In Los Angeles and Beyond, Oxygen Is the Latest COVID Bottleneck

The need for high concentrations of oxygen has stressed the infrastructure for delivering the gas to hospitals and their patients.

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As Los Angeles hospitals give record numbers of COVID patients oxygen, the systems and equipment needed to deliver the life-sustaining gas are faltering.

It's gotten so bad that Los Angeles County officials are warning paramedics to conserve it. Some hospitals are having to delay releasing patients as they don't have enough oxygen equipment to send home with them.

"Everybody is worried about what's going to happen in the next week or so," said Cathy Chidester, director of the L.A. County Emergency Medical Services Agency.

Oxygen, which makes up 21% of the Earth's air, isn't running short. But COVID damages the lungs, and the crush of patients in hot spots such as Los Angeles; the Navajo Nation; El Paso, Texas; and in New York last spring have needed high concentrations of it. That has stressed the infrastructure for delivering the gas to hospitals and their patients.

The strain in those areas is caused by multiple weak links in the pandemic supply chain. In some hospitals that pipe oxygen to patients' rooms, the massive volume of cold liquid oxygen is freezing the equipment needed to deliver it, which can block the system.

"You can completely — literally, completely — shut down the entire hospital supply if that happens," said Rich Branson, a respiratory therapist with the University of Cincinnati and editor-in-chief of the journal Respiratory Care.

There is also pressure on the availability of both the portable cylinders that hold oxygen and the concentrators that pull oxygen from the air. And in some cases, vendors that supply the oxygen have struggled to get enough of the gas to hospitals. Even nasal cannulas, the tubing used to deliver oxygen, are now running low.

"It's been nuts, absolutely nuts," said Esteban Trejo, general manager of Syoxsa, an industrial and medical gas distributor based in El Paso. He provides oxygen to several temporary hospitals set up

specifically to treat people with COVID.

In November, he said, he was answering calls in the middle of the night from customers worried about oxygen supplies. At one point, when the company's usual supplier fell through, they were hauling oxygen from Houston, more than a 10-hour drive each way.

Branson has been sounding the alarm about logistical limitations on critical care since the SARS pandemic nearly 20 years ago, when he and others surveyed experts about the specific equipment and infrastructure needed during a future pandemic. Oxygen was near the top of the list.

Oxygen as Cold as Neptune

Last spring, New York, New Jersey and Connecticut faced a challenge similar to what is now unfolding in Los Angeles, said Robert Karcher, a vice president of contract services for Acurity, a group purchasing organization that worked with many hospitals during that surge.

To take up less space, oxygen is often stored as a liquid around minus 300 degrees Fahrenheit, about as cold as the surface of Neptune. But as COVID patients filling ICUs were given oxygen through ventilators or nasal tubes, some hospitals began to see ice form over the equipment that converts liquid oxygen into a gas.

When a hospital draws more and more liquid oxygen from those tanks, the super-cold liquid can seep further into the vaporizing coils where liquid oxygen turns to gas.

Branson said some ice is normal, but a lot of ice can cause valves on the device to freeze in place. And the ice can restrict airflow in the pipes sending the oxygen into patients' rooms, Karcher said. To combat this, hospitals could switch to a backup vaporizer if they had one, hose down iced vaporizers or move patients to cylinder-delivered oxygen. But that puts additional strain on the hospitals' cylinder oxygen supply, as well as the medical gas supplier, Karcher said.

Hospitals in New York began to panic in the spring because the icing of the vaporizer was much greater than they had seen before, he added. It got so bad, he said, that some hospitals worried they'd have to close their ICUs.

"They thought they were in imminent danger of their tank piping shutting down," he said. "We came pretty close in a couple of our hospitals. It was a rough few weeks."

The strain on Los Angeles health care infrastructure could be worse given the now-common treatment of putting patients on oxygen using high-flow nasal cannulas. That requires more of the gas pumped at a higher rate than with ventilators.

"I don't know of any system that is really set to triple patient volumes — or 10 times the oxygen delivery," Chidester said of the L.A. County hospitals. "They're having a hard time keeping up."

The Oxygen Shortage Doom Loop

In and around Los Angeles, the Army Corps of Engineers has so far surveyed 11 hospitals for freezing oxygen pipe issues. The hospitals are a mix of older facilities and smaller suburban hospitals seeing such high demand amid skyrocketing cases in the area, said Mike Petersen, a Corps spokesperson.

One of the worst examples he saw included pipes that looked like a home freezer that had not been defrosted in some time.

The problem gets worse for hospitals that have had to convert regular hospital rooms to intensive care units. ICU pipes are bigger than those leading to other parts of a hospital. When rooms get repurposed as pop-up ICUs, the pipes can simply be too narrow to deliver the oxygen that COVID patients need. And so, Chidester said, the hospitals switch to large cylinders of oxygen. But vendors are having a hard time refilling those quickly enough.

Even smaller cylinders and oxygen concentrators are in short supply amid the surge, she said. Those patients who could be sent home with an oxygen cylinder are left stuck in a hospital waiting for one, taking up a much-needed bed.

‘Extreme Rurality’

In early December, doctors serving the Navajo Nation said they needed more of everything: the oxygen itself and the equipment to get oxygen to patients in the hospital and recovering at home.

“We’ve never reached capacity before — until now,” said Dr. Loretta Christensen, chief medical officer for the Navajo Area Indian Health Service, in mid-December. Its hospitals serve a patient population in the southwestern U.S. that’s spread across an area bigger than West Virginia.

The buildings are aging, and they aren’t built to house a large number of critical patients, said Christensen. As the number of patients on high-flow oxygen climbed, several facilities started to notice their oxygen flow weaken. They thought something was broken, but when engineers took a look, Christensen said, it became clear the system was just not able to provide the amount of high-flow oxygen patients needed.

She said a hospital in Gallup, New Mexico, put in new filters to maximize oxygen flow. After delays from snowy weather, a hospital serving the northern part of the Navajo Nation managed to hook up a second oxygen tank to boost capacity.

But medical facilities in the area are always a little on edge.

“Honestly, we worry about supply a lot out here because — and I call it extreme rurality — you just can’t get something tomorrow,” said Christensen. “It’s not like being in an urban area where you can say, ‘Oh, I need this right now.’”

Because of the small size of certain hospitals and the difficulty of getting to some of them, Christensen said, Navajo facilities aren’t attractive to big vendors, so they rely on local vendors, which may prove more vulnerable to supply chain hiccups.

Tséhootsooí Medical Center in Fort Defiance, Arizona, has at times had to keep patients in the hospital and transfer incoming patients to other facilities because it couldn't get the oxygen cylinders needed to send recovering patients home.

Tina James-Tafoya, COVID incident commander at Fort Defiance Indian Hospital Board, which runs the center, said at-home oxygen is out of the question for some patients. Oxygen concentrators require electricity, which some patients don't have. And for patients who live in hogans, homes often heated with a wood stove, the use of oxygen cylinders is a hazard.

"It's really interesting and eye-opening for me to see that something that seems so simple, like oxygen, has so many different things tied to it that will hinder it getting to the patient," she said.

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