

Erta Kalanxhi

Hello everyone, and welcome to CDDEP's Global Health conversation series. Thank you for joining us. In today's webinar, we will discuss the issue of access to medical oxygen, an issue that has only been exacerbated from the ongoing COVID-19 pandemic.

For today's discussion, we have collaborated with Every Breath Counts coalition and OxygenForIndia. We are very honored to have with us Leith Greenslade, Coordinator of Every Breath Counts coalition, and Dr. Ayobami Bakare, community health physician from the University College Hospital in Ibadan, Nigeria and the Karolinska Institute Sweden. We also have CDDEP's director and co-founder of OxygenForIndia, Dr. Ramanan Laxminarayan.

We have some specific questions for the speakers, which they will address in the first part of the webinar. We will have some time towards the end of the hour to address any of your questions, so please feel free to enter them in the Q&A section of the Zoom app. Before we start the discussion, Dr. Laxminarayan, director of CDDEP, will give a brief introduction to the topic we're discussing today. So over to you, Ramanan. Thank you.

Ramanan Laxminarayan

Thank you Erta, and a pleasure to see all of you. This has been a great continuing series. Many of you have come back for all of the webinars and it's great to see all of you again.

Oxygen is typically not a problem that CDDEP has worked on, except for the last year, when, in the middle of a crisis when things were really bad in India, our teams got together to figure out how to solve the problem of oxygen shortages in India, which were very acute during the second wave. There were many deaths due to COVID, which is a subject of our research... but not as much attention to oxygen, which was kind of surprising, given that it's such an essential commodity that's required at all times.

We do work on pneumonia, we work on respiratory disorders, but we've never really focused on oxygen as really being a major issue. And I think COVID really brought home for many of us, especially in India, but around the world, how important oxygen really is, even during non-COVID times.

Of course, CDDEP was part of a much larger effort called OxygenForIndia, which raised a lot of money internationally from about 12,000 people who contributed to help bring oxygen assets to India. This was part of multiple initiatives that were held at the same time. We then built on top of what we did during the COVID outbreak in India in the second wave, to be able to create what we are calling a National Oxygen Grid: something we'll spend some time talking about when we get into the panel discussion.

I think for all countries that have faced oxygen problems during COVID, the questions in front of them are:

- Is this something that is an ongoing problem?
- To what extent is oxygen available, even during normal times, when deaths are invisible and people suffering are invisible, whether it's from trauma or from being pregnant without oxygen in case of a significantly difficult situation, or in the case of children with pneumonia?

- How much attention do we really pay to the normal suffering from lack of oxygen during non-COVID times?
- How can we use the opportunity provided by COVID, in terms of the attention on oxygen, to be able to solve the problem for the longer term?

These are the sort of themes that we wanted to discuss, and I think these are relevant not just to India, not just to Africa, but to many countries around the world. In fact, oxygen shortages have been felt in Italy, they were faced in the UK, and they were faced in New York, as well.

This has not been a single country issue, although the degree of challenge has been much greater in some countries compared to others. We really owe it to the people who died from COVID because of oxygen shortages to make sure that we are able to fix the problem for the longer term, and that's what we're committed to doing at CDDEP. We look forward to these conversations and more around the specific oxygen issue to figure out how we might want to do that. So thanks, Erta, and back to you.

Erta Kalanxhi

Alright, thank you very much for that introduction. We will start with our first speaker, Leith Greenslade, coordinator at Every Breath Counts coalition.

Good morning Leith, and thank you for joining us today. The issue, as Ramanan just mentioned, of oxygen supply during the COVID-19 crisis, is actually a broader issue of lack of routine access to oxygen for respiratory care. Can you speak more about where the shortages are and why they occur?

Leith Greenslade

Thanks, Erta. Thanks, Ramanan. I want to share my screen and show a few images as I answer your question.

The image you see continues to haunt me. This is an image that was taken in Peru in February this year at the height of what was Peru's, not their first, but their second, oxygen crisis. The long line of green cylinders that you see, empty, waiting to be filled, and the people waiting for them, one of them is sleeping overnight. You can see they're waiting for oxygen to take home or to take to a hospital to treat a loved one.

We saw images and we continue to see images of these kinds of scenes from the pandemic. Now, you don't get to a situation where someone is that desperate and that alone without decades of underinvestment in oxygen as an essential medicine.

Prior to COVID, oxygen was not a medical commodity that governments were focused on, particularly governments in low and middle income countries. Neither was it an issue that had much support from the global health community. The multilateral health and development agencies also were not focusing on oxygen.

So when COVID hit, with the massive quantities of oxygen required by COVID patients, this was a disaster waiting to happen. That's why we've seen continually now, since summer of last year, in every region of

the world images like this. The suffering and the deaths that have resulted from lack of access to oxygen are tragic, and must never be allowed to happen again.

The Every Breath Counts coalition has been monitoring the oxygen crisis, since we worked on what we call the Oxygen Needs Track Up with international NGOs path and the Clinton Health Access Initiative.

We launched this in November of last year, and every week we've been publishing what we call the oxygen crisis risk map. Every country with a dot on it is either experiencing or at risk of oxygen shortages. The countries in red, we call them code red, are facing what we call hockey stick increases: the curve goes up like a hockey stick in terms of their daily oxygen need for COVID patients.

The countries where we're seeing deaths now change because if we were looking at this map in May/April, as Ramanan well knows, it would have been India and Nepal driving oxygen need, but the virus moves quickly and leaves oxygen shortages in its way. At this point in time, these are the countries that are facing elevated COVID deaths from lack of access to oxygen. I just want to pull out some of them. This is the hockey stick curve I mentioned before.

This is some of those countries on that map, but it shows you their three month increase in oxygen need. You can see this is just three months in, look at Russia. It was fairly stable until about a month ago and then it took off. It moves so quickly that the health systems are inundated with patients needing oxygen and they can't respond. We saw that play out in India and then Nepal with tragic, tragic consequences.

Other countries are experiencing similar surges, although not at the scale of India because of India's population. We need to keep our eyes on all of these countries. These are the countries that need support - national, regional and international - or we will see oxygen related deaths.

This picture is just a reminder, before I conclude this question, that COVID is just the tip of the iceberg for oxygen need, and the pandemic has revealed to us what has always been a problem: the underlying needs of patients with hypoxemia for oxygen, lots of children with pneumonia, lots of neonates and lots of adults as well with conditions- not just infectious but COPD and chronic conditions.

We have this massive underlying need for oxygen, which is why we have to deal with it during the pandemic. The investments we've put in place now, if done correctly, can serve this hidden need and save many, many, many lives over the next decade- only if we get the investments right.

Erta Kalanxhi

Thank you Leith, that was very moving. The opening image, I think, is going to continue to haunt many of us. When it comes to addressing this issue, how well has the private sector performed in solving the problem of oxygen supply? Is there a role for governments to step in and provide access in places where it's currently lacking?

Leith Greensdale

Yes, there's a huge role for governments but not only governments. Like any area of COVID, or any area of public health, you need governments working with industry, working with non-government

organizations, the United Nations is critical. There's a network of actors that need to come together. This is what we didn't have with oxygen.

We did have it with vaccines, and we had vaccines developed early by industry with government investment. We had a network of relationships going into the pandemic with the pharmaceutical industry and public health leaders that we didn't have with oxygen.

To put it bluntly, the leaders of our global health agencies and many governments just didn't know who the people were running oxygen in industry - they couldn't pick up the phone or send an email to the head of some of the big medical gas companies or the big oxygen concentrator companies. We didn't have those relationships, so we had to scramble to build them.

Now it's still not a perfect situation, as there's much more work to be done to bring industry to work in full partnership with public health when it comes to oxygen. But the oxygen industry now understands it is part of the public health infrastructure. This has been the big leap forward that we've been able to make. They understand that there probably will be more respiratory pandemics. COVID is not going to be the last and it may not be the worst, and they need to be in constant partnership with public health.

Now, to the industries' credit, they have actually stepped up. So Air Liquide, one of the major medical gas companies, have reported to us just a few weeks ago that between 2020 and 2021 the amount of oxygen they were delivering for an emergency went from 400 tons in 2020 and to 9400 tons a year later.

This is not a technology we have to develop, they have the capacity to supply the oxygen. What's missing are the government partnerships, the logistics, all the infrastructure that goes around transferring that from an industrial environment to a medical environment.

This is where we failed tragically and Ramanan knows better than most because it was India's big challenge to move the oxygen from industry to the medical system. This is what we have to learn from and get right next time. I'm positive about our potential to work with industry on oxygen, very positive.

Erta Kalanxhi

Thank you, Leith. We are now going to move on to our second speaker, Dr. Ayobami Bakare. Thank you for joining us. Prior to the pandemic, you co-authored some of the most important studies on children's access to oxygen in hospitals across Nigeria. What did you learn about access to oxygen before the pandemic and do you think that you could generalize your findings across as hospitals in Africa?

Ayobami Bakare

Thank you Erta. Prior to the pandemic, our team learnt five big lessons, which I'm going to go through one by one, regarding oxygen access to children in Nigeria.

The first one is that the access to oxygen is poor and there are several reasons. No hospitalized children have their pulse oximetry or their blood level checked routinely. About one out of five children with low oxygen levels receive oxygen therapy and among those who are actually given oxygen, about two thirds

did not require oxygen. You can see a kind of surge oxygen delivery for children. This is the raw implication, especially for pre times and robots and low blood rates.

Reasons for such were structural problems, lack of pulse - oximeters, lack of oxygen equipment, qualified structures, technical problems, maintenance and repair, no biomedical engineers or technicians who don't know whether the filters need to be changed.

There is also the issue of accessibility to spare parts: it is not easy to get spare parts when procurement has been done. No negotiation for spare parts or training of site technicians for continuity and sustainability.

Apart from that was Nikka failures, lack of clemency, lack of guidelines, lack of training or not seeking therapy, lack of training on the use of oxygen concentrators and the likes. This span through pre service training, and also in service training, not enough training for healthcare workers.

Then we'll also learn, secondly, that the presence of oxygen equipment does not translate to oxygen assets to patients. Sometimes oxygen equipment is sitting down in the children's ward and is sitting down in the double room, but the healthcares workers were held up due to culture due to the hospital system. The patient does not get the needed oxygen; rather, he or she gets transferred to another center where oxygen equipment is available.

We also found out that there are many reasons for equipment failure. In the Indian context, we need to emphasize on poor management and not giving due accord to the biomedical technicians or engineers. Many times these people are not considered as gift layers.

I still remember that one of the technicians reported that she wanted to know that they have oxygen concentrators when the concentrator broke down: they're not being carried along in the procurement plan. That is one of the other major concerns in Nigeria leading to poor access and all the biomedical technicians are not motivated.

On the positive note, we found out that, although switching equipment is expensive, providing for some hospitals with moderate access to oxygen cylinders, oxygen concentrators with pulse oximeters, can significantly improve how they use the oxygen.

I did mention earlier that one out of five children that needed oxygen received oxygen and those that did not even need oxygen were given oxygen. We found out from our studies that if you provide for pulse oximeters, health care workers can make the best use of the lead to available oxygen and ensure that it gets to those that are critical on that day. Oxygen does everything to increase the impact of oxygen therapy.

Lastly we found that the supply chain is inefficient. It is also expensive, not only to hospitals but also to patients. Patients opt for discharge against the medical advice because they could not pay for the oxygen and sometimes hospitals do not keep track or keep paying the bill that has accrued from the oxygen purchase. These are the five big lessons that prior to COVID we learned from our study.

Your second question regarding generalization. It is fine to some extent - some problems demonstrate to African settings, such as coal power for route networks and inefficient supply chains. There are some publications from other countries that have actually confirmed what we found out from our studies. Last

year, we also published a paper with dark waters from Uganda and also Kenya trying to share lessons learned from our oxygen work on the feed prior to COVID.

We recommended the need to support health care workers with training and pulse oximetry and also the need to ensure that medical technicians are given adequate support so that the assistant oxygen supplies will be optimized through training protocol and logistics. Thank you.

Erta Kalanxhi

Thank you so much for these very unique insights from your part. It's so important to highlight that lack of access does not always correlate with lack of availability or lack of equipment. We move on to the next question where we'll talk a bit about the COVID-19 pandemic.

During the pandemic, how has Nigeria been able to address this oxygen shortage for COVID-19 patients? Do you think that the new oxygen equipment that was purchased during this period is going to address some of the shortages that were there from before, that you have identified for children?

Ayobami Bakare

Thank you for your question. How Nigeria actually addresses oxygen shortages, I will just give a slight background.

Prior to COVID-19, we have the United for Oxygen coalition, which is a sister position to Every Breath Counts. The focus of the coalition is to ensure that no patient in Nigeria died from hypoxemia or due to lack of oxygen. That coalition is already formed, which has been led by the Federal Ministry of health for Coordination and through support from the internet Assets Initiative. We already have that on the ground.

As part of the presidential response to COVID-19, we have a Presidential Task Force, a kind of ad hoc committee, to supervise and coordinate government-led responses to COVID-19.

Through these two platforms, we're able to make a way to ensure that we tried to mitigate the oxygen subject. The PTF, which is the Presidential Task Force committee, supported the Federal Ministry of Health to ensure reactivation of dormant PSA plants in the country.

That was an immediate, urgent call from United For Oxygen and then NGOs like Clinton Assets initiative, did a rapid assessment. We're able to at least reactivate the non functional oxygen plant. The COVID-19 Presidential Task Force also released approximately 7 million US dollar procurement and installation of 38 new oxygen PSA plants.

That is from the government side. We already had the platform which is being coordinated by the Federal Ministry of Health . We have partners like Clinton Assets Initiative, Oxygen for Life, Saving children, fought back. That platform gives the opportunity for everybody to come together. We're having a monthly meeting to review the oxygen cap and I'm happy to say that through that we're able to have a coordinated response to ensure that oxygen shortage did not really affect the treatment.

Specifically, through Bill and Melinda Gates Fund, CHAI was able to support the Federal Ministry of Health to construct and get it running a new oxygen plant at the infectious disease hospital that we serve as the main isolation center in Lagos states for COVID-19 patients. That was done through the United For Oxygen platform.

We also have donations from the WHO, of over 500 oxygen concentrators were donated to the PTF on COVID-19. We also have a live bank, which also took upon itself to distribute oxygen cylinders to different isolation centers across the country. Over 1000 oxygens in the US were actually distributed by live banks across the country. Based on our previous works, we have partners and actors in oxygen prior to COVID-19.

So CHAI has supported trained healthcare workers. We had known before that extra workers need to be trained, so CHAI was able to support that chain of healthcare workers and bmes, biomedical technicians, and engineers through fund from Bill & Melinda Gates and also through funding from Unitate, CHAI was able to

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...PSA plants, plants were not able to function.

CHAI was able to actually supply the oxygen generators for them, so that at least they were able to start producing oxygen. They also have other UN bodies like UNICEF that donated oxygen concentrators to the National Center for Disease Control, and over 1000 senators house also donated to tertiary aid facilities, and also additional about 802 secondary facilities across the Federation.

All these efforts to ensure the increase in increased access or availability of oxygen equipment. They also have an Oxygen for Live initiative, another NGO, is also a partner and a member of the United For Oxygen platform that supported isolation centers in two states in southwestern Nigeria with oxygen concentrators and pulse oximetry.

Save the Children also true, an inspiring project funded by GSK to support two states and Lagos state and then Jigawa states in northern Nigeria with concentrators. In northern Nigeria, they also construct a height oxygen system in some selected secondary facilities to ensure that there is increased oxygen access to the COVID-19 patients.

I need to also highlight that CHAI also did something innovative, oxygen kiosk. Oxygen kiosk, like a mobile oxygen structure at the community, such that a patient that needed oxygen prior to transfer to isolation centers and deprived of oxygen therapy. It's just an innovative oxygen delivery method when we're at the eats of the COVID-19 pandemic in Nigeria.

Those like Air Liquide are supplying liquid oxygen to facilities that have capacity for storage. They have also been supporting maintenance of oxygen equipment and other assessments. They also work to ensure that they increase their production. SF also is another private company who works tirelessly to ensure availability of plant components for installation of the new PSA plant.

These are just some of the efforts that the government and also developments that partner United For Oxygen to ensure that we are able to show the oxygen demand. Thank you very much

Erta Kalanxhi

Thank you very much Dr. Bakare, it's really impressive to hear of so many different initiatives and so much effort going into this. Thank you for sharing this with us.

We'll move on now to Dr. Ramanan Laxminarayan and this time, not as director of CDDEP, but as co-founder of OxygenForIndia. In the spring of 2021, the COVID 19 pandemic in India took on the proportions of a humanitarian crisis and people living only miles away from an oxygen plant still did not have access to oxygen, and they were dying from the lack of medical oxygen. Could you tell us what are the factors that contributed to this? How did it get to this point in India?

Ramanan Laxminarayan

Thanks, Erta. India, as most people know, went through a terrible second wave of COVID during March and April of this year, and the demand for oxygen went up 10 times from about 800 metric tons per day to 8000 metric tons per day.

During a normal period of time, the medical oxygen demand in the country is only 10 or 15% of the overall medical oxygen demand. Most of the other oxygen is used for industrial purposes, but the medical oxygen requirement during the second wave exceeded the total oxygen production in the country. Of course, that was only one part of the problem.

The second part was that even the production that was available was not available in places where patients existed. 80% of India's oxygen production happens in only eight states and those states are not necessarily the ones where the demand is the greatest. The places in which oxygen tends to get produced for industrial uses tend to be places like steel plants, which are very far away from any sort of urban center.

India both had a supply issue as well as a distribution issue because there is typically not the infrastructure to move that quantity of oxygen by rail or by road and oxygen is not an easy commodity to move. You can only drive oxygen tanks at the rate of about 30 kilometers per hour. If you're about 200 kilometers away from an oxygen plant and 200 kilometers is not that far, it still is going to take you about seven hours to get the oxygen from one place to the other. And that's assuming that the trucking capacity actually exists.

We had a supply issue and we also had a distribution issue, and consequently, many people died. It's estimated that millions of people died during the second wave. The estimates range anywhere from about 3 to 8 million people having died during COVID overall, but the vast majority who died during that second wave. As the other speakers have said, we've forgotten that oxygen was the first and most medically important medical intervention for saving lives and, and sadly, India had not learned from the experience of other countries before it that have also had oxygen shortages.

Somehow this was not part of the prepared and climate preparedness planning at the scale that it really needed to be. The path forward is of course that we prevent oxygen through vaccination, but the major effort right now, that CDDEP is involved in, is in pulling together a National Oxygen Grid. The National Oxygen Grid is based on a few observable facts.

For one, we have oxygen in places that are different from the places where people need the oxygen, that's number one. Number two is that the volume of production is insufficient to meet the needs of medical oxygen when you consider all the uses that are required. Number three is that there could be seasonality in oxygen requirements. There could be variations over time in oxygen requirements as COVID or any sort of follow up respiratory diseases could bring upon us.

What we need is something similar to a gas grid or electricity grid, where the production can happen in one part of the country or a few parts of the country, but it's relatively easy to move this production to other parts as they actually need it.

We're working with the Government of India and a couple of state governments with Uttar Pradesh and Karnataka to figure out how to do pilots of these kinds of oxygen grids, which will first operate at the state level and then move on to a national level.

The challenges are many: one is that a grid by necessity requires transportation infrastructure. If you see the quantum of oxygen assets that are coming to the country, they are actually production assets, they're not transportation assets or storage assets. We can have any number of pressure swing adsorption plants or we can have oxygen concentrators or production options, but we also need storage tankers, we need to be able to move liquid oxygen from one place to the other.

As Leith mentioned, the biggest change that has happened because of COVID is that the oxygen manufacturers have realized that they're not just an industrial commodity producer, they are a critical part of the public health system.

Governments recognize this as well, that keeping track of medical oxygen is an essential public health function. If we can retain that thought, and make that the focus for how we plan our logistics and infrastructure going forward, then we would have had something positive emerge over a really bad tragedy that has befallen in many parts of the world in 2021.

The capacity to put all this together requires knowledge of logistics, supply chain associated with refilling cylinders, replacement parts, capabilities related to healthcare workers on using the oxygen. We know that having oxygen is not sufficient if it's not actually used and figuring out how to use it is very important. A power infrastructure is important because if you don't have power, production becomes unreliable and storage also can be unreliable if you're using liquid metal oxygen storage tanks.

There's certainly a need for some sort of business model to make sure that the price of oxygen is consistent and affordable for people in different parts of the country. It's of course a huge issue of maintaining these assets, whether of PSA plants or of LMO generation plants or of storage capacity, that asset management and particularly in remote areas, where this capacity doesn't exist right now, is really going to happen going forward.

A lot of work lies ahead of this community that is interested in ensuring that nobody dies because of lack of medical oxygen again, and that is a tall order because many people do die even today because of lack of medical oxygen, even when there is not a COVID crisis. But those deaths are invisible to us because we don't necessarily attribute those to lack of medical oxygen, although that's really what is going on here.

In the coming months, we've got a lot of work that we will be able to share in terms of, at least for India, what the architecture of such a grid would really look like, the software platforms which will provide

transparency on where oxygen is available and where it needs to move to, and much more in terms of bringing in sort of the business model for how we are able to maintain these assets at a national scale in a nonprofit sort of a way.

The commercial model for oxygen works well for industrial purposes. A commercial model of oxygen which is based purely on a profit motive is probably inconsistent with a public health objective. This is where the government needs to step in and be part of a strong public private partnership, which encourages the private sector to help solve the problem, but also keeps a lid on what the prices might look like for patients, who at the end of the day are the ones who are mostly paying for the oxygen when they really need it.

Happy to talk about this some more in terms of the National Oxygen Grid, but we'll turn back to you for questions.

Erta Kalanxhi

You have sort of addressed my next question, but I will ask it anyway because there are some parts of it that would be nice to get your insight. India received a lot of support from people in organizations across the globe and the government is now investing in oxygen to prevent a repeat of last spring's tragedy. But do you think India is doing enough in terms of these investments and how can we make sure that these investments that are made now continue to save lives 5, 10 years from now?

Ramanan Laxminarayan

In response to the oxygen crisis, both the government and private philanthropy have brought in a huge number of oxygen assets into the country. Oxygen for India itself has brought in 40,000 cylinders and 3000 concentrators. That's just one entity which CDDEP led. All put together, the estimate is about 100,000 concentrators, probably the same number of cylinders, and about 2000 PSA plants, which are capable of producing oxygen for the level of a hospital, have come into the country.

The way in which these have been deployed has been not a coordinated approach, and much more importantly, has not recognized that there is an existing infrastructure of liquid medical oxygen that already exists. Unless we are able to build on top of the existing infrastructure, we may end up disrupting the existing infrastructure.

Let me give you an example. If you're placing PSA plants in the middle of a city, which is already served by liquid medical oxygen, and typically PSA plants cost more money to operate to produce per cubic meter of oxygen than a LMO plant would. What we would have done there is we would have displaced an existing production and an existing set of players who are working there, but replaced it with a system that is less efficient in the hands of a hospital that is not really well equipped to manage oxygen generation.

Consequently, we may end up with a situation where this PSA plant breaks down and the LMO producers are no longer supplying to the hospital, and we have a worst problem in the future. The road to hell is paved with good intentions and I think a lot of good intentions in the context of COVID could end up leaving us in a worse situation than where we were - not because of lack of resources, but simply

because we haven't carefully thought through what the implications are of what we do and what we disrupt when we bring in new assets.

I think doing enough is a simplistic way of looking at it. It's a question of doing the right thing and we have to be careful to not end up in a place where we're worse off because in our intent to do more, we actually disrupt the functioning part of a system rather than compensate for a dysfunctional part of the existing system. That's a responsibility that we all have.

Erta Kalanxhi

Thank you very much Ramanan. We are now moving on to some questions from the audience. We have two questions so far, so please do bring them on if you have them in the chat or the Q&A section. The first question is on new technologies. Are there any promising technologies in the pipeline, for example, improved oxygen concentrators? This question is open to all of you.

Leith Greensdale

I'm happy to comment. One of the positive things when you have a lot of focused energy on a neglected area, is that it becomes ripe for innovation. And we do need innovation in the oxygen space. We need it from the oxygen concentrators, which are the mobile units, right through to the very expensive liquid oxygen plants and everything in the middle.

We don't have a system yet that is really suited to the needs, particularly the medical needs in low resource settings. We know we've been supplying equipment that's not quite right.

Take the oxygen concentrators: those units have done mighty work during COVID, but they certainly were not designed for it. They were designed for the home care market in rich countries for all the chronic chronic disease patients but they have been repurposed during COVID and they've done mighty work, but they're not where they need to be.

There's an exciting new initiative funded by the UK government with a group called the Oxygen CoLab. I hope you've all heard of the Oxygen CoLab. We can put a link in the chat and they're working with UNICEF on a new target product profile for a concentrator specifically designed for low resource settings. It's designed to be easy to use, minimal power, alternative power, and something that doesn't break.

We haven't talked about graveyards of equipment but further to Ramanan's comment, we're all very worried that all this oxygen equipment that is now streaming into countries is going to break and there won't be the biomedical engineers and clinical engineers there to fix it. That's another problem we could be creating that we need to get ahead of. Innovation is part of the answer to that: designing equipment that's less likely to break and can be easily fixed.

There's an exciting initiative around concentrators, but we also need innovation in PSA plant technology and liquid oxygen. We're hoping that after COVID, there'll be enough groups now engaged in this and enough funders interested that will have a proper innovation pipeline with medical oxygen.

Erta Kalanxhi

Thank you very much. We have another question that is on the last mile issue with delivering oxygen to patients. Zooming into the last mile, do we also need to see and prioritize concerted efforts over its effective oxygen administration to the patient - going beyond oxygen production and delivery? In other words, being able to prioritize effective oxygen administration to the patient once it is in the hospital, or once it is in the health care facility, I'm assuming.

Ramanan Laxminarayan

I think Dr. Bakare should take that question. This is really a question of how we are able to use the oxygen to save lives.

Ramanan Laxminarayan

I'll take it because I don't know if he's able to hear the question, but this is a concern I've heard in many cases, where the capacity or the human resource ability to be able to use oxygen doesn't exist in every place.

As he had mentioned as well, you need to have the pulse oximetry and the clinical expertise, perhaps telemedicine, to be able to make sure that availability of oxygen is translated into lives saved. That's not something we can really take for granted.

An effort to vastly expand the research that we have right now on how oxygen can save lives, in what context it should be used, etc. is really needed. This is not an area in which we work at all, but I was shocked to see how little research there really is on making the case for or explaining why and how oxygen can save lives.

I would say that that's a relatively small literature compared to what seems to be the importance of this topic. Leith, I don't know if you know more about this than I do, but I've been astonished that we know so little.

Leith Greenslade

About oxygen?

Ramanan Laxminarayan

Yeah, there are probably only a handful of papers showing the effect of oxygen on child mortality, for instance. Don't we need far more research to be able to encourage policymakers to make consistent investments in this area?

Leith Greenslade

Oh my goodness, the lack of data on access to oxygen. I remember watching when the pandemic hit February/March last year, it was clear to many of us working in oxygen that this would be a disaster. We all had Dr. Bakare and his colleagues' papers. We knew what was not in the health system from all that scholarship. We knew it was a disaster waiting to happen, but watching the international actors scramble for data, it took them months just to understand what hospitals had across Africa, Asia and Latin America.

A lot of time was lost, precious time, trying to collect data just to understand what countries might need to treat COVID patients. We can't be that blindsided again. One of the other things we need to do after this pandemic is get the data in shape.

There's no reason why the global burden of disease, which is a great data set, can't create estimates of hypoxemia related deaths, for example, cases and deaths by country. There's no reason that can't be part of the GBD and UNICEF and WHO. There's no reason they can't be tracking pulse oximetry coverage, oxygen coverage for children and adults.

We have a massive data collection exercise ahead of us. It started but we're going to need to do a whole lot more to answer some of these other questions in the chat.

There was a question we missed an early one from Erta Kalanxhi about: what do we know about what oxygen countries produce and what the need is? We don't know. That is almost like priority number one, after we emerge from the immediate crisis.

Erta Kalanxhi

Thank you Leith. I think we can address two questions at the same time and that's about innovative ways for oxygen production. One of the questions from Garrenz Uprum is how about hospitals undertaking oxygen production? Would that be an option since Ramanan says that he read that the industry sells oxygen very expensively? This was a report from the Public Citizen. And the second to last question is also asking about other ways to produce oxygen apart from centralized production.

Ayobami Bakare

Yeah, let me take the question on hospitals undertaking oxygen production. I think it is a good idea, but that does not make the cost affordable, especially for settings like Africa where power supply is poor.

If you are to construct oxygen plants now, it requires power. An institution whereby an oxygen plant is not being run 24 hours on diesel generators, doesn't add to the cost of production. Most of these, like Nigeria, we need to import virtually everything. It gets more expensive.

Perhaps there can be a movement because I spoke with one of the suppliers yesterday and I asked about the price of concentrators, and I found out that it is even quite more expensive now than it was maybe five years ago. I was surprised that this cannot be afforded and there are further problems requiring logistics.

And then the issue of demand and supply- how the market forces react because there is now an increase in global demand for oxygen equipment. From this forum, we also need to look into how the company will not seize this opportunity to even increase the cost of oxygen equipment.

I forgot about building an oxygen plant, but the cost is now skyrocketing, even far beyond what it was before COVID-19. If hospitals are to be producing oxygen, we need more oxygen plants than what we have now. In the facility that I work, we have oxygen plants, but yet it's still not sufficient.

If you have to increase and construct more oxygen plants, now the gas company has increased the price of oxygen equipment. It's a dilemma that I feel like we need to look at maybe humanitarian work to ensure that the price is directly afforded to countries in low and middle income countries. I don't know if Leith has one or two things to add. Thank you.

Leith Greenslade

Just to agree with everything you said about cost, and I'm so glad you raised it. A lot of people in the north don't understand that during COVID, even before, patients have been asked to pay themselves sometimes hundreds of dollars per oxygen cylinder, which may only last for 24-48 hours.

There's been an oxygen crisis and even to the extent there has been oxygen available- families have been asked to find huge sums of money to pay for it because it's not covered, unlike the COVID vaccines, which we receive for free. There's a huge system around financing those so that people don't pay.

We have not had that level of support for the treatment side of COVID. Patients and hospitals have been left to fund those costs themselves. I think the cost of oxygen is a huge issue. I agree very much with Dr. Bakare, we have to look at it.

Erta Kalanxhi

Thank you everybody. We don't have any other questions from the audience. I don't know if you have any closing remarks to conclude today.

Ramanan Laxminaryan

Leith, go ahead.

Leith Greenslade

Okay, just very briefly. According to the World Health Organization, we're losing 50,000 people every week still from COVID-19. We know it's a massive underestimate. We know it can be 5, 10 times higher - the real numbers.

At this stage of the pandemic, more than 18 months in, with vaccines available, not everywhere but in most places, we are still losing 50,000 people a week, which speaks to the treatment challenge we have.

We are still in an oxygen crisis. We don't know what lies ahead with this pandemic. We don't know if there'll be a new variant emerging and the needs could take off again.

We really need to prioritize the need for oxygen and the other treatments that keep COVID patients alive. We are almost at 5 million dead overall and to keep that number as low as it can be, so it doesn't keep rising, we have to keep our eye on oxygen and treatment and make sure when COVID patients turn up and need it, it's there, no matter where they are.

We're a long way from that reality and I'm hoping for webinars like this, and I thank Ramanan and the team for hosting us. I hope webinars like this can reach all of you with that message so you can then go into your spheres of influence and argue strongly for investments in oxygen. Thank you.

Erta Kalanxhi

Thank you very much Leith.

Ramanan Laxminarayan

Dr. Bakare, did you have any final thoughts?

Ayobami Bakare

Just to thank the organizer for this excellent discussion. Try to charge everyone to look towards ensuring a form of subsidy for oxygen so that, just like what Ramanan said, we don't destroy some other function in part of the system prior to COVID-19. That is the last order for me, to look at how we can subsidize that oxygen more just like what has been done for COVID for us. Thank you.

Ramanan Laxminarayan

My own last thoughts, I'll also respond to Doug Call. I think that we do need to incentivize governments to think about oxygen as a utility, and I think that they are awake to this important need because the public would simply not permit another oxygen crisis to arise without there being significant consequences and repercussions.

States, and even the federal government in India, are already willing to think about it and these sorts of lines. The fundamental reason why there is a government role is twofold. One is to make sure that prices are affordable, and second to make sure that there is rapid movement of oxygen assets from one place to another, and the ability to transport the oxygen. In that sense, it's much like an insurance policy.

A lot of the time this may not be needed, but just like a fire equipment investment, this may be needed in times of crisis and, therefore, it's important for governments to pay for those assets and maintain them so that when there is a crisis, you're dousing the fire with oxygen. That's the way in which to really think about it. In order to get governments to do it, we need to present them with a clear case of what the ask is, how we're going to make a system like this work, and third, what it would cost and how would the whole thing hang together?

Unless we really make that happen: today, there is not a program for oxygen in most governments, but there is a TB program, there is a malaria program, there's a HIV program, there's not an oxygen program. The capability doesn't exist in most governments to be able to address oxygen and I would say that in rich and poor countries.

We need to use this crisis and turn it into an opportunity to be able to build that capacity. There's a lot of potential for health improvement if we have a stable and reliable oxygen supply in the form of a grid. The responsibility is really on us, as people interested in this, to make this happen.

I want to thank everyone for coming to this webinar and sharing your thoughts. Do stay tuned for more work that CDDEP will do in this area and of course from our partners at the coalition that Leith leads. I would strongly recommend if you're interested in this area, to join her phone calls that she has every other week, which are extremely informative.

Maybe you can drop a link on the chat for people to know where to join for your calls. I found them extremely helpful in terms of understanding and connecting with private sector players working in the area, because this is not going to get solved as just a public sector idea. It's going to require the private sector in a significant and involved way. Thank you.

Erta Kalanxhi

Thank you, Ramanan. I'd like to thank, on behalf of everyone who joined us today, our speakers for the work they do every day to bring attention to this very important issue and address this issue. It's well known during the COVID 19 pandemic, but it has been affecting vulnerable groups for years.

One of the audience members asked about where they could find the link for this webinar. I'm just going to repeat and say that you can find it on our website. I included the link on the chat as well.

Thank you very much and for those of you who have been following us on this conversation series, we have two more webinars coming up and the next one will be on modeling COVID-19 disease transmission studies. Thank you and have a great day.