

Webinar 4—Oxygen Logistics: Key Learnings from the Second Wave and Lessons for Future

21st October 2021

Technical Assistance for National Capacity-Building and Enhancing the Oxygen Logistics and Supply Management System to the States of West Bengal, Meghalaya, Uttarakhand, and Andhra Pradesh

The World Bank

October 2021



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WEBINAR SERIES
BUILDING SUSTAINABLE MEDICAL OXYGEN SYSTEMS:
EXPERIENCES AND LESSONS FROM INDIA'S COVID-19 RESPONSE

AGENDA FOR WEBINAR #4

OXYGEN LOGISTICS: KEY LEARNINGS FROM SECOND WAVE AND LESSONS FOR FUTURE

October 21, 2021 | 4:30 PM to 06:00 PM IST (GMT +5:30)

04:30 PM – 04:35 PM Welcome

Mr. Rajaji Meshram, Consultant, World Bank

04:35 PM– 04:50 PM Context Setting

Mr. James Robert Markland, Senior Transport Specialist, World Bank

04:50 PM – 05:05 PM Keynote Address

Transportation of liquid oxygen: Lessons from Indian Railway

Dr. Manoj Singh, Executive Director (Traffic Transportation), Railway Board, Ministry of Railways, Government of India

05:05 PM – 05:10 PM Questions and Answers with the Keynote Speaker

05:10 PM – 05:40 PM Panel Discussion

Lessons on transportation, operations, and maintenance of oxygen assets

Mr. Ram Kumar, Mission Director, National Health Mission, Government of Meghalaya

Mr. Ranabir Chatterjee, Vice-President of Deliver-South Asia, Linde

Mr. Ayanabh DebGupta, Co-founder and Joint Managing Director, Medica Hospitals

05:40 PM – 05:55 PM Open House

Questions and answers from the audience

05:55 PM – 06:00 PM Summary and Closing Remarks

Mr. Rajaji Meshram, Consultant, World Bank

Background

The second wave of COVID-19 has had dreadful consequences pertaining to the increase in the number of cases, inadequate treatment facilities, and shortage of oxygen. Oxygen proved to be a life-saving drug for the treatment of COVID-19 patients. However, with the sudden surge in cases and a fragile medical oxygen management infrastructure, most of the COVID-19-related deaths in India occurred due to a mere lack of oxygen supply. India has seen a huge gap in the demand and supply of medical oxygen during the peak of the second surge in cases in May 2021. Despite adequate production of medical oxygen, shortages were experienced in multiple regions across the country. The reason for these shortages was primarily the unequal distribution of oxygen production units, with most of these units being situated in the eastern states of India.

The center as well as the state governments undertook various initiatives to bridge the demand-supply gap and ensure transportation and availability of medical oxygen to the remotest of locations. Some of the interventions contributing to an improved oxygen logistics in India include the introduction of “Oxygen Express” for efficient medical oxygen transport across rural areas in the country, use of cryogenic ISO containers for oxygen transport, airlifting the empty oxygen tankers back to the production units, creation of buffer reserves, and so on.

To initiate relevant discourse on the myriad of issues related to medical oxygen management taking into account the anticipated third wave, the World Bank, in collaboration with PATH, is conducting a five-part regional webinar series. The webinar series aims to share the challenges faced, best practices emerged, lessons learnt, and insights into India’s evolving oxygen ecosystem in the context of the COVID-19 pandemic. The fourth of these five webinars, conducted on Thursday, October 21, 2021, was attended by 195 subject-matter experts, government officials, and various other stakeholders from across the world. This webinar brought together government, not-for-profit, corporate, and other stakeholders from India and other South Asian countries to share their experience and practices with respect to oxygen logistics and oxygen supply management.

The speakers for the webinar on “Oxygen Logistics: Key Learnings from Second Wave and Lessons for Future”:

- explored the experience of state and non-state stakeholders on improving the availability of oxygen to health centers
- drew on the best practices in transportation and delivery of liquid oxygen and cylinders
- discussed lessons on practices that improve sustainability and capacity building of oxygen assets

This report provides a summary of key discussions, lessons learnt, and recommendations that emerged from the webinar on medical oxygen logistics management.

Role of transport and logistics in ensuring that oxygen is available for patients

Mr. James Robert Markland, Senior Transport Specialist, World Bank, set the context to the webinar by discussing the importance of transport and logistics in ensuring oxygen availability. He observed that India had faced several challenges when the daily oxygen demand rose by ten times the normal demand during the peak of second wave of COVID-19. One of the biggest challenges was the distance between most of the oxygen plants and the medical facilities.

As a solution, it is essential to minimize logistics with the help of digital technology and have an efficient logistics system using predictive ability. Some of the key elements, shared by him, for a sustainable and responsive medical oxygen supply chain are:

- Accurate demand assessment at a local level using predictive trend model based on tracking real-time oxygen demand
 - To manage the oxygen demand and supply, it is essential to understand trends by preparing a predictive model. An oxygen digital tracking system could be utilized for this purpose.

- Efficient route planning and management, with multimodal transport mix
 - Several challenges could be overcome through collaboration and systematic planning. A central coordination agency must monitor all the aspects of oxygen transport such as availability of tankers, route mapping, and tracking the tankers.
 - Appropriate transport infrastructure must be put in place to achieve the last mile connectivity. A hub-and-spoke model could be followed by integrating road and railways to gather benefits of each of these transportation modes.
 - Adequate number of strategically distributed cryogenic tankers or ISO containers are necessary.
- A robust tracking and tracing system for medical oxygen transport
 - Radio Frequency Identification (RFID)/ Quick Response (QR) codes could be used to track real-time movement of cylinders for an improved medical oxygen supply system.
- Adequate storage is necessary for an uninterrupted supply
 - It is essential to have adequate reserve storage capacity at strategic locations/districts/cities
 - Liquid medical oxygen (LMO) is a cheap commodity as compared to the cost of infrastructure used for storing it. However, buying a stock bounce would help ensure an uninterrupted supply of oxygen.
 - Common LMO storage pool for multiple LMO manufacturers: A grid system could be created with the use of a common LMS storage pool, which would allow different manufacturers to put oxygen into one tank, which would then be utilized at the facility.
- Facilities must be well equipped with local as well as secondary sources of oxygen
 - Local and captive oxygen production, via pressure swing adsorption (PSA) plants and oxygen concentrators, which do not require any transport used as "in place" arrangement, must be encouraged.
 - Secondary sources for oxygen such as oxygen cylinders must be available at a facility level as many hospitals cannot be serviced through LMO.
 - Adequate hospital beds must be ensured for an effective delivery.

Transportation of liquid oxygen: Lessons from Indian Railways

Dr. Manoj Singh, Executive Director (Traffic Transportation), Railway Board, Ministry of Railways, Government of India, shared his experience on the best practices that were implemented by the Indian Railways for efficient transportation and management of liquid oxygen across the country to ensure an uninterrupted supply.

The traditional systems for liquid oxygen movement include road-based transport, wherein the oxygen-producing companies owned around 1,300-1,400 oxygen tankers that were used for supplying LMO across the country. Most of the LMO production centers are situated in the eastern parts of the country, whereas the steep nationwide surge in COVID-19 cases during the second wave led to an increased medical oxygen demand that was spread all over the country. The distances between the LMO generation points and where it was required were very large, making it unfeasible to be covered by road transport for rapid and timely delivery. This is where the Indian Railways stepped in for assistance in transportation of LMO, as larger quantities of LMO could be transported through railways at a much faster pace over a long haul.

Various initiatives were taken by the Indian Railways to ensure that the LMO is delivered through its network. Some of them are as follows:

- Preparation of a Standard Operating Procedure (SOP) for ensuring various precautionary measures such as venting, oxygen trains to be dealt away from passenger platforms, fire protection, and decanting-related process by the Indian Railways with the help of LMO manufacturers to ensure safe operations.
- In case of an emergency like COVID-19, it is beneficial to ease restrictions and penalties over minimum carrier limit and dimensional regulations that are in place in a conventional system.

- Over dimensional consignment clearances, which are usually time-consuming could be accelerated by managing them online, and operative innovations could be implemented to increase the speed.
- For the implementation of roll-on, roll-off trains, ramps need to be created for loading-unloading and decantation needs to be done at railway terminals.
- Introduction of cryogenic containers instead of LMO tankers makes it feasible for the rails to run at a speed as high as 100 mph as compared to the regular speed of 65 mph. In case of India, these tankers were not manufactured in the country and therefore had to be imported from other countries with the significant contribution of the Indian Air Force. The use of cryogenic containers with such a high-speed result in reduction in the overall journey time.
- It is essential to monitor the movement of these trains in real-time. This could be done with the help of a dashboard. This is beneficial for recognizing challenges with the implementation process.
- Involvement of various agencies of government and private sector such as the Department of Railways, Defence, Gas Manufacturing Association, and the Central Government, and effective coordination among these agencies is vital for successful implementation of strategies.

At the Central Government level, there are two very significant digital interventions that were put into play to manage the oxygen supply and demand: the oxygen digital tracking system (ODTS), and the oxygen demand aggregation system (ODAS). Dr. Harsh Varma of the World Bank team demonstrated the oxygen demand simulator (ODS), which could complement the two digital tools in use by the Government of India.

Lessons on transportation, operations, and maintenance of oxygen assets

Mr. Ram Kumar, Mission Director, National Health Mission, Government of Meghalaya, shared his experiences on the management of medical oxygen supply in the state of Meghalaya. The state of Meghalaya faced some challenges since they did not have a coordinated oxygen setup or an oxygen management system prior to the pandemic. Secondly, the state also does not have any major railway stations, which made transportation of medical oxygen difficult. The state government took various measures to sustain access to medical oxygen through strategic planning:

- The first step is to predict the amount of medical oxygen that the state would require by analyzing data such as the patterns of current active cases and oxygen consumption rate. The predicted demand must then be compared with the stocks of medical oxygen available with the state.
- In case of Meghalaya, after exploring all the possible sources of oxygen, the most feasible and quickest way was the use of oxygen cylinders during the peak surge. However, it is also essential to simultaneously invest in the development of other resources such as setting up of PSAs and LMOs in multiple districts for a long-term benefit. Having alternative oxygen resources would aid in averting the oxygen crisis across the state.
- Instead of only focusing on government hospitals, it is important to consider health as one sector including private- and public-sector health facilities. Association of private- and public-sector players along with nodal officers from the Department of Industries contribute toward recording and analyzing oxygen consumption data, based on which future predictions could be made. These predictions play a crucial role in planning future oxygen supply to the state.
- It is also beneficial to collaborate with certain not-for-profit organizations for better planning and management of oxygen infrastructure. Preparation of an oxygen management plan with specific guidelines for all the stakeholders involved in oxygen ecosystem is also an advantageous step taken by the Meghalaya Government.
- Managing oxygen in an efficient manner includes training of professionals such as Industrial Training Institute (ITI) students and biomedical engineers. It is important to have good-quality human resource available.
- Using digital technology for real-time monitoring of the number of patients, beds, oxygen consumption, etc., is beneficial to keep a record of the demand and manage the supply system

accordingly. Management of oxygen ecosystem requires a lot of interdepartmental coordination, and all of these departments must be involved under one digital intervention. Such dashboards must be simple interventions with minimum variables, making them easy to use and more effective.

- Meghalaya is planning with a multilayered approach including multiple alternatives as oxygen supply sources such as LMO plants, PSA plants, oxygen concentrators, and oxygen cylinders.
- It is also essential to not only learn from one's own experiences but also seek lessons from the experiences of other states in India. Meghalaya drew on such lessons and managed to avoid certain shortcomings to a great extent.

Mr. Ranabir Chatterjee, Vice-President of Deliver-South Asia, Linde, shared his insights on how the production companies manage the surge in oxygen demand during the second wave of COVID-19. The pandemic was as sudden for the production organizations as it was for the rest of the world, and the leanings from the first wave of COVID-19 came to aid while preparing for the second wave. Tweaking in their regular plans to obtain more oxygen, various steps were taken by the production companies to increase the oxygen production at its full capacity and provide support in improving the supply infrastructure.

- In times of emergency, it is necessary to compromise on the production of other gases, such as nitrogen and argon, and divert all the resources toward production of oxygen. Secondly, production of industrial oxygen must be cut down to cater to the demand for medical-grade oxygen for supply to the hospitals.
- Logistics are as important as ramping up the production capacity. The tanks licensed for other gases must be processed and converted for medical oxygen use. This process involves many steps and statutory cadence that must be undergone before getting these tanks into use. Similarly, the use of cylinders could be diverted for medical oxygen transportation in times of crisis.
- The use of ISO containers is a useful approach in improving the transport logistics. In times of need, relations with global suppliers could be leveraged for importing these ISO containers from various parts of the world. Transportation of these cryogenic tanks through railways has ramped up the transport logistics to another level.
- Collaboration and coordination between different departments such as railways, Indian Army, and private production companies result in effective implementation of these initiatives.

Mr. Ayanabh Debgupta, Co-Founder and Joint Managing Director, Medica Hospitals, discussed about the oxygen infrastructure across private health facilities and management of medical oxygen supplies across these facilities during the second wave. Medical is a chain of health care centers/hospitals located in the eastern states of India. Since most of the oxygen production plants are situated in the east, supply of medical oxygen was never an issue for them. However, with such a steep surge in the number of cases during the second wave, it was necessary to meet medical demands such as availability of beds and medical oxygen in a very short span of time.

- Learnings from the first wave and future predictions about the surges played a very crucial role in preparing hospitals for the expected emergencies. The private hospitals must plan and install oxygen supply sources such as PSA plants and LMO tanks to meet the future demand.
- The health care infrastructure must be ramped up by construction of new facilities. In case of Medica hospitals, all spaces of the facilities including the lobby parking were utilized in admitting patients. The private players must work with the government toward installing new short-term facilities in spacious locations such as stadiums or convert old or abandoned hospitals back into use with the objective of sustaining the demand. One challenge that hospitals often face is the manpower including doctors and nurses for efficient functioning of these facilities.
- Adequate oxygen supply is another vital aspect of these facilities. This could be ensured by joining hands with oxygen production companies and working toward enhancing the oxygen supply infrastructure.

- The private-sector personnel as well as the government-sector personnel must work together as a team to maintain the supply and demand balance in terms of medical oxygen.

Conclusion

The key takeaway from this webinar is that with the involvement of multiple stakeholders ranging from the Central Government, State Governments, Indian Air Force, Indian Railways, etc. to the private sector personnel including oxygen production companies and private health care representatives, is vital for ensuring sustainable oxygen supply as each one of these plays a very crucial role in improving the oxygen logistics in the country. In case of health care, it is essential to think of health as one sector, thus blurring the division between government and private sectors. With numerous innovative strategies including contribution of railways in the transport of medical oxygen, the use of ISO containers for transport, data analysis for the prediction of oxygen demand and appropriate preparation for supply, using a multilayered approach of oxygen supply, and increasing the production capacity as well as the supply logistics, it is possible to sustain the oxygen demand across the country for the predicted future surge in COVID-19. Medical oxygen supply ecosystem is a broad domain involving multiple facets that need careful microplanning and systematic implementation.

Agenda



The image shows two medical professionals in a clinical setting. One is wearing a blue surgical mask and a green scrub top, while the other is in a light blue scrub top. They are both focused on a black medical oxygen cylinder with various valves and gauges. The cylinder is connected to a patient's oxygen delivery system.

**Building Sustainable
Medical Oxygen Systems**

South Asia Webinar Series

Oxygen Logistics: Key Learnings from the Second Wave
and Way Forward

21 October 2021
4:30 PM to 6:00 PM IST (GMT+5:30)

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Detailed Agenda

I Welcome

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Mr. Rajaji Meshram
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I Context Setting

04:35 – 04:50 PM



Mr. James Robert Markland
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Keynote Address

04:50 – 05:05 PM

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Dr. Manoj Singh
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Question and Answers with the Keynote Speaker

05:05 – 05:10 PM

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Panel Discussion

05:10 – 05:40 PM

Lessons on transportation, operations, and maintenance of oxygen assets



Mr. Ram Kumar

Mission Director, National Health Mission, Government of Meghalaya



Mr. Ranabir Chatterjee

Vice-President of Deliver -South Asia, Linde



Mr. Ayanabh Debgupta

Co-founder and Joint Managing Director,
Medica Hospitals

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Summary and Closing Remarks

05:55 – 06:00 PM



Mr. Rajaji Meshram

Consultant, World Bank

Save the Date



Building Sustainable Medical Oxygen Systems
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SAVE THE DATE

Transporting medical oxygen supplies such as cylinders and oxygen concentrators safely is no easy task. Predictive methods of transportation and technology are gaining relevance every day. New initiatives and technologies are being launched to make these systems more responsive, robust, and reliable.

Learn more at the World Bank and PATH's upcoming webinar session on:
Oxygen Logistics: Key Learnings from the Second Wave and Way Forward

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Co-founder and Joint Managing
Director, Medica Hospitals



Moderated By

Mr. Rajaji Meshram

Consultant, World Bank

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