Medical Oxygen Ecosystem Gap Assessment for Uttar Pradesh

December 2025

PATH

This report is based on research funded by the Gates Foundation. The findings and conclusions contained herein are those of the authors and do not necessarily reflect the positions or policies of the Gates Foundation.

The work described in this report was carried out as part of the Strengthening Oxygen Utilization and Respiratory Care Ecosystems (SOURCE) project, an initiative led by PATH to improve equitable access to high-quality respiratory care services at all levels of the health care system and, ultimately, reduce maternal, child, and overall mortality from hypoxemia-related causes. Working closely with global and country stakeholders, the initiative supports governments and partners in focus geographies to advance efforts to reinforce oxygen and respiratory care systems as essential components of national health care systems, pandemic preparedness, and global health architecture.

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Abbreviations

BiPAP	bilevel positive airway pressure
COVID-19	coronavirus disease 2019
CPAP	continuous positive airway pressure
ICU	intensive care unit
LOX	liquid oxygen
NFHS (-3,-4,-5)	National Family Health Survey (third, fourth, or fifth)
PSA	pressure swing adsorption
SNCU	special newborn care unit

Executive summary

Medical oxygen is an essential medicine. Despite its critical role in treating hypoxemia across numerous disease areas, many facilities still lack access to this lifesaving treatment. Therefore, it is important to assess the availability of different sources of oxygen—including the production, delivery, and use of medical oxygen systems—to ensure that resources are prioritized and allocated to meet the demand for oxygen therapy. PATH, in collaboration with the Uttar Pradesh Department of Health and Family Welfare, conducted a biomedical equipment survey in health facilities across the state in January 2024. This initiative was carried out as part of the Strengthening Oxygen Utilization and Respiratory Care Ecosystems (SOURCE) project to support country decision-makers in the development and execution of a comprehensive respiratory care plan to ensure long-term access to medical oxygen and resilient systems for future pandemic response efforts. The project also is pursuing strategies to help prioritize and improve access to oxygen therapy and other essential respiratory care equipment as an integral part of health systems strengthening.

This report analyzes data collected through facility assessments to provide a snapshot of the medical oxygen ecosystem of 149 health facilities in 65 districts across Uttar Pradesh, India. The purpose of this work is to quantify existing oxygen delivery and production equipment, consumables for administering oxygen therapy, bed capacity, and facility infrastructure characteristics. The survey included level 3 public health facilities that, per Uttar Pradesh's standards, should provide respiratory care.

The availability of oxygen services and respiratory care equipment was shown to be highly variable in Uttar Pradesh. Of the 149 facilities surveyed, 83% had pulse oximeters, but in most cases the quantity was too low relative to the number of beds. Additionally, 111 facilities (74%) reported having on-site pressure swing adsorption plants for continuous and reliable oxygen delivery to patients. Most facilities that provide services with high oxygen demand—such as maternity, surgical, and intensive care wards—had oxygen concentrators and cylinders to help maintain a reliable supply. The quantity of small equipment and delivery devices, such as flowmeters and cannulas, varies considerably across facilities and limits the delivery of available oxygen supply to patients.

Intensive care treatment capacity is critical to providing respiratory care to patients with respiratory illnesses across disease areas.

Survey data will inform equitable allocation and redistribution of equipment to ensure that it is placed in facilities where it can be optimally used.

Background

Geography and demographics

Uttar Pradesh, located in northern India, is the most populated state in India with over 241 million inhabitants. It is the fourth largest state by area, covering approximately 243,286 km² (approximately 93,933 square miles). The state shares its borders with Uttarakhand and Nepal to the north, Rajasthan to the west, Haryana, Himachal Pradesh and Delhi to the northwest, Madhya Pradesh, Chattisgarh and Jharkhand to the south and Bihar to the east. Uttar Pradesh is the fourth largest state economy with large economic outputs from grain and sugar, as well as manufacturing.

The state has a relatively low urbanization rate, with only about 24% of its population residing in urban areas as per recent estimates. According to the 2011 census, Uttar Pradesh had a population of 32,988,134, with a density of 414 people per square kilometer. The sex ratio stood at 948 females per 1,000 males. As of 2020, Uttar Pradesh's literacy rate was approximately 66.4% (76.8% for males and 55.4% for females).

Administratively, Uttar Pradesh is divided into 18 divisions and 75 districts. The urban governance structure includes municipal corporations, municipal councils, and Nagar Panchayats, which manage various towns and cities.

Health indicators

Uttar Pradesh's health indicators remain a concern, with limited health care infrastructure, low availability of medical professionals, and high maternal and child mortality rates. The state has made gradual progress in improving maternal and child health outcomes, however. The neonatal mortality rate declined from 38 per 1,000 live births (NFHS-3, 2005–06) to 30 (NFHS-5, 2019–21). Similarly, the infant mortality rate reduced from 50 per 1,000 live births (NFHS-3) to 37 (NFHS-5). However, malnutrition and anemia remain significant public health challenges, particularly among women and children. As per the NFHS-5, an estimated 3.7% of children in Uttar Pradesh suffer from acute respiratory infection or hypoxemia.

Organization of public health facilities

Uttar Pradesh has a multitiered public health care system comprising primary (level 1), secondary (level 2), and tertiary (level 3) health care facilities:

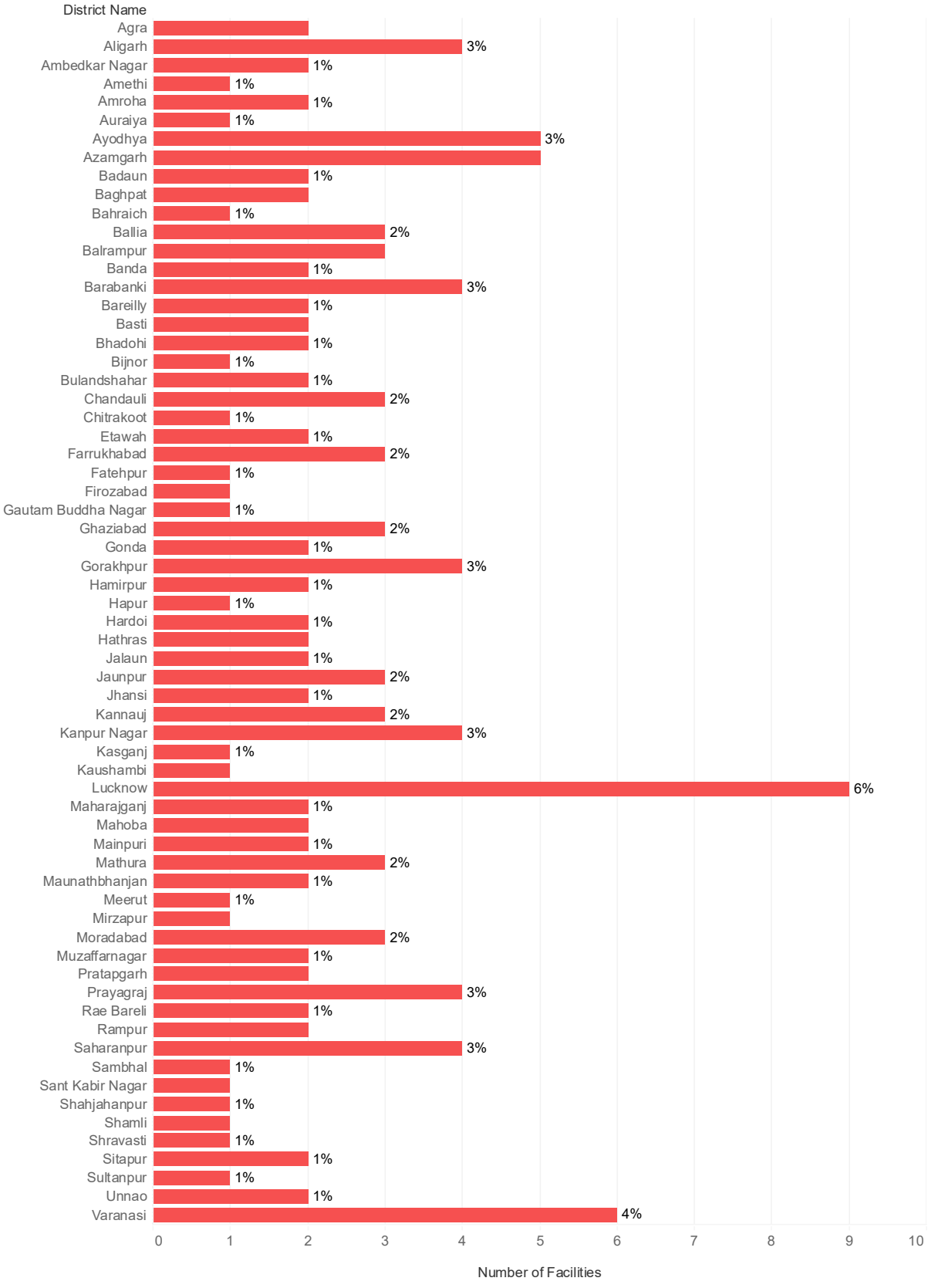
- **Primary health care facilities**: health and wellness centers and primary health centers
- **Secondary health care facilities**: subdivisional, district, and specialized hospitals.
- **Tertiary health care facilities**: medical college hospitals and super-specialty centers.

Despite improvements, Uttar Pradesh faces challenges in health care access, particularly in remote tribal areas, necessitating continued efforts to strengthen its health infrastructure and services.

Survey scope and site selection

A cross-sectional study of respiratory care equipment was conducted in 149 publicly managed level 3 hospitals in 65 of Uttar Pradesh's 75 districts. These hospitals were selected based on budget, Ministry of Health and Family Welfare priorities, and the fact that PATH provides technical assistance for oxygen in these areas. The distribution of health facilities by district was weighted by the total number of facilities in each district. **Figure 1** characterizes the health facilities in the dataset, by subnational distribution.

Figure 1. Health facilities surveyed, by subnational distribution.



Data collection and validation methods

Collection

The biomedical equipment survey data collection tool was adapted by PATH for use in Uttar Pradesh with support from the Directorate General-Medical & Health. The questions included in the survey were informed in part by the World Health Organization's list of priority medical devices for COVID-19 case management.[1]

The instrument was hosted on the Survey CTO platform, and data generated from it were used to develop this report.

Using teams of field investigators, PATH conducted data collection for two months in the 149 sample facilities, in partnership with contracted enumerator firm IQVIA.

Validation

IQVIA employed standard methods to validate data quality during assessment—specifically, spot checks, back checks, and high-frequency checks, with the support of the PATH team—to ensure accuracy and reliability:

- **Spot checks**: IQVIA state supervisors conducted random visits to health care facilities to observe the survey process. Spot checks helped to ensure correct and consistent implementation of data collection procedures. Any issues identified during spot checks were promptly addressed and communicated to the IQVIA core team for resolution.
- **Back checks**: Back checks were conducted in coordination with the PATH team, involving a sample of 10% of the facilities surveyed. These checks involved re-surveying a random sample of initially surveyed health facilities to compare their responses with the original survey data. Discrepancies or inconsistencies were highlighted and addressed to rectify errors or biases.
- **High-frequency checks**: The IQVIA core team regularly monitored data collection activities throughout the review of completed questionnaires, examination of data entry logs, and periodic data quality assessments. The team also consulted key nodal persons at health care facilities to verify any issues and ensure clarity on key indicators or data points. All issues related to data collection were resolved in consultation with facility staff and data collectors.

Results

This section describes the scope of the facility assessments, key characteristics observed (e.g., bed counts), and factors that may constrain respiratory care treatment capacity. Observations on the availability of oxygen delivery equipment, oxygen production equipment, and consumables within health facilities are highlighted throughout the report. Other devices described include ventilators, pulse oximeters, oxygen concentrators, pressure swing adsorption (PSA) plants, and various types of oxygen masks and airways.

Facility characteristics

Critical care services

Services available at the facilities surveyed are detailed in **Table 1**. Critical care services for respiratory care include emergency wards, intensive care units (ICUs), neonatal and maternity wards, high-dependency units, and surgical wards.

Table 1. Percentage of health facilities reporting service ward.

Ward/unit type	% of level 2 facilities
Emergency	91%
Intensive care	19%
Maternity	55%
Special newborn care	42%
Pediatric	34%
Surgery (male)	53%
Surgery (female)	64%
Tuberculosis	19%
Adult high dependency	15%
Pediatric high dependency	7%

Bed capacity for surveyed level 2 facilities

Treatment capacity can be significantly constrained by the number of available beds (for both general and ICU patients). Intensive care beds are especially important in the care of patients with severe and critical illnesses involving hypoxemia, as they are needed to support consistent oxygen therapy at higher flow

rates. Intensive care bed requirements are not standardized globally, and health care workers' perceptions of what constitutes an intensive care bed can vary. In this survey, it was defined as a bed capable of providing mechanical ventilation and/or sustained oxygen for severe acute respiratory illness. It is important to note that, even if a bed may be capable of providing mechanical ventilation and/or sustained oxygen, a facility may not have sufficient ventilators and/or oxygen supply to provide those services to patients.

The total number of beds in all wards across the 149 facilities surveyed was 21,318 (**Table 2**). Facility bed counts vary widely. Balrampur Hospital Lucknow has the largest number, with 726 beds, and Trauma Center Jaunpur has the smallest number, with 4 beds. Hospitals provide services according to catchment size.

Table 2. Summary statistics for bed capacity across 149 surveyed level 2 facilities.

Count type	Capacity
Total	21,318
Minimum	4
Maximum	726
Average	143

Infrastructure

While bed counts are essential for evaluating health facility treatment capacity, additional characteristics can impact effective provision of care, such as the type of electricity source used and the variety and number of clinical staff available. Where constraints in these two areas are an issue, it is important to have alternative oxygen sources and medical devices readily available, such as bedside cylinders, ventilators, and oxygen concentrators.

Primary sources of electricity

All 149 surveyed facilities, reported that their primary power source is the central electricity grid, (**Table 3**).

Table 3. Primary electricity sources of surveyed health facilities.

	# of facilities	% of facilities
Central electricity grid	149	100%
Power generator	0	0%
Grand total	**149**	**100%**

Staffing

Among the surveyed facilities, 36% reported having available biomedical engineers and/or technicians for the maintenance of medical devices, including respiratory care equipment. **Table 4** outlines the availability of biomedical engineers in level 3 facilities.

Table 4. Availability of biomedical engineers in surveyed level 2 facilities.

# of facilities with biomedical engineers and/or technicians		**# of facilities without biomedical engineers and/or technicians**	
# of facilities	% of reporting facilities	# of facilities	% of reporting facilities
53	36%	96	64%

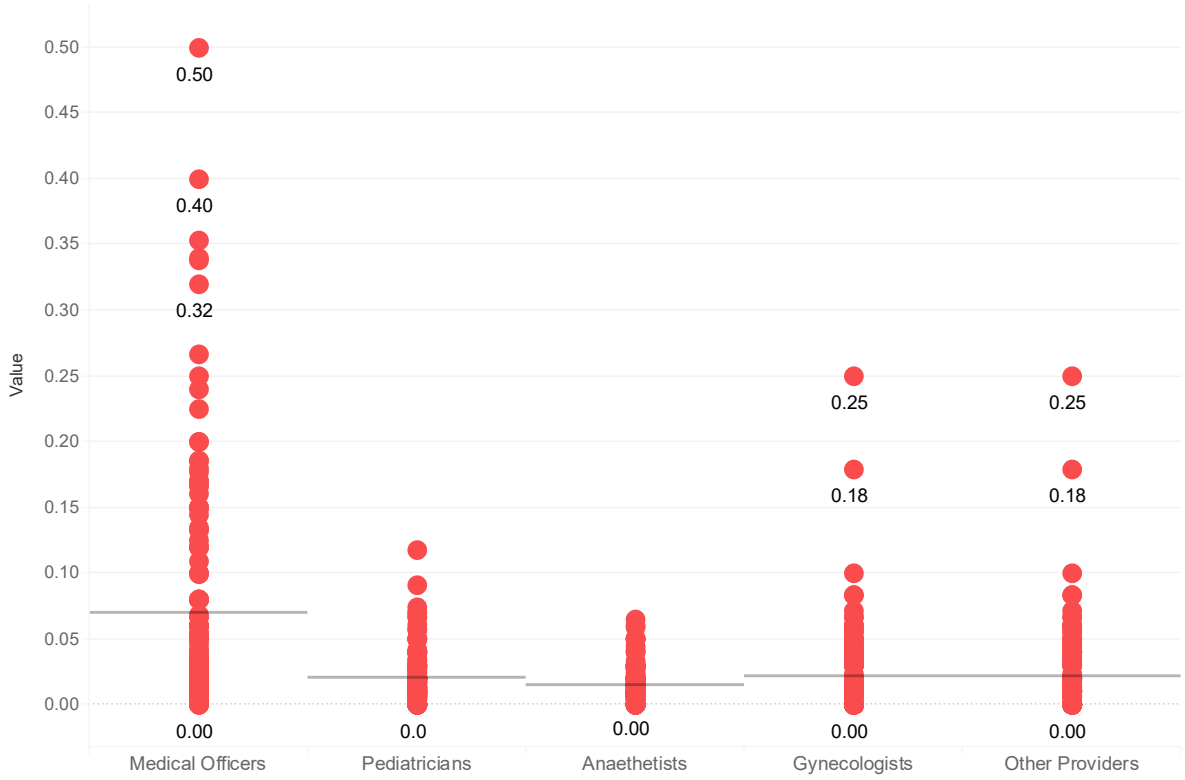
Clinical staffing numbers vary across facilities. Not all clinical staff within the same health cadre are trained specifically to provide respiratory care. **Table 5** outlines the availability of staff trained in respiratory care in the surveyed level 2 facilities.

Table 5. Average numbers of clinical staff in surveyed level 2 facilities.

Human resource	**Average # per facility**
Doctors	8
Anesthetists	2
Gynecologists	2
Pediatricians	2

A comparison of available staffing relative to the number of beds within a facility is presented in **Figure 2**. Looking at the most resourced health cadres, per bed there is an average of 0.07 medical officers, 0.01 anesthetists, 0.02 pediatricians, 0.02 gynecologists, and 0.02 other providers.

Figure 2. Staff-to-bed ratios, by clinical cadre.



Respiratory care capacity

The provision of oxygen varies by district and facility. There are multiple components of a medical oxygen ecosystem involved in delivering respiratory care, including having an adequate and reliable supply and the necessary equipment to deliver oxygen to patients. Oxygen can be supplied to a facility through bulk oxygen resources—such as oxygen production plants, liquid oxygen (LOX) tanks, and cylinder manifolds—or through bedside resources such as cylinders and concentrators (see “Hypoxemia Treatment” section for more information on bedside resources).

Bulk oxygen production and supply

Of the 149 facilities surveyed, 23 did not have access to a bulk oxygen source. The 126 facilities with a bulk oxygen source have either a PSA oxygen generation plant or a bulk oxygen storage source like a cylinder manifold or LOX tank, or a combination of both. **Table 6** summarizes the mix of bulk oxygen production and storage sources across the surveyed facilities.

Table 6. Distribution of bulk oxygen sources among surveyed level 2 facilities.

Type of bulk oxygen	# of facilities
None	23
PSA plant only	36
Manifold only	14
PSA plant + manifold	59
PSA + LOX	5
PSA + LOX + manifold	11
LOX + manifold	1
Grand total	**149**

Abbreviations: LOX, liquid oxygen; PSA, pressure swing adsorption.

PSA plants

PSA oxygen-generating plants are a source of medical-grade oxygen. A PSA oxygen generator plant is a unit designed to concentrate oxygen from ambient air at scale, with output capacity varying according to calculated oxygen demand, typically ranging from 2 Nm^3/hour to 200 Nm^3/hour, or 2,000 to 200,000 liters per minute. Oxygen produced from PSA plants can be either piped directly to the wards or further compressed to fill cylinders via a supplemental booster compressor and a cylinder filling ramp or manifold.[2]

The majority of PSA oxygen plants have been installed since the onset of the COVID-19 pandemic in 2020. **Figures 3 and 4** show total number of PSA plants and average production capacity, respectively, at level 2 facilities.

Figure 3. Total number of pressure swing adsorption plants, by year of installation.

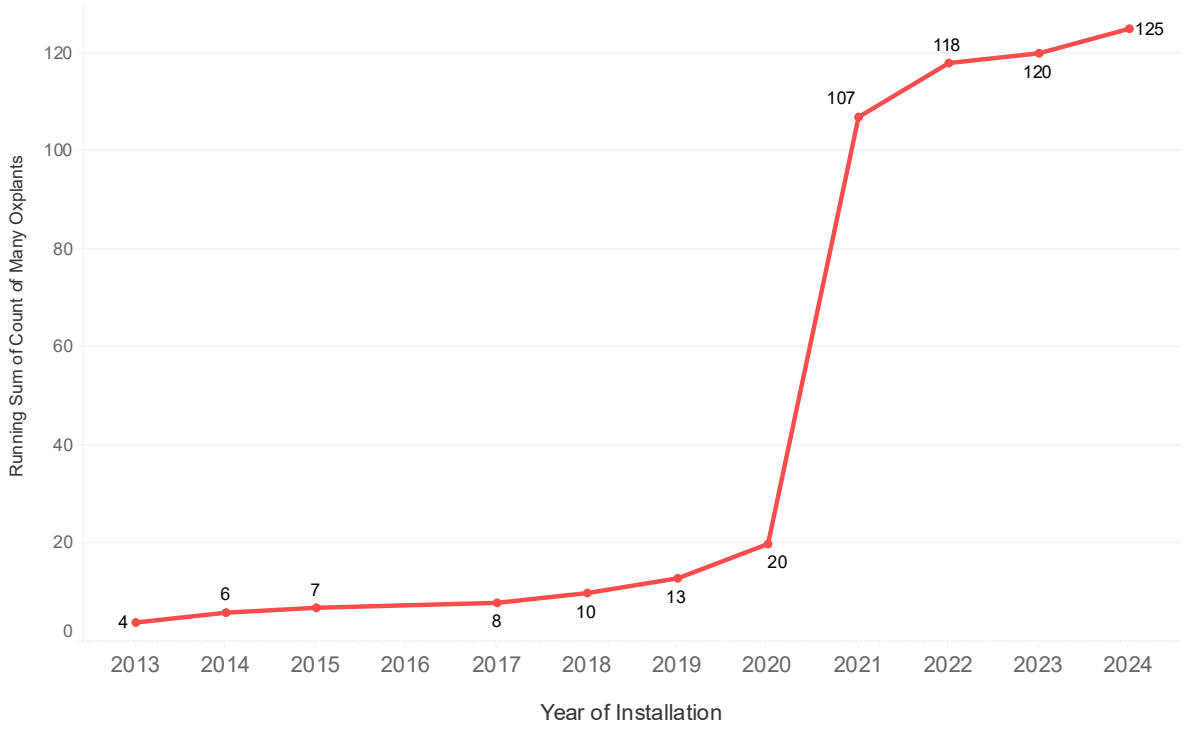
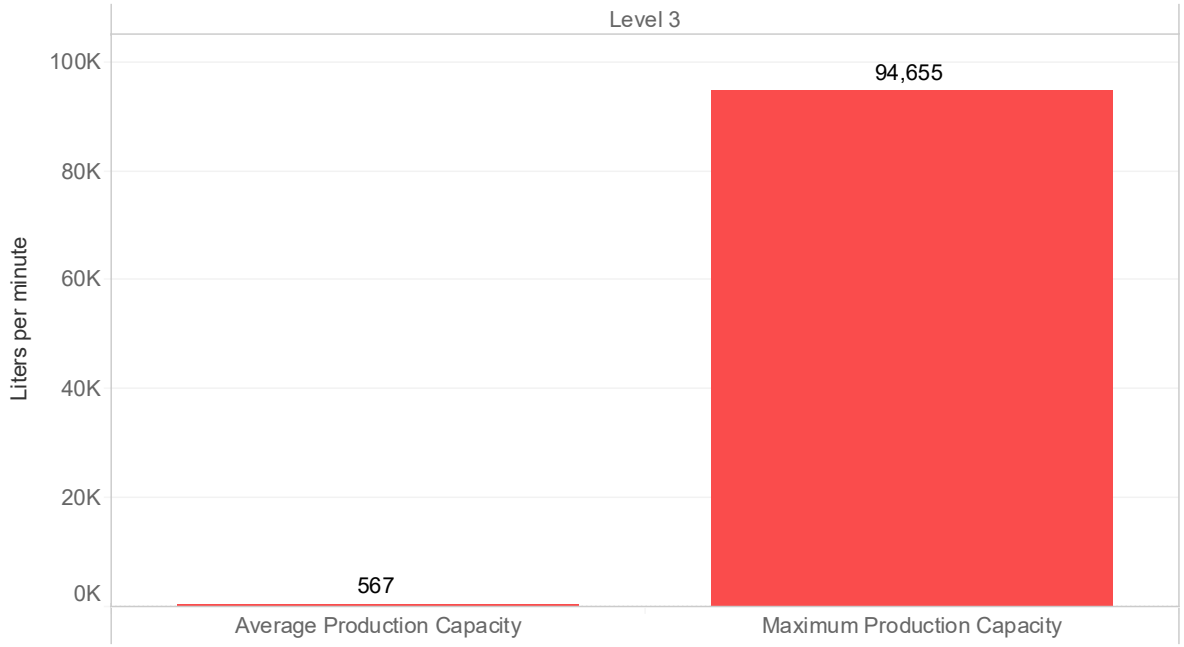


Figure 4. Average production capacity of pressure swing adsorption plants.



PSA plants in Uttar Pradesh have an average production capacity of 567 liters per minute. About 87% of PSA plants operate year-round, and 36% of PSA plants operate 24 hours per day.

Of the 149 facilities surveyed, 111 had a PSA plant, or approximately 75%. There are a total of 125 PSA plants, with many facilities having more than one. Availability of PSA plants vary by district. However, all districts had at least one facility with a PSA plant (**Table 7**).

Table 7. Distribution of facilities with and without pressure swing adsorption plants, by district.

	Facilities with plant		Facilities without plant	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Agra	2	1%	0	0%
Aligarh	4	3%	0	0%
Ambedkar Nagar	2	1%	0	0%
Amethi	1	1%	0	0%
Amroha	1	1%	0	0%
Auraiya	1	1%	0	0%
Ayodhya	5	3%	0	0%
Azamgarh	4	3%	1	1%
Badaun	1	1%	0	0%
Baghpat	1	1%	0	0%
Bahraich	1	1%	0	0%
Ballia	2	1%	0	0%
Balrampur	2	1%	1	1%
Banda	1	1%	0	0%
Barabanki	4	3%	0	0%
Bareilly	1	1%	0	0%
Basti	1	1%	0	0%
Bhadohi	1	1%	0	0%
Bijnor	1	1%	0	0%
Bulandshahar	2	1%	0	0%

	Facilities with plant		Facilities without plant	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Chandauli	3	2%	0	0%
Chitrakoot	1	1%	0	0%
Etawah	1	1%	0	0%
Farrukhabad	3	2%	0	0%
Fatehpur	0	0%	1	1%
Firozabad	1	1%	0	0%
Gautam Buddha Nagar	1	1%	0	0%
Ghaziabad	3	2%	0	0%
Gonda	1	1%	0	0%
Gorakhpur	3	2%	0	0%
Hamirpur	2	1%	0	0%
Hapur	1	1%	0	0%
Hardoi	0	0%	2	1%
Hathras	1	1%	0	0%
Jalaun	1	1%	0	0%
Jaunpur	2	1%	0	0%
Jhansi	1	1%	0	0%
Kannauj	3	2%	0	0%
Kanpur Nagar	2	1%	0	0%
Kasganj	1	1%	0	0%
Kaushambi	0	0%	1	1%
Lucknow	7	5%	1	1%
Maharajganj	2	1%	0	0%
Mahoba	2	1%	0	0%
Mainpuri	2	1%	0	0%

	Facilities with plant		Facilities without plant	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Mathura	3	2%	0	0%
Maunath Bhanjan	1	1%	1	1%
Meerut	1	1%	0	0%
Mirzapur	0	0%	1	1%
Moradabad	1	1%	2	1%
Muzaffarnagar	2	1%	0	0%
Pratapgarh	2	1%	0	0%
Prayagraj	1	1%	3	2%
Rae Bareli	2	1%	0	0%
Rampur	1	1%	1	1%
Saharanpur	4	3%	0	0%
Sambhal	1	1%	0	0%
Sant Kabir Nagar	1	1%	0	0%
Shahjahanpur	0	0%	1	1%
Shamli	1	1%	0	0%
Shravasti	1	1%	0	0%
Sitapur	2	1%	0	0%
Sultanpur	1	1%	0	0%
Unnao	0	0%	2	1%
Varanasi	5	3%	1	1%

LOX tanks

LOX tanks hold cryogenic liquid oxygen, which is vaporized into gaseous oxygen for medical use.[3] Of the 65 districts surveyed, 15 had an LOX tank installed with a storage capacity of 10,000 liters (**Table 8**).

Table 8. Level 2 facilities surveyed with liquid oxygen tank capacity, by district.

	Facility	Capacity (L)
Bahraich	100-bed Maternal and Child Health Wing	10,000
Barabanki	District Male Hospital	10,000
	District Women Hospital	10,000
Farrukhabad	Dr. Ram Manohar Lohia District Male Hospital	10,000
Ghaziabad	MMG District Hospital	10,000
Hathras	District Male Hospital	10,000
Jaunpur	District Women Hospital	10,000
Kannauj	100-bed Maternal and Child Health Wing	10,000
Kasganj	District Combined Hospital	10,000
Lucknow	Dr. Shyama Prasad Mukherjee Civil Hospital	10,000
Mainpuri	District Male Hospital	10,000
Muzaffarnagar	District Male Hospital	10,000
Rampur	District Male Hospital	10,000
Saharanpur	District Women Hospital	10,000
Shamli	District Combined Hospital	10,000
Sitapur	District Women Hospital	10,000

Cylinder manifolds

Cylinder manifolds allow oxygen to be piped to various wards. They can hold multiple cylinders and automatically switch from depleted to full cylinders to maintain a steady flow of oxygen.[4] An oxygen cylinder filling station is a facility or equipment setup designed to refill empty oxygen cylinders. Of the 149 facilities surveyed, 85 had a cylinder manifold or filling station, representing approximately 57% of facilities (**Table 9**). Emergency rooms, surgical wards, and maternity wards were most likely to be connected to a cylinder manifold.

Table 9. Availability of cylinder manifolds / filling stations among level 2 facilities surveyed.

Availability status	# of facilities
Has manifold / filling station	85
Does not have manifold / filling station	64
Total	**149**

The availability of cylinder manifolds and filling stations varies by district, with 54 of the 65 districts surveyed having at least one facility equipped with a cylinder manifold and/or filling station (**Table 10**).

Table 10. Distribution of facilities with and without cylinder manifolds or filling stations, by district.

	Facilities with cylinder manifold or filling station		Facilities without cylinder manifold or filling station	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Agra	2	100%	0	0%
Aligarh	2	50%	2	50%
Ambedkar Nagar	2	100%	0	0%
Amethi	0	0%	1	100%
Amroha	0	0%	2	100%
Auraiya	1	100%	0	0%
Ayodhya	4	80%	1	20%
Azamgarh	4	80%	1	20%
Badaun	1	50%	1	50%
Baghpat	0	0%	2	100%
Bahraich	1	100%	0	0%
Ballia	1	33%	2	67%
Balrampur	3	100%	0	0%
Banda	1	50%	1	50%

	Facilities with cylinder manifold or filling station		Facilities without cylinder manifold or filling station	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Barabanki	4	100%	0	0%
Bareilly	1	50%	1	50%
Basti	1	50%	1	50%
Bhadohi	1	50%	1	50%
Bijnor	1	100%	0	0%
Bulandshahar	0	0%	2	100%
Chandauli	2	67%	1	33%
Chitrakoot	0	0%	1	100%
Etawah	1	50%	1	50%
Farrukhabad	0	0%	3	100%
Fatehpur	0	0%	1	100%
Firozabad	1	100%	0	0%
Gautam Buddha Nagar	0	0%	1	100%
Ghaziabad	1	33%	2	67%
Gonda	1	50%	1	50%
Gorakhpur	3	75%	1	25%
Hamirpur	1	50%	1	50%
Hapur	1	100%	0	0%
Hardoi	2	100%	0	0%
Hathras	1	50%	1	50%
Jalaun	1	50%	1	50%
Jaunpur	2	67%	1	33%

	Facilities with cylinder manifold or filling station		Facilities without cylinder manifold or filling station	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Jhansi	1	50%	1	50%
Kannauj	0	0%	3	100%
Kanpur Nagar	4	100%	0	0%
Kasganj	1	100%	0	0%
Kaushambi	0	0%	1	100%
Lucknow	7	78%	2	22%
Maharajganj	2	100%	0	0%
Mahoba	2	100%	0	0%
Mainpuri	1	50%	1	50%
Mathura	0	0%	3	100%
Maunath Bhanjan	2	100%	0	0%
Meerut	1	100%	0	0%
Mirzapur	1	100%	0	0%
Moradabad	1	33%	2	67%
Muzaffarnagar	0	0%	2	100%
Pratapgarh	1	50%	1	50%
Prayagraj	0	0%	4	100%
Rae Bareli	1	50%	1	50%
Rampur	1	50%	1	50%
Saharanpur	2	50%	2	50%
Sambhal	0	0%	1	100%
Sant Kabir Nagar	1	100%	0	0%

	Facilities with cylinder manifold or filling station		Facilities without cylinder manifold or filling station	
	# of facilities	% of facilities within district	# of facilities	% of facilities within district
Shahjahanpur	1	100%	0	0%
Shamli	0	0%	1	100%
Shravasti	1	100%	0	0%
Sitapur	2	100%	0	0%
Sultanpur	1	100%	0	0%
Unnao	1	50%	1	50%
Varanasi	3	50%	3	50%

Piping

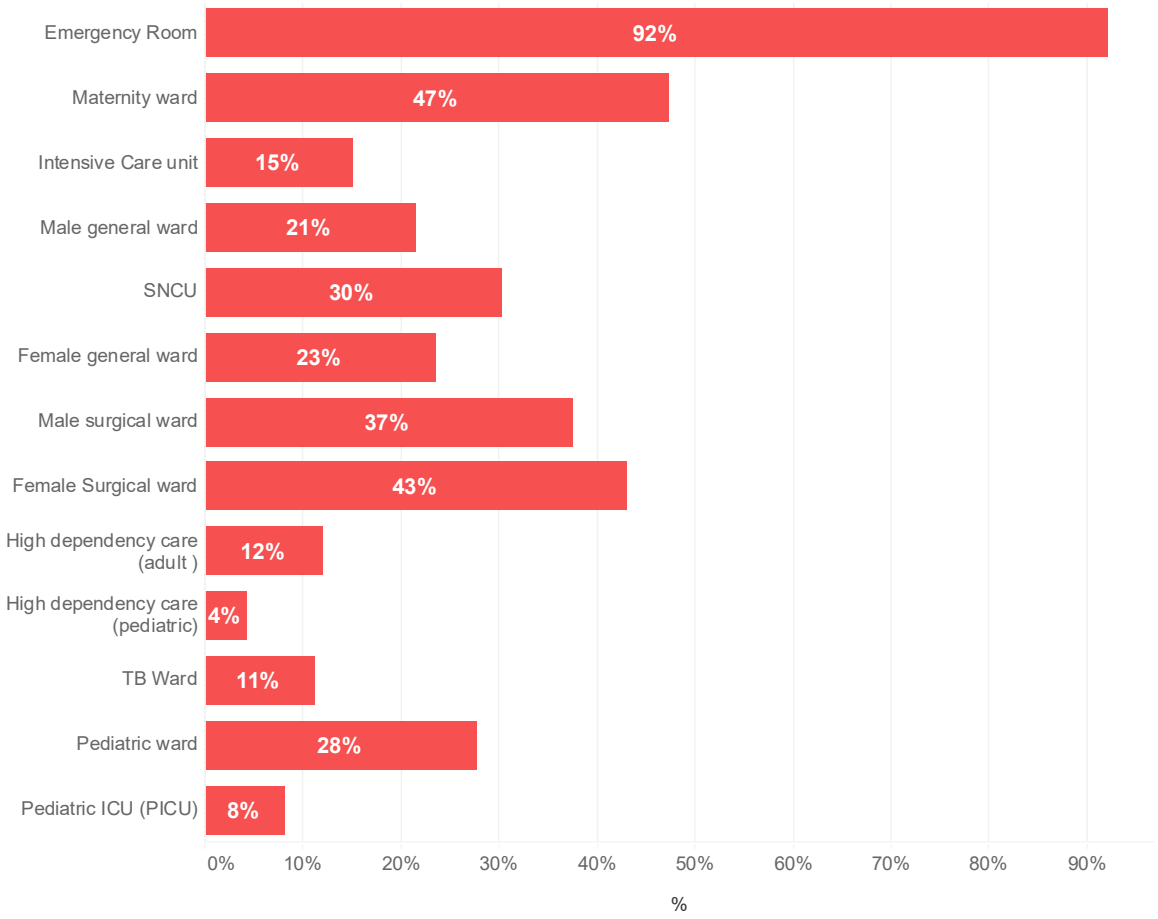
Piping for medical oxygen is required only when a bulk source—PSA plant, cylinder manifold, or LOX tank—is available to efficiently distribute oxygen within a health facility. Out of the 149 facilities assessed, 128 (86%) reported having oxygen piping. Of these 128 facilities, 122 (95%) had an associated bulk oxygen source (**Table 11**).

Table 11. Number of facilities surveyed with piping, with and without a bulk oxygen source.

	With bulk oxygen source		Without bulk oxygen source	
Source type	# of facilities	% of the reporting facilities	# of facilities	% of the reporting facilities
Oxygen only	33	25%	4	3%
Oxygen and air	19	15%	0	0%
Oxygen, air, and vacuum	70	55%	2	2%
Total	**122**	**95%**	**6**	**5%**

Among facilities with piping infrastructure, critical wards with high oxygen demand—such as ICUs, emergency rooms, high-dependency care units, and special newborn care units—are fully piped, while maternity wards reported being 95% piped. However, access to piped oxygen may be limited by the number of available bedside wall units. **Figure 5** shows the percentage of wards with bedside wall units.

Figure 5. Percentage of wards with bedside wall units.



Abbreviation: SNCU, special newborn care unit.

Emergency vehicles

Emergency vehicles equipped with an oxygen source are important for transporting patients both to health facilities and between facilities for more specialized care. **Table 12** shows the number of surveyed facilities that reported having at least one emergency vehicle equipped with an oxygen source, such as a concentrator.

Table 12. Facilities surveyed with emergency vehicles that are or are not equipped with oxygen.

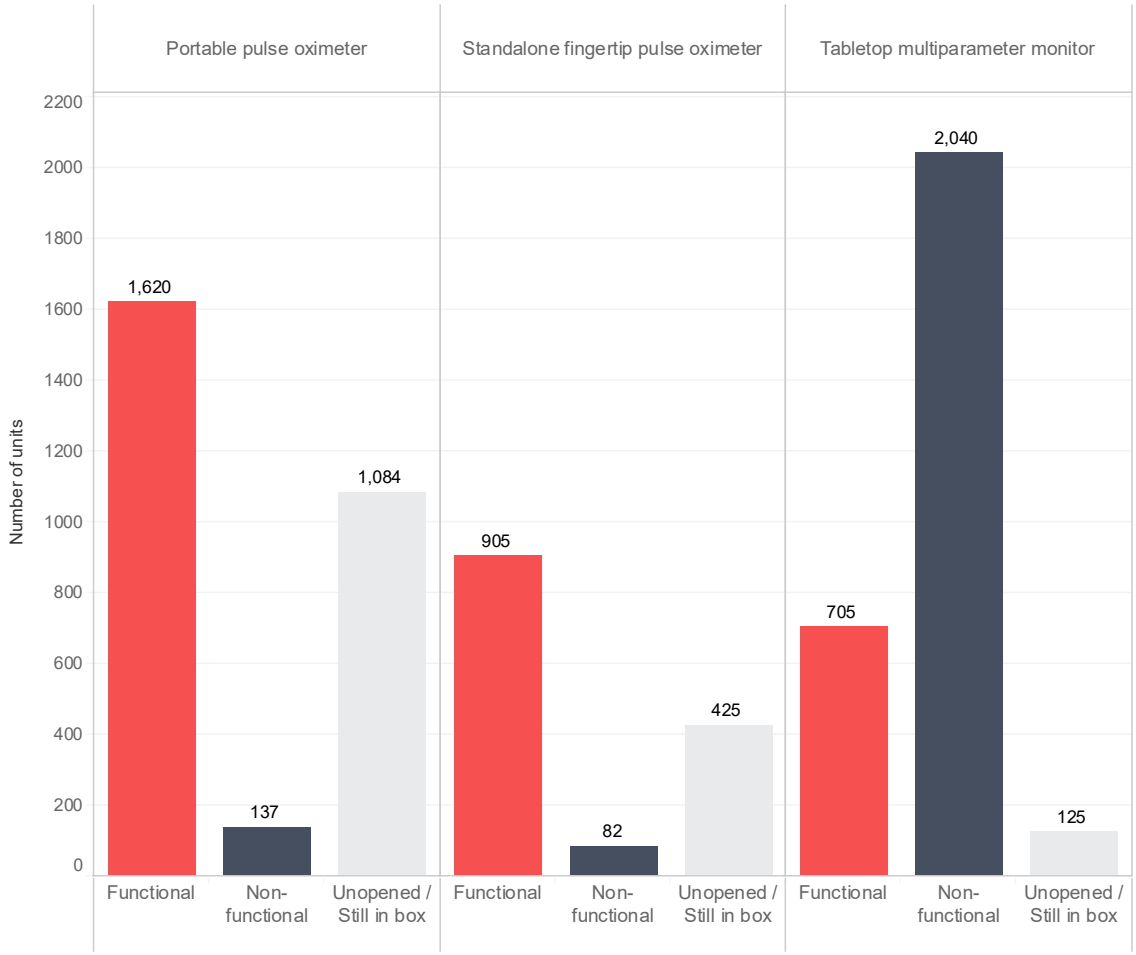
	# of facilities	% of facilities
Equipped with oxygen	83	56%
Not equipped with oxygen	66	44%

Hypoxemia screening

Pulse oximeters

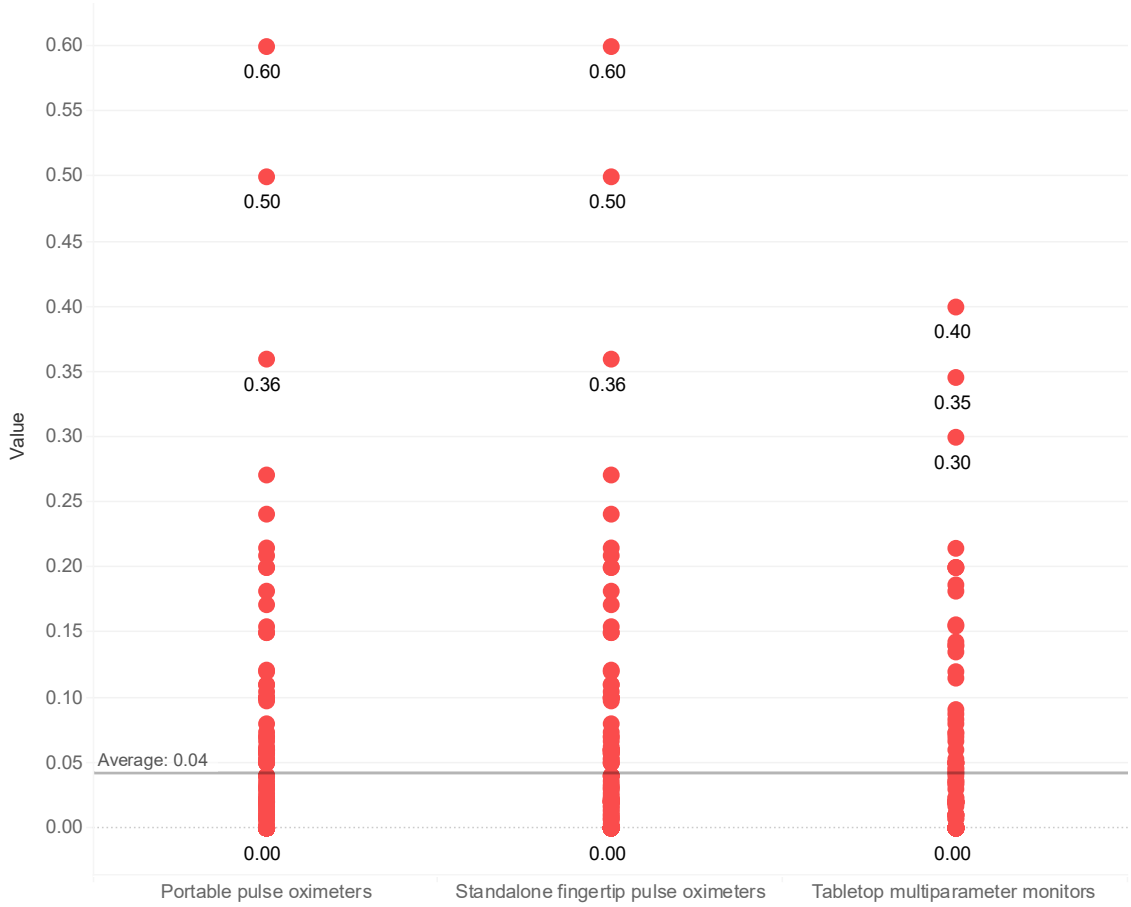
Pulse oximeters are essential for timely diagnosis of hypoxemia (low blood oxygen levels) and are important for safe oxygen therapy across various applications, including COVID-19 treatment, surgery, pneumonia treatment in both children and adults, and neonatal care.[4] Survey respondents reported using three types of devices for patient monitoring and pulse oximetry: portable pulse oximeters, tabletop multiparameter monitors, and standalone fingertip pulse oximeters (**Figure 6**). For all equipment, a functional device is one that powers on and is not visibly damaged. This definition does not reflect the device's calibration status or quality.

Figure 6. Availability and functionality of pulse oximeters and patient monitors in surveyed facilities.



Ideally, oxygen therapy is administered with pulse oximetry; therefore, it is useful to compare pulse oximeter quantities to bed counts and to counts of other respiratory care equipment. For all types of pulse oximeters, there is an average of one device to every 25 beds in a facility. This is highly variable across facilities, with District Hospital Mainpuri reporting the most devices at a ratio of 0.60 (1 pulse oximeter to every 1.7 beds) and 47 facilities (approximately 32%), reporting no pulse oximeters (**Figure 7**).

Figure 7. Ratio of pulse oximeters and patient monitors to beds across surveyed facilities.

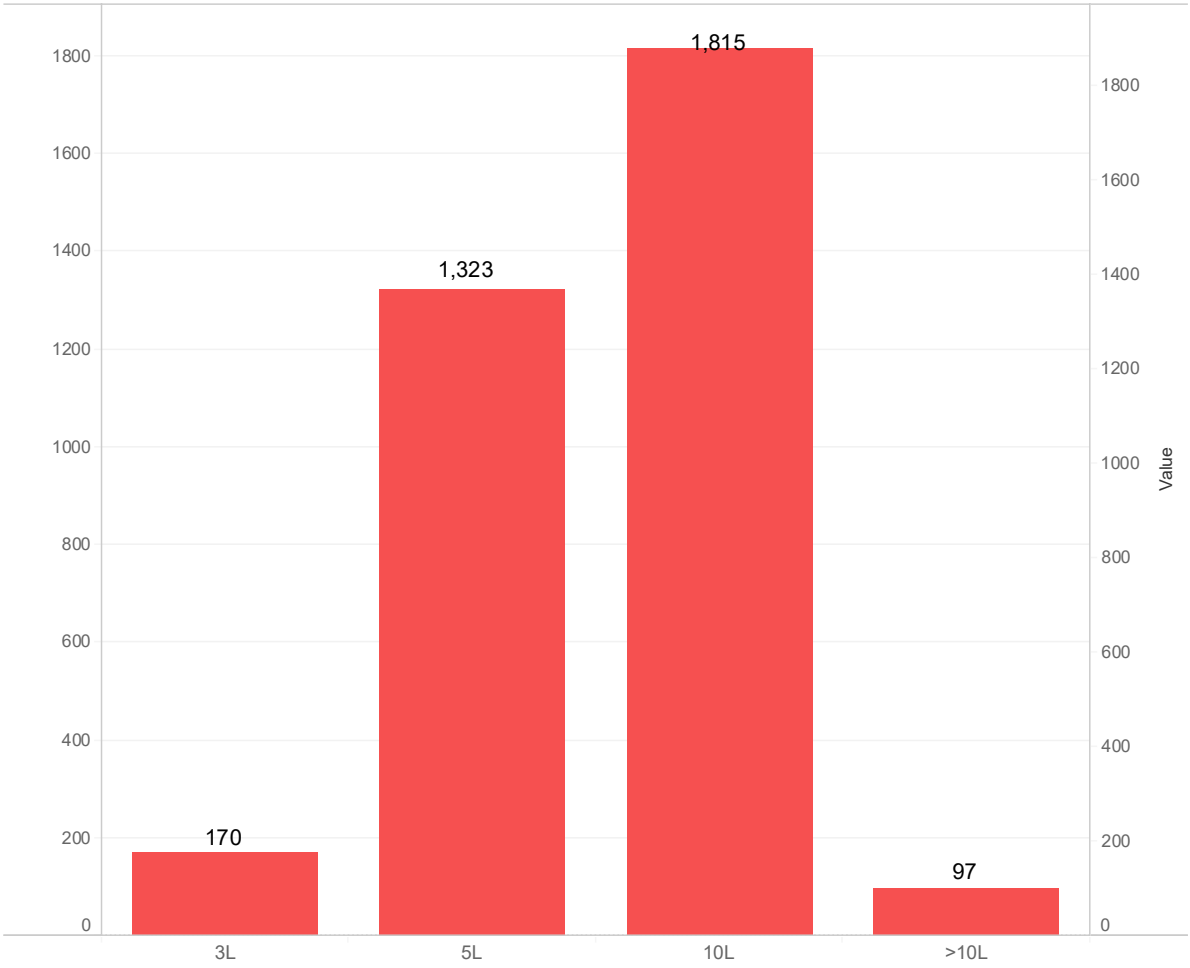


Hypoxemia treatment

Concentrators

Oxygen concentrators produce medical oxygen from atmospheric air. They provide a continuous source of oxygen, assuming regular maintenance and the availability of necessary consumables and delivery devices (such as masks and tubing).[5] The World Health Organization recommends high flow rates (above 10 liters per minute) for severe and critical COVID-19 patients.[5] Oxygen provided at lower flow rates is critical for treatment of respiratory distress and other illnesses. **Figure 8** shows the distribution of concentrators by flow rate across the surveyed facilities.

Figure 8. Number of oxygen concentrators in surveyed facilities, by flow rate capacity.



Of the 149 facilities surveyed, 122 have oxygen concentrators. **Table 13** presents the availability of concentrators in critical wards of surveyed facilities.

Table 13. Availability of oxygen concentrators in critical wards.

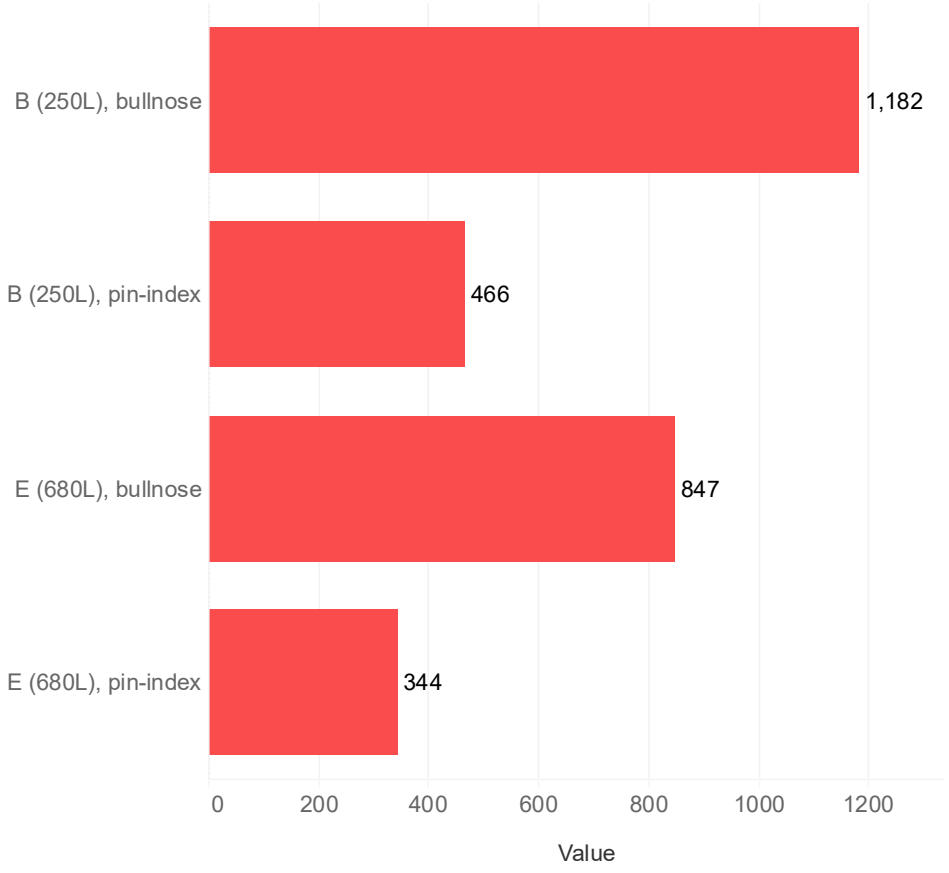
Ward/unit type	# of facilities with concentrators	Total # of reporting facilities
Emergency	108	116
Surgical (female)	32	34
High-dependency care (adult)	8	8
High-dependency care (pediatric)	2	2
Intensive care	11	12

Ward/unit type	# of facilities with concentrators	Total # of reporting facilities
Surgical (male)	30	32
Maternity	40	44
Pediatric	18	18
Pediatric intensive care	7	7
Special newborn care	28	29
Tuberculosis	7	7
Grand total	**122**	**132**

Cylinders

Oxygen cylinders are metal canisters that must be refilled regularly and delivered to health facilities by an oxygen supplier. They require minimal maintenance and no electricity, making them suitable in settings with poor infrastructure.[3] However, like other oxygen delivery and production devices, they depend on the availability of consumables such as refills, masks, tubing, and cylinder assembly units to facilitate oxygen delivery. **Figure 9** shows the total number of cylinders by size and connection type across the 149 facilities surveyed.

Figure 9. Number of oxygen cylinders by size and connection type across surveyed facilities.



Size “B” cylinders were the most commonly used across health facilities, particularly the 250 L bullnose type.

Reported weekly cylinder procurement costs varied by facility, ranging from US$0.11 to $34.00. More detailed pricing data are needed to better understand cylinder procurement costs.

Of the 149 facilities surveyed, 58 reported having no available cylinders on the day of the survey. The distribution of available cylinders by district is shown in **Table 14**. On average, cylinders are filled and transported 23 kilometers from the filling plant to a health facility.

Table 14. Number of available oxygen cylinders per each surveyed district.

District	# of cylinders
Agra	78
Aligarh	45
Ambedkar Nagar	57
Amethi	0
Amroha	0
Auraiya	10
Ayodhya	208

District	# of cylinders
Azamgarh	45
Badaun	38
Baghpat	46
Bahraich	0
Ballia	17
Balrampur	66
Banda	17
Barabanki	28
Bareilly	55
Basti	87
Bhadohi	0
Bijnor	0
Bulandshahar	18
Chandauli	12
Chitrakoot	6
Etawah	0
Farrukhabad	0
Fatehpur	0
Firozabad	90
Gautam Buddha Nagar	0
Ghaziabad	41
Gonda	155
Gorakhpur	142
Hamirpur	20
Hapur	1
Hardoi	0
Hathras	9
Jalaun	63
Jaunpur	54
Jhansi	14
Kannauj	0
Kanpur Nagar	78
Kasganj	8
Kaushambi	0
Lucknow	749
Maharajganj	2
Mahoba	20

District	# of cylinders
Mainpuri	0
Mathura	26
Maunath Bhanjan	14
Meerut	0
Mirzapur	0
Moradabad	0
Muzaffarnagar	0
Pratapgarh	60
Prayagraj	0
Rae Bareli	281
Rampur	39
Saharanpur	28
Sambhal	0
Sant Kabir Nagar	9
Shahjahanpur	0
Shamli	0
Shravasti	65
Sitapur	20
Sultanpur	0
Unnao	157
Varanasi	204
Grand total	**3,182**

High-flow oxygen delivery devices

Ventilators

Ventilators pump air with supplemental oxygen into a patient's airways during severe respiratory distress, when they are unable to breathe on their own.[6] Ventilators require patients to be intubated. These devices are often key components of ICU beds. Facilities were assessed for two types of ventilators: transportable/portable and stationary intensive care. Ventilators are limited across medical facilities in Uttar Pradesh, with only 53 of the 149 facilities (36%) reporting having any. **Figure 10** shows the number of ventilators by type and functionality.

Figure 10. Number of ventilators by type and functionality.

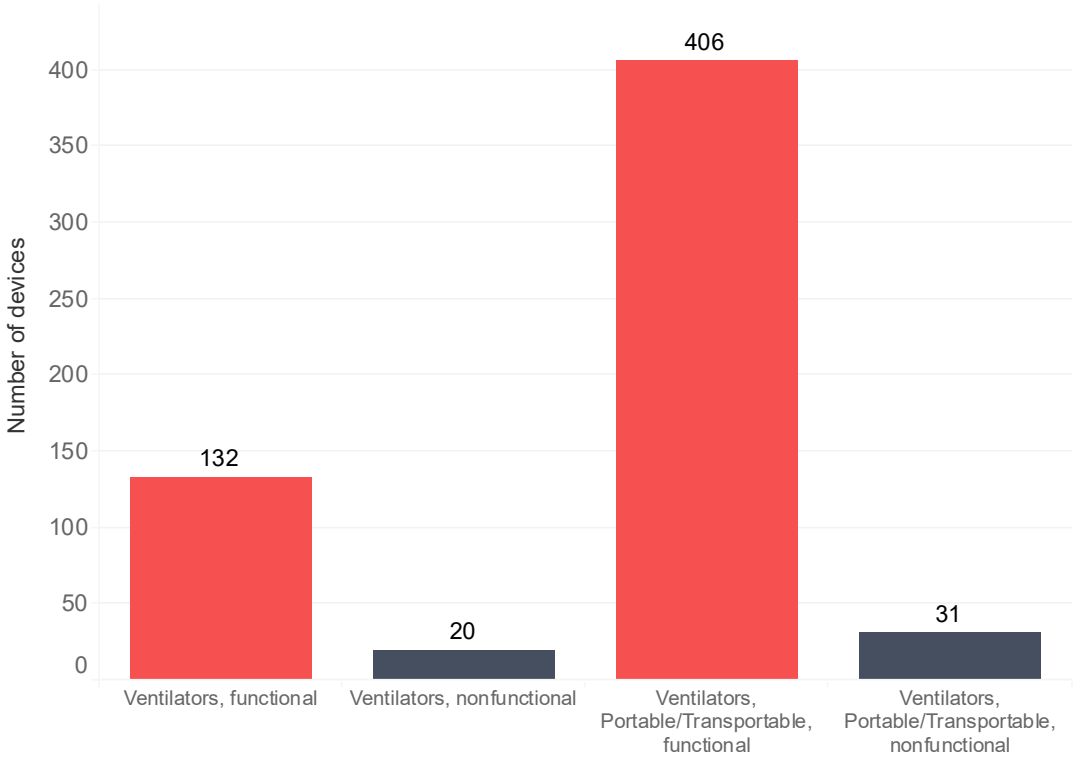


Table 15 shows the distribution of ventilators across the 65 surveyed districts.

Table 15. Distribution of ventilators by district and functionality.

District	Stationary, functional	Stationary, nonfunctional	Portable / transportable, functional	Portable / transportable, nonfunctional
Agra	12	0	0	0
Aligarh	7	7	0	0
Ambedkar Nagar	10	0	2	0
Amethi	12	12	0	0
Amroha	0	0	0	0
Auraiya	0	0	20	0
Ayodhya	6	0	38	0
Azamgarh	5	0	11	2
Badaun	0	0	0	0
Baghpat	0	0	19	0
Bahraich	0	0	0	0
Ballia	2	0	8	0

District	Stationary, functional	Stationary, nonfunctional	Portable / transportable, functional	Portable / transportable, nonfunctional
Balrampur	0	0	9	0
Banda	0	0	0	0
Barabanki	5	0	22	1
Bareilly	0	0	0	0
Basti	4	0	10	0
Bhadohi	0	0	0	0
Bijnor	11	1	23	2
Bulandshahar	0	0	0	0
Chandauli	2	0	3	0
Chitrakoot	0	0	0	0
Etawah	0	0	0	0
Farrukhabad	0	0	0	0
Fatehpur	0	0	0	0
Firozabad	0	0	0	0
Gautam Buddha Nagar	0	0	0	0
Ghaziabad	0	0	0	0
Gonda	2	0	5	0
Gorakhpur	2	0	7	0
Hamirpur	0	0	0	0
Hapur	1	0	0	0
Hardoi	0	0	7	0
Hathras	0	0	0	0
Jalaun	0	0	2	0
Jaunpur	0	0	19	16
Jhansi	0	0	0	0
Kannauj	0	0	6	0
Kanpur Nagar	0	0	2	0
Kasganj	0	0	0	0
Kaushambi	0	0	0	0
Lucknow	33	0	80	0
Maharajganj	0	0	0	0

District	Stationary, functional	Stationary, nonfunctional	Portable / transportable, functional	Portable / transportable, nonfunctional
Mahoba	0	0	0	0
Mainpuri	10	0	30	0
Mathura	0	0	4	0
Maunath Bhanjan	0	0	7	0
Meerut	0	0	0	0
Mirzapur	0	0	2	0
Moradabad	0	0	0	0
Muzaffarnagar	0	0	8	1
Pratapgarh	0	0	0	0
Prayagraj	0	0	0	0
Rae Bareli	0	0	0	0
Rampur	0	0	0	0
Saharanpur	0	0	45	4
Sambhal	0	0	1	1
Sant Kabir Nagar	0	0	0	0
Shahjahanpur	0	0	0	0
Shamli	3	0	2	0
Shravasti	0	0	4	0
Sitapur	0	0	2	2
Sultanpur	0	0	0	0
Unnao	2	0	2	0
Varanasi	3	0	6	2

Continuous positive airway pressure (CPAP) / bilevel positive airway pressure (BiPAP)

CPAP and BiPAP are two modes of noninvasive ventilation. In CPAP, a constant flow of pressurized room air is delivered through tubing via a face mask.

Figure 11 shows the number of CPAP and BiPAP machines reported, disaggregated by functionality.

Figure 11. Number of available bilevel and continuous positive airway pressure machines, by functionality.

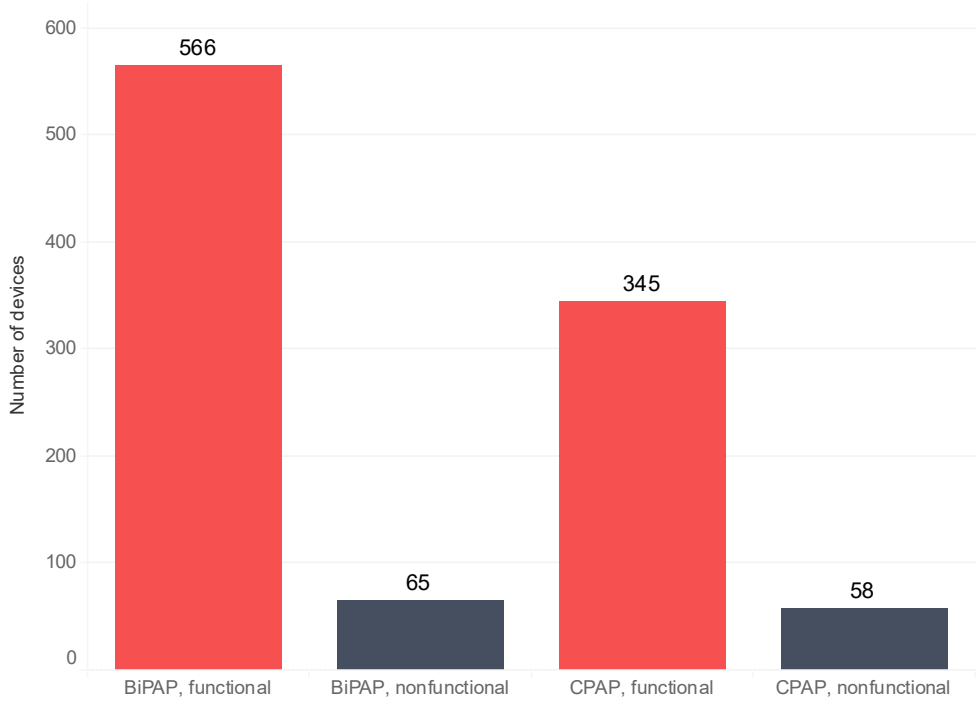


Table 16 shows the distribution of BiPAP and CPAP machines across the 65 surveyed districts.

Table 16. Distribution of bilevel and continuous positive airway pressure machines by district and functionality.

District	BiPAP, functional	BiPAP, nonfunctional	CPAP, functional	CPAP, nonfunctional
Agra	6	0	3	0
Aligarh	0	0	0	0
Ambedkar Nagar	4	0	0	0
Amethi	0	0	3	4
Amroha	0	0	0	0
Auraiya	2	0	0	0
Ayodhya	36	6	38	8
Azamgarh	43	5	15	5
Badaun	12	0	0	0
Baghpat	5	0	6	0
Bahraich	0	0	0	0
Ballia	1	0	1	0

District	BiPAP, functional	BiPAP, nonfunctional	CPAP, functional	CPAP, nonfunctional
Balrampur	13	3	8	4
Banda	0	0	0	0
Barabanki	20	8	19	2
Bareilly	0	0	0	0
Basti	29	0	28	0
Bhadohi	6	0	0	0
Bijnor	19	3	20	3
Bulandshahar	7	0	2	0
Chandauli	0	0	0	0
Chitrakoot	0	0	0	0
Etawah	0	0	0	0
Farrukhabad	0	0	0	0
Fatehpur	0	0	0	0
Firozabad	4	0	0	0
Gautam Buddha Nagar	3	0	0	0
Ghaziabad	5	0	0	0
Gonda	0	0	6	2
Gorakhpur	19	17	19	17
Hamirpur	0	0	0	0
Hapur	4	0	0	0
Hardoi	6	0	0	0
Hathras	0	0	0	0
Jalaun	2	0	0	0
Jaunpur	8	2	14	1
Jhansi	2	0	0	0
Kannauj	11	0	11	0
Kanpur Nagar	5	0	0	0
Kasganj	2	0	0	0
Kaushambi	0	0	0	0
Lucknow	113	12	77	5
Maharajganj	0	0	0	0
Mahoba	0	0	0	0

District	BiPAP, functional	BiPAP, nonfunctional	CPAP, functional	CPAP, nonfunctional
Mainpuri	0	0	0	0
Mathura	16	0	0	0
Maunath Bhanjan	0	0	0	0
Meerut	0	0	0	0
Mirzapur	0	0	2	0
Moradabad	0	0	0	0
Muzaffarnagar	20	2	13	1
Pratapgarh	0	0	0	0
Prayagraj	0	0	0	0
Rae Bareli	0	0	0	0
Rampur	0	0	0	0
Saharanpur	83	5	20	5
Sambhal	6	1	6	1
Sant Kabir Nagar	0	0	0	0
Shahjahanpur	6	0	0	0
Shamli	9	1	9	0
Shravasti	3	0	0	0
Sitapur	5	0	2	0
Sultanpur	0	0	0	0
Unnao	0	0	0	0
Varanasi	31	0	23	0

High-flow nasal cannulas

A high-flow nasal cannula is an oxygen delivery system capable of supplying humidified and heated oxygen at a flow rate of up to 60 liters per minute, a much higher rate than traditional low-flow nasal cannulas.[7] **Figure 12** shows the availability of high-flow nasal cannulas by functionality.

Figure 12. Availability of high-flow nasal cannulas, by functionality.

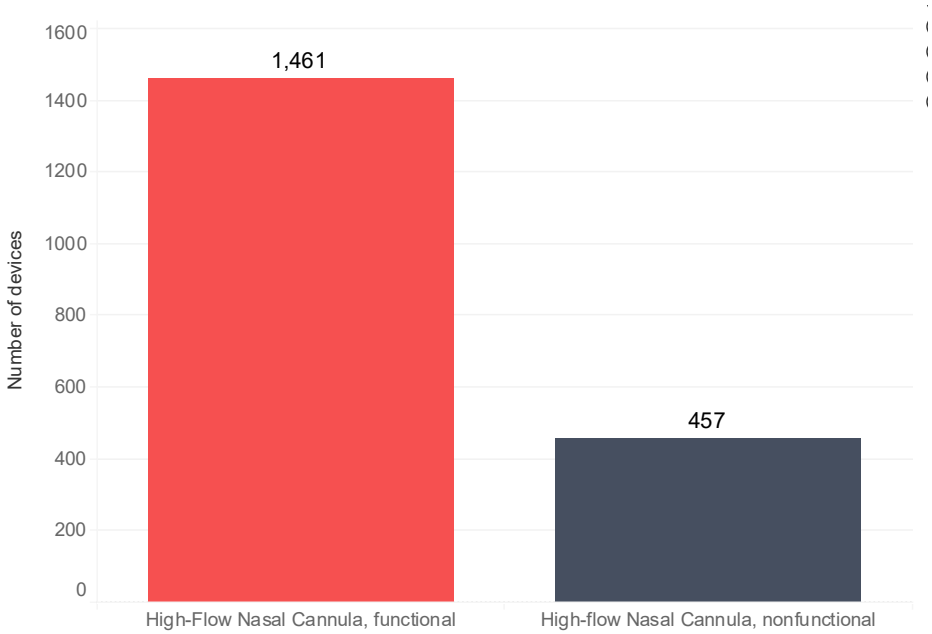


Table 17 shows the distribution of high-flow nasal cannulas across the 65 surveyed districts.

Table 17. Distribution of high-flow nasal cannula, by district and functionality.

	High-flow nasal cannula, functional	High-flow nasal cannula, nonfunctional
Agra	22	0
Aligarh	60	0
Ambedkar Nagar	23	2
Amethi	0	0
Amroha	0	0
Auraiya	32	0
Ayodhya	34	3
Azamgarh	67	406
Badaun	0	0
Baghpat	49	2
Bahraich	0	0
Ballia	4	0
Balrampur	7	2
Banda	1	0

	High-flow nasal cannula, functional	High-flow nasal cannula, nonfunctional
Barabanki	20	6
Bareilly	0	0
Basti	39	5
Bhadohi	313	3
Bijnor	9	1
Bulandshahar	0	0
Chandauli	0	0
Chitrakoot	2	0
Etawah	6	0
Farrukhabad	0	0
Fatehpur	0	0
Firozabad	10	0
Gautam Buddha Nagar	18	0
Ghaziabad	36	0
Gonda	8	0
Gorakhpur	24	1
Hamirpur	155	0
Hapur	2	0
Hardoi	14	4
Hathras	0	0
Jalaun	5	0
Jaunpur	28	0
Jhansi	4	0
Kannauj	0	0
Kanpur Nagar	24	8
Kasganj	0	0
Kaushambi	0	0
Lucknow	179	0
Maharajganj	0	0
Mahoba	15	0
Mainpuri	0	0
Mathura	4	0

	High-flow nasal cannula, functional	High-flow nasal cannula, nonfunctional
Maunath Bhanjan	10	2
Meerut	12	0
Mirzapur	17	0
Moradabad	0	0
Muzaffarnagar	1	1
Pratapgarh	5	0
Prayagraj	0	0
Rae Bareli	0	0
Rampur	0	0
Saharanpur	25	5
Sambhal	0	0
Sant Kabir Nagar	0	0
Shahjahanpur	8	3
Shamli	0	0
Shravasti	0	0
Sitapur	0	0
Sultanpur	0	0
Unnao	100	0
Varanasi	69	3

Consumables

Oxygen consumables are devices or delivery interfaces that facilitate the administration of oxygen therapy to patients. These are typically single-use, though some are reusable with shorter lifespans than medical devices and require different management practices.

Unlike capital assets, the availability of consumables can fluctuate significantly over time. As a result, consumable quantities reported here may be lower or higher than average at a given facility, depending on the timing of recent inventory orders.

Table 18 shows the variation in consumable stock across the 149 surveyed facilities, including the average number of units and standard deviation for each item.

Table 18. Variation in consumable stock across surveyed facilities.

	Facilities with > 0 units	Total units	Average units	Standard deviation
CO2 detector	29	414	1	2
Catheter	76	6,546	9	39
EndoTube™ (Merlyn Medical)	68	5,380	8	36
Nasal cannula	92	8,584	12	44
Nasopharyngeal cannula – reusable	0	N/A	N/A	N/A
Non-rebreather mask	38	2,392	3	18
Oropharyngeal cannula – reusable	0	N/A	N/A	N/A
Oropharyngeal cannula – single use	0	N/A	N/A	N/A
Oxygen mask	109	17,104	24	58
Resuscitation balloon	0	N/A	N/A	N/A
Suction device, electric	0	N/A	N/A	N/A
Suction device, manual	0	N/A	N/A	N/A
Venturi mask	57	3,211	5	19

Total quantities of each consumable varied significantly. Oxygen masks, which were reported to have the highest quantity among all listed consumables, also had the highest standard deviation, suggesting that a few facilities had a large stock while others had very little. Comparing the availability of oxygen consumables with delivery equipment is important for evaluating how effectively medical equipment is being used in facilities. For instance, if a facility has a very large number of oxygen concentrators but very few masks for oxygen delivery, its treatment capacity may be constrained. Additional data on consumable counts are provided in **Appendix B**.

Conclusion

The data collected through this biomedical equipment assessment yield new insights into the respiratory care treatment capacity of health facilities in Uttar Pradesh. This report provides an overview of the availability of oxygen delivery equipment, oxygen production equipment, and consumables critical for providing respiratory care treatment. In particular, the data suggest gaps in hypoxemia screening equipment, such as pulse oximeters. Significant progress has been made in oxygen production capacity, which has increased in the state by over 300% from 2020 to 2022; however, there are still critical shortages of essential small delivery devices, such as oxygen masks, at many facilities.

Understanding the availability of respiratory care equipment is the first step toward accurately estimating the gap in equipment supply and assessing facility capabilities and limitations in treating hypoxemic patients. An overall unequal distribution of equipment was observed across the surveyed facilities in Uttar Pradesh. Equitable allocation of new equipment will be more complex than simply purchasing equipment to fill the gap and dividing it among facilities.

Key recommendations for next steps are as follows:

- Use the gap analysis alongside oxygen needs estimations to develop costed operational plans to increase the availability of respiratory care equipment.
- Develop specific requests and advocacy directed at the Ministry of Health and Family Welfare, donors, and partners to address potential budget shortfalls.
- Establish long-term data management systems for tracking respiratory care equipment inventories and oxygen-related clinical indicators for routine monitoring and evaluation of the medical oxygen ecosystem.

References

1. World Health Organization (WHO). *Biomedical Equipment for COVID-19 Case Management – Inventory Tool: Interim Guidance*. WHO; 2020. https://www.who.int/publications/i/item/WHO-2019-nCov-biomedical-equipment-inventory-2020.1
2. World Health Organization (WHO). *Technical Specifications for Pressure Swing Adsorption (PSA) Oxygen Plants: Interim Guidance*. WHO; 2020. https://www.who.int/publications/i/item/WHO-2019-nCoV-PSA_Specifications-2020.1
3. Vanderburg S, Lipnick M, Neighbour R, Sendagire C. Overview of oxygen sources. Open Critical Care. Last updated August 15, 2024. Accessed July 31, 2025. https://opencriticalcare.org/encyclopedia/overview-of-oxygen-sources/
4. PATH. *Oxygen Is Essential: A Policy and Advocacy Primer*. PATH; 2025. https://www.path.org/our-impact/resources/oxygen-is-essential-a-policy-and-advocacy-primer/
5. World Health Organization (WHO). *Oxygen Sources and Distribution for COVID-19 Treatment Centres: Interim Guidance*. WHO; 2020. https://www.who.int/publications/i/item/WHO-2019-nCoV-Oxygen_sources-2020.1
6. Hardavella G, Karampinis I, Frille A, Sreter K, Rousalova I. Oxygen devices and delivery systems. *Breathe (Sheffield, England)*. 2019;15(3):e108–e116. https://doi.org/10.1183/20734735.0204-2019
7. Sharma S, Danckers M, Sanghavi DK, Chakraborty RK. High-flow nasal cannula. In: *StatPearls [Internet]*. StatPearls Publishing; 2023. https://www.ncbi.nlm.nih.gov/books/NBK526071/

Appendix A. Project team

Data collection

- IQVIA

Supervision

- Rohitashwa Kumar, State Lead
- Jayendra Kasar, Senior Program Officer

Report writing

- Sonu Babu, Consultant
- Danielle Connor, Senior Monitoring and Evaluation Officer

Appendix B. Additional tables on respiratory care equipment by district

Table 19. Distribution of flowmeters by district.

District	Flowmeters (2L/min)	Flowmeters (5L/min)	Flowmeters (10L/min)	Flowmeters (15L/min)	Flowmeters (>15L/min)
Agra	0	0	27	135	0
Aligarh	14	0	234	24	0
Ambedkar Nagar	0	1	6	0	79
Amethi	0	40	0	10	0
Amroha	0	0	0	0	0
Auraiya	0	0	0	40	0
Ayodhya	39	159	38	10	0
Azamgarh	12	22	29	27	0
Badaun	125	0	0	0	0
Baghpat	0	6	0	0	0
Bahraich	0	0	0	0	0
Ballia	13	11	5	5	0
Balrampur	6	57	59	1	1
Banda	53	0	0	0	0
Barabanki	66	71	36	30	0
Bareilly	0	16	5	136	0
Basti	6	25	22	0	0
Bhadohi	17	0	0	24	0
Bijnor	5	6	7	7	7
Bulandshahar	27	0	0	48	0
Chandauli	24	27	17	22	12
Chitrakoot	75	0	0	0	0
Etawah	13	0	5	0	0

District	Flowmeters (2L/min)	Flowmeters (5L/min)	Flowmeters (10L/min)	Flowmeters (15L/min)	Flowmeters (>15L/min)
Farrukhabad	0	0	0	0	0
Fatehpur	0	104	0	0	2
Firozabad	0	0	120	20	0
Gautam Buddha Nagar	0	4	2	0	0
Ghaziabad	0	92	12	0	0
Gonda	17	4	0	0	0
Gorakhpur	31	31	24	20	0
Hamirpur	0	0	0	47	0
Hapur	0	8	8	0	0
Hardoi	75	0	0	0	0
Hathras	0	0	6	0	0
Jalaun	0	0	0	46	0
Jaunpur	11	0	11	18	8
Jhansi	22	4	0	0	0
Kannauj	13	14	3	3	3
Kanpur Nagar	0	97	13	141	41
Kasganj	60	0	0	0	0
Kaushambi	0	0	0	0	0
Lucknow	71	149	268	43	1
Maharajganj	30	27	25	0	0
Mahoba	74	0	0	0	0
Mainpuri	58	58	58	0	0
Mathura	114	0	0	0	0
Maunath Bhanjan	58	0	0	0	24
Meerut	0	5	5	10	0
Mirzapur	0	0	0	25	0
Moradabad	3	3	3	0	0
Muzaffarnagar	40	32	0	0	0

District	Flowmeters (2L/min)	Flowmeters (5L/min)	Flowmeters (10L/min)	Flowmeters (15L/min)	Flowmeters (>15L/min)
Pratapgarh	10	0	10	60	0
Prayagraj	0	0	0	0	0
Rae Bareli	122	58	0	0	0
Rampur	0	0	0	234	0
Saharanpur	539	31	34	15	25
Sambhal	6	7	0	0	0
Sant Kabir Nagar	69	77	67	67	0
Shahjahanpur	17	0	0	0	0
Shamli	15	11	5	0	0
Shravasti	12	15	17	7	0
Sitapur	6	5	26	17	1
Sultanpur	0	0	0	75	0
Unnao	2	22	2	0	0
Varanasi	65	36	38	24	1

Table 20. Distribution of flow splitters by district.

District	2 outlets, 1L/min	2 outlets, 2L/min	3 outlets, 1L/min	3 outlets, 2L/min	4 outlets, 1L/min	4 outlets, 2L/min	5 outlets, 1L/min	5 outlets, 2L/min	Other, 1L/min	Other, 2L/min
Agra	0	0	0	0	0	0	0	0	0	0
Aligarh	0	0	0	0	0	0	0	5	0	2
Ambedkar Nagar	0	24	0	23	0	16	0	15	0	6
Amethi	0	0	0	0	0	0	0	0	0	0
Amroha	0	0	0	0	0	0	0	0	0	0
Auraiya	0	0	0	0	0	0	0	0	0	0
Ayodhya	34	31	28	25	27	37	29	30	3	3
Azamgarh	0	32	17	22	4	8	4	5	10	1
Badaun	0	0	0	0	0	0	0	0	0	0

District	2 outlets, 1L/min	2 outlets, 2L/min	3 outlets, 1L/min	3 outlets, 2L/min	4 outlets, 1L/min	4 outlets, 2L/min	5 outlets, 1L/min	5 outlets, 2L/min	Other, 1L/min	Other, 2L/min
Baghpat	0	0	0	0	0	0	0	0	0	0
Bahraich	0	0	0	0	0	0	0	0	0	0
Ballia	12	10	10	10	10	10	10	10	5	5
Balrampur	10	11	11	10	10	10	10	10	1	1
Banda	0	0	0	0	0	0	0	0	0	0
Barabanki	6	5	3	3	4	3	4	6	4	4
Bareilly	0	18	0	7	0	7	0	0	0	0
Basti	45	35	45	4	45	3	39	8	1	2
Bhadohi	1	2	1	4	1	1	1	1	0	0
Bijnor	6	6	6	6	6	6	6	6	1	1
Bulandshahar	0	0	0	0	0	0	0	0	0	0
Chandauli	12	12	10	10	10	2	2	2	0	0
Chitrakoot	0	0	0	0	0	0	0	0	0	0
Etawah	0	0	0	0	0	0	0	0	0	0
Farrukhabad	0	0	0	0	0	0	0	0	0	0
Fatehpur	12	12	10	10	10	2	2	2	0	0
Firozabad	0	0	0	0	0	0	0	0	0	0
Gautam Buddha Nagar	0	0	0	0	0	0	0	0	0	0
Ghaziabad	0	0	0	0	0	0	0	0	0	0
Gonda	2	5	2	5	5	8	4	4	4	4
Gorakhpur	29	29	28	28	64	27	36	27	0	0
Hamirpur	0	0	0	0	0	0	0	0	0	0
Hapur	0	0	0	0	0	0	0	0	0	0
Hardoi	11	9	1	4	1	1	1	1	0	0
Hathras	0	0	0	0	0	0	0	0	0	0
Jalaun	0	0	0	0	0	0	0	0	0	0
Jaunpur	0	0	0	0	0	0	0	0	0	0
Jhansi	0	0	0	0	0	0	0	0	0	0

District	2 outlets, 1L/min	2 outlets, 2L/min	3 outlets, 1L/min	3 outlets, 2L/min	4 outlets, 1L/min	4 outlets, 2L/min	5 outlets, 1L/min	5 outlets, 2L/min	Other, 1L/min	Other, 2L/min
Kannauj	0	0	0	0	0	0	0	0	0	0
Kanpur Nagar	9	69	4	4	13	4	4	4	0	0
Kasganj	60	0	0	0	0	0	0	0	0	0
Kaushambi	0	0	0	0	0	0	0	0	0	0
Lucknow	27	23	7	9	12	9	8	9	21	27
Maharajganj	28	25	26	26	26	26	26	26	25	25
Mahoba	0	0	0	0	0	0	0	0	0	0
Mainpuri	0	0	0	0	0	0	0	0	0	0
Mathura	0	40	0	8	0	0	0	0	0	0
Maunath Bhanjan	11	14	0	2	0	1	0	0	0	0
Meerut	0	0	0	0	0	0	0	0	0	0
Mirzapur	0	0	0	0	0	0	0	2	0	5
Moradabad	3	3	3	3	3	3	3	0	0	0
Muzaffarnagar	21	21	14	14	11	11	11	11	17	10
Pratapgarh	0	0	0	0	0	0	0	0	0	0
Prayagraj	0	0	0	0	0	0	0	0	0	0
Rae Bareli	0	26	0	18	0	68	0	18	0	0
Rampur	0	10	0	0	0	0	0	0	0	0
Saharanpur	640	512	515	15	515	516	12	15	9	11
Sambhal	0	0	0	0	0	0	0	0	0	0
Sant Kabir Nagar	69	69	69	69	69	69	69	69	64	62
Shahjahanpur	1	2	1	4	1	1	1	1	0	0
Shamli	9	5	3	3	3	0	0	0	0	0
Shravasti	2	3	3	3	3	3	0	0	0	0
Sitapur	1	0	1	1	2	2	0	0	0	0
Sultanpur	0	0	0	0	0	0	0	0	0	0
Unnao	0	0	0	0	0	0	0	20	0	0
Varanasi	0	0	3	3	0	0	0	0	0	0

Table 21. Distribution of cylinder assembly units by district.

District	# of units
Aligarh	64
Ambedkar Nagar	280
Auraiya	24
Ayodhya	28
Azamgarh	27
Badaun	95
Baghpat	6
Ballia	6
Balrampur	26
Banda	20
Barabanki	8
Bareilly	21
Basti	14
Bhadohi	13
Bijnor	39
Bulandshahar	20
Chandauli	12
Chitrakoot	13
Etawah	8
Ghaziabad	11
Gonda	21
Gorakhpur	7
Hamirpur	34
Hardoi	24
Hathras	38
Jalaun	50
Jaunpur	8

District	# of units
Jhansi	15
Kannauj	39
Kanpur Nagar	93
Kasganj	50
Kaushambi	2
Lucknow	408
Maharajganj	5
Mahoba	24
Mainpuri	0
Mathura	81
Maunath Bhanjan	32
Mirzapur	10
Moradabad	5
Muzaffarnagar	79
Pratapgarh	1
Rae Bareli	2
Rampur	47
Saharanpur	416
Sambhal	24
Sant Kabir Nagar	7
Shahjahanpur	6
Shamli	41
Shravasti	15
Sitapur	15
Sultanpur	1
Unnao	21
Varanasi	38

Table 22. Distribution of oxygen concentrators by district.

District	Oxygen concentrators (3L)	Oxygen concentrators (5L)	Oxygen concentrators (8L)	Oxygen concentrators (10L)	Oxygen concentrators (>10L)
Agra	0	0	0	69	0
Aligarh	0	58	0	49	0
Ambedkar Nagar	0	51	0	18	5
Amethi	0	7	0	19	0
Amroha	0	0	0	0	0
Auraiya	0	16	0	14	0
Ayodhya	0	86	0	51	0
Azamgarh	0	24	2	5	0
Badaun	0	49	0	20	0
Baghpat	0	2	0	2	0
Bahraich	6	0	0	0	0
Ballia	0	43	0	2	0
Balrampur	4	70	0	54	8
Banda	0	13	0	2	0
Barabanki	18	13	0	730	0
Bareilly	0	30	0	25	0
Basti	5	30	0	36	0
Bhadohi	0	4	0	3	0
Bijnor	0	0	3	3	3
Bulandshahar	0	48	0	40	0
Chandauli	0	9	0	2	0
Chitrakoot	0	12	0	1	0
Etawah	0	17	0	10	0
Farrukhabad	0	0	0	0	0
Fatehpur	0	29	6	0	0
Firozabad	0	74	0	132	0
Gautam Buddha Nagar	0	4	0	2	0

District	Oxygen concentrators (3L)	Oxygen concentrators (5L)	Oxygen concentrators (8L)	Oxygen concentrators (10L)	Oxygen concentrators (>10L)
Ghaziabad	0	7	0	46	0
Gonda	4	2	0	0	0
Gorakhpur	0	28	0	1	0
Hamirpur	0	18	0	2	0
Hapur	0	2	0	2	0
Hardoi	0	6	0	11	0
Hathras	0	0	0	17	0
Jalaun	0	20	0	5	0
Jaunpur	0	0	5	0	0
Jhansi	0	6	0	2	0
Kannauj	12	18	0	0	0
Kanpur Nagar	0	28	0	48	2
Kasganj	0	47	0	20	0
Kaushambi	0	2	0	0	0
Lucknow	37	87	2	147	79
Maharajganj	0	6	0	0	0
Mahoba	0	9	0	8	0
Mainpuri	10	12	10	10	0
Mathura	0	25	0	98	0
Maunath Bhanjan	0	6	0	8	0
Meerut	0	4	0	0	0
Mirzapur	0	0	0	0	0
Moradabad	0	0	0	0	0
Muzaffarnagar	13	1	0	0	0
Pratapgarh	30	90	0	40	0
Prayagraj	0	0	0	0	0
Rae Bareli	0	54	0	0	0
Rampur	0	24	0	15	0

District	Oxygen concentrators (3L)	Oxygen concentrators (5L)	Oxygen concentrators (8L)	Oxygen concentrators (10L)	Oxygen concentrators (>10L)
Saharanpur	16	7	8	6	0
Sambhal	0	6	0	0	0
Sant Kabir Nagar	0	30	0	0	0
Shahjahanpur	0	4	0	3	0
Shamli	3	0	0	0	0
Shravasti	0	10	0	0	0
Sitapur	7	0	8	0	0
Sultanpur	0	5	0	0	0
Unnao	0	43	0	14	0
Varanasi	11	27	5	23	0

Table 23. Distribution of pulse oximeters by district.

District	Portable pulse oximeter	Standalone fingertip pulse oximeter	Tabletop multiparameter monitor
Agra	33	0	0
Aligarh	27	3	0
Ambedkar Nagar	107	57	47
Amethi	0	0	5
Auraiya	0	9	39
Ayodhya	77	46	34
Azamgarh	18	9	0
Badaun	0	10	20
Baghpat	5	17	2
Ballia	9	18	4
Balrampur	26	11	18
Banda	8	0	12
Barabanki	31	15	9
Bareilly	0	92	0

District	Portable pulse oximeter	Standalone fingertip pulse oximeter	Tabletop multiparameter monitor
Basti	28	9	8
Bhadohi	0	12	6
Bulandshahar	0	0	12
Chandauli	4	6	6
Chitrakoot	0	12	0
Etawah	0	2	0
Fatehpur	119	0	0
Firozabad	8	7	0
Gautam Buddha Nagar	0	4	21
Ghaziabad	7	42	16
Gonda	28	7	4
Gorakhpur	7	22	1
Hamirpur	9	11	0
Hapur	0	1	1
Hardoi	10	10	2
Hathras	4	0	0
Jalaun	0	10	31
Jaunpur	30	0	0
Jhansi	0	10	0
Kanpur Nagar	15	54	30
Kasganj	3	30	2
Kaushambi	0	1	4
Lucknow	490	129	194
Maharajganj	0	10	4
Mahoba	0	6	18
Mainpuri	9	60	20
Mathura	0	0	22
Maunath Bhanjan	26	10	0
Meerut	0	2	9

District	Portable pulse oximeter	Standalone fingertip pulse oximeter	Tabletop multiparameter monitor
Mirzapur	0	4	12
Pratapgarh	9	0	0
Rae Bareli	156	0	0
Rampur	0	15	40
Saharanpur	93	18	20
Sant Kabir Nagar	0	72	9
Shahjahanpur	0	6	2
Shravasti	0	0	0
Sitapur	3	0	0
Sultanpur	22	0	0
Unnao	105	21	1
Varanasi	94	15	20

Table 24. Distribution of delivery interface devices by district.

District	CO2 detector	Catheters	EndoTube*	Nasal cannula	Non-rebreather mask	Oxygen mask	Resuscitation balloon	Venturi mask	Suction device, electric	Suction device, manual	Oropharyngeal cannula, reusable	Oropharyngeal cannula, single use	Nasopharyngeal cannula, reusable
Agra	0	6	0	33	3	212	0	0	0	0	0	0	0
Aligarh	0	20	15	45	10	320	0	10	0	0	0	0	0
Ambedkar Nagar	41	102	53	107	75	300	0	77	0	0	0	0	0
Amethi	0	29	0	42	0	82	0	12	0	0	0	0	0
Auraiya	0	93	105	64	0	185	0	0	0	0	0	0	0
Ayodhya	10	22	20	39	16	81	0	14	0	0	0	0	0
Azamgarh	3	62	48	86	10	309	0	113	0	0	0	0	0
Badaun	0	0	0	0	0	104	0	0	0	0	0	0	0
Baghpat	0	35	2	75	0	127	0	0	0	0	0	0	0
Ballia	1	8	1	3	0	135	0	3	0	0	0	0	0
Balrampur	6	25	14	64	15	70	0	11	0	0	0	0	0
Banda	0	189	61	58	0	24	0	3	0	0	0	0	0
Barabanki	14	36	63	49	9	28	0	14	0	0	0	0	0
Bareilly	0	27	18	145	0	250	0	3	0	0	0	0	0
Basti	0	14	261	313	29	143	0	15	0	0	0	0	0
Bhadohi	2	38	10	21	0	42	0	25	0	0	0	0	0
Bijnor	2	3	2	1	2	4	0	12	0	0	0	0	0
Bulandshahar	0	0	0	57	0	157	0	0	0	0	0	0	0
Chandauli	5	32	22	26	0	150	0	6	0	0	0	0	0
Chitrakoot	0	23	5	38	0	63	0	0	0	0	0	0	0
Etawah	0	0	7	15	0	0	0	0	0	0	0	0	0
Fatehpur	0	0	0	0	0	0	0		0	0	0	0	0
Firozabad	0	4	0	12	3	125	0	5	0	0	0	0	0
Gautam Buddha Nagar	0	100	100	100	150	350	0	0	0	0	0	0	0
Ghaziabad	8	0	100	604	0	135	0	0	0	0	0	0	0

District	CO2 detector	Catheters	EndoTube*	Nasal cannula	Non-rebreather mask	Oxygen mask	Resuscitation balloon	Venturi mask	Suction device, electric	Suction device, manual	Oropharyngeal cannula, reusable	Oropharyngeal cannula, single use	Nasopharyngeal cannula, reusable
Gonda	0	0	0	0	0	0	0		0	0	0	0	0
Gorakhpur	9	40	23	29	3	298	0	18	0	0	0	0	0
Hamirpur	0	363	56	125	0	172	0	0	0	0	0	0	0
Hapur	0	200	50	50	0	100	0	0	0	0	0	0	0
Hardoi	2	113	1	31	0	47	0	33	0	0	0	0	0
Hathras	0	0	0	0	0	15	0	0	0	0	0	0	0
Jalaun	0	14	76	125	0	77	0	4	0	0	0	0	0
Jaunpur	32	7	25	82	34	527	0	11	0	0	0	0	0
Jhansi	0	7	16	15	5	56	0	2	0	0	0	0	0
Kannauj	0	0	0	0	0		0	0	0	0	0	0	0
Kanpur Nagar	0	54	59	146	0	149	0	12	0	0	0	0	0
Kasganj	0	0	0	30	10	75	0	0	0	0	0	0	0
Kaushambi	0	0	0	0	0	4	0	0	0	0	0	0	0
Lucknow	33	782	706	833	438	1,666	0	367	0	0	0	0	0
Maharajganj	0	11	5	11	0	28	0	5	0	0	0	0	0
Mahoba	0	32	4	40	0	115	0	0	0	0	0	0	0
Mainpuri	0	0	0	0	0	880	0	118	0	0	0	0	0
Mathura	0	0	1	1	75	227	0	10	0	0	0	0	0
Maunath Bhanjan	2	115	0	39	0	71	0	23	0	0	0	0	0
Meerut	0	33	42	14	10	65	0	0	0	0	0	0	0
Mirzapur	0	38	23	13	1	23	0	14	0	0	0	0	0
Moradabad	0	0	0	0	0	0	0	0	0	0	0	0	0
Muzaffarnagar	0	53	0	18	2	66	0	180	0	0	0	0	0
Pratapgarh	0	3	0	12	2	90	0	0	0	0	0	0	0
Rae Bareli	0	0	0	0	0	0	0		0	0	0	0	0
Rampur	0	25	137	82	0	65	0	0	0	0	0	0	0
Saharanpur	21	73	30	33	32	45	0	83	0	0	0	0	0
Sambhal	0	0	0	0	0	0	0		0	0	0	0	0

District	CO2 detector	Catheters	EndoTube*	Nasal cannula	Non-rebreather mask	Oxygen mask	Resuscitation balloon	Venturi mask	Suction device, electric	Suction device, manual	Oropharyngeal cannula, reusable	Oropharyngeal cannula, single use	Nasopharyngeal cannula, reusable
Sant Kabir Nagar	0	35	212	55	10	159	0	10	0	0	0	0	0
Shahjahanpur	2	28	1	16	0	22	0	25	0	0	0	0	0
Shamli	0	0	0	0	0	0	0		0	0	0	0	0
Shravasti	0	0	0	17	0	15	0	0	0	0	0	0	0
Sitapur	0	0	0	0	0	0	0	10	0	0	0	0	0
Sultanpur	0	0	0	0	0	22	0	0	0	0	0	0	0
Unnao	0	0	0	100	30	28	0	2	0	0	0	0	0
Varanasi	29	60	130	173	32	108	0	81	0	0	0	0	0

* EndoTube is a trademark of Merlyn Medical.