



## SPATIAL DISTRIBUTION AND ACCESSIBILITY OF HEALTHCARE FACILITIES IN NIGER STATE, NIGERIA

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### ABSTRACT

The provision of adequate basic healthcare services is becoming increasingly difficult due to rapid population growth and lack of available resources. One of the imperatives of healthcare provision is a concern for both social and spatial justice. This study examines the spatial distribution and accessibility of healthcare facilities in Niger State. Secondary data were collected from the Niger State Ministry of Health and the National Population Commission. ArcGIS 10.4.1 software was used to create distribution maps of healthcare facilities throughout the state. The results of the study indicated that healthcare facilities in Niger State were not evenly distributed across the state. Niger East had the most accessible healthcare facilities, followed by Niger South. Despite having a sufficient number of healthcare facilities that meet the minimum global average recommended by the World Health Organization (WHO) in-terms of population ratio, the distribution of these facilities per population ratio were also not evenly distributed across the State with Niger North having the least healthcare facilities per population ratio which needs to be addressed to meet the WHO-recommended threshold. Moreover, several local government areas, including Muya, Agwara, Mashegu, Edati, Gbako, and Katcha, had no secondary healthcare facilities, indicating that healthcare accessibility in Niger North and Niger South was significantly limited. The study highlights the need for more well-equipped general hospitals in currently inadequate areas and the provision of primary healthcare facilities, particularly in rural areas throughout the State. Overall, the findings suggest that healthcare accessibility in Niger State is a critical issue that requires immediate attention.

**Keywords:** *Accessibility, Healthcare facilities, Population ratio, Spatial distribution*

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## INTRODUCTION

Maintaining optimal health is of paramount importance to the overall well-being of individuals, encompassing physical, mental, and social dimensions and extending beyond the mere absence of disease. Health represents a holistic state of well-being that enables individuals to live a productive life, serving as a means to an end and providing resources to achieve the highest mental, emotional, and physical stability (World Health Organisation, 2023). As a fundamental human right (WHO, 2010), access to good health should be made available to every member of society, as it is essential for economic and social development (Federal Ministry of Health, 2010). Maintaining good health is further emphasized because man is responsible for all economic activity. Therefore, optimal health enhances the quality of life and contributes to sustained economic and social development.

Healthy population and access to healthcare services are significant factors influencing economic development and prosperity. Thus, accessibility to healthcare facilities describes people's ability to use healthcare services when and where they are needed. Healthcare decisions are strongly influenced by the type and quality of services available in the local area and the distance, time, cost, and ease of traveling to reach those services (Haynes *et al.*, 2003). Accessibility is sometimes measured in waiting time, which can be hours in a medical reception room for some people, and even days for people in the developing world who have already walked with sick children for many miles (Melinda and Michael, 2010). In the utilization of these healthcare services, various parameters tend to have influence. This include population of healthcare facilities (HCF) in relation to the population of a given location, physical distance, race, ability to pay, and social distance among others. The language used by doctors, the ability to understand and be understood, and the attitude of medical staff toward patients' matters a lot (Melinda and Michael, 2010).

Nigeria has numerous healthcare providers, both in the public and private sectors that offer healthcare services. As of December 2020, Nigeria had a total of 40,399 healthcare facilities located in all 36 states and the Federal Capital Territory. Most of these facilities (85%) were primary healthcare facilities, 14% were secondary healthcare facilities, and only 1% were tertiary healthcare facilities. Over 66% of these facilities were owned by the government, specifically the Federal Ministry of Health (Federal Ministry of Health, 2020). However, it is essential to note that certain population thresholds must be met before a healthcare facility can be established. For instance, a primary healthcare facility requires a population ranging from 2000 to 20,000 for a health clinic and 20,000 for a health centre, with a service radius of 5km to 24km, before establishing it. The population of secondary healthcare facilities, such as general hospitals, must be 150,000, with a service radius of 80km. In contrast, tertiary healthcare facilities, including teaching hospitals, cover the entire State's population and service radius (National Health Policy, 2016).

Most primary healthcare facilities in Nigeria lack essential equipment and amenities, including reliable electricity, emergency transportation, and proper waste management (National Health Policy, 2016). The rural population receives inadequate service compared to urban populations, and less than 20% of potential patients have access to primary healthcare due to various challenges in the health system in rural areas (Abdulrahee *et al.*, 2012; Agofure and Sarki, 2017).

The distribution of healthcare workforce and increasing trend of professionals leaving Nigeria has led to critical shortages and low health indicators compared to other developing nations (National Primary Healthcare Development Agency, 2015). The under-5 mortality rate is 138 per 1000 live births, while the maternal mortality ratio

is 840 per 100,000 live births. This contrasts a regional ratio of 620 per 100,000 live births and a worldwide average of 260 per 100,000 live births (National Health Policy, 2016).

Regions with few health professionals are linked to poor health outcomes in Nigeria, including Niger State (FMOH, 2012). Inadequate medical attention leads to preventable ailments and deaths in Nigeria (FMOH, 2005). The root cause is the lack of quality healthcare services, with unequal distribution of facilities and staff in Niger State. Nearly 70% of the population lacks access to medical care, with only urban areas having access to quality services from general hospitals (Niger State Government, 2015).

According to Accelerated Action for Impact (2018), Niger State saw a decline in maternal and child health between 2011 and 2016. Infant and children under five mortality rates increased and the percentage of births attended by skilled professionals declined by almost one-third. Immunization rates dropped from 28% to 20%. Full immunisation coverage slightly increased from 13.4% to 13.8%. There is a significant shortage of skilled healthcare workers and a pressing need for more functional health facilities (Accelerated Action for Impact, 2018).

Numerous studies have investigated the uneven spatial distribution and access to healthcare facilities. For example, Owoyele *et al.* (2015) researched service radii and accessibility of healthcare facilities in Suleja, Niger State, Nigeria, and found that the ratio of healthcare workers to the population, including doctors, nurses, and midwives, needs to be well-balanced. Similarly, other studies by Agaja (2012); Kibon and Ahmed (2013); Fanan and Felix (2014); Mukhtar *et al.* (2018), have also suggested that the spatial distribution of healthcare facilities is not evenly distributed in Benue State, Jigawa State, Kano State and Delta State respectively. However, most of these studies solely focus on the spatial distribution of healthcare facilities without analyzing the population ratio in-terms of accessibility.

Furthermore, all studies except for Owoyele *et al.* (2015) were conducted outside the study area. Owoyele *et al.* (2015) conducted their work within a local government area of Niger State. As a result, this study aims to address the research gap identified above by examining the spatial distribution and accessibility to healthcare facilities in Niger State, Nigeria. The assessment of accessibility involved analyzing the numbers of healthcare facilities in relation to the population of the State and LGAs. This analysis utilized the World Health Organization (WHO) minimum benchmark as a reference point for measuring accessibility.

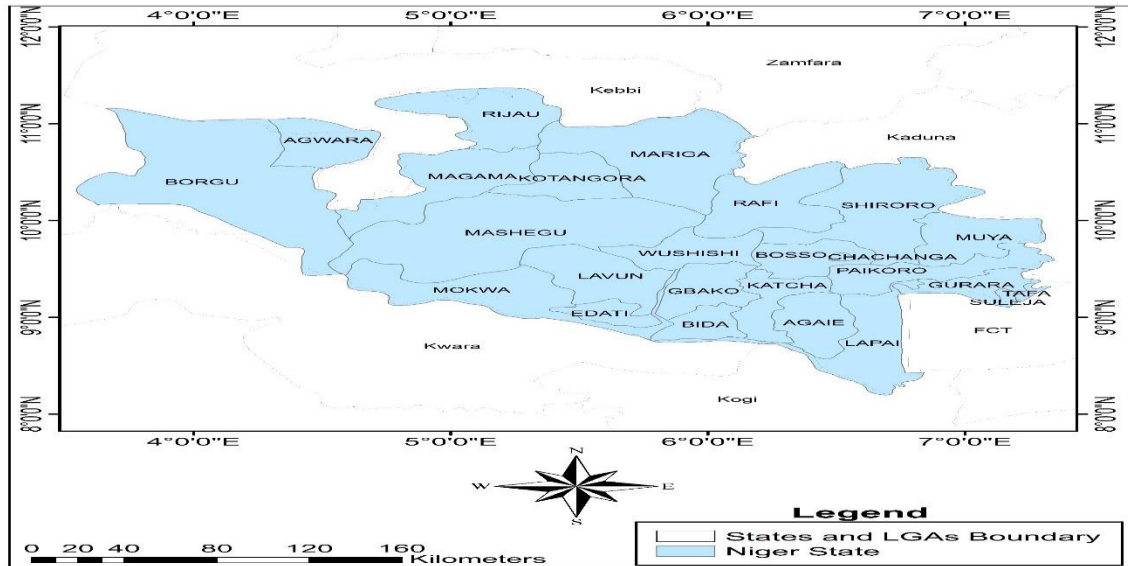
## **MATERIALS AND METHODS**

### **Description of Study Area**

Niger State lies between latitude 8° to 11° 30' North and Longitude 3° 30' and 7° 40' East. The State shares a border with the Republic of Benin (West) and within Nigeria it is bordered by the Federal Capital Territory (FCT) on the South-East, to the North by Zamfara State, North-West by Kebbi State, South by Kogi State, South-West by Kwara State and North-East by Kaduna State (Niger State Government, 2015), (Figure 1). It has 25 Local Government Areas and Minna is the State Capital. The State houses the three major hydro-electric power stations in Nigeria, namely; Kainji, Jebba and Shiroro stations hence the official slogan of “Power State”.

The population of Niger State as at 1991 was 2,421,581 people. The 2006 population and housing census put the State’s population at 3,954,772 (National Population Commission, 2008). However, as at 2020 the population of the state is put at 6,222,944 (Author’s Projected Population, 2020). Niger state is populated mainly by the Nupe people in the south, the Gwari in the east, the Busa in the west, and Kambari (Kambari), Hausa, Fulani, Kamuku, and

Dakarkari (Dakarawa) in the north. The people of Niger State are predominantly Muslims and Christians with very few traditional religionists (Niger State Government, 2015).



**Figure 1:** The Study Area

Source: Cartography Lab, Geography Department B.U.K (2020).

**Data collection and sources**

Data on the number and locations of healthcare facilities for the State, including their types (primary, secondary, and tertiary) and ownership (government and private), were obtained from the Niger State Ministry of Health. Population figures for the State were sourced from the National Population Commission (NPC). The map (shape file) of Niger State, used to create the distribution maps for the study, was collected from Bayero University, Kano at the Department of Geography. The data for assessing healthcare facility accessibility relative to the population were sourced from World Health Organization bulletins and publications. Additional literature for the study was gathered from a variety of published and unpublished sources, including books, journals, and seminar papers.

The population of Niger State was projected to 2020 using an exponential growth model at an annual growth rate of 3%, as provided by the National Population Commission. The following formula was used for the projection:

$$P_i = P_{2006} X (1 + X)^n \dots\dots\dots (1)$$

Where:

- P<sub>i</sub> is the projected population at year I;
- P<sub>2006</sub> is the population in the year 2006;
- x is the annual growth rate
- n is the number of years from 2006 to the projection year I;

Source: Adopted from the work of Adamu and Sani (2017).

This formula was used to estimate the population for each local government area since population data at the ward level were not available.

## Data analysis

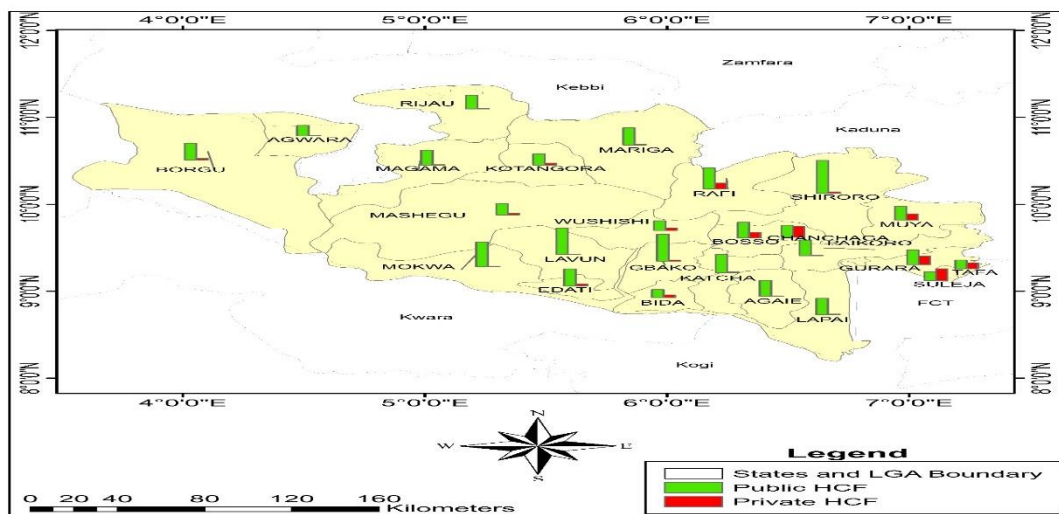
The study involved contacting the State Ministry of Health to gather data on the number, locations, types (primary, secondary, and tertiary), and ownership (public and private) of healthcare facilities throughout the State. This data, along with a map of Niger State, was imported into the ARCGIS 10.4.1 environment and combined to create the database for analysis. Using this database, distribution maps of the total number of healthcare facilities by types, ownership and location were produced. Tables were also used to display the total number of primary, secondary, and tertiary healthcare facilities across the State. Additionally, the tables show the population figures for both the State and its local government areas, along with the ratio of healthcare facilities to the population. Formulas were applied to calculate the population-to-healthcare facility ratio, which was also illustrated in the tables:

$$\frac{\text{Number of Health Facilities} \times 10,000}{\text{Total Population}} \quad \dots\dots\dots (2)$$

## RESULTS AND DISCUSSIONS

### Distribution of Healthcare Facilities in Niger State

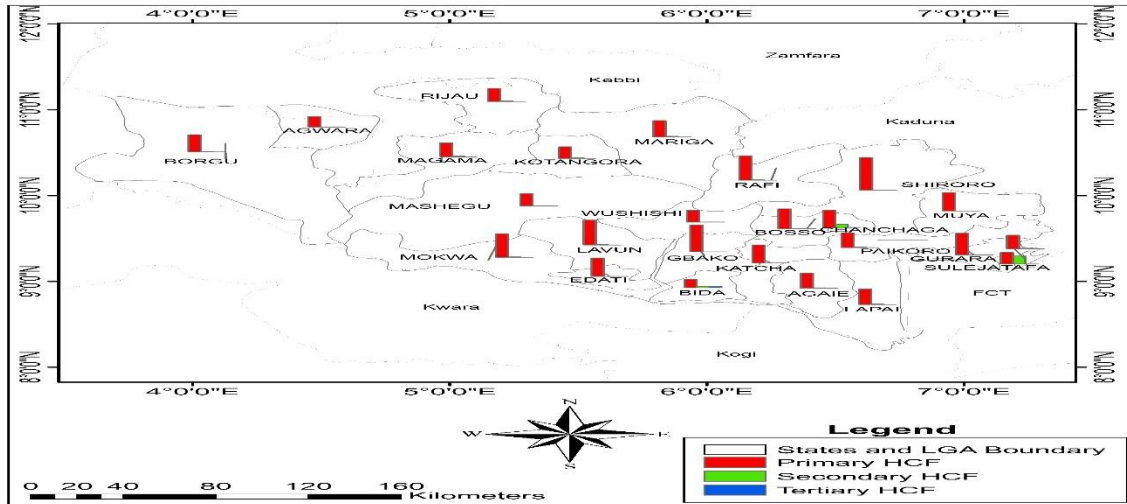
A comprehensive understanding of healthcare facilities' distribution is crucial to identifying underserved areas and improving healthcare delivery. Niger State has 1587 healthcare facilities (primary, secondary, and tertiary) across all the 25 local government areas. Of these, 1337 (84%) are public, and 250 (16%) are private (Figure 2). Primary healthcare facilities have more numbers, with 1511 (94%), followed by secondary with 75 (5%), and tertiary with 1 (1%) (Figure 3 and Table 1). Table 1 clearly shows that Shiroro LGA in Niger East, with 115 (7%) facilities, has the highest concentration of healthcare facilities, closely followed by Gbako in Niger South, with 94 (6%) facilities. Out of these figures, Shiroro LGA only has one secondary healthcare facility, while the others are primary healthcare facilities.



**Figure 2:** Ownership of Healthcare Facilities by LGA's

Conversely, all 94 healthcare facilities in Gbako are primary healthcare facilities. Bida LGA in Niger South has the lowest number of healthcare facilities, with only 36 (2%), followed by Agwara, with 37 (3%) facilities in Niger North. Although Bida LGA has the fewest primary healthcare facilities overall, it has more secondary, 6 (8%) and tertiary

healthcare facilities, 1 (100%) than Shiroro and Gbako, the two LGAs with the most healthcare facilities in the state, respectively. The lists top two locations for secondary healthcare facilities are Chanchaga 14 (19%) and Suleja LGA 28 (38%). While several LGAs, such as Muya, Agwara, Mashegu, Edati, Gbako, and Katcha, had no secondary healthcare facilities. However, all six LGAs mentioned, except Agwara, meet the minimum population requirement of 150,000 to establish a secondary healthcare facility (General Hospital) (see National Health Policy, 2016).



**Figure 3:** Distribution of Healthcare Facilities by Categories in Niger State

Considering the state's highest degree of healthcare facilities in terms of hierarchy, only Bida (Federal Medical Centre) LGA had the presence of one tertiary healthcare facility for the entire state. The implication of these is that LGA without the presence of general hospital will be denied access to general and important services (treatment) that the primary healthcare facilities cannot rendered. It may also lead to loss of life due to delay in receiving treatment in the case of referral as the patients have to travel to nearby LGA with general hospital to receive such services. In the long run, this may lead to patients' apathy in utilizing modern healthcare services.

### Distribution of Healthcare Facilities by Senatorial Districts

The largest number, 665 (42%), of the state's 1587 healthcare facilities are located in the Niger East senatorial district. In terms of hierarchy, Niger East has 614 (40%) primary healthcare facilities, followed by Niger South with 526 (35%) and Niger North with 372 (25%). For secondary healthcare facilities, Niger East also has the highest with 51 (69%), followed by Niger South with 12 (16%) and Niger North with 11 (15%). Moreover, lastly, for the tertiary healthcare facilities, Niger East has 0 (0%), Niger South has 1 (100%), and Niger North has 0 (0%) (Table 1). It is significant to note that, in terms of direct access to medical services, Niger East outpaces the other senatorial zone. This is because four (4) of the local government areas within this zone (Bosso, Chanchaga, Suleja and Tafa) are highly cosmopolitan, urbanised, and have adequate social amenities compared to other LGAs in other zones. These factors influence the State Government and other private investors in the healthcare industry to setup more healthcare facilities within these local government areas. In addition, Niger East also has the highest population among the three senatorial districts with 2,240,000 (36%), followed by Niger South with 2,037,392 (33%), and Niger North at 1,945,552 (31%), making the total population of the state to be 6,222,944 people (Table 2).

**Table 1:** Distribution of Healthcare Facilities by Categories in Niger State

SENATORIAL DISTRICT	LGA	NO. OF		PRIMARY		SECONDARY		TERTIARY	
		HCF	%	%	%	%	%	%	
NIGER EAST									
(ZONE B)	Bosso	71	4	70	5	1	1	0	0
	Chanchaga	77	5	63	4	14	19	0	0
	Gurara	77	5	76	5	1	1	0	0
	Muya	65	4	65	4	0	0	0	0
	Paikoro	54	3	52	3	2	3	0	0
	Rafi	89	6	86	6	3	4	0	0
	Shiroro	115	7	114	8	1	1	0	0
	Suleja	68	4	40	3	28	38	0	0
	Tafa	49	3	47	3	2	3	0	0
	<b>SUB TOTAL</b>	<b>665</b>	<b>41</b>	<b>613</b>	<b>41</b>	<b>52</b>	<b>69</b>	<b>0</b>	<b>0</b>
NIGER NORTH									
(ZONE C)	Agwara	37	2	37	2	0	0	0	0
	Borgu	61	4	60	4	1	1	0	0
	Kontagoro	43	3	40	3	3	4	0	0
	Magama	50	3	48	3	2	3	0	0
	Mariga	59	4	57	4	2	3	0	0
	Mashegu	43	3	43	3	0	0	0	0
	Rijau	48	3	46	3	2	3	0	0
	Wushishi	42	3	41	3	1	1	0	0
	<b>SUB TOTAL</b>	<b>383</b>	<b>25</b>	<b>372</b>	<b>24</b>	<b>11</b>	<b>15</b>	<b>0</b>	<b>0</b>
NIGER SOUTH									
(ZONE A)	Agaie	53	3	52	3	1	1	0	0
	Bida	36	2	29	2	6	8	1	100
	Edati	64	4	64	4	0	0	0	0
	Gbako	94	6	94	6	0	0	0	0
	Katcha	63	4	63	4	0	0	0	0
	Lapai	56	4	54	4	2	3	0	0
	Lavun	88	6	87	6	1	1	0	0
	Mokwa	85	5	83	6	2	3	0	0
	<b>SUB TOTAL</b>	<b>539</b>	<b>34</b>	<b>526</b>	<b>35</b>	<b>12</b>	<b>16</b>	<b>1</b>	<b>100</b>
<b>TOTAL</b>		<b>1587</b>	<b>100</b>	<b>1511</b>	<b>100</b>	<b>75</b>	<b>100</b>	<b>1</b>	<b>100</b>

Source: Niger State Ministry of Health (2021)

The distribution of healthcare facilities in the three senatorial zones follows a similar pattern when comparing the ratio of healthcare facilities to population. The zone with the most healthcare facilities has an average ratio of 3:10000, with 1 facility for every 3368 people in Niger East. Niger South follows with 1 facility for every 3779 individuals, resulting in an average ratio of 3:10000, and Niger North has 1 facility for every 5079 individuals, resulting in an average ratio of 2:10000. The state's healthcare facility ratio stands at 1:3921, with an average ratio of 3:10000 for the entire state (Table 2). The state average is higher than the WHO global average of 2:10000. Niger East and Niger South health facility ratio averages is also the same with that of the state average but higher than the global averages. Niger State still lacks an adequate number of different categories of healthcare personnel, notwithstanding these remarkable numbers.

**Table 2:** Healthcare Facilities Ratio by Senatorial Districts in Niger State

NIGER EAST			RATIO PER 10000	NIGER NORTH			RATIO PER 10000	NIGER SOUTH			RATIO PER 10000
POP	HCF			POP	HCF			POP	HCF		
LGA				LGA				LGA			
Bosso	233072	71	3:10000	Agwara	90272	37	4:10000	Agai	207872	53	3:10000
Chanchaga	318080	77	2:10000	Borgu	271936	61	2:10000	Bida	291984	36	1:10000
Gurara	143024	77	5:10000	Kontagoro	239120	43	2:10000	Edati	251440	64	3:10000
Muya	162848	65	4:10000	Magama	285600	50	2:10000	Gbako	199584	94	5:10000
Paikoro	248864	54	2:10000	Mariga	314048	59	2:10000	Katcha	190176	63	3:10000
Rafi	292880	89	3:10000	Mashegu	338576	43	1:10000	Lapai	184128	56	3:10000
Shiroro	370832	115	3:10000	Rijau	277312	48	2:10000	Lavun	330064	88	3:10000
Suleja	338464	68	2:10000	Wushishi	128688	42	3:10000	Mokwa	382144	85	2:10000
Tafa	131936	49	4:10000								
SUB				SUB				SUB			
TOTAL	2,240,000	665	3:10000	TOTAL	1,945,552	383	2:10000	TOTAL	2,037,392	539	3:10000
<b>TOTAL</b>	<b>6,222,944</b>	<b>1587</b>	<b>3:10000</b>								

Source: Niger State Ministry of Health (2021)

This study therefore shows an uneven distribution of healthcare facilities across the state, with most facilities concentrated in the Niger East senatorial district. This finding is consistent with previous studies, such as Owoyele *et al.* (2015), Abdulkarim *et al.* (2017), Adamu and Sani (2017), Agaja (2012), Fanan and Felix (2014), Kibon and Ahmed (2013), and Mansour (2016), which found out that healthcare facilities are not equally distributed in their study areas and are instead concentrated in a specific region of the state. Consequently, Niger North will have limited access to healthcare facilities, as there are fewer healthcare facilities in proportion to the population, making it the only senatorial zone that falls short of the state and WHO average ratio of healthcare facilities. As a result, patients may experience long waiting times to see medical personnel, inadequate equipment, and a shortage of healthcare personnel, ultimately leading to poor service delivery due to population pressure to utilise the few available healthcare facilities.



## CONCLUSION

Healthcare facilities distribution is unequal across the three senatorial districts and local government areas (LGAs) in Niger State. Niger East has the most facilities while Niger South and Niger North have few. Several LGAs like Muya, Agwara, Mashegu, Edati, Gbako, and Katcha require more secondary healthcare facilities. Despite meeting the minimum WHO global average of healthcare facilities to population ratio, the unequal allocation of these amenities remains a pressing concern. Niger East has a higher ratio of healthcare facilities per population, while Niger South and Niger North fall short of the recommended threshold. One area that warrants special attention is Niger North, where a lack of facilities in proportion to the population size may lead to protracted waiting time, inefficient service delivery, and insufficient equipment and staff. To guarantee fair and easy access to healthcare services for everyone, each LGA must have a general hospital. The state government should also build and equip general hospitals in LGAs that lack basic healthcare services, especially in rural areas. Additionally, it is critical to carry out additional study that assesses the geographic distribution and accessibility of healthcare professionals in Niger State, including physicians, nurses, midwives, and community health extension staff. This will make it easier to determine where healthcare workers are most needed and how best to distribute them around the state to improve healthcare delivery.

## CONFLICT OF INTEREST

The authors affirm that they do not have any competing interests.

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