

# Assessment of the Spatial Distribution of Health Centers in Adamawa State, Nigeria

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**Abstract - Good health is a precondition for socio-political and economic development of any nation. The study aim at assessing the spatial distribution of health care facilities in Adamawa State, Nigeria. The research will be of use to the health sector such as health workers, medical personnel, and international organizations such as UNISEF, UNO, WHO, NGO'S and stakeholders alike. The research employs the use of primary and secondary data. The Research Instrument used is survey questionnaires and Focused Group Discussion alongside Purposive interview. The study population is made up of all the health centers in the 21 Local Governments areas of Adamawa State. The results show the distribution of health facilities across Adamawa State is markedly uneven, reflecting broader patterns of urban-rural disparity. The study recommends that Building of new modern health centers that will cater for the need of the people and the renovation of old ones. Strategic investment in infrastructure, particularly in rural areas, is essential to ensure that health centers are fully functional and accessible all the year-round.**

**Keywords:** Spatial distribution, Healthcare Centers, Accessibility, Healthcare, Hospitals.

## I. INTRODUCTION

Good health is a precondition for socio-political and economic development of any nation. Human health is a key factor in the sustainable development agenda and goals of any country. Irrespective of the developmental and technological status of the society, health care system is crucial to the welfare of the society (World Health Organization, 2010; Bhatt & Joshi, 2013; Owoyele et al., 2015). In recognition of this, the fourth National Development Plan, 1985, documented that good health has a direct relationship with happiness, intelligence, political stability and productivity of the citizens of a country. This is predicated on accessibility to health care facilities identified to be one of the major indicators of development and, according to (Alabi, 2015), a strong influence of individual's earning capacity.

However, the locational perspective, of any facility, (Medical facilities inclusive) can determine the level of its

utility. From the locational perspective, the spatial distribution of any facility could be determined. Adejuyigbe, (2000) sees spatial structure of a distribution as both the location of each element relative to each other. Just as the need for health care varies in space and organization, the physical environment also varies in characteristics from place to place and this has implications for the pattern of demand for health care facilities. The closer a health facility is to the people, the greater it's utility and benefits. This can be connected to how they are distributed.

Access to health care services means timely use of available health services to achieve the best health outcomes, and it influences the overall physical, social, and mental health status; prevention of disease and disability; detection and treatment of health conditions; quality of life; preventable death; and life expectancy and it is central in the performance of health care systems around the world (Levesque et al. 2013, RUPRI 2014).

In contrast, limited access to health care is a significant problem which results in unmet health care needs, delays in receiving appropriate care, inability to get preventive services, and hospitalizations that could have been prevented (Novertis 2016; RUPRI 2014). Adamawa state is characterized by diverse topography that includes hills, valleys, and rivers. The terrain can affect the accessibility of health centers, particularly in rural areas.

The aim of this study is to provide a comprehensive geospatial distribution of health centers in Adamawa State, so that indenting users will be able to find which health center is accessible.

## Study Area

Adamawa State lies between latitudes 7° 15' and 10° 58' N of the equator and between longitude 11° 9' and 13° 47' E of the Greenwich Meridian, It share boundaries with Taraba State in the South and West, Bauchi to its north-west, Yobe and Borno States to the North. Adamawa State has an international boundary with the Cameroun Republic up along its Eastern side.

The state covers a land area of about 39,742.13 sq. km. The mountainous land- forms between Adamawa State and the Cameroun Republic provide an effective political boundary unlike what we have between Niger Republic or the Republic of Benin with Nigeria. Man's ability to adapt to the hilly environment in Adamawa State has allowed the borderland to be used by herdsmen no transcending political boundaries.

Adamawa is a state in northeastern Nigeria, whose capital and largest city is Yola. In 1991, when Taraba State was carved out from Gongola State, the geographical entity Gongola State was renamed Adamawa State, with four administrative divisions: Adamawa, Michika, Ganye, Mubi and Numan. It is one of the thirty-six states that constitute the Federal Republic of Nigeria (figure 1). (Adamawa State in Maps)

Adamawa State relief range from 348-1240m above sea level and it has a range of mountains as seen in figure 1.

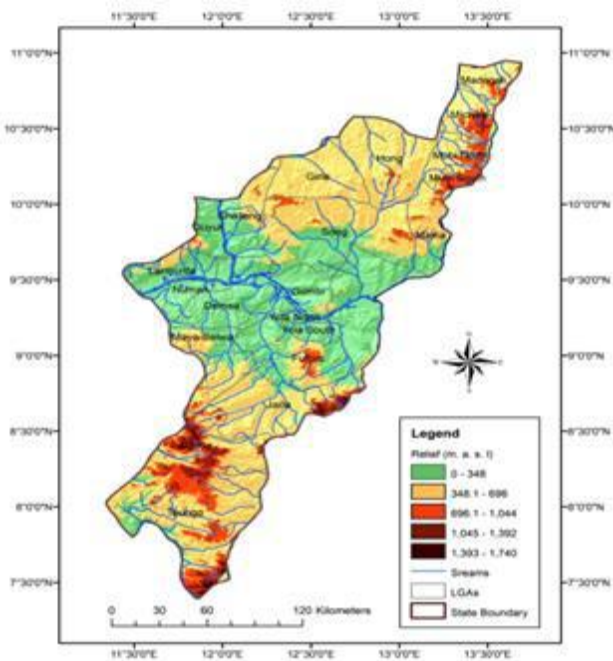


Figure 1: Relief map of the study

Source: ADSU GIS Laboratory

## II. METHODOLOGY

### Data type and source

Data was sourced from both primary and secondary source. The primary sources constitute the locations of the health centers which were collected with the use of global positioning system (GPS). The data were collected in each local government area for the period of two months while the secondary source is made up of published and unpublished materials.

### Sampling Procedure

A purposive Stratified and systematic sampling was used to sample the locations and population for the study. A purposive was used to stratify the study area into three zones. That is, into Northern, Central and Southern Senatorial zones.

A proportion was sampled from each senatorial zone using the Cretje & Morgan Formula (1970).

$$n = x^2 \frac{NP(1 - P)}{e^2(N - 1) + x^2P(1 - P)}$$

Where;

- N = number of population
- x/2 = Chi square table Value
- e/2 = Margin of error (0.05)
- N = Population Size
- P = Population Proportion
- 1 = Degree of Freedom

From the North senatorial zone, 69 health centers were selected. From the central senatorial zone, 97 health centers were selected while from the southern senatorial zone, 125 health centers were sampled, given a total of 291 health centers as the sample size. The method used for collection of data was a fieldwork. For the selection of the health centers, a systematic sampling technique was used to select the health centers. The GPS was used to capture the coordinates of the health centers in each local government areas as stated already. The ArcGIS 10.3 version was used in analyzing the data collected from the field, producing maps of all the locations of health centers in Adamawa state.

## III. RESULTS AND DISCUSSION

The spatial distribution of health centers plays a critical role in determining healthcare access and delivery, especially in regions with diverse geographical and socio-economic landscapes. Adamawa State, located in northeastern Nigeria, as seen in figure (2) exemplifies these challenges due to its complex topography, uneven population distribution, and socio-political dynamics. Understanding the distribution of health facilities across this state is essential for effective public health planning and ensuring equitable healthcare services.

There about 1,158 health centers in the State as at the time of this research, but these health centers are unevenly distributed which could be as a result of political, economic and geographical settings. The extreme end of the northern part of the state, that is around Madagali L.G.A. and the extreme southern part like Ganye and Toungo, has fewer health centers. While places in the central senatorial zone like Yola north and south have the highest number of health

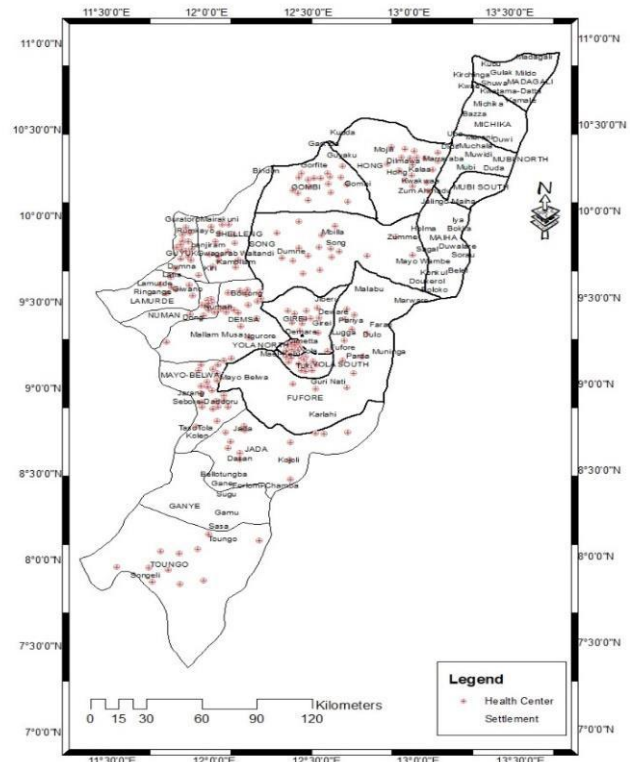
centers which are clustered together in the state capital. This could be attributed to the fact that Yola north is the seat of Government and state capital, so could be characterized with a lot of civil and economic activities. There are over 500 health centers in the central senatorial zone, more than 400 in the southern senatorial zone and more than 300 in the Northern senatorial zone.

Federal Medical Centre (FMC), Yola, is one of the most prominent healthcare facilities in Adamawa State, located in the state capital, this tertiary hospital serves as a major referral center not only for Adamawa but also for neighboring states like Borno, Gombe, and Taraba. The FMC offers a wide range of specialized medical services, including surgery, obstetrics and gynecology, internal medicine, and pediatrics. Its central location in Yola makes it accessible to a significant portion of the state's population, although patients from remote areas often face challenges in reaching the facility.

The General Hospital in Mubi serves the northern part of Adamawa State. Mubi, a significant town in the state, has been impacted by insurgent activities in recent years, which have strained its healthcare services. Despite these challenges, the hospital continues to provide essential services, including emergency care, maternal and child health services, and treatment for common ailments. However, the hospital faces issues such as inadequate staffing and limited resources, which hinder its ability to fully meet the healthcare needs of the population.

One of the health centers that plays rural health services is the Ganye Cottage Hospital. Ganye; in the more rural and remote areas of Adamawa, smaller health facilities like the Cottage Hospital in Ganye play a crucial role. Ganye is located in the southern part of the state, and the Cottage Hospital provides primary healthcare services to the local population, including basic medical consultations, maternity care, and treatment of common diseases. The hospital's rural location, however, means that it struggles with challenges such as limited medical supplies, inadequate infrastructure, and difficulty in retaining healthcare workers. The Primary Health Centre (PHC) in Numan is representative of the many PHCs scattered across the state. These centers are intended to provide basic healthcare services at the community level, including immunizations, antenatal care, and treatment for minor illnesses. The PHC in Numan, like many others, is critical for the rural population that relies on it as their first point of contact with the healthcare system. However, the effectiveness of these centers is often hampered by shortages of medicines, insufficient medical staff, and the need for better maintenance of the facilities. Many of the health centers lack Maternal Services.

In contrast, rural regions, particularly in the northern and southern parts of the state, face significant challenges in accessing healthcare. Health centers in these areas, like the Cottage Hospital in Ganye and the PHC in Numan, are often under-resourced and struggle with issues such as poor infrastructure, lack of medical supplies, and inadequate staffing. The geographical barriers in these regions, including difficult terrain and poor road networks, further exacerbate the challenges of healthcare delivery.

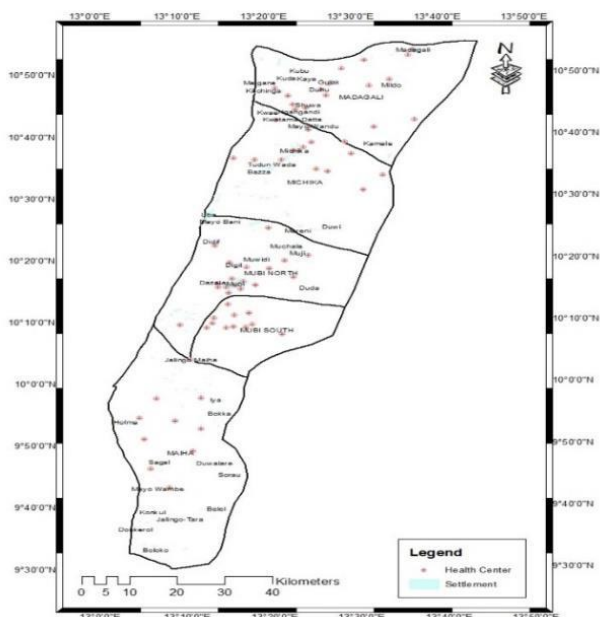


**Figure 3: Spatial distribution of Health centers in Adamawa State**  
Source: Fieldwork 2024

The Northern Senatorial Zone of Adamawa State, comprising the Local Government Areas (LGAs) of Madagali, Mubi North, Mubi South, Michika, and Maiha, is a region marked by both strategic significance and profound challenges. The distribution of health centers in this zone as seen in figure (4), reflects the complex interplay of geography, socio-political dynamics, and ongoing security concerns.

The Northern Senatorial Zone occupies a crucial position within Adamawa State, bordering Cameroon and serving as a commercial and social hub. Its geography is varied, encompassing mountainous regions, valleys, and floodplains, which create both opportunities and barriers to the establishment of healthcare facilities. The region has been heavily affected by insurgent activities, particularly from Boko Haram, which has led to the destruction of infrastructure, displacement of populations, and a general

atmosphere of insecurity that hinders healthcare delivery, most especially ante natal services. The Northern senatorial zone has over 300 health centres of which majority are located within the local Government headquarters probably due to educational, economic and political reasons. Places like Bakin Dutse in Madagali srestil inaccessible due to the activities of Boko-haram insurgency. The researcher has to commend the effort and activities of NGO’s such as PLAN and RESCUE which have their hallmark all over the northern senatorial zone. They helped in renovation and provision of drugs and other services to the existing health centers.

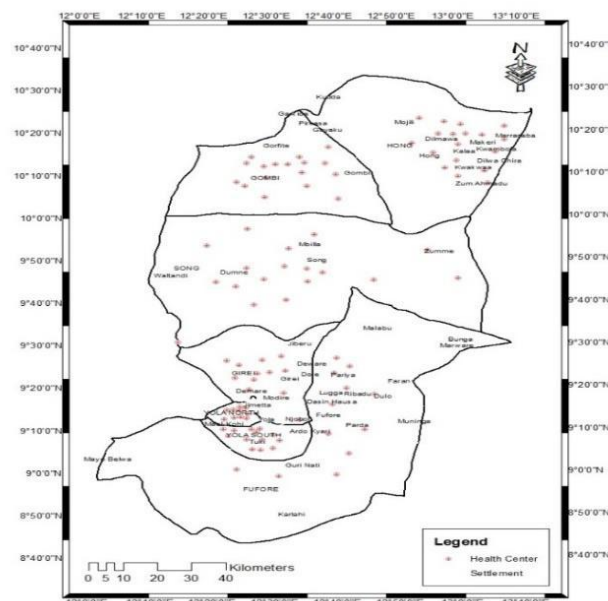


**Figure 4: Distribution of health centers in Northern senatorial zone**  
Source: Fieldwork 2024

The Central Senatorial Zone of Adamawa State, comprising the Local Government Areas (LGAs) of Hong, Gombi, Song, Girei, Yola North, Yola South, and Fufore, as seen in figure (5), presents a complex landscape of healthcare distribution. The region's mix of urban and rural areas, coupled with varying population densities and socio-economic activities, results in a diverse distribution of health centers. These facilities range from urban hospitals offering advanced medical services to rural clinics providing basic care, reflecting the healthcare needs and challenges of the zone. Compared to other zones in the state, the central senatorial zone has a larger number of health centers. This cannot be separated from the fact that the Central zone has the state capital and the seat of government.

Fufore LGA has the highest number of health centers at 82, however most of these are inaccessible due to its location along the Cameroon border and its riverine as well as mountainous terrain. Girei LGA has the lowest number of

health centers at 43 and this is probably due to its proximity to the state capital. There were several locations where health centers are not functional due to lack of personnel. For instance, Naiwa and Dalami Jalingo in Hong LGA and Dwalwari Gaanda in Gombi where health centers have been built but no services are being offered. This translates to limited medical services.



**Figure 5: Distribution of health centers in the Central Senatorial Zone**  
Source: Fieldwork 2024

The Southern Senatorial Zone of Adamawa State is a diverse region, characterized by a mix of urban, semi-urban, and predominantly rural communities. This region, comprising nine Local Government Areas (LGAs) Demsa, Numan, Lamurde, Shelleng, Guyuk, Mayo-Belwa, Jada, Ganye, and Toungo as seen in figure (6), presents a unique landscape in terms of healthcare accessibility and distribution. The spatial distribution of health centers across these LGAs reflects both the population density and the geographical challenges inherent to the area. The southern senatorial zone is made up of 7 LGAs. About 300 health centers that are unevenly distributed due to political, economic and geographical settings.

The LGA of Mayo Belwa has the highest number of health centers 66 while the local Government with the lowest number is Lamurde LGA with 25 health centers. In the southern senatorial zone, it was observed that health centers were clustered within the LGA headquarters and sparsely distributed in the rural/surrounding areas. There are health centers that have collapsed or got demolished and have not been rebuilt or replaced e.g Banda Tsarga health post in Toungo LGA has collapsed and as a result, sick people have to travel to neighboring villages in order to obtain medical care.

Other places without medical services include Farai in Demsa which is still under construction, Ganigaku clinic and old Demsa clinic; all under Demsa LGA. Others are Dubwange and Suwa Lassun in Lamurde LGA, then Sabon Pegi, Imburu Kwapukai, Bare Ubandoma and Tudun Wada in Numan LGA.

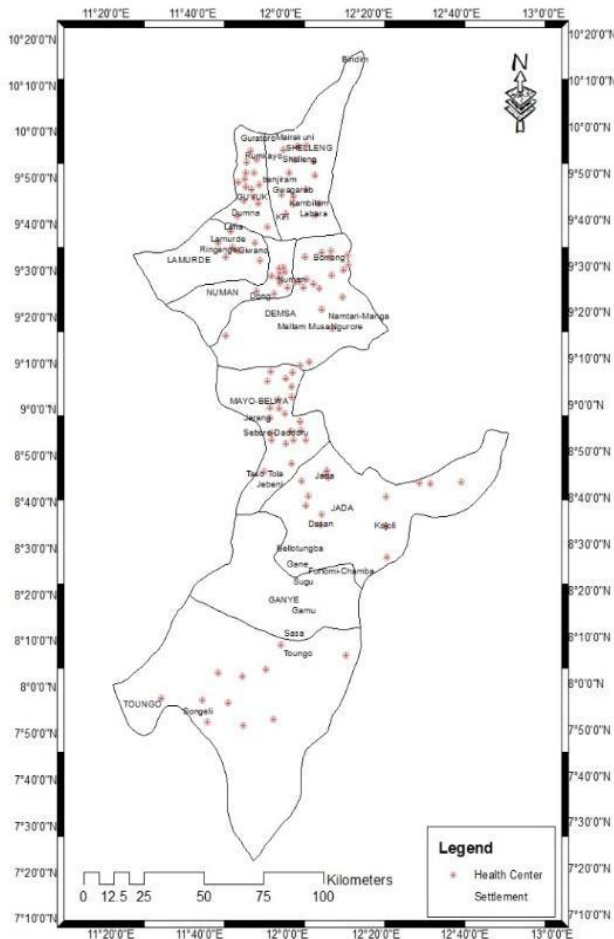


Figure 6: The spatial distribution of health centers in the Southern Senatorial Zone

Source: Fieldwork 2024

Table 1: Spatial distribution of general hospitals in Adamawa state

Name of local government area	Category of health center	No
Michika	General Hospital	1
Mubi-South	General Hospital	1
Song	General Hospital	1
Ganye	General Hospital	1
Toungo	General Hospital	1
Numan	General Hospital	1
Gombi (Garkida)	General Hospital	1
Jada	General Hospital	1
Demsa (Borrong)	General Hospital	1
Hong	General Hospital	1
Guyuk	General Hospital	1
Total		11

Table 1 shows that there are only 11 general hospitals in Adamawa state, the remaining 10 local government areas don't have general hospitals.

Table 2: Spatial distribution of cottage hospitals in Adamawa state

Name of local government area	Category of health center	NO
Madagali	Cottage	1
Maiha	Cottage	1
Gombi	Cottage	1
Ganye	Cottage	1
Girei	Cottage	1
Fufore	Cottage	1
Shelling	Cottage	1
Demsa	Cottage	1
Guyuk	Cottage	1
Lamurde	Cottage	1
Total		10

Table 2 shows the spatial distribution of cottage hospitals in Adamawa state, this cottage hospital were built in areas that don't have a general hospital or were the distance from the general hospital is much.

Table 3: Spatial distribution of health centers in the 21 local government areas of Adamawa state

s/no	Local government area	No of health facilities
1	Demsa	67
2	Numan	55
3	Lamurde	52
4	Shelling	59
5	Guyuk	55
6	Mayo-belwa	55
7	Jada	40
8	Ganye	41
9	Toungo	30
10	Yola noth	74
11	Yola south	70
12	Girie	55
13	Fufore	65
14	Song	67
15	Gombi	66
16	Hong	70
17	Maiha	54
18	Mubi north	53
19	Mubi south	54
20	Michika	37
21	Madagali	40
Total		1,158

Table 3 shows the spatial distribution of health centers in all the 21 local government areas of Adamawa state, this distribution includes both the specialist hospitals, the general hospitals, the cottage hospitals, the primary health care centers, the maternity clinics and the private hospitals in the state.

**Table 4: The Summary of the distribution of the health centers**

S/No	Category of the health center	Total No
1	Primary health care centers	995
2	General hospitals	11
3	Cottage hospitals	10
4	Specialist hospital	1
5	Federal medical center	2
6	Teaching hospital	1
7	Private clinics	138
Total		1,158

### Regional Disparities in Health Infrastructure

The distribution of health facilities across Adamawa State is markedly uneven, reflecting broader patterns of urban-rural disparity. The central region, encompassing Yola, Jimeta, and surrounding areas, enjoys the highest concentration of health centers. These urban regions, with their better-equipped and staffed facilities like FMC Yola and Specialist Hospital Jimeta, offer a wider range of services and serve not only the local population but also patients from surrounding rural areas who travel long distances to seek care.

In contrast, rural regions, particularly in the northern and southern parts of the state, face significant challenges in accessing healthcare. Health centers in these areas, like the Cottage Hospital in Ganye and the PHC in Numan, are often under-resourced and struggle with issues such as poor infrastructure, lack of medical supplies, and inadequate staffing. The geographical barriers in these regions, including difficult terrain and poor road networks, further exacerbate the challenges of healthcare delivery.

### Challenges in Healthcare Delivery

The challenges faced by health centers in Adamawa State are multifaceted. Geographical barriers, such as mountains and rivers, make it difficult to establish and maintain health facilities in remote areas. During the rainy season, many communities become inaccessible due to flooding or deteriorating road conditions, further isolating them from essential healthcare services.

Socioeconomic and cultural factors also play a significant role in health service delivery. In many rural areas, traditional medicine remains the first line of treatment due to its accessibility and cultural significance. Additionally, poverty and low literacy rates contribute to the underutilization of available health services, as many people cannot afford the costs associated with modern healthcare or lack the necessary awareness to seek it out. Insecurity, particularly in the northern parts of the state, has a profound impact on healthcare delivery. Insurgent activities have led to the destruction of health centers and the displacement of both healthcare workers and residents. The ongoing security

challenges deter health professionals from working in these areas, leading to severe shortages of qualified staff and further diminishing the capacity of the healthcare system in these regions.

### Opportunities for Improvement

Despite these challenges, there are several opportunities to improve the spatial distribution of health centers in Adamawa State. Technology, particularly Geographic Information Systems (GIS), offers a powerful tool for optimizing the placement of health facilities. By mapping population upgrades, density, disease prevalence, and existing healthcare infrastructure, policymakers can identify gaps in service provision and prioritize areas for new health center construction.

Mobile health (mHealth) solutions also present an opportunity to bridge the gap in healthcare delivery. Mobile clinics and telemedicine services can extend the reach of healthcare professionals to remote and underserved communities, providing essential services without the need for permanent facilities. These technologies are particularly valuable in areas where geographical and security challenges make the establishment of traditional health centers difficult.

In addition to technological solutions, policy reforms are necessary to address the underlying issues in healthcare distribution. Decentralizing health services and empowering local government areas (LGAs) with resources and decision-making authority can lead to more responsive and locally tailored healthcare delivery. Public-private partnerships could also play a crucial role in expanding healthcare infrastructure, particularly in underserved areas. Collaborations w provision of medical supplies, and training of healthcare workers.

### IV. CONCLUSION

The spatial distribution of health centers in Adamawa State is a complex issue influenced by geography, socioeconomics, historical factors, and ongoing security challenges. While there are significant disparities in healthcare access, particularly between urban and rural areas, there are also opportunities for improvement through the use of technology, policy reforms, and community involvement. By addressing these issues with a strategic and integrated approach, Adamawa State can improve health outcomes and enhance the overall well-being of its population.

### Recommendations

1. Building of new modern health centers that will cater for the need of the people and the renovation of old ones.

2. Provision of modern health equipment to ease the work of health workers.
3. To address the disparities in the spatial distribution of health centers in Adamawa State, a multifaceted approach is required. Strategic investment in infrastructure, particularly in rural areas, is essential to ensure that health centers are fully functional and accessible year-round. This includes improving road networks and ensuring that health facilities are equipped with essential utilities like electricity and clean water.
4. Human resource management is another critical area that requires attention. Offering incentives such as housing, hazard allowances, and continuous professional development opportunities can help attract and retain healthcare workers in rural and insecure areas.
5. Additionally, strengthening security measures in vulnerable regions is crucial to ensure that health centers can operate without disruption.
6. The involvement of local communities in health planning and service delivery is also vital. Community health committees can play an essential role in identifying healthcare needs, mobilizing resources, and ensuring that health facilities meet the specific needs of their populations.
7. Regular monitoring and evaluation of the health system, coupled with community feedback, can help in identifying areas for improvement and ensuring that health services are delivered equitably across the state.

## REFERENCES

- [1] Adejuyigbe, O (2000). Location of social science centres in Western Nigeria: 'The Case of Medical Facilities. *Man and Society*. 1:115-142.
- [2] Alabi MO. (2011). Towards Sustainable Distribution of Health Centers Using GIS: A Case Study from Nigeria, *American journal of tropical medicine & public health*. 1(3):130-136. Accessed 25 February, 2015. Available: [www.sciencedomain.org](http://www.sciencedomain.org).
- [3] Bhatt, B., & Joshi, J. P. (2013). A geospatial approach for assessing and modeling spatial accessibility of the primary health centers in the tribal talukas of the Vadodara district. *International Journal of Geomatics and Geosciences*, 3(3), 582-591.
- [4] Lovesque, J.F, Harris, M.F. Russell G.(2013) Patient-centered access to health care: conceptualizing access at the interface of health systems and populations, *Int. J. Equity H. Health* 12 (1) 18, doi:10.1186/1475-9276-12-18.
- [5] Novartis. (2016). Access to healthcare; novartis position. Retrieved August 31, 2016, from <https://www.novartis.com/sites/www.novartis.com/files/access-to-healthcare-perspective.pdf>
- [6] Owoyele, G.S. (2014). Assessment of the Relationship between Neighborhoods.
- [7] RUPRI Health Panel. (2014). Access to rural health care: a literature review and new synthesis. Retrieved August 31, 2016, from <http://www.rupri.org/?library=access-to-rural-health-care-a-literature-review-and-new-synthesis-report-prepared-by-the-rupri-health-panel-august-2014>.
- [8] United Nations (2018). Sustainable Development Goals. New York: United Nations.
- [9] World Health Organization. Fact sheets, (2010).
- [10] Zemba A. (2020). Adamawa State in Maps. Yola. Paraclete Publishers.

## Citation of this Article:

Jummai V. Zirra, Abbas Bashir, & Jerry H. Samuel. (2024). Assessment of the Spatial Distribution of Health Centers in Adamawa State, Nigeria. *International Research Journal of Innovations in Engineering and Technology - IRJIET*, 8(10), 78-84. Article DOI <https://doi.org/10.47001/IRJIET/2024.810013>

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