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## Towards improving stroke services in Africa: Results from the Africa-UK Stroke Partnership [AUKSP] surveys

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## ABSTRACT

**Background:** The African Stroke Organization (ASO) in partnership with the University of Central Lancashire's Stroke Research Team launched the Africa-UK Stroke Partnership (AUKSP). AUKSP undertook two (stroke expert and hospital Stroke Unit (SU)) on-line surveys mapping existing capacity and capability to deliver African stroke care.

**Methods:** An on-line expert survey tool was sent to 139 stroke experts in 54 African countries October 2021-March 2022 and the hospital SU survey to 120 hospital SUs (identified from the expert survey) June-October 2022. Both survey tools were prepared according to the World Stroke Organisation's Roadmap for Delivering Quality Stroke Care. Completed responses were exported from Qualtrics into Microsoft excel and were analysed descriptively.

**Results:** Forty-five expert responses and 62 hospital SU responses were analysed, representing 54(87%) public hospitals, 7(11%) private and 1(2%) charitable organization. In both surveys, three main priorities for improvement of stroke services were: a rapid and prompt stroke diagnosis; effective primary and secondary stroke prevention, and acute stroke management. Survey findings suggest that there is a low presence of national stroke surveillance systems and registries, and heterogeneity in availability of diagnostic services, SUs, endovascular treatments, and rehabilitation.

**Conclusion:** Significant gaps exist in Africa's capacity and capability to deliver essential elements of effective and quality stroke care. Tackling these challenges requires urgent and sustained multi-stakeholder action including: government, administrators, policy makers and other partners. Our survey findings highlight key priority areas for multi-stakeholder engagement and crafting of a pragmatic, prioritized and context-sensitive African Stroke Action Plan.

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## Background

Stroke is a significant global health problem and a major cause of mortality and morbidity in high income countries, and increasingly in low-middle income countries (LMIC)<sup>1</sup>. The Global Burden of Diseases, Injuries and Risk Study estimates that almost 70% of stroke-related deaths and 87% of stroke-related disability occur in LMICs<sup>2</sup>; many of which are in Africa.

The profile of stroke risk factors in Africa is similar to those reported globally<sup>3</sup> but there are challenges with integrating stroke risk factor screening and treatment at primary healthcare levels within communities<sup>4,5</sup>, and this has been compounded by rapid urbanization and ageing populations<sup>6</sup>. As a consequence, Africa records some of the highest rates of stroke with an annual incidence of 316 per 100,000, a prevalence of 1460 per 100,000, and 3-year fatality of 84%<sup>7</sup>. Many Africans are struck in the prime of their lives, around 10-15 years younger, compared to Western societies with grave implications for individuals, families, and society<sup>8-10</sup>.

Providing post-stroke care in an organized multidisciplinary team (MDT) inpatient Stroke Unit (SU) is known to save lives and reduce disability<sup>11</sup>. SUs in LMICs are feasible but may be difficult to achieve, due to scarcity of basic components of healthcare services (staffing, equipment, and infrastructure)<sup>12</sup>.

Contextual interdisciplinary strategies are needed to tackle the burden of stroke<sup>13-15</sup>. In response, the African Stroke Organization (ASO) aims to strengthen stroke services in the unique landscape of Africa (socioeconomic obstacles, cultural barriers, uncoordinated care, and shortage of competent health workers)<sup>16</sup>. The ASO with University of Central Lancashire's (UCLan's) Stroke Research Team developed the Africa-UK Stroke Partnership (AUKSP), to undertake two (stroke expert and hospital SU) on-line surveys to map existing capacity and capability to deliver stroke care across Africa. This paper reports survey results on stroke services availability, capacity, and capability.

## Study design

### Subjects and setting

#### Expert survey

The on-line expert stroke survey tool (Supplementary File 1) was developed by experts from AUKSP Steering Group (stroke physicians, neurologists, nurses, allied health professionals (AHPs) and researchers). The survey tool had 44 questions, covering: respondent demographics; pre-hospital stroke care; acute stroke care systems; stroke treatments; stroke rehabilitation; stroke awareness; stroke prevention systems; stroke research and training, and financial status for stroke management insurance system. A link to the expert survey was e-mailed, between October 2021 and March 2022, to 139 stroke experts across Africa's 54 countries. Stroke experts were: anyone with primary expertise in stroke medicine or related fields/sectors including neurology, nursing, neurorehabilitation, neurosurgery, speech and language therapy, occupational therapy, physiotherapy, psychotherapy, and public health. Experts were identified from the ASO, African Academy of Neurology (AFAN), World Stroke Organisation (WSO) Future Leader's African Fellows, and if not available, through national stroke organizations, or stroke-related publications.

#### Hospital SU survey

The hospital SU survey tool developed in 4 steps. Step 1: questions were informed by the WSO's Roadmap to Delivering Quality Stroke Care<sup>17</sup>. Step 2: through discussions with a range of experts, members of the wider project Steering Group and research working group including stroke physicians, neurologists, nurses, AHPs and researchers to agree the included questions. Step 3: piloting of the survey tool at 10 non-study sites. Step 4: Revision of the survey following feedback from the

pilot and with further expert discussion to reach consensus. The survey (Supplementary File 2) included questions on: capacity for delivering minimal, essential, and advanced elements of stroke care, resources, stroke surveillance systems, stroke research, management guidelines, stroke education and training. Both surveys were translated and back-translated from English into French and Portuguese increasing accessibility for Francophone and Lusophone countries. The surveys were developed and implemented using Qualtrics software (<https://www.qualtrics.com>).

A link to the hospital SU survey was e-mailed between June and October 2022 to 120 SUs across Africa, identified through the expert and hospital SU surveys (as they were completed). For both surveys, if no response was received within 2 weeks, reminders were e-mailed for up to 6 weeks.

### Data analysis

In some cases, where more than one representative from a country (expert survey) or hospital (hospital SU survey) completed the survey, the response selected, and included in the analysis, was chosen based on: 1. Completeness of response submitted 2. Respondent's seniority and 3. Respondent's career level (advanced (>10 years), mid-career (6-10 years), early career (1-5 years)).

Included survey responses were exported from Qualtrics into Microsoft excel. A descriptive analysis was undertaken, and data summarized using frequencies and percentages, means, medians, standard deviations, and inter-quartile ranges, where appropriate. Percentages were calculated from the total number of responding countries unless otherwise stated. Mean responses to rank statements have been reported in priority order (lowest scores=highest priority). In the hospital survey, hospitals have been grouped by the WSO Roadmap to Delivering Quality Stroke Care criteria: minimum, essential, advanced<sup>18</sup>.

### Ethical approval

Ethical approval for the study was granted by the University of Ibadan/University College Hospital Health Research Ethics Committee (UI/UCH HREC) (UI/EC/21/0137) and UCLan's (Health 0199). Informed consent was presumed by survey completion and submission.

## Results

### Stroke expert survey

A total of 84(60%) unique stroke expert survey responses were received. Of those, 39 were excluded based on completeness, and respondent's seniority and experience, leaving one completed survey per country (45 total responses). Twenty-five (56%) were English, 17(38%) French and 3(6%) Portuguese, representing 45 of Africa's 54 countries (83%) and covering ~ 94.7% of Africa's population. There were 10 African countries where we received no response (Algeria, Comoros, Equatorial Guinea, Eritrea, Eswatini, Guinea Bissau, Liberia, Mauritius, Sao Tome & Principe, and South Sudan) (Fig. 1).

Of the 45 respondents, 32(71%) were male. Twenty-five (56%) reported career level as advanced (>10 years), 8(18%) as mid-level (6-10 years) and 12(27%) as early career (1-5 years). Thirty-two (71%) respondents were neurologists, 6(13%) were stroke physicians, 2(4%) were general medicine doctors, and 5(11%) designated their role as 'other' (1 each of public health doctor, policy analyst, family medicine doctor) and 2 did not specify.

Availability of stroke services are summarized in Fig. 2. Population-based programmes for screening and treating modifiable stroke risk factors were available in 15(37%) countries, with a further 2(5%) planned (Cote d'Ivoire and Guinea). Only Ethiopia and Uganda had national stroke surveillance systems.

Over half of responding countries (23,55%) had a national

emergency medical service (EMS) but only 8(35%) had an EMS stroke protocol.

Only Egypt and South Africa reported having a national stroke registry, and only 7 countries (Botswana, Congo, Cote d'Ivoire, Egypt, Senegal, Sudan, Tanzania) reported having a stroke action plan/strategy. At least one stroke guideline was implemented in practice in almost three-quarters of responding countries, with the European Stroke Organisation (ESO) guidelines being most commonly implemented (15,35%), the American Stroke Association (ASA) guidelines (12,27%), national guidelines (10,23%) and others (9,20%) including the WSO, Angels Initiative, and local guidelines.

Forty-four respondents estimated the number of CT scanners available in their country: 22(50%) reported 1-9; 14(32%) 10-49; 4(9%) 50-99; 1(2%) 100-199; and 3(7%) ≥200 (Fig. 3). MRI scanner availability was reported as: 33(75%) 1-9; 7(16%) 10-49; 1(2%) 50-99; 2(5%) 100-199; and 1(2%) ≥200 (see Fig. 4).

Stroke patients were admitted to general medicine wards (28, 62%), emergency wards (27, 60%), Intensive Care Units (19, 42%), SUs (13, 29%), High Dependency Units (8, 18%), and 5 (11%) others (neurology wards, polyclinics and cardiology services).

The estimated number of SUs was reported for 37 countries, 20 countries reporting having at least 1 SU. Overall, the total number of SUs per 1,000,000 people was 0.11 (Supplementary Table 1). Sixteen (43%) countries reported having no SUs (Botswana, Burkina Faso, Burundi, Côte d'Ivoire, Djibouti, Gambia, Libya, Malawi, Mali, Mauritania, Mozambique, DR Congo, Sierra Leone, Tchad, Zambia and Zanzibar).

Intravenous thrombolysis was available in 50% of countries but only used for all eligible patients in Egypt and Namibia. Endovascular

thrombectomy was available in 7(16%) countries (Cote d'Ivoire, Egypt, Morocco, South Africa, Sudan, Tanzania and Tunisia) but was not widely accessible for eligible patients in any country.

Stroke rehabilitation services varied across countries with physiotherapy (40,89%), in-hospital (38,84%) and out-patient rehabilitation services (37,82%) most widely available in comparison, for example, to cognitive rehabilitation services only available in 7(16%) countries (Fig. 1).

The three main priorities for the improvement of the delivery of stroke services were: a rapid and prompt stroke diagnosis; followed by effective primary and secondary stroke prevention and acute stroke management (Supplementary Table 2).

### Hospital SU survey

One hundred and twenty invitations to complete the hospital SU survey were sent: 77(64%) to respondents who had also completed the stroke expert survey; 26(22%) additional SU contacts who were identified through the stroke expert survey; a further 13(11%) who were identified by respondents who completed the hospital SU survey and 4 (3%) received the survey after it had been passed on by colleagues of those already identified.

A total of 82(68%) survey responses were received. Of those, 20 responses were excluded based on completeness, respondent seniority, and experience. There were 62(76%) completed surveys in total, from hospitals across 39(71%) countries (see Fig. 5). Thirty (48%) surveys were completed in English, 28(45%) in French and 4(7%) in Portuguese.

Of the 62 respondents, 49(79%) were neurologists, 7(11%) were

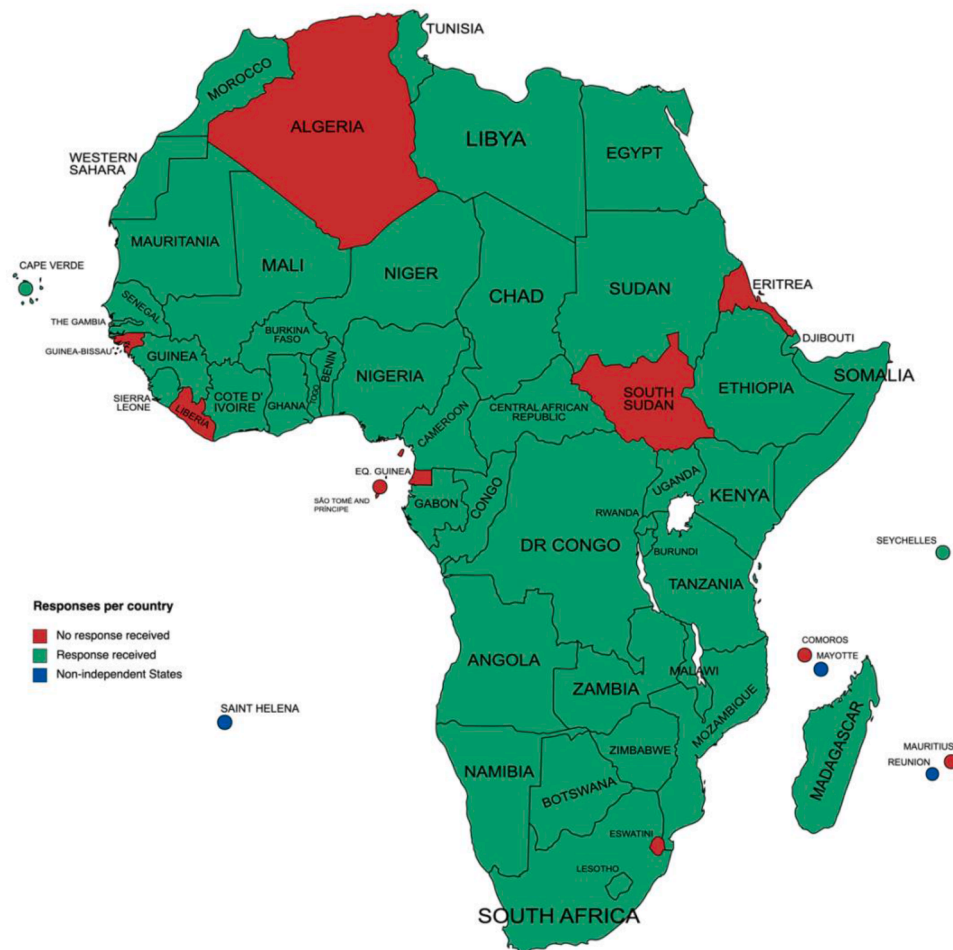


Fig. 1. Map of countries represented by expert survey respondents.

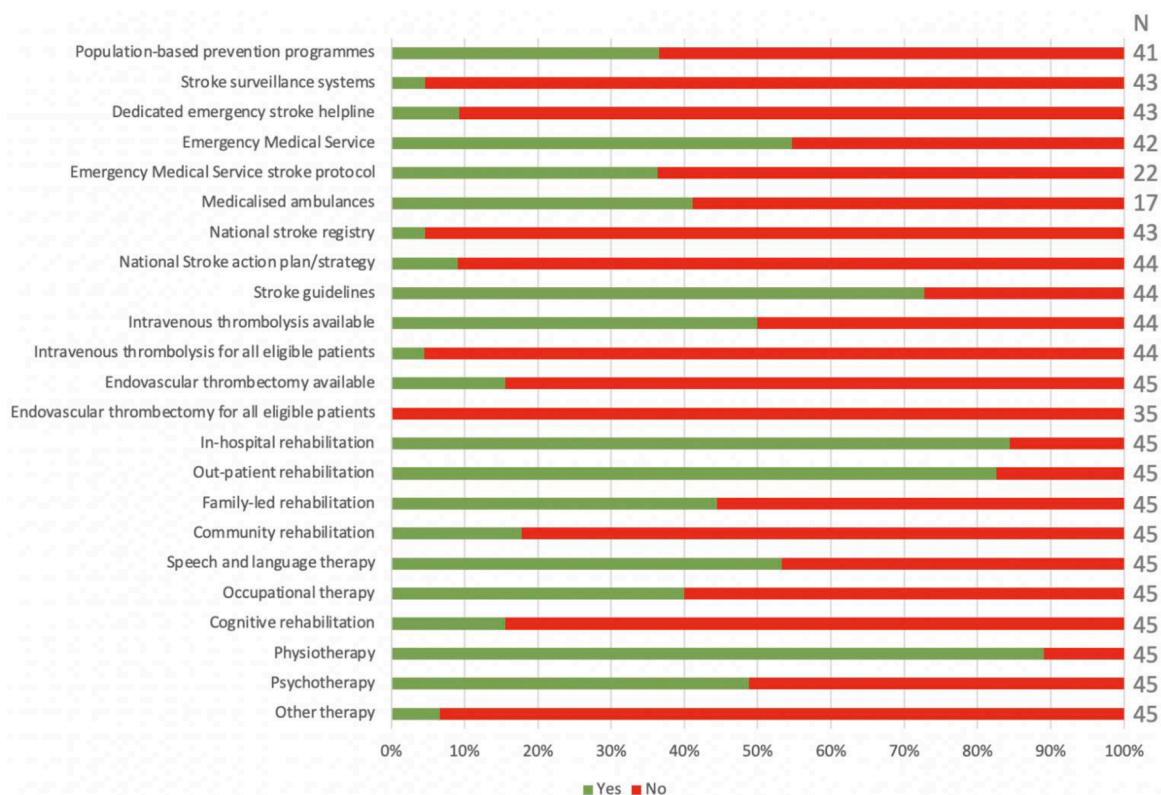


Fig. 2. Availability of national stroke systems and services.

physicians, 3(5%) physiotherapists, 2(3%) researchers and 1 nurse (2%). Fifty-four (87%) hospitals were public, 7(11%) private and 1(2%) was a charitable organization. The majority, 52(84%) were tertiary care providers, 9(14%) secondary care providers and 1(2%) a primary care provider. Of the 52 tertiary care providers 46(89%) were University Teaching Hospitals and 6(11%) non-teaching hospitals. Fifty (81%) hospitals had access to stroke prevention therapies, 8(13%) had limited access and 4(6%) had no access (1 hospital in each of Ghana, Mali, Niger, and Rwanda).

Sixty-one (98%) hospitals admitted stroke patients, the majority (85%) in hospitals categorized as essential according to the WSO framework. Only 13(21%) hospitals had a SU and a further 19(31%) had a partial/elements of a SU. Across the 13 SUs, 9(69%) had essential category services and the mean number of stroke beds was 11.3(11.2 SD). Of the 30 hospitals with no SU, 13(43%) had a stroke MDT.

According to the WSO criteria, 37(60%) described their level of acute diagnostic services as basic, 18(29%) as advanced and 7(11%) had no diagnostic services available (hospitals in Democratic Republic of Congo, Lesotho, Rwanda, Sierra Leone, Tunisia, Uganda and Zimbabwe).

Only 5(8%) hospitals reported having an acute stroke emergency helpline and of 58(94%) responding hospitals, 18(31%) had a stroke registry. Only 5(8%) hospitals had the capability to deliver advanced interventions (reperfusion therapy) including both thrombolysis and thrombectomy (1 hospital in each of Egypt, Kenya, Morocco, South Africa and Tanzania). Eleven hospitals (18%) were able to deliver thrombolysis and 46(74%) did not have the capability to provide thrombolysis or thrombectomy. Almost half (26,44%) of 59 responding hospitals reported that both acute stroke and rehabilitation were covered by health insurance, 6(10%) reported that health insurance covered acute stroke care only and 27(46%) reported that health insurance covered neither acute stroke care nor rehabilitation.

Two-thirds of hospitals had a stroke consultant/physician (41,66%) and/or a stroke neurologist (40,66%). Other health professionals

providing stroke care can be seen in Fig. 6.

The most commonly used standardized assessments were those assessing: functional ability/motor deficits (56,93%) and swallowing screening (49,85%). Other commonly used assessment can be seen in (Supplementary Fig. 1).

Patients from 54(87%) hospitals had access to out-patient rehabilitation services, 25(40%) had access to rehabilitation at home, 23(37%) hospitals provided in-patient rehabilitation services and 6(10%) hospitals had no rehabilitation services.

Only 5(8%) of hospitals described the care provided as fully co-ordinated, 24(39%) had limited co-ordination and 33(53%) hospitals described the geographic coordination of care as being provided in local communities. The availability of community programmes was limited (Supplementary Fig. 2).

The most important priorities for the improvement of the delivery of stroke services identified within the hospital SU survey were the same as those identified by respondents in the expert survey: a rapid and prompt stroke diagnosis; followed by effective primary and secondary stroke prevention and thirdly, acute stroke management (Supplementary Table 3).

**Discussion**

This study highlights key gaps for the improvement of stroke care services in Africa and builds on findings from previous research<sup>19</sup>. The three main priorities for the improvement of the delivery of stroke services were identified as: a rapid and prompt stroke diagnosis; effective primary and secondary stroke prevention, and acute stroke management. These priorities are reflected in the survey findings showing that many essential elements of effective stroke care systems were unavailable<sup>20</sup>. There was a low reported availability of primary prevention initiatives and national stroke surveillance systems, few national stroke registries and stroke action plans, heterogeneity in the availability of diagnostic services, SUs, endovascular treatments, and rehabilitation

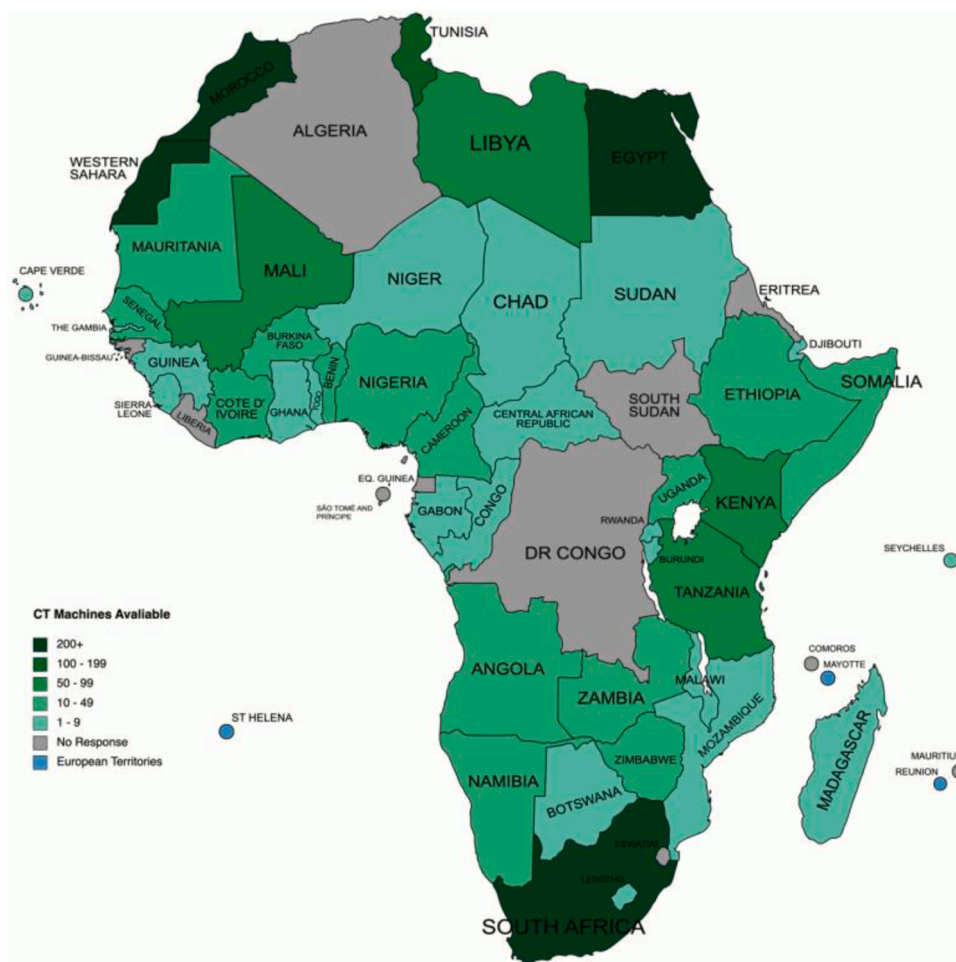


Fig. 3. Number of CT scanners available per country.

services.

Factors responsible for the absence/low levels of essential elements of effective acute stroke care in Africa include a dearth of available health professionals for stroke care<sup>21,22</sup>, challenges with integrating stroke risk factor screening and treatment at primary health care levels within communities<sup>4,5</sup>, high financial barriers to accessing healthcare<sup>23</sup>, poorly developed emergency medical systems<sup>24</sup> and poor awareness of stroke presentation and stroke risk factors in the community<sup>25,26</sup>. However, effective population-based primary prevention, quality pre-hospital and hospital acute stroke care, as well as timely secondary prevention and rehabilitation are critical to the success of stroke systems of care and must be developed given the current high stroke incidence and prevalence rates<sup>27</sup>.

Our study presents evidence for governments, policy makers and administrators in Africa for the need to develop interventions for improving stroke care in their respective health systems by developing stroke centres of excellence. Only Egypt and South Africa have national stroke registries, and only 7 countries had a national stroke action plan or strategy. Urgent context-sensitive implementation strategies are needed to improve highlighted gaps to achieve better stroke prevention and provision of high-quality acute stroke care. For instance, developing national stroke action plans by respective countries will help in setting priorities for stroke care and provide a framework against which improvements can be measured. Similarly, the establishment of national stroke registries will help to standardize acute stroke care and monitor key performance indicators at local, regional and national levels.

Whilst over half of countries reported having an EMS, only a third had an EMS stroke protocol. Africa's EMS are poorly developed, except

in some areas in South Africa and northern Africa<sup>28</sup>. Developing publicly available EMS protocols, with associated training and implementation strategies could be important tools for EMS personnel and an aid to improving pre-hospital stroke care<sup>29</sup>.

Brain imaging is important to identify stroke pathology, and to exclude mimics. The absence of brain imaging on hospital admission is associated with high in-hospital death from stroke<sup>30</sup>. Expert survey findings suggest variable neuroimaging availability, with 50% of countries having less than 10 CT scanners and 75% of countries having less than 10 MRI scanners. Further details from the hospital SU survey found that 60% of hospitals had only basic level diagnostic services. Improving Africa's stroke diagnostics by increasing the availability of neuroimaging facilities will require government involvement and commitment as well as the support of interested organizations and private radio-diagnostic facilities.

The WSO has produced the global stroke services guidelines and action plan as a framework for the development of stroke services (minimal, essential, and advanced) worldwide<sup>17</sup>. Findings from our study suggest that 92% of all stroke patients were treated in hospitals with essential level services, with only 21% having a dedicated SU.

Global best recommendations for the care of stroke patients is in a SU<sup>31,32</sup>; defined as a dedicated space within hospitals, with care provided by trained healthcare professionals with expertise in acute stroke care<sup>30</sup>. Our study found a lack of SU availability across many Africa countries and only 0.11 SUs per 1,000,000. Understandably, there are numerous barriers to the set-up, organization and provision of SU care due to a lack of resources and a scarcity of specialists<sup>12</sup>. Where the establishment of dedicated SUs is not possible, alternative strategies

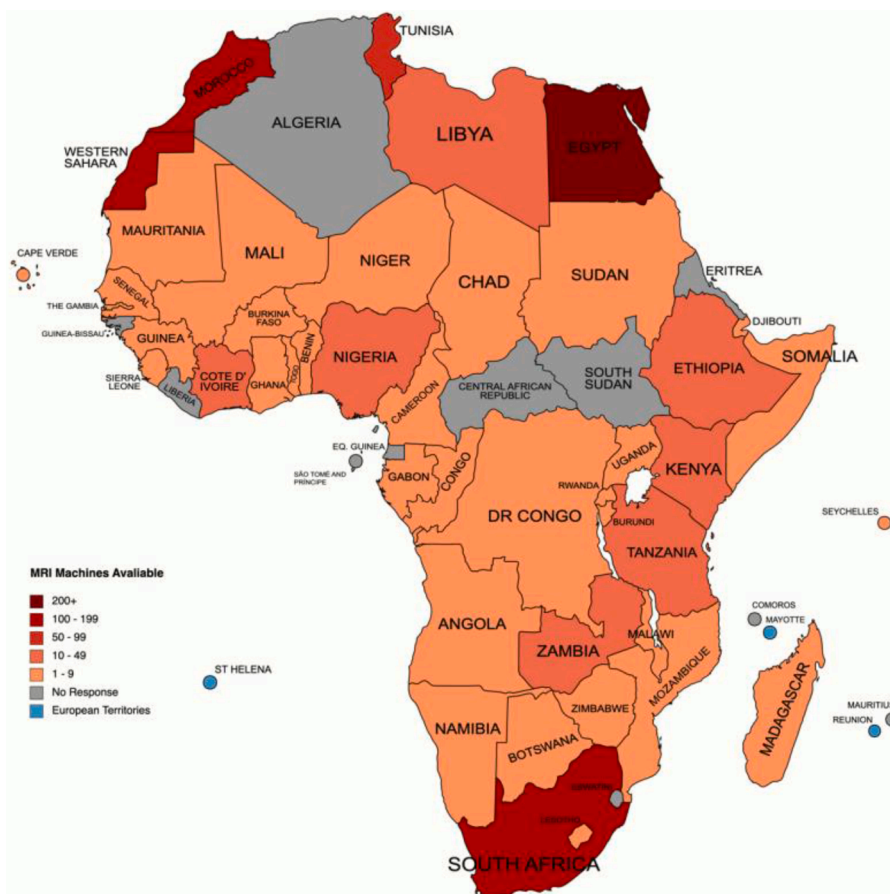


Fig. 4. Number of MRI scanners available per country.

may include having a dedicated area or beds on general medical wards or the provision of a minimal level SU<sup>31</sup>. Setting-up acute stroke MDTs has demonstrated effectiveness in African settings and may be another way to improve acute stroke care in settings where there are few or no SUs<sup>33,34</sup>.

Intravenous thrombolysis despite being available in half of countries was only widely available for eligible patients in Egypt and Namibia. Mechanical thrombectomy, although available in some countries was not widely available in any. Poor uptake, even in countries where they are available, may be due to high costs and the low penetration of health insurance and universal health coverage<sup>35</sup>. Clearly, support is needed to improve the availability of these interventions for acute stroke patients in Africa. Government commitment to subsidizing the costs of reperfusion therapies will help to improve their uptake and support from interested sponsors and organizations such as the Angels initiative<sup>36</sup> could help to improve access to interventions for acute stroke patients.

A high number of respondent countries had in-patient and out-patient rehabilitation available for stroke, although most rehabilitation was available at hospital (in-patient and out-patient); 10% of hospitals reported no rehabilitation services. The resources for post-stroke rehabilitation, especially the therapy workforce and infrastructure, are very limited in many LMICs, particularly beyond tertiary centres<sup>37</sup>. Further research is needed to gain an understanding of post-discharge care provision in Africa and the needs of stroke survivors and their caregivers.

#### Strengths, limitations, and future directions

This study builds on a previous survey of stroke services in 17 African countries by providing new data from 45 African countries (covering 97% of the African population) on different aspects of the stroke care

continuum including primary prevention, stroke surveillance, diagnostics, acute care and reperfusion therapy and rehabilitation. Data were captured from the three major language blocks of Africa (English, French, Portuguese) and the five African geographical blocks (eastern, western, central, northern, and southern), thus enhancing representativeness of datasets and capturing the diversity of Africa. Availability of SUs was standardized to population size in each country rather than the incident/prevalent stroke rates.

Our study has some limitations. Despite efforts there were no respondents from 10 countries for the expert survey, and 16 countries for the hospital SU survey. We do not know the number of non-identified/non-responding sites and so findings may not be representative of other hospitals within and between countries. Where more than one hospital respondent completed the survey tool, we only included one response in the analyses. Responses provided by surveyed experts were estimates which may be prone to over or underestimation. However, stroke experts were leaders of national stroke services or organizations who could access stroke health care data in their countries. Similarly, hospital SU questionnaires were completed by a range of staff who were of senior cadre and sufficiently knowledgeable about the stroke services at their hospital. Respondents were predominantly medical doctors and further research should explore priorities from a MDT perspective.

This study has provided impetus for concerted engagement of multiple stakeholders to undertake more granular exploration of different aspects of African stroke care and to facilitate conversations relating to the development of an African Stroke Action Plan.

#### Conclusion

Significant gaps exist in the capacity and capability of African countries to deliver the essential elements of an effective and quality

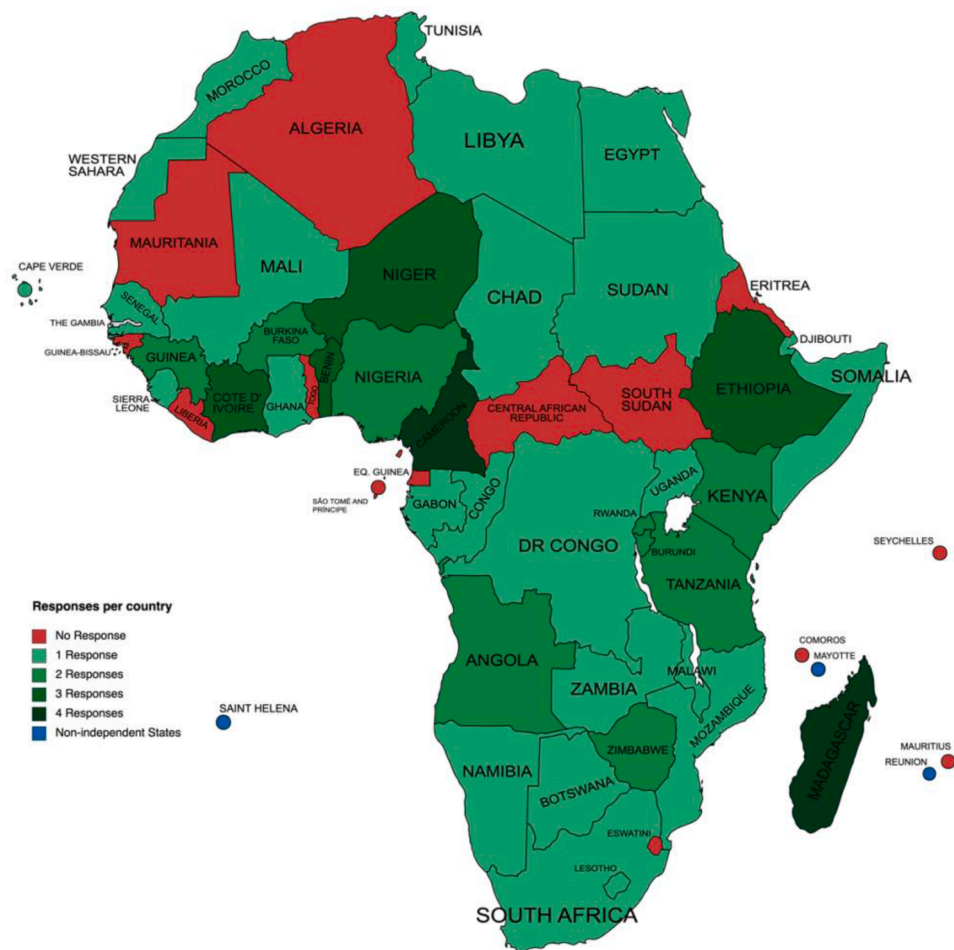


Fig. 5. Hospital SU survey responses received.

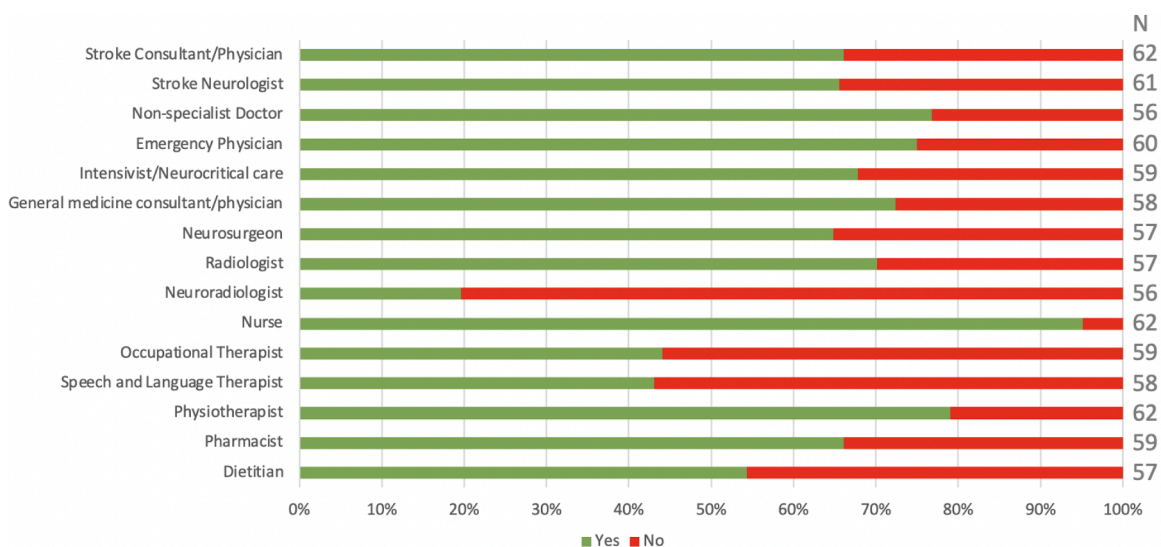


Fig. 6. Health professionals providing stroke care at hospital.

stroke care system. Tackling these challenges will require urgent and sustained multi-stakeholder action across many levels of society including government, administrators, policy makers and other partners. We have highlighted key priority areas for multi-stakeholder engagement and development of a pragmatic, prioritized and context-

sensitive African Stroke Action Plan. Operationalizing such a plan will invariably scale up interventions that will produce a reduction in the burden of stroke on individuals, families, communities, and society and improve overall population health in-line with objective 3 of the Sustainable Development Goals, particularly in Africa.

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## CRediT authorship contribution statement

**Stephanie P Jones:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Joseph Spencer:** Data curation, Formal analysis, Writing – review & editing, Methodology, Writing – original draft. **Olaleye Adeniji:** Conceptualization, Data curation, Methodology, Writing – review & editing. **Foad Abd-Allah:** Conceptualization, Writing – review & editing. **Gabriel Ogunde:** Data curation, Methodology, Writing – review & editing. **Ad Adams Ebenezer:** Conceptualization, Writing – review & editing. **Raj Kalaria:** Conceptualization, Writing – review & editing. **Catherine E Lightbody:** Conceptualization, Methodology, Writing – review & editing. **Peter Langhorne:** Conceptualization, Writing – review & editing. **Rita Melifonwu:** Conceptualization, Writing – review & editing. **Pamela Naidoo:** Conceptualization, Writing – review & editing. **Paul Macaire Ossou-Nguet:** Conceptualization, Writing – review & editing. **Adesola Oggunniyi:** Conceptualization, Writing – review & editing. **Paul Olowoyo:** Conceptualization, Writing – review & editing. **Mayowa O Owolabi:** Conceptualization, Writing – review & editing. **Fred S Sarfo:** Conceptualization, Writing – review & editing. **Richard Walker:** Conceptualization, Writing – review & editing. **Joseph Yaria:** Conceptualization, Data curation, Writing – review & editing. **Caroline L Watkins C:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Rufus O Akinyemi:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

The Authors declare that there are no conflicts of interest.

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## Data availability statement

No additional data available.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jstrokecerebrovasdis.2024.107891](https://doi.org/10.1016/j.jstrokecerebrovasdis.2024.107891).

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