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Supplementary appendix

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Supplement to: Mangipudi S, Leather A, Seedat A, Davies J. Oxygen availability in sub-Saharan African countries: a call for data to inform service delivery. *Lancet Glob Health* 2020; published online July 3. http://dx.doi.org/10.1016/S2214-109X(20)30298-9.

Table 1: Electricity or oxygen availability within health facilities for Senegal, DRC, Tanzania, and Malawi for the most recent year of data collection. Results are shown as n/total number of facilities supplying data (%), unless stated otherwise. Total number of facilities surveyed in each country are shown in the uppermost row.

	All Countries (n=4466)	**Senegal (n=794)**	**DRC (n=1412)**	**Tanzania (n=1200)**	**Malawi (n=1060)**
	Most recent year of Data	2017	2016/ 2017	2014/ 2015	2013/ 2014
Constant electricity AND any oxygen available					
All facilities	**56/129 (43.41)**	**20/27 (74.07)**	**6/26 (23.08)**	**17/44 (38.64)**	**13/32 (40.63)**
Urban facilities	47/82 (57.32)	20/26 (76.92)	5/20 (25.00)	13/15 (86.67)	9/21 (42.86)
Rural facilities	9/47 (19.15)	0/1 (0.00)	1/6 (16.67)	4/29 (13.79)	4/11 (36.36)
Any electricity					
All facilities	1975/2913 (67.80)	61/238 (25.63)	888/1146 (77.49)	132/553 (23.87)	894/976 (91.60)
Urban facilities	572/1023 (55.91)	50/121 (41.32)	134/280 (47.86)	93/324 (28.70)	295/298 (98.99)
Rural facilities	1363/1890 (72.11)	11/117 (9.40)	754/866 (87.07)	39/229 (17.03)	559/678 (82.45)
Constant electricity*					
All facilities	726/1971 (36.83)	169/342 (49.42)	59/271 (21.77)	275/684 (40.20)	223/674 (33.09)
Urban facilities	378/1001 (37.76)	87/156 (55.77)	34/177 (19.21)	153/378 (40.48)	104/290 (35.86)
Rural facilities	348/970 (35.88)	82/186 (44.09)	25/94 (26.60)	122/306 (39.87)	119/384 (30.99)
Any form of O2 available					
All facilities	297/308 (96.43)	47/49 (95.92)	51/53 (96.23)	46/50 (92.00)	153/156 (98.08)
Urban facilities	171/178	40/42	26/27	32/34	73/75

	(96.07)	(95.24)	(96.30)	(94.12)	(97.33)
Rural facilities	126/130 (96.92)	7/7 (100)	25/26 (96.15)	14/16 (87.50)	80/81 (98.77)
Secondary Level Facilities or Higher	214/217 (98.62)	25/25 (100)	49/50 (98.00)	26/27 (96.30)	114/115 (99.13)
Central Supply of O2 available	240/262 (91.60)	27/28 (96.43)	112/117 (95.73)	56/63 (88.89)	45/54 (83.33)
Oxygen Concentrators available	442/489 (90.39)	36/36 (100)	111/127 (87.40)	163/172 (94.77)	132/154 (85.71)
Oxygen Cylinders available	307/348 (88.22)	42/44 (95.45)	77/87 (88.51)	113/128 (88.28)	75/89 (84.27)
* constant = <2hrs/week of interruption reported					
n is number of facilities.					

Table 2: Additional Electricity and Oxygen Availability Data for Senegal, DRC, Tanzania, and Malawi. Results are shown as n/total number of facilities supplying data (%), unless stated otherwise. Total number of facilities surveyed in each country are shown in the uppermost row.

	Senegal[b]				**DRC**[c]	**Tanzania**	**Malawi**
Electricity availability	2014 (n=464)	2015 (n=483)	2016 (n=484)	2017 (n=794)	2016/2017 (n=1412)	2014/2015 (n=1200)	2013/2014 (n=1060)
Constant electricity*	147/294 (31.68)	171/302 (35.40)	198/302 (40.94)	169/342 (49.42)	59/271 (21.77)	275/684 (40.20)	223/674 (33.09)
Grid Electricity	294/452 (63.36)	302/473 (62.53)	298/473 (61.57)	342/781 43.07	271/1380 (19.64)	684/1188 (57.58)	674/977 (68.99)
Solar Power	3/203 (0.65)	116/206 (24.02)	5/206 (1.03)	175/257 (22.04)	915/1140 (66.30)	15/803 (1.26)	266/464 (27.23)
Backup Generator with Battery	398/452 (85.78)	430/473 (89.03)	415/473 (85.71)	690/781 (86.90)	1243/1380 (90.07)	1068/1188 (89.90)	904/977 (92.53)
Any form of O2 available	13/14 (92.86)	17/19 (89.47)	11/14 (78.57)	47/49 (95.92)	51/53 (96.23)	46/50 (92.00)	153/156 (98.08)
Functional Oxygen Concentrators							
Secondary Level Facilities or Above	10/21 (47.62)	13/20 (65.00)	12/24 (50.00)	24/36 (66.67)	104/111 (93.69)	92/163 (56.44)	66/132 (50.00)
Health Centers	7/21 (33.33)	4/20 (20.00)	6/24 (25.00)	8/36 (22.22)	5/111 (4.50)	63/163 (38.65)	39/132 (29.54)
Clinics	4/21 (19.05)	3/20 (15.00)	6/24 (25.00)	0 (0.00)	2/111 (1.80)	2/163 (1.23)	27/132 (20.45)

Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	-	7/163 (4.29)	0 (0.00)
Functional Oxygen Cylinders							
Secondary Level Facility or Above	17/35 (48.57)	21/37 (56.76)	15/34 (44.12)	25/42 (59.52)	71/77 (92.21)	68/113 (60.18)	33/75 (44.00)
Health Centers	12/35 (34.29)	12/37 (32.43)	9/34 (26.47)	12/42 (28.57)	5/77 (6.49)	36/113 (31.86)	17/75 (22.67)
Clinics	6/35 (17.14)	4/37 (10.81)	10/34 (29.41)	5/42 (11.90)	1/77 (1.30)	2/113 (1.77)	25/75 (33.33)
Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	-	6/113 (5.31)	0 (0.00)

**other= Senegal: Case de Sante; Tanzania: private hospitals and dispensary; Malawi: maternity, dispensary, health post

b- Note different facilities provided data in different years

C - No data from DRC on health centres or other

For Senegal, change in the number of facilities with both oxygen or electricity available was assessed using chi squared comparing each time point with 2014 as a baseline. Considering oxygen availability, compared with 2014, "any form of O2 available" (including concentrators, cylinders, central supply) for 2015, χ^2=0.1117, p=0.73; 2016, χ^2=1.1667, p=0.28; 2017, χ^2=0.225, p=0.63). For electricity availability, compared with 2014, "any electricity available" (including central grid or backup generator, solar, other), for 2015, χ^2 = 2.6253, p=0.10; for 2016, χ^2 = 14.80, p=<0.01; for 2017, χ^2 = 0.0216, p=0.88). Findings on solar power are puzzling, but potentially explained by the survey methodology, with different facilities being surveyed for each year of data

Table 3: Summary of Electricity and Oxygen Availability within health facilities for Senegal, DRC, Tanzania, and Malawi for Most Recent Year of Data with non-responses categorised as "Unavailable." Results are shown as n/total number of facilities supplying data (%), unless stated otherwise

	All Countries (n=4466)	**Senegal (n=794)**	**DRC (n=1412)**	**Tanzania (n=1200)**	**Malawi (n=1060)**
	Latest Year of Data	2017	2016/ 2017	2014/ 2015	2013/ 2014
Constant electricity and any oxygen available	171/4466 (3.83)	34/794 (4.28)	16/1412 (1.13)	70/1200 (5.83)	51/1060 (4.81)
Urban Facilities	123/1252 (9.82)	30/165 (18.18)	9/304[a] (2.96)	53/444 (11.94)	31/339 (9.14)
Rural Facilities	48/3186 (1.51)	4/629 (0.64)	7/1080 (0.65)	17/756 (2.25)	20/721 (2.77)
Any electricity	3648/4466 (81.68)	493/794 (62.09)	1191/1412 (84.35)	1070/1200 (89.17)	894/1060 (84.34)
Urban Facilities	1163/1252 (92.89)	157/165 (95.15)	291/304 (95.72)	420/444 (94.59)	295/339 (87.02)
Rural Facilities	1855/3186 (78.00)	336/629 (53.42)	900/1080 (83.33)	650/756 (85.98)	559/721 (83.08)
Constant electricity*	726/4466 (16.26)	169/794	59/1412	275/1200	223/1060

		(21.28)	(4.18)	(22.92)	(22.82)
Urban Facilities	378/1252 (30.19)	87/165 (52.73)	34/304 (11.18)	153/444 (34.46)	104/339 (30.68)
Rural Facilities	348/3186 (10.92)	82/629 (13.04)	25/1080 (2.31)	122/756 (16.14)	119/721 (16.50)
Any form of oxygen available	561/4466 (12.56)	49/794 (6.17)	165/1412 (11.69)	197/1200 (16.42)	150/1060 (14.15)
Urban Facilities	287/1252 (22.92)	42/165 (25.45)	56/304 (18.42)	124/444 (27.93)	65/339 (19.17)
Rural Facilities	274/3186 (8.60)	7/629 (1.11)	109/1080 (10.09)	73/756 (9.66)	85/721 (11.79)
Central Supply of oxygen available	240/4466 (5.37)	27/794 (3.40)	112/1412 (8.12)	56/1200 (4.67)	45/1060 (4.25)
Oxygen Concentrators	442/4466 (9.90)	36/794 (4.53)	111/1412 (7.86)	163/1200 (13.58)	132/1060 (12.45)
Oxygen Cylinders	307/4466 (6.87)	42/794 (5.29)	77/1412 (5.45)	113/1200 (9.42)	75/1060 (7.08)
* constant = <2hrs/week of interruption; a= 28 missing values for DRC urban/rural					
N is number of facilities					

DHS SPA Data Collection Methods:

Details on how surveys were conducted in each country are available on the DHS SPA website.[1] In brief, data collection was done by in-person facility visits by trained data collectors. Multiple variables were asked about in each survey; for this analysis we extracted data pertaining to questions on oxygen and electricity availability. Outcomes for these variables were reported as “reported, but not observed”, “observed,” or “unavailable.”

Each country’s sampling and completeness are described in brief, for each country, below:

Malawi:

The 2013-14 SPA surveyed all formal sector health facilities in Malawi. Of the 1,060 formal health facilities, 83 were permanently closed, unreachable, duplicates of other facilities, or refused to participate. Data were collected from a total of 977 facilities according to the methodology, but 1060 unique cases were available in the downloadable data from the DHS SPA website.

Democratic Republic of Congo:

The 2017-2018 SPA in DRC used probability sampling to select health facilities. In total, data were collected from 1,380 health facilities. The numbers of planned and missing facilities are not supplied in the report, however, 1412 unique cases were available in the downloadable data from the DHS SPA website.

Senegal:

According to the 2015 survey methodology, data were obtained from 375 facilities out of the 384 selected for assessment; however, in the dataset available on the DHS SPA website, a total of 464 unique data points were reported. Similarly, in the 2016 survey methodology reporting, 371 out of 386 facilities selected for survey supplied data; however, the data set contained 483 unique entries. In the 2017 survey, Out of a total of 3,764 health structures in Senegal available for survey, 794 provided data in the downloadable dataset from DHS SPA.

Tanzania:

The 2014-15 survey sampled 1,200 facilities throughout Tanzania. Of these, 1,188 were successfully surveyed, 7 refused to participate, and 4 were closed or not yet functional and one facility could not be reached; however, 1200 unique cases were available in the downloadable dataset from the DHS SPA.

1. Burgert CR, Prosnitz D. Linking DHS household and SPA facility surveys: data considerations and geospatial methods. DHS spatial analysis reports 10. Rockville, MD: ICF International, 2014.