Production & Supply of Medical Oxygen: Kerala Model of Pandemic (Covid-19) Management

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Research Article

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Abstract

The second wave of COVID-19 severely hit the country, India. Many hospitals, across the country, faced acute shortage of medical oxygen. However, a small state in southern part of India, the State of Kerala, has been highly successful in managing production & supply of medical oxygen. In spite of highest daily confirmed COVID-19 cases & escalated demand for medical oxygen, the State efficiently managed to have sufficient medical oxygen to meet its own demand and supplied excess to needy neighbouring States (Goa, Karnataka and Tamil Nadu). The author tries to identify success factors that having a key role in uninterrupted production & supply of medical oxygen to meet unprecedented increase in demand across the State of Kerala during the pandemic (COVID-19). The study involved a detailed analysis of secondary data. The data was collected from various (offline & online) platforms such as newspapers, news portals, reports, websites etc. The early preparedness, visionary investments (for infrastructure development), effectual monitoring (of production, supply & consumption of medical oxygen), effective communication (among all stakeholders) and continuous coordinated collective efforts (of Oxygen Production Units, the PESO Kerala, the Hospitals, the State Health Department and, the State Government) are the key success factors. The State has been highly successful in managing production & supply of medical oxygen, across the state, during uncertain time of COVID-19 and thus, stood as an exemplary for rest of the country.

Introduction

The second wave of COVID-19 (C19) severely hit the country, India. The country witnessed ballistic increase in number of confirmed C19 cases and daily, more than 0.3 million (7-day average) were reported (The New York Times, 2021). As hospitals were packed with C19 patients, need for medical oxygen (MO) has increased sharply (Jacob, 2021). The MO is vital component for survival and recovery of patients under COVID-19 Care (CC) and Non-COVID-19 Care (NCC) treatments. However, the country struggled to meet its increasing demand of MO especially in National Capital Region, Maharashtra, Gujarat, Uttar Pradesh and Madhya Pradesh (Jacob, 2021). The gravity of the situation was exposed when one of the members of Delhi State legislative assembly released a video (from the hospital where he was admitted) which unveiled paucity of MO in the hospital. The hospital was left with a meagre of MO for just three hours (Shankar, 2021).

Conversely, when the whole country mourned for MO, a small State in the southern part of India, the State of Kerala (hereonwards it is referred as ‘the State’), was doing wonders in managing MO. Though, daily, the State had more than 25,000 cases of C19, it had sufficient MO to meet its own demand and supplied excess to needy neighbouring States (Nayak, 2021) (Shankar, 2021) (Jacob, 2021). The State supplied 20, 72 and 36 metric tonnes of MO to hospitals in Goa, Tamil Nadu and Karnataka respectively (Jayarajan, 2021). As a token of gratitude, Health Minister of the State of Goa tweeted thanks to Health Minister of the State of Kerala (Abraham, 2021).
In the paper, author explores the success factors having a key role in uninterrupted production & supply of medical oxygen to meet its unprecedented increase in demand, across the State of Kerala, during the pandemic (COVID-19).

Literature Review

Many studies have been conducted on Kerala Model of Pandemic (COVID-19) Management. For instance, the State's preparedness to handle the pandemic (Valsan, Thomas, Chirayath, P R, & Kuttichira, 2021) (Rahim, Chacko, & Rajan, 2020) (Vaman, et al., 2020), initial responses of the State (Rahim, Chacko, & Rajan, 2020) (Vaman, et al., 2020) (Nagare, Gupta, & Darji, 2020) (Jalan & Sen, 2020) and success factors of the State in managing C19 (Choolayil & Putran, 2020) (Chathukulam & Tharamangalamb, 2021) (Kaim, AHIRwar, AHIRwar, & Sakarde, 2021) were widely studied. However, no studies has been conducted on uninterrupted production and supply of medical oxygen to meet the unprecedented increase in demand.

Hence, a research gap is existing to identify the success factors having a key role in the uninterrupted production & supply of medical oxygen, during the pandemic (COVID-19), across the State of Kerala.

Materials And Methods

The study involved a detailed analysis of secondary data. The data was collected from various (offline & online) platforms such as newspapers, reports, news portals, websites etc.

Analysis

a) Demand for Medical Oxygen

By end of first week of April, the State's demand for MO was 62.95 Metric Tonne Per Day (MTPD) (Jayarajan, 2021). It includes a demand of 20.6 MTPD of MO for CC and 42.35 MTPD for NCC (Jayarajan, 2021). Within two weeks, the demand increased to 74.25 MTPD, out of which, demand of MO for CC had increased considerably by 11 MTPD to touch 31.60 MTPD and that for NCC increased marginally by 0.30 MTPD to reach 42.65 MTPD (Jayarajan, 2021). By April 25, the State expected the total demand to touch around 98 MTPD with an increase of about 19 MTPD for CC and a minimal increase of about 4 MTPD for NCC (Jacob, 2021). However, by the end of April, total demand was expected to cross 103 MTPD, out of which, demand for CC may cross 56 MTPD (Jacob, 2021) and that of NCC may remain nearly constant (Jayarajan, 2021) (Jacob, 2021)

b) Production & Supply of Medical Oxygen

The private firms played a pivotal role in production and supply of MO across the State (Nandakumar, 2021). In beginning of last week of April, utilizing 97 % of its total production capacity, the State produced 199 MT of MO per day (Jacob, 2021) (Shankar, 2021) to adequately meet its own demand and to lend
helping hands to neighbouring States (Jayarajan, 2021). The list of major producers and their production capacity are given below.

Table 01: List of producers of medical oxygen and production capacity

<table>
<thead>
<tr>
<th>S.No</th>
<th>PRODUCERS OF MO</th>
<th>CAPACITY (MTPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inox</td>
<td>149</td>
</tr>
<tr>
<td>2</td>
<td>Air Separation Units (ASUs) (11 nos.)</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>Kerala Minerals and Metals Ltd</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Cochin Shipyard</td>
<td>5.45</td>
</tr>
<tr>
<td>5</td>
<td>Bharat Petroleum Corporation</td>
<td>0.322</td>
</tr>
</tbody>
</table>

[Source: Author; Data Source: (Jacob, 2021)]

Additionally, as on April 17, 2021, the State has a total reserve of 586 MT of MO (Jayarajan, 2021) and the State's 23 MO filling plants were in a position to provide an output of more than 10,000 oxygen cylinders per day (Jayarajan, 2021). Comparing to April, 2020, the State has increased its production by 1200 litres per minute (Reghukumar, 2021), an astonishing hike of 2400 %.

c) Key Departments

The Petroleum and Explosives Safety Organization (PESO), started in 1898 to screen & guarantee availability of MO across the country (Jayarajan, 2021) and for the same, in every State in the country, a nodal officer is appointed (Shankar, 2021).

The PESO Kerala Unit and the State Health Department were the two entities that took helm to ensure uninterrupted supply of MO (Shankar, 2021). The two departments started their preparedness, one year before, in March 2020 (Reghukumar, 2021). In initial meeting (with its stakeholders) itself, strict direction were given to work round the clock to meet unforeseen demand (Reghukumar, 2021). It supplied and ensured availability of MO cylinders across the State and Lakshadweep Islands (Nandakumar, 2021). Also, well in advance, it accomplished all essential repairs and technical works on ASU plants (Reghukumar, 2021). Similarly, it assessed and ensured required fittings and devices for uninterrupted supply of MO to hospitals/healthcare institutions (Nandakumar, 2021). Besides, for smooth supply, the PESO Kerala appraised distance to cover, condition of roads, safety of transport, availability of tanker and carriage capacity (Jacob, 2021).

On the other side, nodal officer (the State health department), appointed by the State, unceasingly screened and gathered data on consumption & requirement of MO at hospitals and made it available for nodal officer of PESO Kerala. Upon receiving, the PESO Kerala manage production of MO and ensures uninterrupted supply to medical institutions across the State (Shankar, 2021).
d) Developing Infrastructure

The PESO Kerala and the State Health Department, put their efforts to improve existing capacities of production units of MO. To avoid delay in supply, the PESO Kerala successfully diverted purified oxygen from industries for medical purposes (Jayarajan, 2021). The State government’s prestigious 100 day project, installed a new oxygen plant with a capacity of 70 MTPD at the Kerala Minerals and Metals Ltd (KMML). After its own consumption for manufacturing titanium dioxide, the KMML supplied residual oxygen to hospitals (Jayarajan, 2021) (Shankar, 2021) (Samayam Desk, 2021). The visionary act of the State not only augmented its industrial growth but also saved lives. Moreover, while producing industrial oxygen and nitrogen, the KMML produces 7 MT of oxygen per day as a bye product. The PESO Kerala successfully diverted purified ‘waste oxygen’ to hospitals (Jayarajan, 2021).

Furthermore, one additional ASU plant at Palakkad district (Shankar, 2021) and Union Government approved onsite Pressure Swing Adsorption (PSA) systems were in pipeline at three Medical College Hospitals (MCHs) (Nayak, 2021) (Jayarajan, 2021). Once functional, the former could generate MO at a rate of 4MTPD (Shankar, 2021) and the later at 1250 litres of MO per minute (Jacob, 2021) (Nayak, 2021) (Jayarajan, 2021). The PSAs not only meets demand of MO, but also makes the hospitals self-reliant for MO (Jayarajan, 2021).

Similarly, a few MCHs raised funds for improving their existing infrastructure for uninterrupted supply of MO. For instance, the MCH at Thrissur, through crowd funding, the campaign ‘the Prana Air for Care’raised 7,200,000 Indian Rupees to connect MO pipeline to new 600 patient beds (Jayarajan, 2021). Likewise, the MCH at Trivandrum had extended MO pipelines to additional 350 beds (Reghukumar, 2021) to triple its oxygenated beds (Reghukumar, 2021) and also increased MO storage capacity to 40,000 litres by installing additional storage tanker with a capacity of 20,000 litres (Reghukumar, 2021).

Findings

The early preparedness, visionary investments (for infrastructure development), effectual monitoring (production, supply & consumption of medical oxygen), effective communication (among all stakeholders) and continuous coordinated collective efforts (of Oxygen Production Units, the PESO Kerala, the Hospitals, the State Health Department and, the State Government) are the key success factors.

Conclusion

The State has been highly successful in managing production & supply of medical oxygen, across the state, during uncertain time of COVID-19 (second wave) and thus, stood as an exemplary for rest of the country.

Declaration
The authors declare no competing interests

References


