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Assessment of availability, accessibility, and affordability of magnetic resonance imaging services in Ghana

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ABSTRACT

Introduction: The aim of this study was to assess the availability, accessibility, and affordability of MRI services to patients in Ghana.
Methods: A descriptive quantitative research method which involve the use of a structured email 3-page survey questionnaire was employed, and addressed to the MRI radiographer-in-charge for completion.
Results: A response rate of 92% was achieved. Sixty-seven percent (8) of the facilities were located in the Greater Accra region of Ghana with most (6[75%]) being private health facilities. The Western, Eastern, Brong Ahafo, Upper East, and Upper West lacked MRI scanners. MRI scanners per million population was 0.5. The mean cost per MRI examination, was lower in the public (i.e. GH₵ 563–GH₵ 686, $p < 0.05$ for non-contrast MRI examinations) compared to the private (i.e. GH₵ 618–GH₵ 775, $p < 0.05$ also for non-contrast MRI examinations). Most facilities (9[75%]) accept card bearers of some private health insurance to access MRI services, but none accepts that of the public-funded health insurance.
Conclusion: There is wide disparity in the distribution of MRI scanners nationwide, with most of them located in the Greater Accra region. With only 5 regions having MRI scanners, it does imply that close to 40% of the general population do not readily have access to MRI services. Government can achieve an increase in availability, accessibility, and affordability of MRI by providing more public health facilities with MRI scanners and reimbursing MRI services via the NHIS (National Health Insurance Scheme).

Introduction

Ghana is a tropical country located in West Africa, with a population of 24,658,823 (see Table 1 for regional distribution of population).[1] Ghana is divided into 10 administrative regions: Greater Accra, Ashanti, Brong Ahafo, Central, Eastern, Northern, Upper East, Upper West, Western, and Volta (see Fig. 1 for Ghana map showing all regions and capitals). The Northern region is the largest of the 10 regions in Ghana (accounting for 29.5 percent of the total land area of Ghana).[2] In 2010, Ghana attained lower–middle income (LMIC) country status at a per capita income of about $1,820, having experienced steadily increasing economic growth of over 7% per year on average since 2005.[3,4] However, the per capita income is considered to be too narrow as experts argued that key socioeconomic and development indicators i.e. infrastructural and human capital development, management of national resources, corruption– all which are crucial factors for effective governance improved productivity and subsequently increase in GDP, were left out.[3–5]

The annual average household expenditure for the country is estimated at GH₵ 9317 with a mean annual per capita expenditure of GH₵ 6337.[6] The total annual household expenditure for the country is GH₵ 61,507 million.[6] It is estimated that about 2.2 million people, consisting of 8.4% of the population, live in extreme poverty in Ghana, and 70% of people with income that falls below the poverty line (= GH₵ 1314) (see Table 2 for poverty and inequality estimates by Region) are found in the northern (Upper East, Upper West and the Northern Region) and savannah areas.[6] The livelihood of the majority of people from northern Ghana is largely dependent on farming.[1] Even though rapid urbanisation has resulted in poverty rates going down, the case is not the same in the northern part of the country.[1]

The health sector is considered to play a pivotal role in socio-economic development and in the national and international development framework. There is a National Health Policy[7]

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Table 1
Distribution of population by region and locality of enumeration, 2010.[1]

Region	Total population	Locality of enumeration		Share of population (%)
		Urban	Rural	
All regions	24,658,823	12,545,229	12,113,594	100%
Western	2,376,021	1,007,969	1,368,052	9.6
Central	2,201,863	1,037,878	1,163,985	8.9
Greater Accra	4,010,054	3,630,955	379,099	16.3
Volta	2,118,252	713,735	1,404,517	8.6
Eastern	2,663,154	1,143,918	1,489,236	10.7
Ashanti	4,780,380	2,897,290	1,883,090	19.4
Brong Ahafo	2,310,983	1,028,473	1,282,510	9.4
Northern	2,479,461	750,712	1,728,749	10.1
Upper East	1,046,545	219,646	826,899	4.2
Upper West	702,110	114,653	587,457	2.8

designed within the global context for health development and aims to provide a comprehensive and holistic framework that builds on progress made in previous years. Ghana's health expenditure; total (% of GDP) slightly increased from 3.1 (1995) to 3.6 (2014).[8] Within the same period, the health expenditure per capita (current US$), and the health expenditure, public (% of GDP) rose from 19 to 58, and from 1.6 to 2.1 respectively.[9,10] These statistics demonstrate Government's commitment to improve quality of care at all levels of its healthcare system through increased spending on

Figure 1. Ghana map showing all regions and capitals.[20]

Table 2
Poverty and inequality estimates by Region (Poverty line = GH₵ 1314).[6]

Region	poverty Head count	Poverty depth
Western	19.2	5.5
Central	19.6	5.7
Greater Accra	6.6	1.8
Volta	33.3	11.8
Eastern	22.0	6.1
Ashanti	13.6	3.8
Brong Ahafo	28.6	9.5
Northern	44.2	15.5
Upper East	45.9	22.2
Upper West	69.4	35.8

the provision of quality health care. Health providers in the public and private sectors as well as the formal and informal sectors, continue to make significant contributions to health interventions. Despite these increased investments, a large number of the population still lack access to basic quality health services, particularly those in rural areas and deprived communities. The factors responsible for this poor geographic access include inadequate investments in health facilities relative to need, hard-to-reach communities, sub-optimal spatial distribution of health facilities and lack of communication equipment.[7] Other barriers include health services are financial, organization of service delivery and broad socio-cultural barriers, including gender.

In Ghana, costs for health services can be reimbursed via 'Cash and Carry', National Health Insurance Scheme (NHIS), or a Private Health Insurance Scheme (PHIS). The 'Cash and Carry' system of paying for health services still remains a financial barrier to health care access, particularly among the poor.[7] To address this problem of financial barrier to health care access, in 2001, the Government through the Ghana Poverty Reduction Strategy (GPRS) introduced the National Health Insurance Scheme (NHIS) (under the National Health Insurance Act 2003, Act 650) as a social protection policy with the objective to deliver accessible, affordable, and good quality health care services to all Ghanaians especially the poor and most vulnerable in society.[7,11] The NHIS is largely funded by the National Health Insurance Levy (NHIL), which is 2.5% levy on goods and services collected under the Value Added Tax (VAT), 2.5 percentage points of Social Security and National Insurance Trust (SSNIT) contributions per month, return on National Health Insurance Fund (NHIF) investments, and premium paid by informal sector subscribers.[12] Medical service fees which includes services for consultation, diagnostic exams within the diagnosis related-groups (DRG), surgeries, and treatment are to be covered under the NHIS, provided one is registered and of good standing on the scheme. Registered members of the NHIS can access health care services from either public or private health facilities provided the facilities are also registered with the scheme. Health facilities can then be reimbursed on a fee-for-service basis, however up to a predefined cap of expenses. An alternative is to register with a private health insurance institution so as to be able to access medical services at health facilities registered to provide services.

There is lack of written or published national health technology policy yet in Ghana, but there are existing policies that have been established for health technology.[13] The Government of Ghana (GoG) continues to make significant investment in the equipment needs of the health sector by allowing health facilities to procure sometimes, and the Clinical Engineering Department of the MoH also to procure some of the capital equipment especially for the turnkey projects.[13] Over the years, the GoG in parallel with support from the private sector have contributed significantly to the acquisition of diagnostic imaging equipment due to the increasing demand for radiology services. While modalities such as general X-ray, ultrasound, computed tomography scanners, and Mammography are relatively common, little is known about the availability of MRI (magnetic resonance imaging). In recent times, the availability of MRI is now synonymous with quality of medical care, even within the rural hospital setting.[14] This is because it has become a very valuable non-invasive and even indispensable diagnostic tool capable of revealing structure and function of the human body with a level of detail due to its inherent sensitivity to a wide range of tissue properties. MRI plays an important role not only in the diagnostic work-up of diseases and injuries, but also in the monitoring of disease progression and treatment success.[15] As an important diagnostic tool, the first MRI scanner ever in the history of Ghana was acquired by the GoG, and commenced operation in 2006 at the Korle-bu Teaching Hospital, in the Greater Accra region

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of Ghana. This was in keeping with Government's continuous effort to improve accessibility to advanced diagnostic tests. Since then, there has been a rise in the availability of MRI scanners nationwide, in both public and private health facilities. However, to what extent they are available, accessible, and affordable nationwide is unknown. According to the World Health Organization,[16] imaging modalities should be physically available at healthcare facilities (availability), geographically located within the reach of patients (accessibility), and should also be affordable (affordability). The use of MRI is an acceptable essential tool in the diagnostic work-up of patients in Ghana. Its usefulness has been best explored in the central nervous system, spine, thorax, abdomen, pelvis, and the musculoskeletal system. However, compared to other high-end imaging modalities, MRI is very expensive due to its high cost of purchase, installation, software configuration, repairs, refilling of the helium gas, and preventive maintenance. Generally, costs of MRI scanners range from about 120,000€ to about 1 million €.[17] For a country such as Ghana, these enormous costs may weigh a heavy toll on the national health budget. It is widely acknowledged in the literature that due to limited financial resource in developing countries, the growth of medical imaging technologies can slow down.[18] Furthermore, obtaining a substantial and ongoing funding to purchase, install and maintain the technology is a major challenge for healthcare organizations of developing countries.[18] Nevertheless, it is agreed that analysis of availability, accessibility, and affordability may provide a framework for needs, perhaps as an index score, which could allow specific metrics and locations to be more strategically targeted.[19] The aim of this study was to assess the availability, accessibility, and affordability of MRI services to patients in Ghana.

Materials and methods

A total number of 13 MRI suites in tertiary hospitals, private hospitals, and private diagnostic centres were identified nationwide to participate in the study. Due to this relatively small number, a descriptive quantitative research method which involves the use of a structured email survey questionnaire was employed, and addressed to the MRI radiographer-in-charge for completion in August 2016. The questionnaire focused on regional location, type of facility, magnetic field strength, year operation started, price of each MRI examination, and how MRI scans are reimbursed. Repeated reminders were sent via the social media whatsapp, phone calls, and in person. The completed questionnaires were finally received in November 2016. The advantages of employing a survey in this study are not only due to its unobtrusive nature, but also its broader generalizability. It is also economical in terms of researcher time, effort and cost than most other methods such as experimental research and case research.[21] However, due to its non-temporal nature, internal validity (cause–effect relationships) are difficult to infer, and it may be subject to respondent biases (e.g., subjects may provide a "socially desirable" response rather than their true response) which may further hurt internal validity.[21] There was no need for approval from an ethical committee.

The data was analysed descriptively, by presenting them in tables and graph format. We calculated the scanner density (MRI scanners per million population), and means of each MRI examination. In addition, a statistical test (i.e. p value) to compare the cost of MRI examinations was undertaken using Microsoft Excel, and found the difference to be statistically significant.

Results

From Table 3 above, a response rate of 92% was achieved. Notably, 67% (8) of the facilities are located in the Greater Accra region of Ghana with most (6[75%]) being private health facilities, but with relatively low magnetic fields of ≤0.5 T. There has been a significant increase in the number of MRI scanners in Greater Accra since the operation of the first MRI scanner.

Table 3
Summary of MR facilities: regional location, type of facility, magnetic field strength, year operation started, and number of MRI scanners in Ghana.

MRF	Regional location	Type of facility	Field strength (T)	Year operation started	Number of MRI scanners
1	Greater Accra	Public Hospital	1.5	2006	1
2	Greater Accra	Public Hospital	1.5	2009	1
3	Greater Accra	Diagnostic Centre	≤0.5	2010	1
4	Greater Accra	Private Hospital	1.5	2012	1
5	Greater Accra	Diagnostic Centre	≤0.5	2012	1
6	Volta	Public Hospital	1.5	2013	1
7	Greater Accra	Private Hospital	≤0.5	2013	1
8	Ashanti	Public Hospital	1.5	2013	1
9	Central	Public Hospital	1.5	2015	1
10	Northern	Public Hospital	1.5	2015	1
11	Greater Accra	Diagnostic Centre	≤0.5	2015	1
12	Greater Accra	Private Hospital	≤0.5	2015	1

The mean cost per MRI examination, was lower in the public (i.e. GH₵ 563–GH₵ 686, $p < 0.05$ for non-contrast MRI examinations) compared to the private (i.e. GH₵ 618–GH₵ 775, $p < 0.05$ also for non-contrast MRI examinations). Where there are no prices indicated, such examinations are not undertaken in such facilities.

Even though most facilities (9[75%]) accept card bearers of some private health insurance to access MRI services, it was noted that none accepts that of the public-funded health insurance.

Discussion

Magnetic resonance imaging (MRI) is considered one of the most rapidly developing novel medical advances in medicine.[22] However it remains an expensive, and capital intensive modality. In view of the rise in the availability of MRI scanners, the study sought to assess the availability, accessibility, and affordability of MRI services to patients in Ghana. The study revealed that all MRI scanners in Ghana are located in the regional capitals, all identified public health facilities have a 1.5 T MRI scanners, and only one private health facility has a 1.5 T MRI scanner. Majority of private facilities have scanner field of less than 1.5 T. The Greater Accra region has the largest distribution of MRI scanners accounting for 67%, with most located in private health facilities. The Volta, Ashanti, Central, and Northern regions each have an MRI scanner, whereas the Western, Eastern, Brong Ahafo, Upper East, and Upper West regions do not have MRI scanners (see Table 4 for Scanner densities for each region). The large distribution of MRI scanners in

Table 4
Scanner density.

Regions	Number of MRI scanners	Population (mil)	Scanner density[a]
All regions	12	24.7	0.5
Greater Accra	8	4.0	2.0
Volta	1	2.1	0.5
Ashanti	1	4.8	0.2
Central	1	2.2	0.5
Northern	1	2.5	0.4
Western	0	2.4	0
Eastern	0	2.7	0
Upper East	0	1.0	0
Upper West	0	0.7	0
Brong Ahafo	0	2.3	0

[a] MRI scanners per million population.

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Table 5
Price list of MRI Examinations (GH₵).

MRF	Without contrast						With contrast					
	Brain	Spine (per part)	AbP	UL	LL	Thorax (i.e. breast)	Brain	Spine (per part)	AbP	UL	LL	Thorax (i.e. breast)
1	625	625	815	625	625	625	900	885	1075	885	885	885
2	550	550	1100	550	550	–	800	800	1350	800	800	–
3	700	700	1400	700	700	–	950	950	1650	750	750	–
4	600	620	790	790	869	990	800	820	990	990	1069	1190
5	550	600	600	550	550	600	600	650	650	650	650	–
6	300	300	300	300	300	300	–	–	–	–	–	–
7	580	580	580	580	580	580	695	695	695	695	695	695
8	650	650	650	650	650	650	850	850	850	850	850	850
9	650	650	650	600	600	–	700	700	700	650	650	–
10	600	600	600	600	600	600	900	900	900	900	900	900
11	680	680	680	680	680	680	993	993	750	993	993	993
12	600	600	600	600	600	600	850	850	850	850	850	850
Mean	590	596	730	602	609	625	846	827	951	819	827	899

MRF – MR facility; AbP – Abdominopelvic; UL – Upper limb; LL – Lower limb.
Missing values were not included in mean or statistical tests.

the Greater Accra region might be because it is the major hub for commercial, manufacturing and telecommunication industries in Ghana, with 42% of its population being economically active[23] and has the largest urban dwellers. This is in agreement with Shah et al.,[24] that there is disparity in access within developing nations, specifically between the private and public sector, which is evident in this study but marginally. Usually, the private sector has the resources to offer needed imaging services, however due to cost and urban location, it is inaccessible to many people.[24] On the other hand, the public sector which aims to provide for all is over-burdened due to a lack of sufficient resources both in trained staff and imaging devices.[24]

Prior to the acquisition of MRI scanner in Ghana, many patients who needed MRI have had to travel abroad to access it. This has often put enormous stress on patients in terms of cost of flight, cost of examination, and the risk of travelling to access this service, and then as a low-income country, only a very few could afford such trip. Following the operationalization of the first MRI scanner at the Korle-bu Teaching Hospital in 2006, the GoG further procured four more 1.5 T MRI scanners which were installed at the Tamale Teaching Hospital (Northern Region), Komfo Anokye Teaching Hospital (Ashanti Region) in Kumasi, the Volta Regional Hospital (Volta Region) in Ho, and the Cape Coast Teaching Hospital (Central Region) in Cape Coast to improve access and facilitate health delivery in the country.[25] It is this initiative which accounted for the availability of MRI scanners in these regions. However, other regions still lack MRI scanners, indicating that since 40% of the population live in these regions they do not readily have MRI available within their region. This is in agreement with McLane et al.[19] that while Ghana may have higher affordability than in low income countries, it does appear that it only meet accessibility standards for <60% of its population, on average.[19] This is further supported in their study that in public health facilities, i.e. in Ghana, only 20% of the population can obtain an MRI in less than 48 h.[19] The unavailability of MRI scanners in these regions might have stemmed from the high cost of acquiring them for each region, as government is often overstretched with budget constraints for the health sector. This is however in contrast with the assertion by McLane et al.[19] that reasons for unavailability might include absence of skilled workers to undertake the examination or to interpret the images. In fact even though majority of the Radiographers in Ghana are more concentrated in the southern part, there is the availability of a few to carry out MRI scans in regions where MRI scanners are not available when given the needed training.

In the assessment of affordability (Table 5), it was noted that the mean cost per MRI examination, was lower in the public (i.e. GH₵ 563–GH₵ 686 for non-contrast MRI examinations) compared to the private (i.e. GH₵ 618–GH₵ 775, $p < 0.05$ also for non-contrast MRI examinations) even though the latter uses low magnetic fields and depend on the body part that is being scanned. This is in agreement with McLane et al.[19] in their study in which they reported that the mean cost per test, across all neurodiagnostic tests (i.e. MRI) was lower in the public vs private sector. In Ghana, privately paid tariffs are usually considerably higher than in public health facilities. This is because the cost of doing business is expensive, as companies have to pay a staggering 25 percent corporate tax to government. In addition, businesses are plagued by high utility tariffs, high cost of credit, multiplicity of taxes and cedi depreciation against the US dollar.[26] These factors have often resulted in high cost of rendering services by the private sector. Evidence shows that whilst MRI examinations are affordable for >70% of the total populations in the Organization for Economic Cooperation and Development countries (i.e. Americas, Europe, and Western Pacific World Health Organization regions), in Africa and in Southeast Asia, such examinations can only be affordable by < 50% of the total population at < 10% of annual household disposable income.[19]

The study also revealed that even though most facilities (9[75%]) accept card bearers of some private health insurance to access MRI services, it was noted that none of the facilities do accept card bearers of the public-funded health insurance (Fig. 2). Although the NHIS is to cover for all imaging examinations including MRI, facilities in both public and private will either accept cash payment or card bearers of some private health insurance. The NHIS has been bedevilled with numerous challenges which includes administrative bottlenecks, inadequate transparency, corruption, and gaming

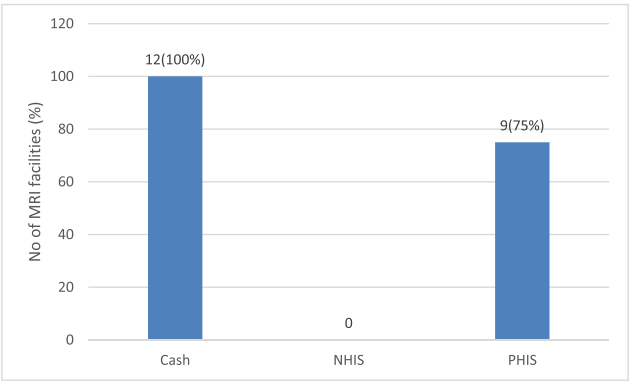

Figure 2. Summary of how MRI scans are reimbursed in Ghana.

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of the system.[12] Many at times, reimbursement of health facilities from the NHIS can take several months to a year, which is often at the peril of many facilities as they run short of funds to keep rendering their services. In extreme cases, service providers allegedly inflate prices, their reasons being that the current 4-months-plus duration for reimbursement and the resulting price fluctuation and shortages were having a heavy toll on their service delivery.[27] For these reasons, many facilities have had to return to the old "cash and carry" system.

Our study is subject to limitations. We chose to use one response per facility to obtain the best response. It is acknowledged that a respondent may have inaccurate or non-representative information.[19] To address this, we asked the respondent about their local practice setting. Furthermore, we did not consider – the perspectives of patients, caregivers, or clinicians. This area can be taken on in future studies.

Conclusion

This study currently revealed the state of availability, accessibility, and affordability of MRI services in Ghana. This is to help health policy managers to take strategic steps in ensuring access to quality health services for all people living in Ghana. It will also serve as a basis for the improvement of policy measures for health sector priorities and planning. The study demonstrated that despite the numerous challenges bedevilling Ghana's health system, there have been significant tremendous strides made by Government and private health facilities to improve access to advanced diagnostic modalities that can help improve medical care. One of such is the acquisition of MRI scanners which have come a long way to contribute to the diagnostic work-up of patients. However, there is wide disparity in the distribution of MRI scanners nationwide. Most of the scanners are located in the Greater Accra region, and in all only 5 regions have MRI scanners, indicating that close to 40% of the general population do not readily have access to MRI services. It is envisaged that the GoG can improve on availability and accessibility of this essential diagnostic tool by acquiring more of it to be installed in other public facilities nationwide. Affordability can be significantly improved if measures are put in place by GoG for both public and private health facilities to accept card bearers of the NHIS to access MRI services. Future studies may consider looking into the perspective of patients, caregivers, or clinicians on availability, accessibility, and affordability of MRI services.

Conflict of interest statement

None.

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