs (ICU beds or oxygen beds, for example), and then transfers patients to the hospital upon confirmation. Those who are eligible for home quarantine are counselled and followed up on by the ward teams on a regular basis. When symptoms are mild enough to be managed by oxygen beds, this personal touch guarantees that people do not block ICU beds.

Surprisingly, any concern is sparked by entitled well-to-do patients who insist on a particular private hospital or refuse to be admitted to municipal facilities, despite assurances that they are clean, well-maintained, and air-conditioned. Those who have taken advantage of the facilities have always praised the BMC.

Furthermore, the BMC permitted patients to stroll into any of the city's seven large centres to be checked or admitted without having to wait for swab tests and findings. Mr Chahal claims that over 20,000 people have taken advantage of the services. [12]

5. CONCLUSIONS

In this paper, we have talked about Mutation - different virus strains that were found. Liquid Medical Oxygen (LMO) – it's use, shortage and Mumbai Model. We have mentioned the reasons for the cause of second wave and discussed the frequency of COVID-19 cases in the states of Maharashtra, Kerala, Uttar Pradesh and West Bengal. Significant decrease was seen in the number of cases after one month of the vaccination drive. In the four studied states, Maharashtra had the highest number of deceased as well as recovered cases. Kerala had the highest active cases in the entire country. Considering the vaccination drive and if people follow the precautions, in a time period of two to three months the cases will reduce to zero. Thus, bringing an end to the pandemic.

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