

AVAILABILITY AND DELIVERY CAPACITY OF MEDICAL OXYGEN IN EMERGENCY CARE SETTINGS IN 14 AFRICAN COUNTRIES PER SARA AND SPA REPORTS

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INTRODUCTION

Oxygen therapy is a potentially life-saving component of medical care in an emergency setting and a critical component of an emergency care facility's resuscitative ability. Concern over substantial shortages in acute and emergency care resources¹ has led to substantial recent investments in emergency care development in low-and-middle-income countries (LMICs). However significant quality issues persist, especially as it relates to measurement of abnormal oxygenation², and delivery of oxygen³. Hypoxemia from many conditions is common in developing countries. Even before Covid pneumonia, especially among pediatric patients, hypoxemia was a substantial contributor to early death and overall mortality burden. Significant morbidity and mortality are associated with the inability to deliver oxygen in a timely and safe manner to a patient in need. Improving access to oxygen and pulse oximetry has demonstrated a reduction in mortality from childhood pneumonia by up to 35% in high-burden pneumonia settings. Efforts to understand best implementation practices rest on knowing where oxygen is needed most. These efforts have become even more relevant in a post-Covid-pandemic world. The need to quantify oxygen availability and delivery capacity is that much more pressing- it is a crucial first step in preparing for a possible similar situation in the future.



METHOD

Data pertaining to oxygen availability and delivery capacity were manually extracted from Service Availability and Readiness Assessment (SARA) and Service Provision Assessment (SPA) reports from 14 African countries, including Kenya, Tanzania, Sierra Leone, Zambia, Somalia, Mozambique, Libya, Democratic Republic of the Congo, Benin, Mauritania, Burkina Faso, Niger, Senegal, and Malawi.

RESULTS

Overall, the available data indicate a severe shortage of oxygen. While increased data would be beneficial in accurately quantifying oxygen capacity on the African continent, the patterns that have emerged thus far with the available data indicate a severely unmet need for adequate treatment of hypoxia consistently across the reporting countries.

Country	Year	Percent of facilities offering treatment for cardio-vascular disease with oxygen available	Percent of facilities offering treatment for chronic respiratory disease with oxygen available	Percent of facilities offering surgical services with oxygen available	Percent of facilities offering C-sections with oxygen available
Burkina Faso	2014	4	5	NR	NR
Democratic Republic of the Congo	2015	5	6	NR	NR
Mauritania	2016	20	21	16	NR
Niger	2016	8	8	49	47
Senegal	2019	NR	15.1	NR	NR
Tanzania	2012	77	75	63	NR
Sierra Leone	2012	15	22	10	NR
Sierra Leone	2011	NR	NR	9	NR
Zambia	2010	NR	NR	28	NR
Somalia	2016	30	29	24	NR
Mozambique	2018	6	6	8	49
Malawi	2013	15	16	NR	NR

- Of note, Benin reported that 34% of all healthcare facilities had "filled oxygen cylinders," however did not provide additional data on number of filled oxygen cylinders, oxygen concentrator availability, or distribution of oxygen cylinders by facility type.
- Kenya also reported oxygen availability in healthcare facilities overall without specifying care type available. Kenya reported "oxygen concentrator/cylinder with flow meter" availability as 13.8% countrywide but, like Benin, neglected to mention quantity of concentrators/cylinders.
- Libya was the only country to specifically report oxygen availability data in emergency care specific settings, among which they reported 93% had oxygen availability. In hospitals overall (not just those specifically offering emergency care) Libya reported 58% with oxygen cylinders, 21% with oxygen concentrators, 60% with ventilators, and 4% with central oxygen supply.

References:

1. Obermeyer Z, Abujaber S, Makar M, Stoll S, Kayden SR, Wallis LA, Reynolds TA. Acute Care Development Consortium. Emergency care in 59 low- and middle-income countries: a systematic review. *Bull World Health Organ*. 2015 Aug 13(6):577-586G. doi: 10.2471/BLT.14.148338. Epub 2015 May 26. PMID: 26478615; PMCID: PMC4581659.
2. Starr N, Rebollo D, Asemu YM, Akalu L, Mohammed HA, Merchenko MY, Melese E, Bihew S, Wilson I, Tadesso M, Weiser TG. Pulse oximetry in low-resource settings during the COVID-19 pandemic. *Lancet Glob Health*. 2020 Sep;8(9):e1121-e1122. doi: 10.1016/S2214-109X(20)30287-4. Epub 2020 Jul 3. PMID: 32628910; PMCID: PMC7333981.
3. Belle J, Cohen H, Shindo N, Lim M, Valazquez-Berumen A, Ndirhokubwayo JB, Cherian M. Influenza preparedness in low-resource settings: a look at oxygen delivery in 12 African countries. *J Infect Dev Ctries*. 2010 Aug 4;4(7):419-24. doi: 10.3855/jdc.859.
4. Gettleman, Jeffrey, et al. "The Night the Oxygen Ran Out." *The New York Times*. 28 June 2021. www.nytimes.com/2021/06/28/world/asia/india-coronavirus-oxygen.html.
5. Frayer, Lauren, and Suashmita Pathak. "Why Is India Running out of Oxygen?" *NPR*. NPR. 5 May 2021. www.npr.org/sections/goalsanddestinations/2021/05/05/989461528/why-is-india-running-out-of-oxygen.
6. Agence Nationale de la Statistique et de la Demographie (ANSD) [Senegal], et ICF. 2020. *Senegal: Enquête Continue sur la Prestation des Services de Soins de Santé (ECPS)* 2019. Dakar, Senegal, et Rockville, Maryland, USA: ANSD et ICF.
7. Ecole de Santé Publique de l'Université de Kinshasa (ESPK) [République Démocratique du Congo] et ICF. 2019. *Évaluation des Prestations des Services de Soins de Santé (EPSS RDC)* 2017-2018. Kinshasa, RDC et Rockville, Maryland, USA: ESPK et ICF.
8. Government of Kenya. 2014. *Kenya Service Availability and Readiness Assessment Mapping (SARAM)*. Ministry of Health, Nairobi Kenya.
9. Government of Sierra Leone Ministry of Health and Sanitation, 2017. *Summary Report of the 2017 SARA Plus in Sierra Leone: Service Availability and Readiness Assessment (SARA). Quality of Care Survey, and Data Quality Review*.
10. Ministère de la Santé de Burkina Faso, Secrétaire Général, Direction Générale des Etudes et des Statistiques Sectorielles, Direction des Statistiques Sectorielles, 2014. *Enquête Nationale Sur Les Prestations Des Services De Santé Et La Qualité Des Données Saines*.
11. Ministry of Health of Libya, 2017. *Service Availability and Readiness Assessment of the Public Health Facilities in Libya*.
12. Ministry of Health (MoH) [Malawi] and ICF International. 2014. *Malawi Service Provision Assessment (MSPA) 2013-14*. Lilongwe, Malawi, and Rockville, Maryland, USA: MoH and ICF International.
13. Ministry of Health and Social Welfare (MoHSW) [Tanzania Mainland], Ministry of Health (MoH) [Zanzibar], National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF International. 2015. *Tanzania Service Provision Assessment Survey (TSPA) 2014-15*. Dar es Salaam, Tanzania, and Rockville, Maryland, USA: MoHSW, MoH, NBS, OCGS, and ICF International.
14. Republic of Zambia Ministry of Health, 2010. *Service Availability and Readiness Assessment 2010 Summary Report*.
15. Republica de Moçambique Ministério Da Saúde, 2018. *SARA 2018, Inventário Nacional*.
16. Somali Health Authorities, 2016. *Somali Service Availability and Readiness Assessment 2016 Report*.
17. WHO. Disponibilité et capacité opérationnelle des services de santé: 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).
18. WHO. Indice de disponibilité et de capacité opérationnelle des services de santé (SARA): Mauritanie 2016. Mauritanie; World Health Organization, 2016. <http://apps.who.int/healthinfo/systems/datacatalog/index.php?dlbrowser/55/download/169> (accessed June 24, 2020).
19. WHO. Rapport de l'évaluation de la disponibilité de la capacité opérationnelle des services de santé 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).
20. "Who Updates Critical Medicines List for Radiological and Nuclear Emergencies." *World Health Organization*, World Health Organization, www.who.int/news/item/27-01-2023-who-updates-critical-medicines-list-for-radiation-and-nuclear-emergencies. Accessed 27 Nov. 2023.

DISCUSSION

Limitations:

- It is difficult to accurately quantify current capability to supply this crucial treatment given a relative paucity of recent data available.
- SARA and SPA reports do not typically report *emergency care-specific* data on service and resource availability, likely because dedicated emergency departments are relatively rare in African countries. Much of the data obtained pertains to a more general medical setting and availability of resources is extrapolated to a general care-seeking populace.
- There is a non-uniform methodology for data collection and publication, as well as no internal validation measures reported. None of the data measures collected were consistently reported across all surveyed countries.

Recommendations:

- In the future, countries should begin to collect data specific to emergency care, including relative concentration and location of dedicated emergency departments, and that the WHO and DHS include emergency-specific survey questions within the SARA and SPA questionnaires.
- The questionnaires that are distributed contain a more standardized set of survey measures, with specific instructions on how to report the data. Each country's respective Ministry of Health or equivalent should invoke for yearly quantification and reporting of service and resource availability to enable a more consistent and reliable assessment for an ever-growing populace, as well as for the ability to trend and track these measures over time.
- The WHO and DHS should make all SARA and SPA reports, and any other documentation reporting oxygen availability and delivery capability in LMICs, readily publicly available to researchers seeking to address and study this disparity.

