



The health workforce status in the WHO African Region: findings of a cross-sectional study

Adam Ahmat ¹, Sunny C Okoroafor ¹, Isabel Kazanga,² James Avoka Asamani,¹ Jean Jacques Salvador Millogo,¹ Mourtala Mahaman Abdou Illou,¹ Kasonde Mwinga,³ Jennifer Nyoni¹

To cite: Ahmat A, Okoroafor SC, Kazanga I, *et al*. The health workforce status in the WHO African Region: findings of a cross-sectional study. *BMJ Global Health* 2022;**7**:e008317. doi:10.1136/bmjgh-2021-008317

Handling editor Seye Abimbola

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjgh-2021-008317>).

Received 17 December 2021
Accepted 22 April 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Health Workforce Unit, World Health Organization Regional Office for Africa, Brazzaville, Congo

²Department of Health Systems and Policy, University of Malawi College of Medicine, Blantyre, Malawi

³Universal Health Coverage - Life Course Cluster, World Health Organization Regional Office for Africa, Brazzaville, Congo

Correspondence to

Dr Adam Ahmat;
adam.ahmat@gmail.com

ABSTRACT

Introduction Several efforts have been made globally to strengthen the health workforce (HWF); however, significant challenges still persist especially in the African Region. This study was conducted by the WHO Regional Office for Africa to present the status of the HWF in 47 countries as a baseline in measuring countries' progress in implementing the Global Strategy for HWF by 2030.

Methods This was a cross-sectional survey of 47 countries in the African Region using a semistructured questionnaire. Data were collected from January 2018 to April 2019. Before data collection, a tool was developed and piloted in four countries. The completed tools were validated in the countries by relevant stakeholders in the 47 countries. Data were collated and analysed in Epi Info and Microsoft Excel.

Results The total stock of health workers was approximately 3.6 million across 47 countries. Among these, 37% of the health workers were nurses and midwives, 9% were medical doctors, 10% were laboratory personnel, 14% were community health workers, 14% were other health workers, and 12% were administrative and support staff. Results show uneven distribution of health workers within the African Region. Most health workers (85%) are in the public sector. Regional density of physicians, nurses and midwives per 1000 population was 1.55, only 4 countries had densities of more than 4.45 physicians, nurses and midwives per 1000 population.

Conclusion This survey has demonstrated that the shortage and maldistribution of health workers in the WHO African Region remain a big challenge towards the attainment of universal access to health services. This calls for the need to substantially increase investment in the HWF based on contextual evidence in line with the current and future health needs.

INTRODUCTION

Adequate, well-trained, fairly distributed and motivated health workers are critical to improving the health of a population, as well as ensuring the achievement of universal health coverage (UHC) and Sustainable Development Goals (SDGs).^{1–3} The Global Strategy on Human Resources for Health

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Ensuring universal access to health services requires adequate, qualified, fairly distributed and motivated health workers.
- ⇒ Despite numerous regional and country efforts, there remains key challenges to address the adequacy of the skilled health workers to respond to the health service needs for universal health coverage (UHC).
- ⇒ Due to low capacity of the human resources for health information systems and health workforce (HWF) registries in the African countries, HWF data are fragmented and are often not accurate.

WHAT THIS STUDY ADDS

- ⇒ A status of the health workers of all categories in all countries in the African Region in 2018.
- ⇒ The density of doctors, nurses and midwives per 1000 population in the WHO African Region in 2018 was 1.55. Only four countries—Seychelles, Namibia, Mauritius and South Africa—have densities above of 4.45 doctors, nurses and midwives needed to make advancements towards UHC.
- ⇒ Health workers in the public sector compared with the private sector in countries within the WHO African Region because there is limited information about the HWF in the private sector.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

- ⇒ In practice, the findings of the survey provides evidence on the state of the HWF in the African Region needed to build stronger health systems and ensure universal access to healthcare services.
- ⇒ Countries need more contextual evidence on the HWF to align their investment with the current and future health needs.

(GSHRH): Workforce 2030 emphasises that health systems can only function well when they have sufficient, well-trained and equitably distributed health workers; who are competent, responsive, motivated and productive.² Health workers are recognised as an important component of all the health

systems inputs and a top priority of the global agenda with the extent of the shortage of health workers in various countries highlighted in several publications.^{4 5} Although some global efforts have been made to improve the health workforce (HWF), nearly all countries are challenged by large deficits and inequitable distribution of health workers.⁵ This is compounded by the lack of accurate data on the HWF that is required to optimally use existing health workers and advocate for investment in the HWF.³ Countries worldwide are facing challenges in the education and development of their HWF.⁵ Africa on the other hand faces long-standing HRH crisis.^{6 7}

In 2014, the Global Health Workforce Alliance and WHO reported on the status of the global HWF status based on the data of 186 countries. The report noted that only a few countries had comprehensive and accurate data on the existing health workers (only 53% of them had reported annual HWF data).⁸ This shortage was most severe in low-resource settings, including the African Region where 36 Member States were classified to have HWF crisis.⁶ It was found that there was a deficit of 7.2 million health workers worldwide and it is predicted that by 2030 the shortage will grow to 18 million. It also indicated that 83 countries were below the WHO minimum threshold density of 22.8 health professionals (physicians, nurses and midwives) per 10 000 population, in relation to the objective of delivering essential health services of relevance to the Millennium Development Goals (MDG)—primarily MDG 4 and 5.

By 2015, only 11 countries in the WHO African Region had met the above-mentioned WHO minimum threshold density.⁵ However, there has been an overall increase in the stock of these categories of health workers in more than half (54%) of the countries, but in terms of density, about 23% only have reached or exceeded this minimum threshold. The projected shortage of health workers in Africa by 2030 is expected to be 6.1 million.⁵ This gap has not only hampered the provision of essential health-care services to meet health-related development goals but has also constrained accelerated progress towards universal healthcare coverage.^{7 9-11} The African Region not only has the lowest number of health workers but also the lowest density of HWF¹² and the highest disease burden.¹³ This high disease burden and the increase in health emergencies have exacerbated the need for qualified health workers in the region.

The GSHRH: Workforce 2030², within the framework of UHC, aims to support countries to scale up interventions aimed at strengthening health systems to ensure equitable and universal access to health workers. The African Region endorsed the Global Strategy in 2017 in adopting the African Regional Implementation Framework of the GSHRH⁶ to provide contextual guidance to the Member States in the Region. The main objective of this framework is to support countries' efforts to make adequate HWF strategies and investment plans to ensure availability and universal access of everyone to qualified health workers. This aligns with the approach

for achieving UHC through health system strengthening, and concerted efforts to build a functional HWF.¹⁴ Health systems strengthening is considered a key to driving progress towards equity and UHC.¹⁴⁻¹⁶ This implies that strengthening universal healthcare systems, capable of addressing the needs of the population, requires, among other things, ensuring universal access to a well-trained, motivated and adequately supported HWF.^{2 17}

The African Regional Implementation Framework of the GSHRH⁶ highlights that there is low production of health workers in the region, due to inadequate HRH education and training capacity. Additionally, the Framework also highlights the continued weakness of HRH management and steering as a key drawback to building a strong and effective HWF and achieving UHC in the African Region. In this regard, the Framework recommends that there is a need for high-level commitment and strong leadership to guide and coordinate stakeholders and to strengthen the capacity of HRH Departments in Ministries of Health (MOH) to improve the implementation of the HRH strategic plans. The Framework also highlights the need for reliable HRH data in the region to inform evidence-based planning of the HWF.

Towards achieving this, Regional Office for Africa conducted a HWF survey in the African Region covering all its Member States. Thus, this paper aims to present the status of the HWF in the WHO Member States in the African Region 2018 and discuss its implications in the context of the African Regional Implementation Framework of the GSHRH.

METHODS

Study design and setting

This study used a cross-sectional survey design with all 47 countries in the WHO African Region invited to complete a semistructured questionnaire.

Data collection

We collected data from January 2018 to April 2019 to update information on the stock and distribution of health personnel in the region. Before data collection, a tool was developed and piloted in four countries. The semistructured questionnaire (online supplemental file 1) was designed to obtain country information on the active health workers based on the International Standard Classification of Occupations nomenclature,³ sector (public, private for-not-profit and private for-profit) and the sources of the secondary information.

Following the pilot and review, the tool was used to brief the heads of human resource departments in the MOH and focal points for HWF information in the MOH and health system focal points of the WHO country offices through virtual meetings. The virtual meeting focused on the objectives of the survey and use of findings, details of the tool and the methodology for administration. Subsequently, the tool and administration protocol was emailed to each country office focal point who worked

closely with the relevant MOH stakeholders in completing the tool based on available secondary information. This secondary information was obtained from institutional registries, published HRH profiles and reports, and registration and licensing tables and reports from the MOH, Labour and Education, Public Service Commissions, national professional councils, and the private sector. The completed tools were validated in the countries by relevant stakeholders, approved and submitted to WHO by the heads of human resource departments in all 47 countries.

Data analysis

Completed questionnaires were collated in Epi Info V.7. After checking the quality of the data collected, including the cleaning of data and data entry errors, data were processed in Microsoft Excel, and descriptive and comparative analyses were done to present information on stock and densities of health workers by country and sector.

Analysis of missing data was done through triangulation of data from external data sources such as the WHO National Health Workforce Accounts platform of the WHO Global Health Observatory and the Africa Health Workforce Observatory of the WHO, Regional Office of Africa.

Patient and public involvement

It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

FINDINGS

Health worker stock

Table 1 presents the stock (an estimate of the total absolute number) of health workers categorised by physicians (generalists and specialists), nurses/midwives, dentists, pharmacists, laboratory personnel, community health workers, health managers and support staff, and other health workers. The physician specialists included surgeons, anaesthetists, cardiologists, emergency medicine specialists, ophthalmologists, obstetricians, gynaecologists, paediatricians, pathologists, preventive medicine specialists, psychiatrists, radiologists, resident medical officers in specialist training. Categorised under other health workers were medical records and health information technicians, medical technicians and equipment operators, optometrists and opticians, health management and support workers, paramedical practitioner, pharmaceutical technicians and assistants, physiotherapists and physiotherapy assistants, social workers, speech therapists, traditional and complementary medicine practitioners, etc.

Findings indicate that the total stock of health workers was approximately 3.6 million with 0.24 million physician generalists, 0.09 million physician specialists, 1.31 million nurses/midwives, 0.06 dentists, 0.09 million pharmacists, 0.37 laboratory technicians, 0.49 million community health workers, 0.42 million health managers and support staff, and 0.5 million other health workers. Thirty-seven

per cent of the health workers in the 47 countries were nurses and midwives and they are followed by community health workers and other health workers at 14% each, health managers and support staff, and laboratory personnel (10%). Disaggregation by country showed that of the 3.6 million health workers in Africa, Nigeria had 26% at 0.94 million, South Africa had 13% at 0.45 million, and Algeria had 9% at 0.32 million. Ethiopia, Democratic Republic of the Congo and Kenya had 7%, 6% and 5% at 0.25 million, 0.22 million and 0.16 million, respectively.

Density of health workers

The densities in figure 1 were calculated based on the absolute number of doctors, nurses and midwives existing in a country calculated as a ratio to the total population (per 1000 population). The population estimates for each country were taken from the United Nation's World Population Prospects 2019.¹⁸ The regional density of physicians, nurses and midwives were 1.55 per 1000 population, with Seychelles, Namibia, Mauritius and South Africa having thresholds above 4.45 physicians, nurses and midwives per 1000 population. Seven countries (Algeria, Botswana, Gabon, Cape Verde, Eswatini, Lesotho and Liberia) had thresholds between 2.0 and 4.0 doctors, nurses and midwives per 1000 population. Eight countries (Madagascar, Malawi, Togo, Benin, South Sudan, Chad, Central African Republic and Niger) had physicians, nurses and midwives per 1000 population thresholds of less than 0.5.

Health workers by occupation and sector

The distribution of the health workers by occupation and sector are presented in tables 2 and 3. The categories of health workers with the high proportions in the public sector are the nurses and associates at 28%, community health workers at 15.3% and administrative and support staff at 12.9% (table 2). In the private for-profit sector, 26.9% were traditional and complementary medicine practitioners, 21.6% nurses and associates and 15.5% were community health workers. Nurses and associates, community health workers, administrative and support staff and laboratory workers comprised 30.6%, 13.6%, 12% and 10.4% of health workers in the private for non-profit sector, respectively.

Sector-disaggregated data in table 3 show that 85% of all categories in countries were in the public sector, 11% in the private for non-profit and 4% in the private for-profit sector. The public sector had the highest proportion for all the categories except the traditional and complementary medicine practitioners where 79% of this staff category were in the private for-profit sector.

DISCUSSION

In general, results for this survey show that there is still a shortage of health workers in the WHO African Region, as reported previously.^{2 4 8} There are low densities of doctors, nurses and midwives in most of the African countries and there are shortages across all HWF cadres, including doctors, nurses and midwives, dentists,

Table 1 Health workers by country and selected cadres in the African Region, 2018

Country	Physician generalists	Physician specialists	Nurses/midwives	Dentists	Pharmacists and technicians	Laboratory personnel	Community health workers	Health managers and support staff	Other health workers	Total
Algeria	34 077	39 091	66 325	12 781	14 106	14 548	-	87 370	61 196	329 494
Angola	3043	3550	47 520	1652	2302	98	1680	28 652	19 961	108 458
Benin	391	319	4073	-	14	241	-	156	5436	10 630
Botswana	815	38	6935	94	487	460	-	-	1978	10 807
Burkina Faso	888	738	16 894	80	792	699	2749	1524	1941	26 305
Burundi	889	195	9156	14	119	1071	11 845	4289	10 404	37 982
Cameroon	2400	859	10 615	308	350	5235	-	250	11 117	31 134
Cabo Verde	165	287	795	81	172	65	117	1418	437	3537
Central African Republic	263	72	1195	10	36	112	115	87	528	2418
Chad	646	157	4799	3	269	749	7	1168	1857	9655
Comoros	130	90	1234	32	55	8	-	44	1163	2756
Congo	269	275	5081	27	157	320	-	901	1982	9012
Côte d'Ivoire	4246	1356	17 190	506	2495	-	14 556	230	35 797	76 376
Democratic Republic of the Congo	30 768	778	107 427	404	1687	2934	-	76 961	3043	224 002
Equatorial Guinea	246	-	406	-	10	2	-	-	1986	2650
Eritrea	160	120	3984	186	451	549	243	3563	579	9835
Eswatini	211	67	2218	74	281	370	6324	1410	3519	14 474
Ethiopia	5867	5396	77 933	1889	10 752	10 450	37 259	77 539	23 808	250 893
Gabon	570	798	6085	40	227	439	-	2257	1038	11 454
Gambia	181	117	1498	3	79	138	1553	-	355	3924
Ghana	3316	1090	53 452	713	2127	1563	15 820	24 660	19 442	122 183
Guinea	2649	138	7195	73	255	181	16 567	670	129	27 857
Guinea-Bissau	290	28	1421	16	82	172	4057	611	1213	7890
Kenya	5602	2440	59 901	1764	2295	-	58 079	2759	31 716	164 556
Lesotho	815	183	3746	159	398	205	14 508	2240	8098	30 352
Liberia	234	12	9415	24	1071	-	3391	5715	4758	24 620
Madagascar	4593	637	7724	556	329	306	35 000	6766	1774	57 685
Malawi	2582	178	6025	112	387	542	10 016	178	3555	23 575
Mali	2151	715	8394	30	1424	-	1152	8331	4779	26 976
Mauritania	808	818	4872	151	100	122	500	1552	531	9454
Mauritius	1188	1207	4986	466	748	291	180	3610	2218	14 894
Mozambique	1 555	625	13 781	545	2 310	1 951	2 205	29 201	6 544	58 717

Continued

Table 1 Continued

Country	Physician generalists	Physician specialists	Nurses/midwives	Dentists	Pharmacists and technicians	Laboratory personnel	Community health workers	Health managers and support staff	Other health workers	Total
Namibia	1044	401	12 956	289	907	510	2292	2470	4771	25 640
Niger	1065	-	4483	30	60	432	55	768	1661	8554
Nigeria	74 543	9364	301 579	25 487	24 668	311 269	116 454	0	76 829	940 193
Rwanda	783	567	10 758	228	167	1 990	45 000	0	503	59 996
Sao Tome & Principe	40	20	256	-	-	-	-	79	417	812
Senegal	676	2207	7592	236	215	328	17 417	6 003	7107	41 781
Seychelles	125	115	1277	163	124	71	-	-	453	2328
Sierra Leone	234	47	5693	423	156	311	505	-	685	8054
South Africa	29 311	14 192	287 458	6816	16 195	-	54 180	-	47 890	456 042
South Sudan	338	73	3726	32	360	272	1455	20	1694	7970
United Republic of Tanzania	2434	451	31 940	682	1845	4361	0	633	61 396	103 742
Togo	230	354	3234	21	226	615	7500	4073	7323	23 576
Uganda	17 007	179	23 644	26	324	3874	-	-	4646	49 700
Zambia	1701	325	17 948	455	1708	1602	1262	17 801	7538	50 340
Zimbabwe	1715	244	26 689	347	776	648	2143	9829	8023	50 414
Total	243 254	90 913	1 311 508	58 028	94 098	370 104	486 186	415 788	503 818	3 573 697

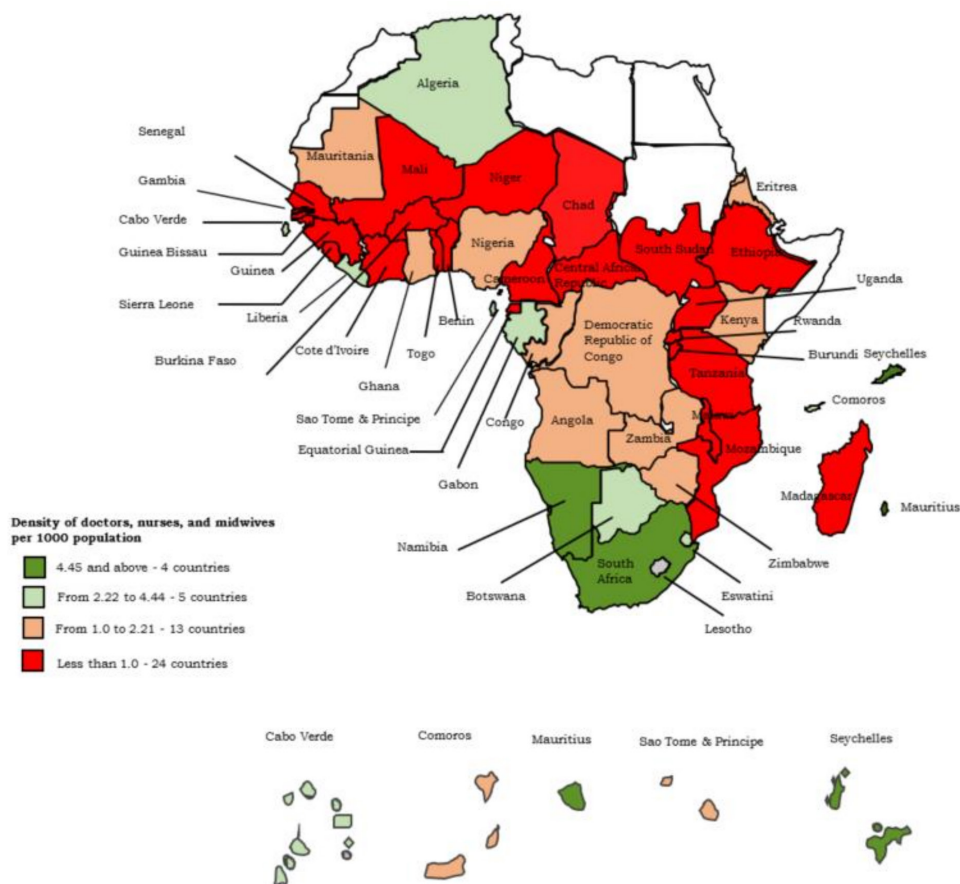


Figure 1 Densities of physicians, nurses and midwives per 1000 population in the African Region.

pharmacists and laboratory technicians.⁷ The average density of 1.55 physicians, nurses and midwives per 1000 population in the African Region estimated in this survey

is below the WHO SDG threshold of 4.45 health workers per 1000 population needed to achieve UHC.² Evidence shows that the low HWF density positively correlates

Table 2 Distribution of health workers by occupation in 47 countries in the African Region, 2018

Categories	% public sector	% private for profit	% private for non-profit	% Total	Total no
Physicians generalists	6.4	6.2	10.1	6.8	243254
Physicians specialists	2.2	0.6	5.7	2.5	90913
Professional nurses and associates	28.2	21.6	52.1	30.6	1093957
Professional midwives and associates	6.8	3.3	1.4	6.1	217551
Dentists and technicians	1.5	0.3	3.2	1.6	58028
Pharmacists and technicians	2.2	1.2	6.7	2.6	94098
Laboratory workers	11.9	2.9	1.2	10.4	370104
Technicians on medical imaging and equipment	0.6	0.5	1.7	0.7	25804
Environment and public health workers	1.2	0.1	0.8	1.1	40043
Health services managers	0.9	0.5	0.4	0.9	30754
Administrative and support staff	12.9	6.3	7.3	12.0	428235
Community health workers	15.3	15.5	0.1	13.6	486186
Traditional and complementary medicine	0.2	26.9	1.2	1.4	49742
Other health workers	9.6	14.1	8.2	9.7	345028
Total	100	100	100	100	3573697

Table 3 Distribution of health workers by sector in 47 countries in the African Region, 2018

Categories	% public	% private for profit	% private for non-profit	% total	Total no
Physicians generalists	79.9	3.8	16.4	100.0	243 254
Physicians specialists	74.2	1.0	24.8	100.0	90 913
Nurses (professionals and associates)	78.2	2.9	18.9	100.0	1 093 957
Midwives (professionals and associates)	95.2	2.2	2.6	100.0	217 551
Dentists and technicians	77.7	0.7	21.6	100.0	58 028
Pharmacists and technicians	70.0	1.9	28.2	100.0	94 098
Laboratory workers	97.6	1.2	1.3	100.0	370 104
Technicians on medical imaging and equipment	71.4	2.8	25.8	100.0	25 804
Environment and public health workers	91.3	0.4	8.4	100.0	40 043
Health services managers	92.9	2.4	4.7	100.0	30 754
Administrative and support staff	91.1	2.2	6.8	100.0	428 235
Community health workers	95.3	4.7	0.0	100.0	486 186
Traditional and complementary medicine	10.8	79.3	9.9	100.0	49 742
Other health workers	84.6	6.0	9.4	100.0	345 028
Total	84.80	4.11	11.09	100	3 573 697

with poor health outcomes (including maternal and infant mortality) and high disease burden.^{2 4 19} Although several countries have made efforts to remedy this deficit of health workers, mainly through the implementation of HRH policies and plans in using global and regional frameworks, the complexity and scope of the issue make it difficult to resolve, and the number of countries under HRH crisis has not changed substantially.

Several factors have contributed to the HRH crisis in the WHO African Member States. Such factors include the inadequate training capacity resulting in low production of health workers, demographic conditions (rapid population growth), international migration, weak leadership and governance of HWE, career changes, poor retention of health workers, morbidity and premature mortality, lack of use of evidence for HRH planning and the limited capacity of the government to employ health workers in the public health sector among other factors.^{6 20}

Results also show an uneven distribution of health workers within the WHO African Region with some of the countries having extremely low densities of health workers. This is compounded by the shortage of health workers and constrained resources in most of the countries within the region. The unequal distribution of health workers implies that many people in Africa, especially those most in need are having the least access to essential health services.^{21 22} Addressing the challenge of shortage and uneven distribution of health workers in the African Region is critical to building stronger health systems and ensuring universal access to health-care services.^{6 23} It is important to conduct health labour market analysis periodically at national and subnational levels and use the findings to inform policies on the

production, recruitment, retention and deployment of health workers.^{24 25} Distribution of health workers in service delivery can also be enhanced by applying the workload indicators of staffing needs tool²⁶ that has been used in several countries in Africa to determine staffing needs based workload, rationalising the distribution of health workers and the recruitment of additional health workers to fill the gap.^{27–31}

There were more health workers in the public sector compared with the private sector in countries within the WHO African Region. However, it should be noted that most of the countries that provided data in this survey had challenges to provide data for the private sector. This means that in some countries there was under-reporting of the data, while in other countries data was not provided at all—this was a limitation of this survey. The lack of reliable data from the private sector underlined a great need to get better data to enable clear situation analysis and projections of HWE needed in the future.⁴ Data from the private sector are frequently missing from the national HWE information systems and are urgently needed to complete a more realistic picture of the HWE at the national level.

CONCLUSION

In conclusion, this survey has demonstrated that the shortage and maldistribution of health workers in the WHO African Region remain a big challenge towards attainment of universal access to health services. Despite increased efforts to strengthen the HWE capacity in the WHO African Region, significant challenges persist in terms of adequate production in quantity and quality, employment capacity, deployment and retention of the

existing health workers. This entails critical gaps in the delivery of essential health services to achieve health-related goals such as the UHC and SDGs. This calls for the need to increase substantially investment in HRH with contextual evidence in line with the current and future health needs. Member states should also implement interventions to increase preservice production and recruitment of health workers, as well as to improve their deployment and retention.

Twitter Adam Ahmat @adamahmat and Sunny C Okoroafor @okoroafor

Acknowledgements The authors acknowledged the Human Resource Departments/Units in the Ministries of Health and all 47 country offices of the WHO African Region in facilitating the data collection and authorising the use. The authors also acknowledged Mr Jean Bernard Moussounda, Administrative Assistant at WHO African Regional office for assisting in the data capturing and data processing of the survey.

Contributors AA and SCO drafted the initial manuscript. AA, SCO, IK, JAA, JN, MMAI and JJSM conceptualised and conducted the analysis. All authors read and approved the final version of the manuscript. AA acts as the guarantor.

Funding This study was funded by WHO.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article .

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Adam Ahmat <http://orcid.org/0000-0002-3708-264X>

Sunny C Okoroafor <http://orcid.org/0000-0003-4690-485X>

REFERENCES

- WHO. *Working for health and growth: investing in the health workforce*. Geneva: World Health Organization, 2016.
- WHO. *Global strategy on human resources for health: workforce 2030*. Geneva: World Health Organization, 2016.
- WHO. *National health workforce accounts: a Handbook*. Geneva: World Health Organization, 2017.
- WHO. *The world health report 2006—working together for health*. Geneva: World Health Organization, 2006.
- WHO. Health workforce requirements for universal health coverage and the sustainable development goals.(human resources for health observer, 17) 2016.
- WHO. *The African regional framework for the implementation of the global strategy on human resources for health: workforce 2030*, 2020.
- Afriyie DO, Nyoni J, Ahmat A. The state of strategic plans for the health workforce in Africa. *BMJ Glob Health* 2019;4:e001115.
- WHO. *A universal truth: no health without a workforce third global forum on human resources for health report*. Geneva, Switzerland: Author, 2013.
- Miseda MH, Were SO, Muriangi CA, *et al*. The implication of the shortage of health workforce specialist on universal health coverage in Kenya. *Hum Resour Health* 2017;15:1–7.
- Zurn P, Zapata T, Okoroafor SC. The importance of strengthening the health workforce in Nigeria to improve health outcomes. *J Public Health* 2021;43:i1–3.
- Cerf ME. Health worker resourcing to meet universal health coverage in Africa. *Int J Healthc Manag* 2021;14:789–96.
- UNICEF2018Declaration of Astana. Global conference on primary health care: from Alma-Ata towards universal health coverage and the sustainable development goalsAstana, Kazakhstan
- Vos T, Allen C, Arora M, *et al*. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the global burden of disease study 2015. *The Lancet* 2016;388:1545–602.
- WHO. *Leave no one behind: strengthening health systems for UHC and the SDGs in Africa*, 2017.
- Kieny MP, Bekedam H, Dovlo D, *et al*. Strengthening health systems for universal health coverage and sustainable development. *Bull World Health Organ* 2017;95:537–9.
- Cometto G, Buchan J, Dussault G. Developing the health workforce for universal health coverage. *Bull World Health Organ* 2020;98:109–16.
- Okoroafor SC, Ongom M, Salihu D, *et al*. Retention and motivation of health workers in remote and rural areas in cross river state, Nigeria: a discrete choice experiment. *J Public Health* 2021;43:i46–53.
- United Nations. World population prospects 2019: highlights. statistical Papers-United nations (Ser a), population and vital statistics report 2019.
- Speybroeck N, Kinfu Y, Dal Poz MR. *Reassessing the relationship between human resources for health, intervention coverage and health outcomes*. Geneva: World Health Organization, 2006.
- Kinfu Y, Dal Poz MR, Mercer H, *et al*. The health worker shortage in Africa: are enough physicians and nurses being trained? *Bull World Health Organ* 2009;87:225–30.
- WHO. *A vision for primary health care in the 21st century: towards universal health coverage and the sustainable development goals*. Geneva: World Health Organization, 2018.
- Joshi R, Alim M, Kengne AP, *et al*. Task shifting for non-communicable disease management in low and middle income countries—a systematic review. *PLoS One* 2014;9:e103754.
- Soucat A, Scheffler R. *The labor market for health workers in Africa: a new look at the crisis*. World Bank Publications, 2013.
- Asamani JA, Christmas CD, Reitsma GM. Modelling the supply and need for health professionals for primary health care in Ghana: implications for health professions education and employment planning. *PLoS One* 2021;16:e0257957.
- Sousa A, Scheffler RM, Nyoni J, *et al*. A comprehensive health labour market framework for universal health coverage. *Bull World Health Organ* 2013;91:892–4.
- WHO. *Workload Indicators of Staffing Need. User's Manual*. Geneva: World Health Organization, 2010.
- WHO. *Workload indicators of staffing need (WISN): selected country implementation experiences*. Geneva: World Health Organization, 2016.
- Okoroafor SC, Ongom M, Mohammed B, *et al*. Estimating frontline health workforce for primary healthcare service delivery in Bauchi state, Nigeria. *J Public Health* 2021;43:i4–11.
- Burmen B, Owuor N, Mitei P. An assessment of staffing needs at a HIV clinic in a Western Kenya using the WHO workload indicators of staffing need WISN, 2011. *Hum Resour Health* 2017;15:1–8.
- Okoroafor S, Ngobua S, Titus M, *et al*. Applying the workload indicators of staffing needs method in determining frontline health workforce staffing for primary level facilities in rivers state Nigeria. *Glob Health Res Policy* 2019;4:35.
- McQuide PA, Kolehmainen-Aitken R-L, Forster N. Applying the workload indicators of staffing need (WISN) method in Namibia: challenges and implications for human resources for health policy. *Hum Resour Health* 2013;11:1–11.