Oxygen availability in Sub-Saharan African countries

Mangipudi, Sowmya ; Leather, Andrew ; Seedat, Ahmed ; Davies, Justine

DOI:
10.1016/S2214-109X(20)30298-9

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (Harvard):
Mangipudi, S, Leather, A, Seedat, A & Davies, J 2020, 'Oxygen availability in Sub-Saharan African countries: a call for data to inform service delivery', *Lancet Global Health*, vol. 8, no. 9, pp. E1123-E1124. https://doi.org/10.1016/S2214-109X(20)30298-9

Oxygen availability in sub-Saharan African countries: a call for data to inform service delivery

Oxygen is central to the management of patients admitted to hospital with severe COVID-19.[1] Furthermore, the availability of oxygen therapy is just as important for the management of other patients who are acutely ill. However, despite recognition from most health-care providers that oxygen is a fundamental component of a health-care system, it has not been a focus of health-care delivery in sub-Saharan African countries, as shown by the lack of data collected on oxygen availability.

Previous research studies have investigated oxygen availability in individual or groups of countries in sub-Saharan Africa to assess future influenza pandemic readiness, or, for example, adequacy of obstetric or critical care.[2-4] Many of these studies date from before 2010, and those that are more current are either single-country surveys or simply collected data on self-reported oxygen availability as present or absent.[5,6] Even fewer quantify cylinders, concentrators, or central availability of oxygen—information which is necessary for a needs assessment during the COVID-19 pandemic. Surveys such as the Demographic Health Survey (DHS) Service Provision Assessment Survey (SPA) or the WHO Service Availability Readiness Assessment (SARA) offer availability of good-quality data using consistent methods across time and countries. However, even these surveys have included questions on oxygen availability only since 2012 (DHS SPA) and 2015 (SARA), and they are not done regularly or in every country. Additionally, although summary SARA reports are available from Benin, Mauritania, and Niger, only the DHS SPA raw data are publicly accessible to enable external analyses using a consistent approach.

Using data available from the Democratic Republic of the Congo for 2016–17, Senegal for 2014–17, Malawi for 2013–14, and Tanzania for 2014–15, where SPA surveys have been done since 2012, we aimed to determine oxygen availability, source, and constancy of supply. WHO SARA data were not used because the data were not publicly available; attempts to contact countries' ministries of health were unsuccessful. For Senegal, where longitudinal data are available, we got an indication of the priority given to increasing supply. We also assessed electricity availability, given the need for electricity to drive many oxygen delivery systems. Information regarding the DHS SPA data collection methods was previously published for each country and are described briefly in the appendix (pp 4–5).

Even in countries with data, we identified important deficiencies in electricity and oxygen availability (further data are in the appendix [pp 1–2]). Across all facilities in all countries, only 43·4% have both continuous power and available oxygen, and only 36·8% have fewer than 2 h of power outage per week (appendix p 1). Unfortunately, the surveys do not allow assessment of whether power supply is totally uninterrupted, as the variable is coded as "always available" if power is interrupted for fewer than 2 h per week. This information is crucial, because critical patients on oxygen concentrators rely on an uninterrupted oxygen supply.

Surprisingly, when only using data from facilities that responded to all the questions, 96·4% of facilities had any oxygen availability, including oxygen concentrators, cylinders, or centrally supplied oxygen (appendix p 1). However, across all countries, only 308 (6·9%) of 4466 facilities responded to these questions, suggesting that the actual proportion with oxygen availability is smaller than that indicated by the data. Indeed, data from Malawi show that 77% of general hospital wards have oxygen availability in 2020,[7] which is lower than we found in our analysis of responders.

On the assumption that facilities who did not respond to the questions had no availability, the picture is much more bleak, with only 3·9% of all facilities having oxygen and constant electricity available, and only 12·6% having any form of oxygen available (appendix p 3). When considering just secondary facilities or higher, where most patients with COVID-19 are ideally treated, availability of oxygen was increased in each country, but only in 20·3% of facilities where no response was categorised as not available (data not shown).

When categorising no response as oxygen or electricity being unavailable, our results are similar to those recorded in the summary SARA reports. Benin only reported oxygen availability in facilities that provided care for obstetric emergencies; in 2015, 29% of these facilities had oxygen available.[8] In Mauritania in 2016 and Niger in 2015, the SARA report indicated that of all facilities offering services to treat respiratory infections, only 21% in Mauritania and 8% in Niger (43% in hospitals) had oxygen available.[9,10]

Longitudinal data from Senegal suggest that improving electricity availability has been a focus of health system strengthening efforts (appendix p 4), but data on oxygen availability are insufficient to do a comparison.

Our findings highlight three major issues. First is the paucity of data collected on oxygen availability. To improve capacity requires assessment of baseline data. If availability of data on oxygen from SARA and SPA reflects general country knowledge on oxygen availability, it highlights the urgent need for further data collection in all sub-Saharan African countries. Second is the seemingly

Published **Online** July 3, 2020 https://doi.org/10.1016/S2214-109X(20)30298-9

For **DHS SPA data** see https://dhsprogram.com/data/available-datasets.cfm

For more on the **DHS Program** see https://dhsprogram.com/What-We-Do/Survey-Types/SPA.cfm

See **Online** for appendix

poor availability of oxygen in some sub-Saharan African countries, when assuming that non-responding facilities had no availability. This lack of availability is concerning not only because of the anticipated increase in demand during the COVID-19 pandemic, but also for the provision of basic medical and surgical care. Additionally, to truly understand whether oxygen is available to patients requires more granular data collection on oxygen availability per inpatient bed, in combination with information on whether the equipment is available to distribute oxygen to patients. Third, the fact that data are not publicly available from SARA surveys is troubling. National governments and supporting international partners urgently need data on oxygen capacity to plan a clinical response to COVID-19 and other health emergencies.

We declare no competing interests.

*Sowmya Mangipudi, Andrew Leather, Ahmed Seedat, Justine Davies
sowmya.mangipudi@gmail.com

King's Centre for Global Health and Health Partnerships, King's College London, London, UK (SM, AL, AS, JD); The George Washington University School of Medicine and Health Sciences, Washington, DC, USA (SM); University of Birmingham, Institute of Applied Health Research, Birmingham, UK (JD); and Centre for Global Surgery, Department of Global Health, Stellenbosch University, Stellenbosch, South Africa (JD)

1 WHO. Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020. Geneva: World Health Organization, 2020. https://apps.who.int/iris/handle/10665/331446 (accessed June 24, 2020).
2 Belle J, Cohen H, Shindo N, et al. Influenza preparedness in low-resource settings: a look at oxygen delivery in 12 African countries. *J Infect Dev Ctries* 2010; **4:** 419–24.
3 Bradley BD, Light JD, Ebonyi AO, et al. Implementation and 8-year follow-up of an uninterrupted oxygen supply system in a hospital in The Gambia. *Int J Tuberc Lung Dis* 2016; **20:** 1130–34.
4 Leligdowicz A, Bhagwanjee S, Diaz JV, et al. Development of an intensive care unit resource assessment survey for the care of critically ill patients in resource-limited settings. *J Crit Care* 2017; **38:** 172–76.
5 Baker T, Lugazia E, Eriksen J, Mwafongo V, Irestedt L, Konrad D. Emergency and critical care services in Tanzania: a survey of ten hospitals. *BMC Health Serv Res* 2013; **13:** 140.
6 Jochberger S, Ismailova F, Lederer W, et al. Anesthesia and its allied disciplines in the developing world: a nationwide survey of the Republic of Zambia. *Anesth Analg* 2008; **106:** 942–48.
7 Sonenthal PD, Masiye J, Kasomekera N, et al. COVID-19 preparedness in Malawi: a national facility-based critical care assessment. *Lancet Glob Health* 2020; **8:** e890–92.
8 WHO. Disponibilite et capacite operationnelle des services de sante: enquête SARA 2015. Benin: World Health Organization, 2015. https://www.who.int/healthinfo/systems/SARA_BEN_2015_Report.pdf?ua=1 (accessed June 24, 2020).
9 WHO. Indice de disponibilité et de capacité opérationnelle des services de santé (SARA): Mauritanie 2016. Mauritania: World Health Organization, 2016. http://apps.who.int/healthinfo/systems/datacatalog/index.php/ddibrowser/55/download/168 (accessed June 24, 2020).
10 WHO. Rapport de l'evaluation de la disponibilite de la capacite operationnelle des services de sante avec les outils sara et dqr. Niger: World Health Organization, 2016. https://www.who.int/healthinfo/systems/SARA_NER_2015_Report.pdf?ua=1 (accessed June 24, 2020).