

COVID 19 Apocalypse in India – Oxygen Conundrum and Lessons Learned

Alok Routray

Strategy, Growth and M&A, Oil to Chemical Business, Reliance Industries Limited, Ghansoli, Navi Mumbai 400701 Maharashtra, India

ABSTRACT

The COVID-19 pandemic had been a defining global health crisis of our time and probably the greatest challenge the entire mankind would have ever faced. COVID-19 pandemic began its onslaught in India in the month of March 2020, 1st wave peaked in September 2020 with 1 million active cases 2nd wave with an unprecedented and steep growth of daily new cases that went up from 12K to 400K, a jump of 33 times in a short span of 30 days. Medical Oxygen has been an extremely critical element in the treatment and recovery of patients infected with COVID-19 and how India managed the ten-fold Medical Oxygen demand. It is important for the country to understand what led to the conundrum, how India overcame it.

Keywords: COVID-19, Medical Oxygen, Cryogenic Storage Infrastructure, Oxygen Express

1. INTRODUCTION

The COVID-19 pandemic has been a defining global health crisis of our time and probably the greatest challenge the entire mankind would have ever faced. A lot has been manifested about the grim battle between that the Indian healthcare system and COVID-19.

Social media and news channels reported numerous instances of worried relatives of the COVID-19 patients in hospitals trying to enter the ICUs to check if their family member is being provided oxygen supply or not. Further, not only individuals but even hospitals were posting SOS messages on social platforms asking for help in replenishing the fast-depleting oxygen supply.

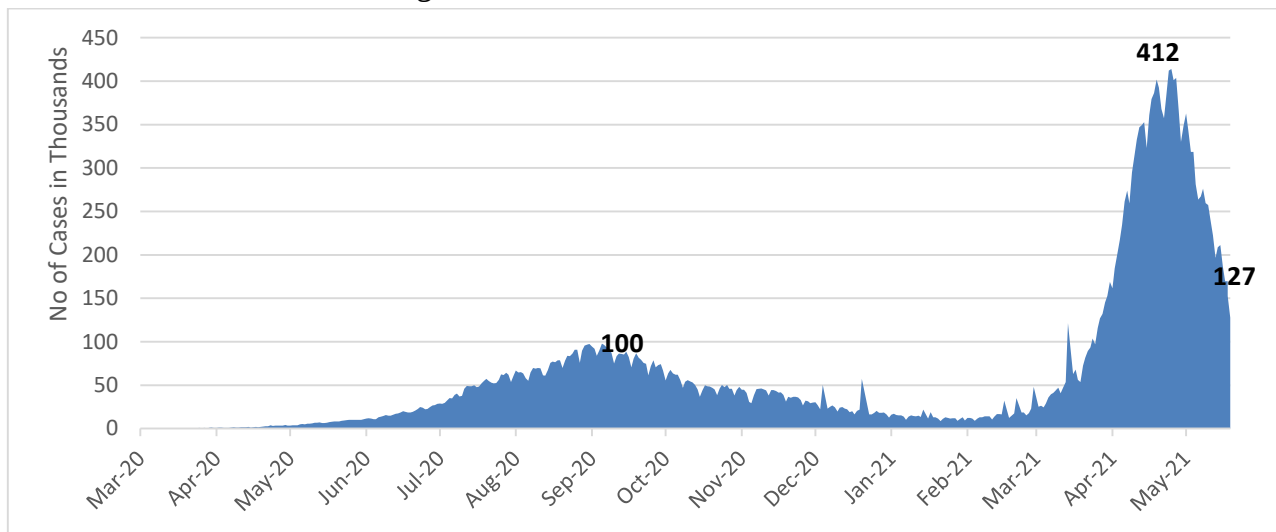
The country has been fighting continuously and relentlessly against the virus since its outbreak in early 2020. Interventions like extended lockdowns, stringent health safety measures, fast-tracking the vaccination rollouts, etc., had put India in a relatively better position as compared to many other countries across the world. However, the mammoth crisis of the second wave sweeping across the nation, blew all our learnings into the wind.

The second bout came with newer and unimaginable implications of the disease, which has left numerous ineradicable impressions. The most precarious conversation has definitely been about the medical oxygen and the sense of predicament around it. It is important for all of us to understand what led to the conundrum, how India overcame it.

Onslaught of COVID-19 in India

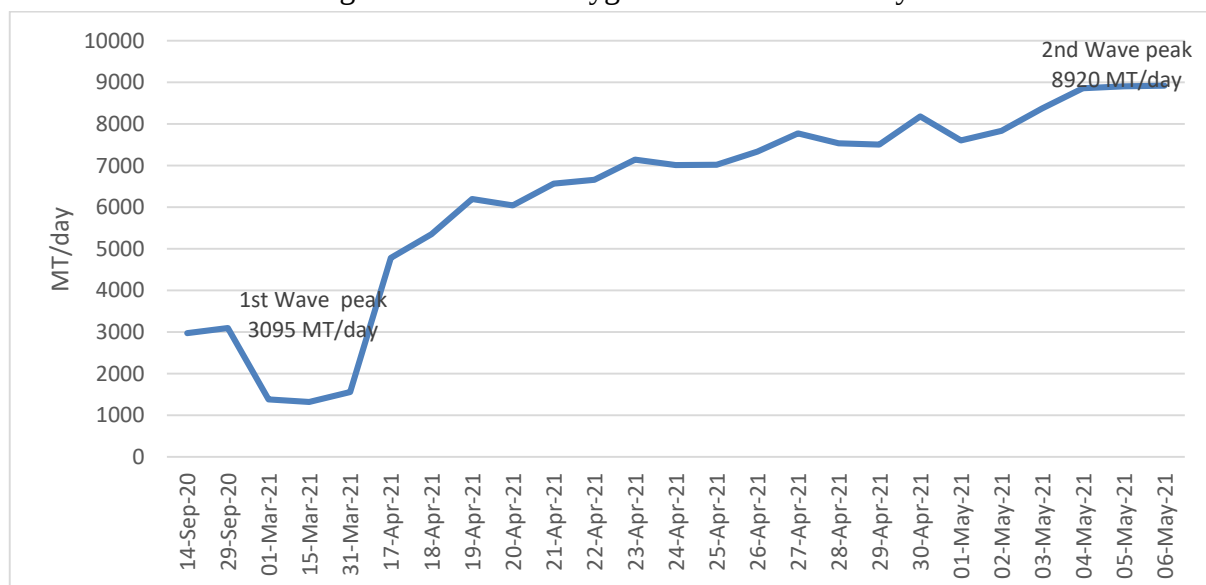
In India, COVID-19 pandemic began in the month of March 2020. The 1st wave peaked in the month of September 2020 with 1 million active cases. In the month of February 2021, the active case count came down to 136K. Beginning March 2021, the country witnessed the 2nd wave with an unprecedented and steep growth in number of daily cases. In a span of one month daily new cases went up from 12K to 400K^[1], a jump of 33 times in a short span of 30 days.

Figure 1. Active COVID Cases in India



Medical Oxygen had been the most essential and effective in the treatment of COVID-19 patients. This sudden rapid rise in daily number of cases resulted in a massive demand for oxygen for treatment, and immediate lack of supply created an emergency situation in the country. At the peak of the second wave, there were more than 900K^[2] people on Medical Oxygen support.

Figure 2. Medical Oxygen Demand in MT/day



Medical Oxygen requirement the country increased from about 1,300 MT/day in March' 21 to 8,920 MT/day on 6th May. During the peak first wave of COVID-19, the maximum demand was 3095 MT/day was observed on 29th September, 2020. The requirement of Medical Oxygen grew more than five-fold from 1559 MT/day on March 31, 2021 to over 8000 MT mark by 3rd May, 2021^[3].

2. BACKGROUND OF THE MEDICAL OXYGEN CONUNDRUM

Medical Oxygen Industry in India

India has a total Liquid Medical Oxygen (LMO) production capacity of 7200 (Tons Per Day) TPD being produced from 70 manufacturing locations, also called Air Separation Units (ASUs) spread across the country. The eastern region of the country has a fairly greater presence of these ASUs. The table below depicts the regional split of Medical Oxygen production and demand during second wave.

Table 1. Region wise Medical Oxygen Productions vs Demand during second wave of COVID-19^[1]

	Production	%	Demand	%
North	1,174	13%	2,303	26%
East	2,867	32%	886	10%
Central	0	0%	797	9%
West	2,838	32%	2,481	28%
South	1,980	22%	2,392	27%
	8,859	100%	8,859	100%

The above data is pictured in the two graphs below.

Figure 3. Liquid Medical Oxygen Production (Region wise % Split)

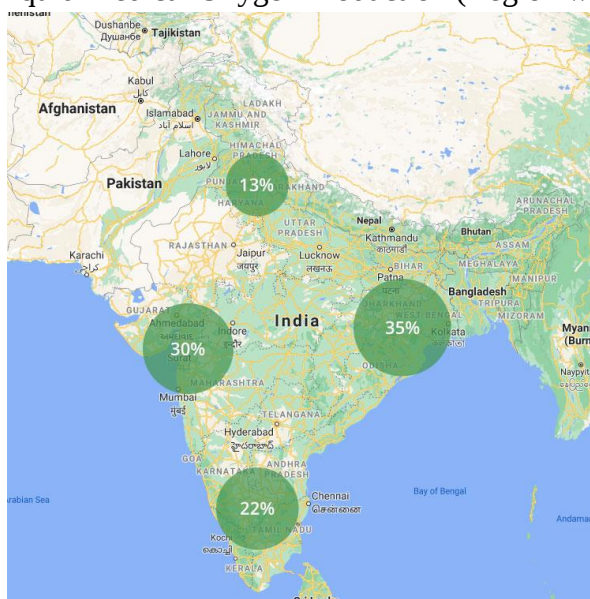
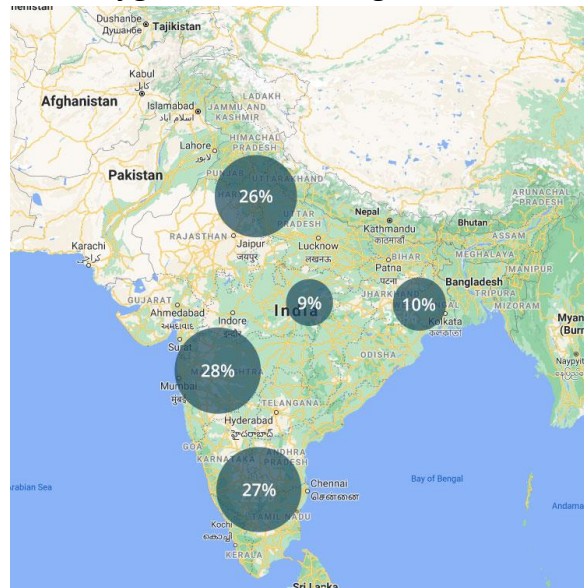


Figure 4. Liquid Medical Oxygen Demand during Second Wave (Region wise % split)



Geographical Mismatch of Production and Demand

This above-mentioned situation during the second wave of COVID-19 pandemic was characterized as a geographical mismatch in demand and supplies of Medical Oxygen. While the Northern parts of India produce barely 13% of the country's oxygen, it consumed 26% of the country's total available oxygen. This is been substantiated by the 35% production capabilities of Eastern India, which requires only 10% of the total oxygen available in the country to treat its COVID patients. Most number of infected cases were being reported from the north. With news of oxygen shortage amidst rising number of critical cases spreading like wildfire, people began panic buying of oxygen cylinders and oxygen concentrators even when not required, which added pressure to the already depleting stock.

Bottlenecks of Hospital Infrastructure

Medical Oxygen is stored in liquid state that needs specialized cryogenic tanks that can hold temperature at -198 degree at desired pressure. It's important to take a note that, with the increased number of COVID-19 cases, every Hospital has increased the number of Beds, ventilators and its associated infrastructure. But the Medical storage capacities and associated equipment configuration were the same based on pre-COVID consumption.

With less storage and increased consumption, these tanks which used to get filled once in 4 day now needed 3 fills in a day. Safety stock of medical oxygen went down to less than 8 hrs there by increasing the number of SOS calls.

Inadequate Medical Oxygen Distribution Tankers

The existing liquid oxygen supply chain network faces many challenges, including inadequate number of Medical Oxygen tankers for moving Oxygen from distant production facilities to meet the demand across

different regions. Also, where a hospital would usually require a weekly refill from a 1000-liter tank, the demand spiked to a refill on an hourly basis, putting immense pressure on the supply chain.

Less-equipped healthcare infrastructure

The healthcare infrastructure was not prepared to meet the sudden surge in critical cases that required oxygenated beds, especially in case of a prolonged stay. Hospitals in both public and private sector were found lacking the resources to cater to unexpected increase in oxygen consumption.

3. LESSONS LEARNED

Nation Unified by a Single Objective of Dealing with the Oxygen Crisis

While the second wave brought to the surface the stark inadequacies in our resources and strategies to deal with the challenges of the pandemic, the stakeholders – the Government, the States, Corporates, Individuals, and our Allies from across the world came together to offer resilient support and assistance.

The 6 Empowered Groups established in early 2020 by DPIIT under Ministry of Commerce to deal with the various challenges of the pandemic and tackle the issues arising in the second wave. Additionally, the Commerce Ministry adopted game changing strategies, including utilizing industrial oxygen as medical oxygen, converting the nitrogen and argon tankers into oxygen tankers thus increasing the number of cryogenic tankers, utilizing all available resources to hasten the supply of oxygen, etc. The state-owned steel plants reduced their safety stock from 3.5 days' worth of oxygen to 0.5 day to help reduce the oxygen shortage.

Commendable feat by the Indian Railways that launched Roll-On Roll-Off "Oxygen Express"^{[8][9]} to transport oxygen tankers from farthest parts of the country to places in need. The Indian Air Force (IAF), Indian Railways, Indian Army, Navy, and the State Police, all pooled their resources and collaborated their efforts to ensure ease of movement of oxygen, setting up of medical facilities, storage facilities, green corridor, etc. The Supreme Court set up a National Task Force^[4] to ensure effective and transparent allocation of liquid medical oxygen across the country.

The Steel Industry pitched in by increasing the country's output by 30% in just one month. Also, within the healthcare sector, not only the frontline warriors but "back in the line" workers like ambulance drivers, oxygen tank drivers, etc. worked 24/7 to help in oxygen reaching the patients.

Countries including the UK, the US and Russia assisted with medical supplies such as raw materials needed for vaccines, critical COVID-related medical supplies, oxygen generation equipment, and an enhanced capability for smoother transportation and storage of oxygen.

Oxygen Allocation Process

To ensure equitably supply medical oxygen across the country oxygen allocation order issued on 15 April 2021.^[5] The formula of Ministry of Health and Family Welfare was used to assess Oxygen requirement for each State in line with the active cases in the state, and accordingly align Oxygen Allocation to each State.

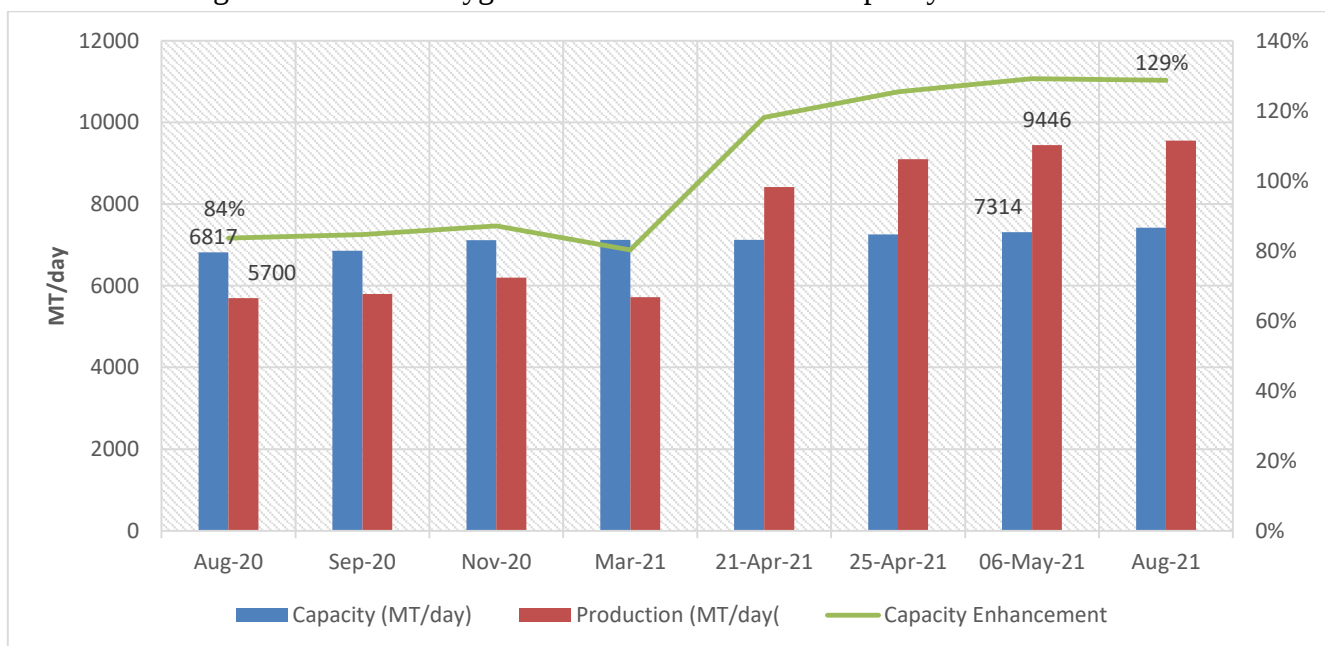
Oxygen allocation was dynamic in nature, based on requirement as per Health Ministry norms, and consultation with States/UTs, manufacturers & other stakeholders. Mapping of source and destination of oxygen has been completed to optimize transportation plan in consultation with States/UTs, manufacturers & other stakeholders.

In order to balance this mismatch, initiatives like Roll-On Roll-Off Oxygen Express Train and Air Lifting of empty cryogenic tankers to reduce one-way travel time by 2 days which would have taken 10 to 11 days otherwise travelling from East/West to North.

Increase in Medical Oxygen Production and Capacity Enhancement

Medical Oxygen availability was increased by allowing Industrial Oxygen for Medical use. Further all the Air Separation Units ran their respective unit in maximum Oxygen production mode. Steel companies also stepped in to meet the nation's requirement of medical oxygen. With all these combined efforts, Oxygen production increased from 5700 MT/day in Aug'20 to 9,446 MT/day in May'21. The capacity utilization went up from 84% to 129% during this period. The increased availability of Medical Oxygen was

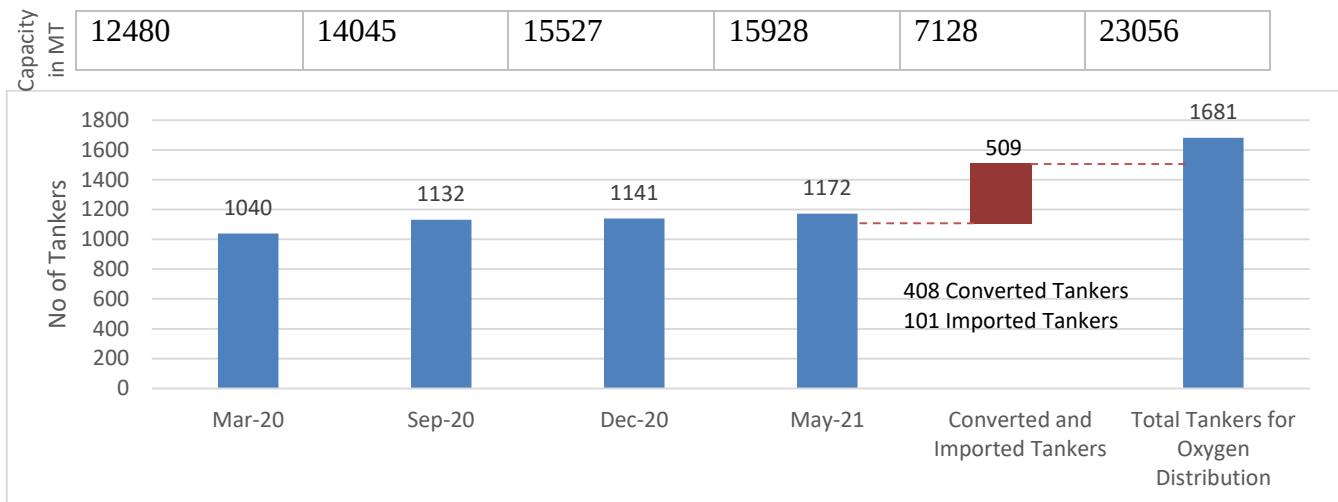
Figure 5. Medical Oxygen Production Increase & Capacity Enhancement^[3]



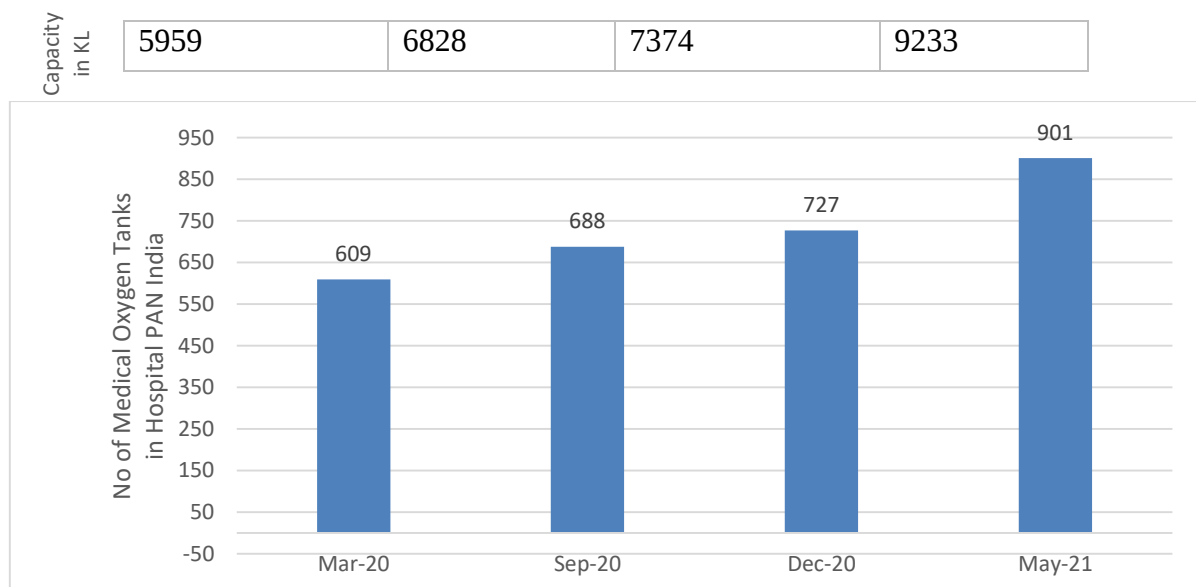
Increase in Medical Oxygen Transportation Tankers

India had 1171 Medical Oxygen Transportation Tankers available for distribution. To ease the stress on the distribution infrastructure to cater to the unusual increase in medical oxygen demand, 509 more Tankers were added to the fleet in less than a month's time. 408 Cryogenic Nitrogen & Argon Tankers were converted Oxygen Tankers and 101 Tankers were imported.

Figure 6. Increase in Tanker Availability & Distribution Capacity^[3]



Increase in Medical Oxygen Storage Tanks & Storage Capacity^[3]



Oxygen Digital Tracking System^[6]

A Web and App based Oxygen Digital Tracking System (ODTS) has been launched to enable real time tracking of Oxygen movement in the country. Its objectives are effective and instantaneous communication of allocation orders to plants and dispatches from plants, and to enable real-time tracking

of Oxygen movement in the country from Plants to States. It integrates with GSTN database for E-waybill based data entry, Tracking of tankers through GPS, SIM (Driver Mobile No.), FASTag, and Automated alerts from system for route deviation, unintended stoppages, delays

Besides, a Virtual Central Control Room has been established with officers from Additional / Joint secretary officers of Health, Road, Rail, Industry, Steel and from State Govt. The Control Room is monitoring Oxygen movement 24 X 7 and to resolve any issues in oxygen transportation.

Training Drivers for Driving Oxygen Tankers^[7]

2,500 additional drivers are being trained to drive oxygen tankers by National Skill Development Corporation (NSDC) and Logistics Sector Skill Council (LSSC). Availability of skilled drivers is essential to ensure uninterrupted transportation of Oxygen. Since LMO Transportation is covered under Hazardous Chemicals regulations, drivers with adequate training and having HAZ Cargo license only are allowed to operate the trucks. Immediate focus is to make Training module has been developed by NSDC and LSSC in English and Hindi & 20 master trainers identified. Online Refresher courses are planned for non-active drivers with training in handling HAZ chemicals. 73 locations have been identified for organizing physical training programs for drivers along with oxygen plants.

4. SUGGESTIONS AND CONCLUSION

The COVID-19 pandemic, specially the second wave has taught some highly vital lessons to deal with any future waves in a more streamlined and effective manner. The need of the hour is to strengthen the country's last mile cryogenic infrastructure. As ASUs take years to set up, reinforcing storage facilities is essential to meet the oxygen requirements at the farthest parts of the country. Also, it has become important to enhance State-wise fleet of cryogenic tankers to meet the sudden demand to transport oxygen across geographies. Further, the healthcare system needs to be encouraged be judicious in its use of oxygen through regular audits.

While the second wave tested the nation's prowess and mettle, the brutality of it has highlighted some major bottlenecks and shortcomings in our existing action plan to fight the pandemic. However, having learnt the lesson, the hard way, the Nation geared up to face the next wave.

REFERENCES

1. The Hindu (30 April 2021) <https://www.thehindu.com/news/national/coronavirus-india-becomes-first-country-in-the-world-to-report-over-400000-new-cases-on-april-30-2021/article61817889.ece> , The Hindu, 30 April 2021
2. The Times Kuwait (9 May 2021) <https://timeskuwait.com/news/over-900000-patients-on-oxygen-support-across-india-health-minister/>
3. Press Information Bureau. (2021, May 10). *Centre undertakes multiple initiatives to enhance oxygen availability, distribution and storage infrastructure*. Ministry of Commerce & Industry, Government of India. <https://pib.gov.in/PressReleasePage.aspx?PRID=1717459>



4. The Economic Times (8 May 2021) https://economictimes.indiatimes.com/news/india/supreme-court-sets-up-a-12-member-national-task-force-to-facilitate-public-health-response-to-the-pandemic/articleshow/82481922.cms?utm_source=chatgpt.com
5. India Today (12 May 2021) <https://www.indiatoday.in/diu/story/india-oxygen-shortage-boosting-capacity-covid-1801828-2021-05-12>
6. The Print (3 June 2021) <https://theprint.in/india/governance/modi-govt-to-expand-digital-tracking-system-for-oxygen-as-it-readies-for-3rd-covid-wave/671028/>
7. MTI News Desk (26 June 2021) <https://mtinews.in/skill-india-commences-training-of-oxygen-tanker-drivers-to-ensure-streamlined-lmo-supply-chain-to-save-lives-during-pandemic/>
8. The Economic Times (19 April 2021) "Railways to run 'Oxygen Express' to meet high demand amid surge in COVID-19 cases".