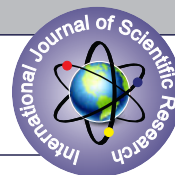


CRITICAL APPRAISAL OF OXYGEN DEMAND AND COST BEFORE, DURING AND AFTER COVID-19 PANDEMIC AT TERTIARY CARE HOSPITAL



Community Medicine

Dr. Deepender

PG Resident, Department of Community Medicine, JMC Jhalawar

Dr. Pankaj Kumar Gupta*

Senior Professor, PG Resident, Department of Community Medicine, JMC Jhalawar
*Corresponding Author

ABSTRACT

Background- During the COVID-19 pandemic oxygen demand increased all over the country. After the second wave of the pandemic, many oxygen plants have been installed at various hospitals. **Objective-** To find the trend of oxygen consumption and its cost of oxygen before, during, and after the COVID-19 pandemic. **Methodology-** The data were collected retrospectively from hospital records regarding oxygen cylinder consumption before and after the installation of the oxygen plant and calculated its cost by estimating the electricity bill. **Results & Discussion-** During the first wave of the pandemic which lasted from April 2020 to October 2020, no oxygen plant was functional in our tertiary care center. In January 2021, the first oxygen plant was started. Oxygen cylinder consumption was minimum (2,607) during April 2020 and maximum (16,292) during May 2021 because the number of patients admitted at a higher rate and the need for oxygen was very high during the second wave of COVID-19 pandemic. The cost of oxygen supplied by the vendor was Rs-260/ cylinder including all charges. Considering only the extra electricity bill paid after working of plants the cost of oxygen is almost half (Rs-154/cylinder). **Conclusion-** The cost of oxygen produced: Oxygen Plant, Covid-19, Oxygen Cylinder, Tertiary Care Hospital, Electricity Unit, IPD Trend

KEYWORDS

INTRODUCTION

Oxygen is an essential lifesaving medicine used for several indications at all levels of health care. The COVID-19 pandemic and its recent second wave have resulted in a surge in demand for necessary resources, including trained staff, hospital beds, and medical supplies like oxygen. India, the second-most populous country, battled for optimal usage of medical infrastructures, such as hospital beds, medical oxygen, and others.¹ Medical oxygen is a widely used life support therapy for various diseases at all levels of health care.²

During the second wave of the COVID-19 pandemic in India, oxygen demand has increased exponentially, resulting in the 'Oxygen Crisis.' In India,³ Given the rapidly increasing cumulative active cases (3.7 million, first week of May 2021), estimates project a much higher oxygen demand of 11–19 thousand MT per day.^{4,5} The Government of India diverted almost all the industrial oxygen for medical use, hoping that the total production can meet hospital demand. However, a relative shortage of cylinders and specialized tankers for storage and transport has precipitated this crisis further. India's Ministry of Health and Family Welfare has fixed the maximum limit for oxygen supply to 40 L/min for an intensive care bed and 15 L/min for a regular bed to limit the wastage.⁶

Children and mothers are often administered medical oxygen to ease breathing when their lives are at risk during medical treatment. Its importance once grew more during the COVID-19 pandemic because of its close association with the respiratory system.⁶ Oxygen is an essential medicine, and despite being vital for the effective treatment of hospitalized COVID-19 patients often cannot access the oxygen they require, resulting in the unnecessary loss of lives.⁷ COVID-19, The pandemic has exacerbated this problem, particularly in 'double-burden' countries which are contending with high levels of pneumonia and COVID-19. As well as meeting the immediate needs of the pandemic. COVID-19 exposed a major weakness in the health systems – that of medical oxygen production and delivery.⁸

India's Ministry of Health and Family Welfare has fixed the maximum limit for oxygen supply to 40 L/min for an intensive care bed and 15 L/min for a regular bed to limit wastage.⁹ World Health Organization has developed a surge calculator tool for COVID-19 to estimate the demand during the surge.¹⁰

Electricity Requirement: Yes

AIM - Critical Appraisal of oxygen demand and cost before, during and after covid-19 pandemic at tertiary care hospital

OBJECTIVES

1. To find the trend of patient admission, and oxygen consumption before, during, and after the COVID-19 pandemic.

2. To compare the cost of oxygen supplied by the vendor and produced by oxygen plants.

METHODOLOGY

Study type: - Database analytical

Study duration: - After ethical permission 15 days for data collection and 15 days for analysis

Study place: - Tertiary health care centre of Jhalawar Medical College

Inclusion criteria: -

1. Electricity bill record from MRD dept from January 2020 to December 2021
2. IPD record of SRG Hospital of Jhalawar medical college from MRD dept since January 2020 to December 2021
3. Oxygen cylinders consumption record from gas agency supplied to SRG hospital from January 2020 to December 2021

Sample size: Not Applicable

Sample frame: Not Applicable

Questionnaire: Not Applicable

Ethical Issues:

The present study would be conducted after getting permission from the institutional ethical committee of Jhalawar Medical College (JMC), Jhalawar.

Research Methodology

We have collected data from hospital records regarding IPD patients, Oxygen cylinders supplied by vendors during 2020 and 2021, we also collected data on electricity unit consumption both in the year 2020 and 2021 and along with O₂ produced by different plants as per their capacity and convert it in terms of the number of cylinders produced per plant. O₂ produced in terms of the cylinder through UNICEF O₂ plant is 100 cylinders/day, through the PSA O₂ plant is 100 cylinders/day, and through the DRDO O₂ plant is 200 cylinders/day.

After collecting particular data from regarding department, we compared the consumption of electricity as well as O₂ supply and production in tertiary care hospitals in terms of the cylinder between the years 2020 and 2021. For calculation of the cost of unit @ Rs 7.50 taken from the electricity bill.

Statistical Methods:

All collected data will be entered in a Microsoft Excel sheet (MS Excel) and calculated from an Excel sheet

RESULTS-

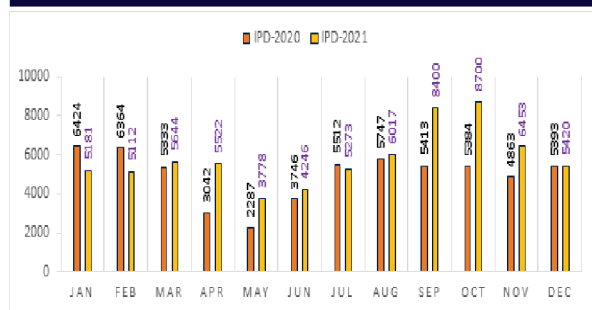


Diagram no. 1: Comparative Records of IPD of Jhalawar medical college.

In above bar diagram showing comparative records of the IPD of Jhalawar medical college from Jan 2020 to Dec 2020 and Jan 2021 to Dec 2021.

In the year 2020 IPD was less in comparison to 2021. In the first two-month, the IPD of 2021 decreased which was high during the same month of the previous year but after that, it was gradually high almost all year in comparison to the same month of the previous year.

Table no. 1: Oxygen cylinder used at Jhalawar medical college.

	2020	2021
Cylinder Supply by the vendor	54,871	44,266
Oxygen Produced by plant	0	67,000
Total	54,871	1,11,266

Above the table no production of Oxygen by the plant in 2020 that's why the total supplied O₂ in 2020 is 54,871 cylinders, which is less in comparison to the supply in 2021 and the number 1,11,266 cylinders in 2021. As we knew 2021 there is a pandemic so the requirement for oxygen exponentially increases in 2021. During this pandemic oxygen supplied by the vendor is 44,266 and produced by the plant is 67,000 cylinders and the total consumption of cylinders is 1,11,266.

Table no. 2: Cost of oxygen produced by the plant as per electricity consumption.

Years	Electricity units	Unit bill Cost @ Rs 7.5 per unit	Oxygen produced
2021	43,31,954	3,24,89,655	67000
2020	29,55,122	2,21,63,415	0
Difference between years	13,76,832	1,03,26,240	67000

The above table shows the electricity bill records and cost of electricity in the year 2020-2021 records are taken from MRD at Jhalawar medical college and also show the difference between the years 2020-2021.

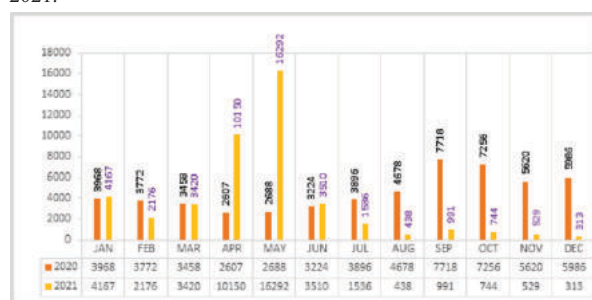


Diagram no. 2: Trend of Oxygen cylinder supplied in Jhalawar medical college 2020-21.

In above diagram This bar diagram shows the consumption of oxygen cylinders per month wise in the years 2020-2021. As we know in the year 2020 total number of 54,871 oxygen cylinders were supplied by vendors. The pattern seen of O₂ cylinders according to IPD records of the hospital in the year 2020 said that in the last quarter of 2020, the demand for oxygen cylinders increased and in the first half of 2021 demand exponentially increased then gradually decreased. From Jan to March 2021, consumption was similar way but from April to May demand for cylinders increased due to the second wave of covid-19. After the second wave of covid-19 demand for O₂ cylinders decreased.

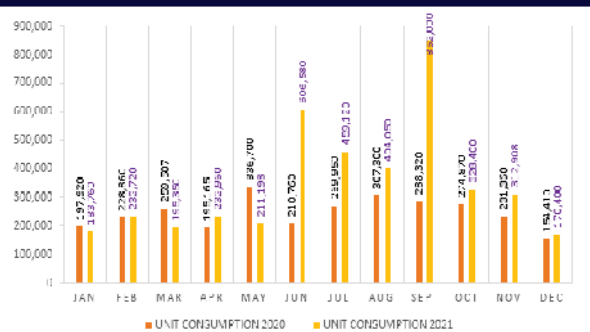


Diagram no. 3: Electricity units consumed at Jhalawar medical college in 2020-21.

Diagram showing month-wise electricity consumption in 2020 and 2021.

Above diagram shows that electricity unit consumption is less in the year 2020 in comparison to the year 2021. The differencing factor between 2020 and 2021 is that from June to September 2021 electricity consumption was very high. According to the electricity bill, we find the difference of units more 13,76,862 than the previous year of calculated months.

Outcomes

Produced by all oxygen plants overall cost of oxygen plants is seen to be lesser than oxygen supplied by the vendor on details analysis. So for saving human life, make hospitals independent, and handling a future crisis like the second wave of covid 19 these plants must be maintained cautiously.

DISCUSSION

A. Comparative records of IPD of Jhalawar medical college.

In the year 2020 due to the closure of all other services and stopping to take admission in other departments, this led to a decrease in IPD from April 20 to June 20. IPD also decreased from April to June due to closing during 1st wave of covid-19 pandemic and then after 1st wave covid pattern of IPD patients same as in previous months. But next year 2021 months of Jan to March same but from April to June decreased the pattern of IPD increased higher to more in August to October due to increasing patient oxygen demand in 2nd wave of covid-19.

B. Oxygen cylinder used at Jhalawar medical college.

The total No. of Oxygen cylinders consumed during the year 2020 were 54,871 which increased to 1,11,266 in the year 2021 due to the high burden of 2nd wave of covid, out of 1,11,226 cylinders more than 55% were supplied by their oxygen plant because 2 plants were installed after 2nd wave of covid-19. The total no. of oxygen cylinders supplied by the vendor in the year 2021 was 44,266 So that approximately oxygen produced by plants was (1,11,266 - 44,266) 67000 cylinders. We assumed the difference in consumption of electricity mainly increased due to the functioning of oxygen plants installed in Jhalawar medical college after 2nd covid wave.

C. Cost of oxygen produced by the plant as per electricity consumption.

Total electricity units increased due to the functioning of all oxygen plants in the year 2021. The rate of units according to the electricity board is 7.5 per rupee. We find in the results that electricity consumption units in the year 2020 were 29,55,122 and the total amount paid by the college in the year 2020 was 29,55,122 * 7.5 = 2,21,63,415 rupees/year. Similarly, electricity consumption units in year 2021 were 43,31,954 and total amount paid by college in year 2021 were 43,31,954 * 7.5 = 3,24,89,655 rupees/year. The difference amounts seen is 3,24,89,655 - 2,21,63,415 = 1,03,26,240 rupees due to the functioning of all oxygen plants in the year 2021. Finally, the cost of an oxygen cylinder is approximately 1,03,26,240 / 67000 = 154.12/per cylinder.

D. The trend of Oxygen cylinders supplied in Jhalawar medical college 2020-21.

In April and May 2021, the consumption of oxygen cylinders was more compared to the same months in the previous year. It is seen that number of oxygen cylinders consumed during 2nd wave covid-19 was five to six times more than the first wave. Requirements for oxygen cylinders suddenly reduced on June 21 due to a smaller number of

covid cases and reduced further due to the functioning of the oxygen plant.

E. Electricity units consumed at Jhalawar medical college in 2020-2021.

Electricity units increased in the year 2021 in comparison to the year 2020 due to the functioning of all oxygen plants. After the installation of UNICEF's plant, there was no gross difference in electricity consumption compared to the same months of the previous year. Electricity bill units were increased 3 times in June 2021 after the functioning of the UK oxygen plant and remain increased by 1.5 to 2 times. In September After the functioning of the DRDO plant only for the consumption of electricity again increases 3 times more than the same months of the previous year and remains consistently high during the next months compared to the same months of the previous year.

RESULTS & DISCUSSION

Need in 2021 total number of oxygen cylinders was 1,11,266 which was 56,395 more than the previous year 2020. Total number of 67,000 oxygen cylinders were produced by plants.

- Cost of oxygen cylinder provided from vendor 262/cylinder + GST (12%)
- The cost of an oxygen cylinder produced by the oxygen plant as we calculated 154.12/ cylinder in our study
- So, the difference amount is $262 - 154 = 108$ rupees (approx.)
- So, we save $67,000 * 108 = 72,36,000$ rupees.
- Even we excluded the maintenance charge of the plant which was Rs. - 20,000 / months $20,000 * 12 = 2,40,000$ / year
- Approximately we save $72,36,000 - 2,40,000 = 6,99,600$ (Rs. - 70,00,000) from the year 2020 to 2021.

We find in our study that oxygen demand in 1st and 2nd waves of covid-19 pandemic capacity beyond the hospital oxygen plant as per our college consumption of oxygen cylinders is very costly. When we Compare electricity units between the years 2020 and 2021, we assume that electricity units are increased due to oxygen plants.

CONCLUSION

Medical oxygen has become a critical lifesaving resource during the COVID-19 pandemic. Detailed knowledge of its production, storage, and distribution to reach the bedside might help plan to overcome the oxygen crisis. As per our study, the cost of oxygen production is cheaper than the supply by the vendor and it also makes health infrastructure strong and independent to fight against any critical situation that leads to increased oxygen demands by the other side Its judicious use and standard measures of safety can prevent wastage and hazards related to this critical resource. As per safety guidelines and at safe hospital locations to prevent any untoward incidents of supply failure, especially during natural disasters.

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