

Oxygen Care for Adult and Pediatric Patients Session 6: Device Management (Africa)

Question and Answer - June 24th 2020

You mentioned there may be a need to change hospital systems. Do any of the panelists have any examples of innovative solutions to this you've seen?

I think one of the best improvements to hospital systems that I've seen to help manage oxygen and oxygen flow, is to introduce piped systems where they have not previously existed. It can be intimidating, because it's considered an expensive investment. However piped systems do not have to be provided for an entire hospital, and can be scaled. For example you can install small piped systems to targeted wards, e.g. surgical centres, intensive care units, emergency departments and other priority departments. That way you can optimize your use of oxygen because the piped system makes it readily available at the bedside, without having to fetch cylinders which might not always be readily available, technicians to make the connection might not be available, and can be labor intensive. You may be vulnerable to running out of oxygen before cylinders can be changed. Piped system doesn't necessarily have to be connected to an oxygen plant, but can be connected to a manifold of cylinders (several cylinders joined together) to serve a ward or an entire department. The benefits of pipes are also (1) Safety -moving cylinders can be dangerous; and (2) These systems are easier to monitor.

We also want to highlight having an active management system - making sure you have a proper inventory of all the devices in your facility, inventory of medical devices are on a preventative maintenance schedule (where devices are being cleaned, filters replaced, calibrated, performance verification tests are accomplished). If hospitals can look into how we are managing our technological assets, we can get closer to tracking costs associated with ensuring supply of oxygen supplies. If any hospital staff need help tracking equipment, putting maintenance schedules together - we'd be happy to share some resources. We've done sessions on the more technological engineering side that would empower your technicians to do these things.

What are other factors to the cylinder system that can limit safety or the number of patients you can treat?

Some hospitals have become creative in using tubing as substitutes for cannulas or masks - the scarcity of oxygen accessories to delivery oxygen can be frustrating. I think that you have to become your own best advocate to hospital administration. I've seen many really good clinicians, nurses, assistants who are caring for patients at the bedside and settling for doing the best they can, without even making the hospital leadership aware of the deficiencies of their supplies. At the same time, we've interviewed hospital directors who aren't aware of these deficiencies. Sometimes healthcare workers don't speak up because they think its just too difficult to speak up and make change - but really end-users need to advocate and make

leadership, regional health leaders know what tools are available. As an example, I spoke to a hospital leader. I asked 'Do you have the oxygen that you need' - and he said yes. I asked him 'do you ever run out of oxygen for surgeries?.' He said - 'No we don't do surgeries - we refer all surgeries. We must refer (and it can be many hours to the next surgical setting), because we don't have oxygen". Example of circular reasoning - this individual was saying they don't need oxygen because they don't do surgeries, but they don't do surgeries because they don't have oxygen. So really - they need to advocate for systems change - e.g. spare cylinders so when other cylinders are being refilled you don't have a gap. End users have the strongest voices to make the administrators of your hospital aware of what you're contending with in your wards.

A participant raised some interesting points in the chat on quality improvement and documentation: Many hospital administrators may not be able to tell you the amount of O2 they're using, because there's no means to check pressure of oxygen in the cylinders. There may not be a culture to keep the records of the number of cylinders in use. There may not always be a high quality of medical grade oxygen available. Can any of the panelists speak to these points?

This is exactly the problem. The tools the clinicians need to do their job are sometimes scarce and difficult to come by. In order to deliver oxygen to patients, you need a flow meter, but I would submit that typically flow meters will have a regulator with a gauge. I will also note that I've seen way too many gauges that don't work properly and are broken. Fundamentally - need to care for these devices - avoid throwing them in a box or drawer, because this breaks them. IT is going to be important to know how much oxygen you have available in cylinders, to know how fast you're using it, so you'll be prepared to replace that cylinder when needed.

We have created a tool on tracking rate of flow and use of oxygen: we know from experience that it is really challenging and while you may not know the exact pressure in the cylinder, if you're starting from full cylinders, you can estimate starting pressure as 2200 PSI and use size of cylinder, and number of patients to estimate how much oxygen you need. We acknowledge its hard to estimate these numbers, and we hope you will download and use the tool to help. Part of this will require some documentation - but I suggest that charts specific to cylinders, if you start to flow oxygen at 5L/minute, documenting this will help you in calculating when the cylinder will need to be changed. We've taken the principles of widely available calculators to elaborate on them for devices with more sizes for expanded use and applicability.

Can you highlight some things you've seen in concentrator systems that affect the number of patients you can treat, and safety?

Low oxygen purity due to lack of maintenance is a big issue. Can be a result of not changing the filters, which reduces purity of output.

Also - there is an alarm on concentrators which signal an issue with the oxygen output. In some settings, it's always ringing so some people will take measures to cut off the alarm. This is a big

issue as well. So you might have settings where to avoid annoyance of an alarm, patients are using systems that are delivering only 60% oxygen, as low as 20% oxygen I've seen because of poor maintenance. And this significantly compromises patient care. Last week's session - goes through simple steps involved in cleaning and maintenance to keep in mind.

What are the dangers of having dirty humidifiers, or using industrial grade (instead of medical grade) oxygen, using dirty or non-sterile water - what are the potential harms to the patient?

Anytime you're not using sterile water, clean systems that are medical grade and pure -- essentially the patient is inhaling all of the impurities and potentially infectious agents into their lungs. This has the potential to cause more harm to the patient than not treating them at all.

Can you speak to the use of oxygen analyzers? Are they available for cylinders and concentrators?

You can use the same type of analyzer for cylinders and concentrators.

If your facility is ordering oxygen supplies, do analyzers typically come with the devices, or is it something you need to separately order? And if so - where can you order analyzers, and how widely available are they?

This depends on the country. Sometimes you need to access from outside the country, and should be planned for as a budget item in purchasing plans. They are a really critical tool, and oftentimes left out of discussion - it goes along with oxygen supply. When Assist International provides supplies, we bring them with analyzers - they are an essential tool for clinicians. Also can be used as a tool for providers to advocate for themselves - before a technician comes around, clinicians can identify gaps. We have seen situations with concentrators providing essentially room air as patients decline and are suffering - and then as soon as a cylinder is brought over, patients wake up and have sharp changes in condition because they are now being treated. Sometimes people consider them to be more of a technician's tool rather than a clinician's tool - but for anesthesiologists, we are used to measuring oxygen with our anesthesia machines and can be useful clinical tools. Analysers should be used to check devices and must be considered essential. They can be shared between departments and wards, you don't need hundreds, but are critical to maintain equipment and advocate for your facility. In the last session we mentioned there is an African Medical Supplies Platform - an online resource and store for medical equipment being made in Africa. This might be a site to find oxygen analyzers. If not - would be great for innovation to develop production of these in LMICs so that they have their own in-country supplies.

Final thoughts?

In the chat, some participants have mentioned a lack of technicians in their hospitals. There's not a whole lot we can do to help there. However if you'd like to reach out to us, we'd be happy to connect you to friends and partners in the region to see if there is a biomedical technician service that is local that can help your facility out. We have partners in many countries, societies across many regions, organizations that can help fill these gaps.

We would also like to point out that we have an entire series on biomedical engineering training - we have a number of tools, sessions and trainings on more technical perspectives on device maintenance and repair. This can be found on the Assist International website:

<https://assistinternational.org/bmet-echo-library/>