Gombe Journal of Geography and Environmental Studies (GOJGES)

Vol. 2 N0.1 Jun. 2021

e-ISSN: 2714-321X

p-ISSN: 2714-3201

http://www.gojgesjournal.com

Gombe Journal of Geography and Environmental Studies (GOJGES) Vol. 2 N0.1 Jun. 2021, e-ISSN: 2714-321X; p-ISSN: 2714-3201

ANALYSIS OF THE SPATIAL PATTERN OF PUBLIC HEALTHCARE FACILITIES AND PERSONNEL IN ADAMAWA STATE, NIGERIA

***Anjorin, Olufemi J.[1] , Galtima, M.[2] and Ray, Helen, H.[2]**
[1]Department of Urban and Regional Planning, Federal Polytechnic, Mubi, Adamawa State.
[2]Department of Geography, Modibbo Adama University, Yola, Adamawa State.
***Corresponding Author's E-mail/phone: anjorinfemi2002@yahoo.com 08034699138, 07068883839**

Abstract

Analysis of spatial pattern of public healthcare facilities and personnel is important to regional development. Hence, this study analyzed spatial pattern of public healthcare facilities and personnel in the 21 Local Government Area (LGAs) in Adamawa State. Secondary data on public healthcare facilities and personnel was collect from the Health Department of each LGA Secretariat as well as from the information and protocol unit of Adamawa State Ministry of Health, Yola. Data were subjected to frequency and percentage count and Location Quotient Analytical Test to determine the concentration pattern of public healthcare facilities and personnel in each LGA and across Adamawa State. LQ results which ranges between less than 1 and greater than 1 (< 1 - > 1) was summed and used to group LGAs into three classes of: low (2.03 - 4.22), moderate (4.23 – 8.53) and high (8.54 - 27.85) and upon which spatial map was generated through Geospatial Technique. Results of the study revealed skewedness in the distribution and concentration pattern of public healthcare facilities and personnel in favour of LGAs such as Yola North and Mubi South. Also, the study found high ratio of population to healthcare facilities and personnel such as medical doctors (1:82,785), nurses and midwives (1:7,788) and Pharmacists (1:298,000) among others, in the state. In some communities without medical doctors, headship of health centers often rest on National Youth Service Corps (NYSC) members' doctors, and other non-medical doctors such as community health extension workers and midwives. Residents of the disadvantaged LGAs such as Demsa, Shelleng and Lamurde, among others are often compelled to either patronize expensive private health facilities or embarked on risky medical trips to seek affordable healthcare services in other LGAs or in Yola (the state capital). Consequently, recommendations were made towards sufficient provision and balanced spatially distributed public healthcare facilities and personnel in the state so as to enhance equitable access of the state residents to affordable public healthcare services.

Keywords: Health, Healthcare Facilities and Personnel, Location Quotient, Public Health, Spatial distribution, Concentration Pattern

1.0 Introduction

Health is one of the important factors that contribute to socio-economic development of any Nation. As such, World Health Organization ([WHO], 1948) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This definition aptly portrays health as fundamental to people's ability to enjoy and appreciate all other aspects of life including physical (personal) growth, educational performance and political interest, among others. Hence, health is a fundamental contributor to the peoples' welfare, universal human right, and central to community's socio-economic development

(WHO, 2006; Balogun, 2009 and Ujoh and Kwaghsende, 2014). To achieve WHO's

description of health that is not just the "absence of disease or infirmity", access to adequate, effective and efficient healthcare services is very crucial, not only to the well-being of the population but also to enhance community development.

Public healthcare system is one method governments employed in providing affordable healthcare services. According to W.H.O (2000) health systems include "all the people and actions whose primary purpose is to improve health". Tali, Divya and Nusrath (2017) further described healthcare (system) as "a program of services that makes available all facilities of health and allied services necessary to promote and maintain the health of mind and body". This system contributes to achieving better health status for people. But, to provide effective and affordable health system, healthcare facilities and personnel must be adequately provided and distributed across regions in a fairly balanced manner. Such facilities include doctor's offices, hospitals, labs, radiology centers, and personnel like doctors, nurses, and other frontline clinicians (Craig, 2019). However, healthcare system is reportedly confronted with limited accessibility due to disparities in the distribution pattern of health facilities and personnel (Nwakeze and Kandala, 2011). Spatial inequality in the distribution of healthcare facilities and personnel was reported in China, Saudi Arabia and Ghana among others. According to Zheng et al (2019), there is "significant difference in the frequency and spatial distribution of public health facilities accessibility…" in Kaifeng, China. Also, Mansour (2016) who examined availability and accessibility of public health in Riyadh Governorate, Saudi Arabia reported uneven spatial distribution of public health facilities in Riyadh Governorate. In Ghana, Manortey and Acheampong (2016) examined the "spatial pattern in the distribution of health facilities and personnel in Ghana's eastern region. GPS and questionnaire were used to collect data on the number of health facilities and personnel in the study. Findings from the study revealed skewed spatial pattern of health facilities and personnel in the study area.

In Nigeria studies such as Nwakeze and Kandala (2011), Makinde, Sule, Ayankogbe and Boone (2018) and Ujoh and Kwaghsende (2014) also showed inequalities in the distribution pattern of health facilities and personnel. For instance, Nwakeze and Kandala (2011) examined "the spatial distribution of health establishments in Nigeria. The study used data from the National Bureau of Statistics (NBS) Nigeria health establishment survey (2007), and analyzed the data through Geographic Information System (GIS) software. Findings from the study revealed large scale spatial inequalities in the health facilities across the country especially when compared to the populations of various localities. Also, Elijah, Registrar, Pharmacist Council of Nigeria ([PCN], 2015) and Ogirima, President of Nigeria Medical Association ([NMA], 2018) confirmed the shortage of medical personnel, especially pharmacist and medical doctors, in Nigeria. While Elijah stated that Nigeria had 1:12,000 pharmacist and 1:1,066 nurses and midwives to the population ratio, Ogirima reported a ratio of 1:6000 Medical doctors to population in Nigeria. In addition, Makinde, Sule, Ayankogbe and Boone (2018) assessed the geographic and sectoral distribution of health facilities in Nigeria and its effects on the adopted universal health coverage strategy. The study reported uneven spatial pattern of health facilities (both public and

private) across the country and submitted that such uneven spatial pattern would limit people's access "to the appropriate health facility" that are crucial to reduction of poor health events such as "maternal and infant mortality. In fact, Eriki et al (2015) reported inadequacy in the supply of health workforce as follows:

> *Nigeria has one of the largest stocks of human resources for health in Africa. Yet, it is still inadequate to meet the country's needs. In 2006, an inventory of healthcare personnel indicated 39,210 doctors (0.3 per 1000 population), 124,629 nurses (1.03 per 1000 population), 88,796 midwives (0.67 per 1000 population), 2,482 dentists (0.02 per 1000 population) and 12,072 pharmacists (0.05 per 1000 population) for the year 2004, less than the minimum recommended by the World Health Organization (WHO, 3).*

At state level, Ujoh and Kwaghsende (2014) examined the spatial pattern of health facilities in Benue State. Data were sought from Benue State Ministry of Health's Health Management Information System (HMIS) and analyzed through factor analysis of variance and Pearson Product Moment Correlation. The study revealed skewedness in the spatial pattern of health facilities especially between the LGAs and within the senatorial zones; and those healthcare facilities in Benue were insufficient for the state's population. Also, Owoeye, Ajobiewe, Idowu, Shuaibu and Martins (2015) in a study that aimed at analyzing the spatial location of health facilities in Suleja, Niger State employed GIS tools and location quotient analytical technique, among others to map and analyse the spatial pattern of health facilities in the study area. The study revealed uneven spatial distribution pattern of health facilities in the study. This finding further proved uneven access to healthcare facilities and delivery by residents of the area as a result of clustering of such facilities in few areas. In Kano State, Abdulkarim, Danbuzu, Dardau and Umar (2017) examined the spatial pattern of healthcare facilities in Bichi LGA, Kano State. Secondary data on hospital and population distribution obtained from Bichi L.G.A's department of health, hospitals, and from the Kano State office of the NPC were analysed. The result of the study indicated uneven spatial pattern of health facilities in the study area and the pattern was blamed for the under service of some wards' population in Bichi LGA. In a related study in Ibadan, Nigeria, Adewoyin, Chukwu and Sanni (2018) assessed the spatial distribution of healthcare facilities in the city of Ibadan. The result of the study revealed that healthcare facilities were unevenly distributed across the regions in the city. The study further stated that the spatial bias is against the regions that are occupied by low income earners as compared to the regions occupied by the rich. In Adamawa State, Bashir (2020) examined the distribution pattern of both public and privates health establishments and reported variation in the distribution pattern between the LGAs.

However, there are indications of crisis due to inadequate public healthcare facilities and personnel in Adamawa State. Such shortage exposes Adamawa State residents, especially rural dwellers, to myriad of healthcare challenges including over-crowding of the few provided public health facilities, and over-labouring of the few available health personnel especially medical doctors and nurses. Consequently, many residents of Adamawa State seeking affordable medical services are sometimes compelled to embark on expensive medical trips to other LGAs while those that could

not afford such trips are either forced to join the queue at the overcrowded available few public health facilities, or to patronize highly expensive private health facilities such as Hospitals, Clinics, Patient Stores and Maternities within their localities. Hence, in view of the challenges people faced before meeting their medical needs, and the evidence of insufficient public healthcare personnel in Nigeria, it is pertinent to analyse the adequacy and spatial pattern of public healthcare facilities and personnel in Adamawa State using several healthcare indices. Such study would not only contribute to development planning, policy making and implementation, but also assist in understanding the spatial pattern of public healthcare facilities and personnel in other regions in Nigeria. However, the specific objectives of the study are to:

i. Identify the distribution pattern of public health facilities in Adamawa State.
ii. Analyse the spatial concentration pattern of public health facilities in Adamawa State.

2.0 Material and Methods

2.1 Study Area

This study was conducted in all the 21 LGAs of Adamawa State, Nigeria. Adamawa State is located between latitudes 07°15′ and 10°58′N and longitudes 11°09′ and 13°47′E (Adebayo, 2020) (Fig. 1). The State shares boundary with Borno State to the North, Gombe and Taraba State to the West and Cameroon Republic to the East. The State has a total land area of 39,753.45km^2 and a total population of 3,168,101 (Zemba, Tukur and Ezra, 2020 and NPC, 2006), which was projected to 4,470,434 in year 2017. Adamawa State landscape is made up of valley and trough, low and upland plains and hills and mountain ranges (Tukur and Mahmud, 2020). In terms of weather and climate, Adamawa State has wet season that runs from April to October and dry season from November to March with high annual mean monthly temperature that range between 26°C (in the south and northern parts) and 29°C in the central part; high daily and annual sunshine duration, as well as high humidity (Adebayo and Zemba, 2020). Also, there are two vegetation types, Guinea and Sudan Savannah, in the State (Akosin, Tella and Jatau, 2020). According to Adebayo and Umar (2020), Adamawa State drainage system comprises of River Benue, River Gongola, River Loko and River Yedzeram, among others.

The State is made up of about 70 indigenous and many non-indigenous ethnic groups and 68 languages (Fakuade, 2020). Few of the indigenous ethnic groups in the state include the Laka, Verre, Bata, Kilba, Marghi, Charmba, Kwah, Bachama and Lunguda, among others, and the non-indigenous ethnic groups include Yoruba, Ibo, Nupe and Idoma people, amongst others. A lot of people in the State are into farming, trading, transportation, civil service and craft making, among others. Among the public healthcare facilities in the state are Federal Medical Center (FMC), Yola, Specialist Hospital Yola, German Hospital Yola, Virgwi Leprosy Hospital Garkida, General Hospitals and Primary Healthcare Centers (PHC) in all the LGAs.

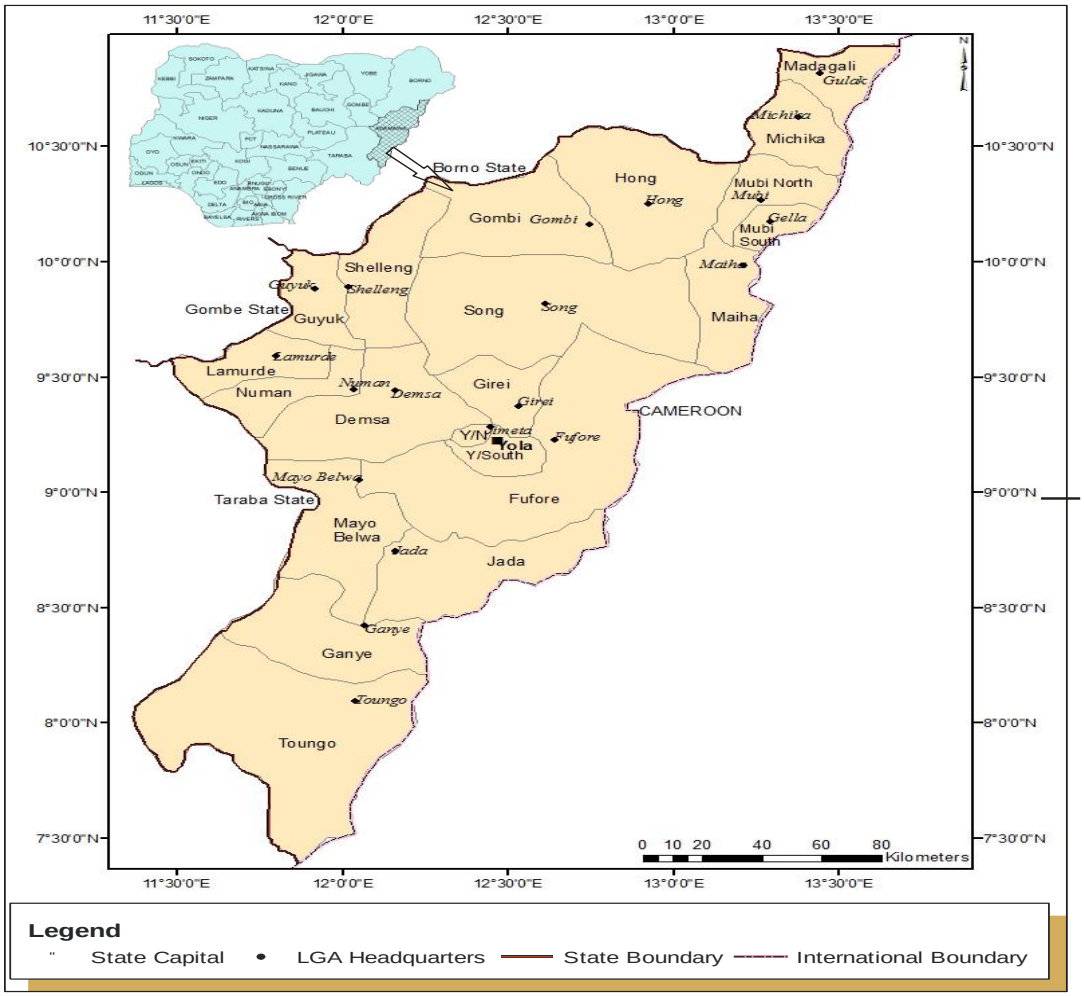

Fig. 1.1: Nigeria showing Adamawa State with its LGAs
Source: Digitized at the Geography Department, Moddibo Adama University (MAU), Yola, (2018)

2.2 Methods

To analyse the spatial pattern of public healthcare facilities and personnel in Adamawa State, public healthcare facilities and personnel shown in Table 1 were selected for this study.

Table 1: Assessed Public Healthcare Facilities and Personnel

S/No	Healthcare facilities and personnel
1	Healthcare Centers
2	Hospital Beds
3	Functional Ambulances
4	Medical Doctors
5	Nurses/Midwives
6	Pharmacists
7	Community Health Extension Workers (CHEW)

Secondary data on the selected public healthcare facilities and personnel were used for the study. They include the number of the selected public healthcare facilities and personnel in each LGA in the state. Data on these public healthcare facilities and personnel was sourced from the Health Departments of each LGA and from Adamawa State Ministry of Health. Other relevant data were sourced from books, journals and newspapers.

Two set of questionnaire were designed for data collection for the study. While the first set (21 in numbers) was administered on the Local Government Councils (LGCs) in Adamawa State (one questionnaire per LGC), the second set was administered on Adamawa State Ministry of Health to capture information on the availability, quantity and location of public health facilities and personnel in their respective LGAs and at the state level. The total of each public healthcare facilities and personnel in all the LGAs were summed to determine the amount of each public healthcare facility and personnel in the state. The collected information on public healthcare facilities and personnel and the state population were coded into Microsoft Excel, 2010 version. Thereafter, spatial distribution and concentration pattern of the assessed healthcare facilities and personnel were determined through frequency count and percentages, and location quotient (LQ) analytical statistics respectively.

LQ technique measures the distribution & concentration pattern, and the level of spatial balance in socioeconomic development in an area (Balogun, 2018). According to Tali, Divya and Nusrath (2017), the interpretation of LQ result is either less than 1 (< 1) which indicate deficiency in the assessed facilities or personnel, LQ value greater than 1 (> 1) means that the concentration of the facilities or personnel exceed the state average. An LQ value that equals 1 means self-sufficiency of the provided health facilities or personnel in the region (LGA). The state average LQ, which is one (1), forms the basis for comparison of the concentration pattern of the assessed health facilities and personnel per LGAs. Thereafter, the LQ values of all the health facilities and personnel in each LGA were summed and compared to the state LQ total and results presented in tables, charts and maps. Formula for Location Quotients is:

$$LQ_i = \frac{e_i/e}{E_i/E}$$

Where,

LQ_i = Location quotient for facilities for the LGA/State.

e_i = The total number of facilities in the LGA i;

e = Total number of facilities in the State;

E_i = Population of the LGA i;

E = Total population of the state.

To generate spatial concentration map for the study, Geospatial technique was used. Balogun (2018) adopted Geospatial technique which used classification module of ArcGIS 10.5 that combines the minimum, maximum, sum, mean, median and standard deviations of LQ values to classify healthcare variables in Kogi state into categories of upper (1.37 – 1.92), middle (0.81 – 1.25) and upper class (0.55 – 0.79). Hence, public health facility and personnel in Adamawa State were subjected to classification module of ArcGIS 10.5 and used the State LQ average as the base to classify the LGAs into three classes of: low (2.03 - 4.22), moderate (4.23

– 8.53) and high (8.54 - 27.85) as shown in plate 1.

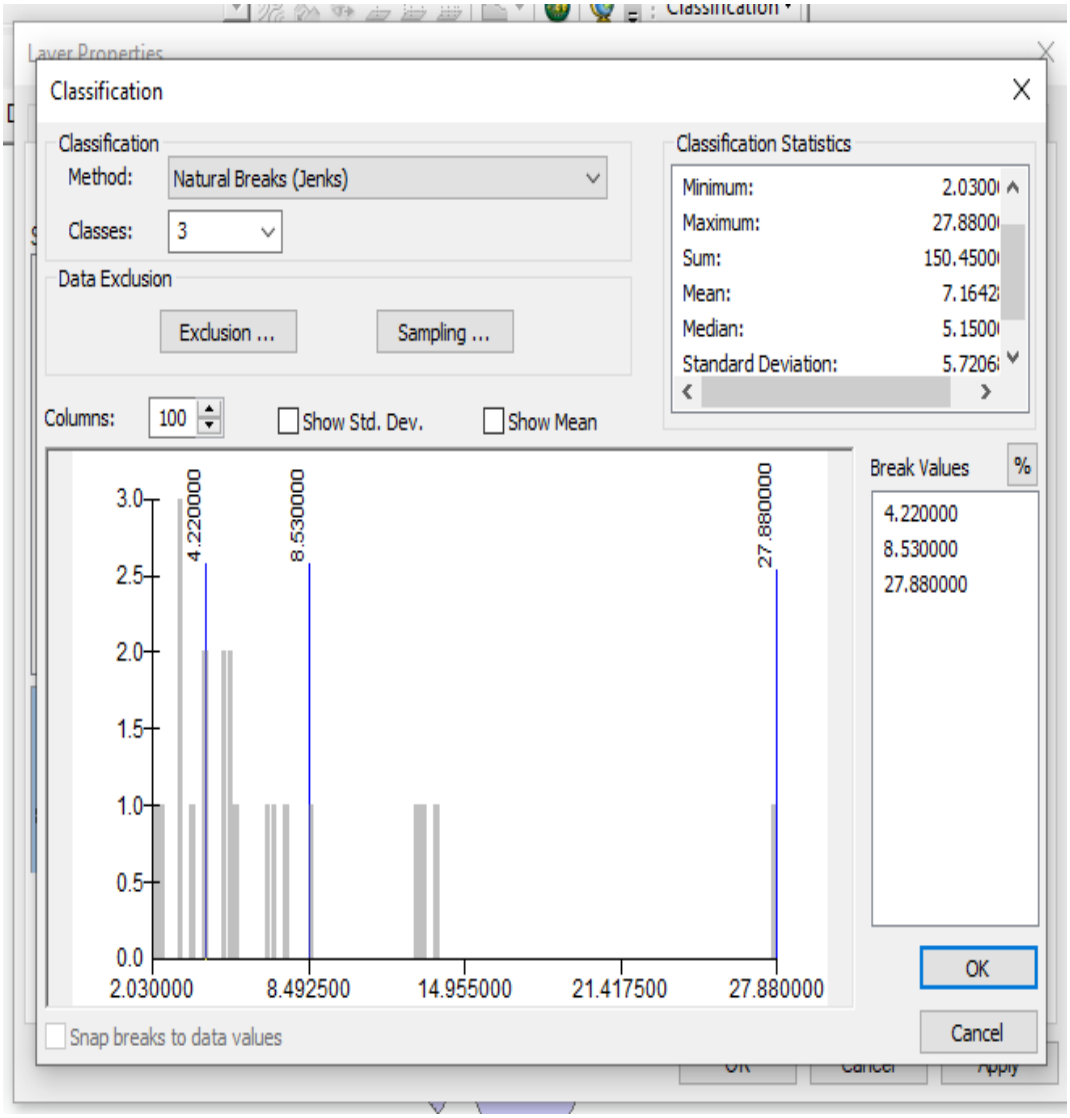

Plate 1: Classification Module of ArcGIS 10.5 for spatial concentration of public healthcare facilities and personnel.

3.0. Result and Discussion

3.1. Distribution Pattern of Public Healthcare Facilities and Personnel in Adamawa State

Spatial pattern of public healthcare facilities and personnel in Adamawa State was assessed so as to determine their distribution and concentration pattern in space, accessibility rate and its implications on the development of Adamawa State. The results are presented in Tables, 2 and 3.

3.1.1. Distribution Pattern of Public Healthcare Facilities by LGAs

Data on the spatial pattern of public healthcare facilities in all the LGAs in Adamawa State is presented in Tables 2.

Table 2: Aggregate of Public Healthcare Facilities in Adamawa State

L.G.As	2006 Population	Projected Population (2017)	Public Health Centres		Hospital Beds		Ambulance	
			No	**%**	**No**	**%**	**No**	**%**
Demsa	180,251	254,348	18	3.02	102	2.30	0	0.00
Fufore	207,287	292,497	23	3.86	278	6.26	2	5.13
Ganye	164,087	231,539	8	1.34	116	2.61	2	5.13
Girei	129,995	183,432	27	4.53	148	3.33	1	2.56
Gombi	146,429	206,622	41	6.88	150	3.38	3	7.69
Guyuk	177,785	250,868	22	3.69	75	1.69	4	10.26
Hong	169,126	238,649	26	4.36	261	5.88	4	10.26
Jada	168,473	237,728	41	6.88	83	1.87	1	2.56
Lamurde	112,803	159,173	10	1.68	71	1.60	1	2.56
Madagali	134,827	190,251	54	9.06	242	5.45	1	2.56
Maiha	111,215	156,932	39	6.54	265	5.97	1	2.56
Mayo-Belwa	153,129	216,076	24	4.03	218	4.91	2	5.13
Michika	155,302	219,143	19	3.19	15	0.34	1	2.56
Mubi-North	151,072	213,174	27	4.53	213	4.80	1	2.56
Mubi-South	128,937	181,940	39	6.54	520	11.71	2	5.13
Numan	90,723	128,017	36	6.04	99	2.23	3	7.69
Shelleng	149,069	210,347	21	3.52	71	1.60	2	5.13
Song	192,697	271,910	56	9.40	321	7.23	1	2.56
Toungo	52,040	73,432	21	3.52	48	1.08	2	5.13
Yola-North	198,247	279,741	24	4.03	957	21.55	2	5.13
Yola-South	194,607	274,605	20	3.36	188	4.23	3	7.69
State Total	3,168,101	4,470,434	596	100.00	4,441	100.00	39	100.00

Sources: Health Departments of LGCs in Adamawa State
Adamawa State Ministry of Health, (ADSMoH), Yola, (2018)

Public health sector in Adamawa State is comprised of primary, secondary and tertiary health centers with 596 health centers, 4,441 hospital beds and 39 functional ambulances (Table 2). However, there is evidence of disparities in the distribution pattern of these public health facilities. For instance, most of public health centers in Adamawa State are in Song LGA (9.40%), Madagali LGA (9.06%), Jada LGA (6.88%) and Gombi LGA (6.88%) LGAs while Ganye, Lamurde and Demsa LGAs have the least public health centers, being 1.34%, 1.68% and 3.02% respectively. Also, the distribution pattern of the 4,441 hospital beds to these health centers varies among the LGAs. Most of the beds at the public health centers are in Yola North LGA with 957 beds (21.55%), Mubi South LGA (11.71%) and Song LGA (7.23%).

Contrarily, Michika, Toungo, Lamurde and Guyuk among other LGAs have the least number of hospital beds (0.34%, 1.08%, 1.60% and 1.69% respectively). The inadequacy of hospital beds might be the reason why many patients who ought to have been admitted to the hospitals are

treated either as outpatient or referred to other hospitals.

In terms of ambulances, there are only 39 functional ambulances at public health centers in the state. Although all the LGAs except Demsa, have at least one functional ambulance in their public health sector, yet the number of functional ambulances vary among the LGAs. While each of Guyuk and Hong LGAs has 10.26% of the ambulances, Gombi, Numan and Yola South LGAs have 7.69% each and Demsa LGA has none. Undoubtedly, delay in evacuating patients, high cost and unconventional means of transporting patients to the hospital among other challenges may often be experienced in Adamawa State as a result of low number of functional ambulances in the States' public health sector. Aside from public health facilities, healthcare personnel plays significant role in public healthcare delivery. Hence, data on the spatial pattern of public health personnel in Adamawa State is presented in Tables, 3.

Table 3: Aggregate of Public Health Personnel in Adamawa State

L.G.As	2006 Population	Projected Population (2017)	Medical Doctors		Nurses & Midwives		Pharmacists		CHEW*	
			No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Demsa	180,251	254,348	0	0.00	6	2.30	0	0	130	5.22
Fufore	207,287	292,497	1	1.85	41	6.26	1	6.67	128	5.14
Ganye	164,087	231,539	3	5.56	7	2.61	1	6.67	90	3.61
Girei	129,995	183,432	0	0.00	0	3.33	0	0	79	3.17
Gombi	146,429	206,622	3	5.56	21	3.38	1	6.67	140	5.62
Guyuk	177,785	250,868	0	0.00	17	1.69	1	6.67	89	3.57
Hong	169,126	238,649	2	3.70	28	5.88	0	0	205	8.23
Jada	168,473	237,728	1	1.85	19	1.87	1	6.67	129	5.18
Lamurde	112,803	159,173	0	0.00	1	1.60	0	0.00	73	2.93
Madagali	134,827	190,251	1	1.85	15	5.45	1	6.67	103	4.14
Maiha	111,215	156,932	1	1.85	6	5.97	0	0.00	141	5.66
Mayo-Belwa	153,129	216,076	0	0.00	3	4.91	0	0.00	133	5.34
Michika	155,302	219,143	3	5.56	1	0.34	0	0.00	169	6.79
Mubi-North	151,072	213,174	0	0.00	4	4.80	0	0.00	186	7.47
Mubi-South	128,937	181,940	6	11.11	43	11.71	1	6.67	140	5.62
Numan	90,723	128,017	3	5.56	29	2.23	1	6.67	94	3.78
Shelleng	149,069	210,347	0	0.00	2	1.60	0	0.00	123	4.94
Song	192,697	271,910	1	1.85	3	7.23	1	6.67	74	2.97
Toungo	52,040	73,432	1	1.85	13	1.08	1	6.67	51	2.05
Yola-North	198,247	279,741	28	51.85	313	21.55	5	33.33	101	4.06
Yola-South	194,607	274,605	0	0.00	2	4.23	0	0.00	112	4.50
State Total	3,168,101	4,470,434	54	100.00	574	100.00	15	100	2,490	100.00

Sources: Health Departments of LGCs in Adamawa State
Adamawa State Ministry of Health, (ADSMoH), Yola, (2018)

There are different categories of health personnel that include medical doctor, nurses and midwives, pharmacists and Community Health and Extension Workers

(CHEW), among others, in Adamawa State public health sector. But the spatial pattern of these public health personnel greatly favours few LGAs such as Yola North and Mubi South LGAs, among others. For example, 51.85% of the medical doctors in the state's public health sector are in Yola North LGA, and distantly followed by Mubi South LGA with 11.11% while Ganye, Gombi and

Numan LGAs have 5.56% each (Table 3). Nine LGAs that include Demsa, Girei, Guyuk, Lamurde, Mayo-Belwa, Michika, Mubi-North, Shelleng and Yola-South have no medical doctor in their public health facilities. Also, most of the 574 nurses and midwives in Adamawa State public health sector are in Yola North LGA (21.55%), Mubi South LGA (11.71%) and Song LGA (7.23%). On the contrary, Michika, Toungo, Lamurde and Shelleng LGAs have the least number of nurses and midwives with 0.34%, 1.08%, 1.60% and 1.60% of the total nurses and midwives in Adamawa State respectively.

Furthermore, the distribution pattern of pharmacists and Community Health and Extension Workers (CHEW) revealed evidence of spatial disparities. Just like the medical doctors and nurses that are mostly concentrated in Yola North LGA, 33.33% of the pharmacists are in Yola North LGA, with only one (6.67%) in each of Fufore, Ganye, Gombi, Guyuk, Jada, Madagali, Mubi-South, Numan, Song and Toungo LGAs. All the remaining 10 LGAs have no pharmacist in their public health centers. However, distribution pattern of Community Health and Extension Workers across the 21 LGAs in the state shows less spatial disparity. Hong LGA has the highest percentage (8.23%) of Community Health and Extension Workers in the state and Toungo LGA has the least (2.05%). Except Girei, Lamurde Song, Guyuk, Toungo, Numan and Ganye Toungo, Lamurde, Song, Girei, Guyuk, Numan and Ganye LGAs, most of the LGAs in Adamawa State have good number of community health workers. Spatial disparities in the distribution pattern of public healthcare facilities and personnel negate the principle of justice and equity in the distribution of public resources as reported in Benue State (Ujoh and Kwaghsende, 2014). The implication of this distribution pattern is that public health facilities ratio to population is much higher. For instance, the ratio of population to health center and hospital bed in Fufore LGA is 1:12,717 and 1:1,052 respectively and 1:11,655 and 1:292 in Yola North LGA. Toungo LGA with the least population has 3,496 people to a public health center and 1,529 to a bed. In terms of healthcare personnel to population, there are 9,990 people to a medical doctor, 893 per nurses and midwives and 55,948 per pharmacists in Yola North LGA. In Mubi South LGA it is ratio 1:30,323; 1:4,231 and 1:181,940 for medical doctor, nurses and midwives and pharmacists respectively. In fact, the ratio of medical doctors and nurses and midwives to population in Adamawa State (1:82,785 and 1:7,788 respectively) among others, contradict World Health Organization recommended ratio of 1:10,000 (Raman and Ranabir, 2018).

Consequently, some public health centres without medical doctors in Demsa, Girei, Guyuk, and Lamurde LGAs etc, and in some clinics that are supported by International Committee of Red Cross (ICRC) rely on the services of National Youth Service Corps (NYSC) members (graduates of Nigeria higher institutions that are posted to various communities across Nigeria for a mandatory one year national service), Community health extension workers and/or the hired staff

(especially midwives) of the ICRC. In fact, ALMANACH Electronic Tablets, an integrated management of childhood illness guideline, which was distributed to ICRC supported public primary healthcare centres in Adamawa State, are being administered by the available healthcare service personnel (not medical doctors) to manage common medical challenges in some benefiting health centres.

Furthermore, disparities in the distribution pattern of public health facilities and personnel in Adamawa State highlight some of the challenges that confront many Adamawa State residents before accessing affordable public healthcare services. It can be relatively difficult, expensive and risky for residents of LGAs such as Demsa, Shelleng, Lamurde and Yola South LGAs among others, with fewer public healthcare facilities and/or personnel to access public healthcare services. Residents in the disadvantaged LGAs are often compelled to either patronise private health facilities such as Hospitals, Clinics, Patient Stores and Maternities, etc that are often more expensive especially for the low income earners, or forced to embark on expensive and risky medical journeys to other LGAs and/or state capital for their medical needs. In such situation, it becomes more expensive to access public healthcare services outside their LGA of residence both in terms of time and money for transportation, hotel accommodation and feeding. In fact, many lives had being lost while struggling to raise sufficient fund to undertake medical trips, others died in road accidents while on medical trip(s). Indeed, uneven distribution pattern of public healthcare facilities among geographic units is considered deprivation of peoples' easy access to affordable and efficient health services (Owoeye et al., 2015 and Sadiq et al., 2016), hindrance to the attainment of Sustainable Development Goals (SDGs) of halting the spread of preventable diseases (Ujoh and Kwaghsende, 2014), and a factor that encourage establishment of many private health facilities to complement the public owned healthcare facilities and also contribute to the development of healthcare services (Nwakeze and Kandala, 2011).

3.2 Concentration Pattern of Public Health Variables in Adamawa State

The result on spatial concentration pattern of public health variables in Adamawa State which was determined through Location Quotient (LQ) analysis is presented in Table 4.

Table 4: Location Quotient of Public Health Facilities and Personnel in Adamawa State

L.G.As	2006 Population	Projected Population (2017)	H_1	H_2	H_3	H_4	H_5	H_6	H_7	Total	Rank	Class of Concentration
Yola-North	198,247	279,741	0.64	3.44	0.82	8.29	8.71	5.33	0.65	27.88	1	
Toungo	52,040	73,432	2.15	0.66	3.12	1.13	1.38	4.06	1.25	13.75	2	
Mubi-South	128,937	181,940	1.61	2.88	1.26	2.73	1.84	1.64	1.38	13.34	3	High
Numan	90,723	128,017	2.11	0.78	2.69	1.94	1.76	2.33	1.32	12.93	4	
Gombi	146,429	206,622	1.49	0.73	1.66	1.20	0.79	1.44	1.22	8.53	5	
Madagali	134,827	190,251	2.13	1.28	0.60	0.44	0.61	1.57	0.97	7.60	6	
Hong	169,126	238,649	0.82	1.10	1.92	0.69	0.91	0.00	1.54	6.98	7	
Maiha	111,215	156,932	1.86	1.70	0.73	0.53	0.30	0.00	1.61	6.73	8	
Fufore	207,287	292,497	0.59	0.96	0.78	0.28	1.09	1.02	0.79	5.51	9	Moderate
Jada	168,473	237,728	1.29	0.35	0.48	0.35	0.62	1.25	0.97	5.31	10	
Guyuk	177,785	250,868	0.66	0.30	1.83	0.00	0.53	1.19	0.64	5.15	11	
Song	192,697	271,910	1.54	1.19	0.42	0.30	0.09	1.10	0.49	5.13	12	
Ganye	164,087	231,539	0.26	0.50	0.99	1.07	0.24	1.29	0.70	5.05	13	
Mubi-North	151,072	213,174	0.95	1.01	0.54	0.00	0.15	0.00	1.57	4.22	14	
Mayo-Belwa	153,129	216,076	0.83	1.02	1.06	0.00	0.11	0.00	1.11	4.13	15	
Michika	155,302	219,143	0.65	0.07	0.52	1.13	0.04	0.00	1.38	3.79	16	
Girei	129,995	183,432	1.10	0.81	0.62	0.00	0.00	0.00	0.77	3.30	17	Low
Shelleng	149,069	210,347	0.75	0.34	1.09	0.00	0.07	0.00	1.05	3.30	17	
Yola-South	194,607	274,605	0.55	0.69	1.25	0.00	0.06	0.00	0.73	3.28	19	
Lamurde	112,803	159,173	0.47	0.45	0.72	0.00	0.05	0.00	0.82	2.51	20	
Demsa	180,251	254,348	0.53	0.40	0.00	0.00	0.18	0.00	0.92	2.03	21	
State Average	3,168,101	4,470,434	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7		

Source: Field Survey (2018)

NB: H_1 = Health Centres, H_2 = Hospital Beds, H_3 = Ambulance, H_4 = Medical Doctors, H_5 = Nurses & Midwives, H_6 = Pharmacists, H_7 = CHEW

Based on Adamawa State concentration (LQ) average of 7 which was derived through summation of LQ values of public health facilities and personnel at the state level, and which is considered optimum concentration level, all the health facilities and personnel were grouped to three classes of high (above 8.54), moderate (4.23 – 8.53) and low (below 4.22) classes (Table 4). While Yola North, Toungo, Mubi South and Numan LGAs ranked in 1st to 4th positions are in the high concentration class, the 5th – 13th ranked LGAs (Gombi, Madagali, Hong, Maiha, Fufore, Jada, Guyuk, Song and Ganye LGAs) occupied the moderate class, and Mubi-North, Mayo-Belwa, Michika, Girei, Shelleng, Yola-South, Lamurde and Demsa LGAs in 14th and 21st positions formed the low concentration class.

However, the total average concentration (LQ) level of public healthcare facilities and personnel is higher than the States' total concentration average of (7) in six (6) LGAs: Yola North LGA (27.88), Toungo LGA (13.75), Mubi South LGA (13.34), Numan LGA (12.93), Gombi LGA (8.53) and Madagali LGA (7.60) which means self-sufficiency of the facilities and personnel in those LGAs. But at the same time, there are variations in the concentration pattern of each of these facilities and personnel within the six (6) LGAs. For instance, while Yola North LGA has low concentration of public health centres (0.64), community health and extension workers (0.65) and ambulances (0.82), Gombi LGA has low concentration of hospital beds (0.73) and nurses and midwives (0.79); Madagali LGA has low concentration of ambulances (0.60), medical doctors (0.44), nurses and midwives (0.61) and community health and extension workers (0.97). Lamurde and Demsa are the most disadvantaged LGAs in the state in term of spatial concentration of public healthcare facilities and personnel having total average concentration of 2.51 and 2.03 respectively.

Uneven spatial concentration pattern of public healthcare facilities and personnel indicate that though public healthcare facilities and personnel were provided and available in most of the LGAs but were inadequate for the population of those LGAs. Finding of uneven spatial concentration pattern of public healthcare facilities and personnel in this study agrees with the findings of Obu, Obienusi, Ozoemene and Iwu (2015), Abdulkarim, Danbuzu, Dardau and Umar (2017) and Adewoyin, Chukwu and Sanni (2018) that reported uneven spatial distribution pattern of healthcare facilities in Anambra State, Bichi LGA, Kano State, and Ibadan city, Oyo State respectively. Also, Balogun (2018) reported even spatial concentration of healthcare facilities among the 21 LGAs of Kogi State. The uneven spatial concentration pattern of public healthcare facilities and personnel in Adamawa State shows the need for more of such facilities especially in the disadvantaged LGA such as Mubi-North, Mayo-Belwa, Michika and Girei LGAs among others. In fact, Mukhta et al (2018) warned that since many rural residents are often the victim of inadequate health facilities, orthodox medicine is often an option to explore due to its cheapness and easy accessibility. The concentration pattern of public health variables in the 21 LGAs of Adamawa State is as shown in fig 2.

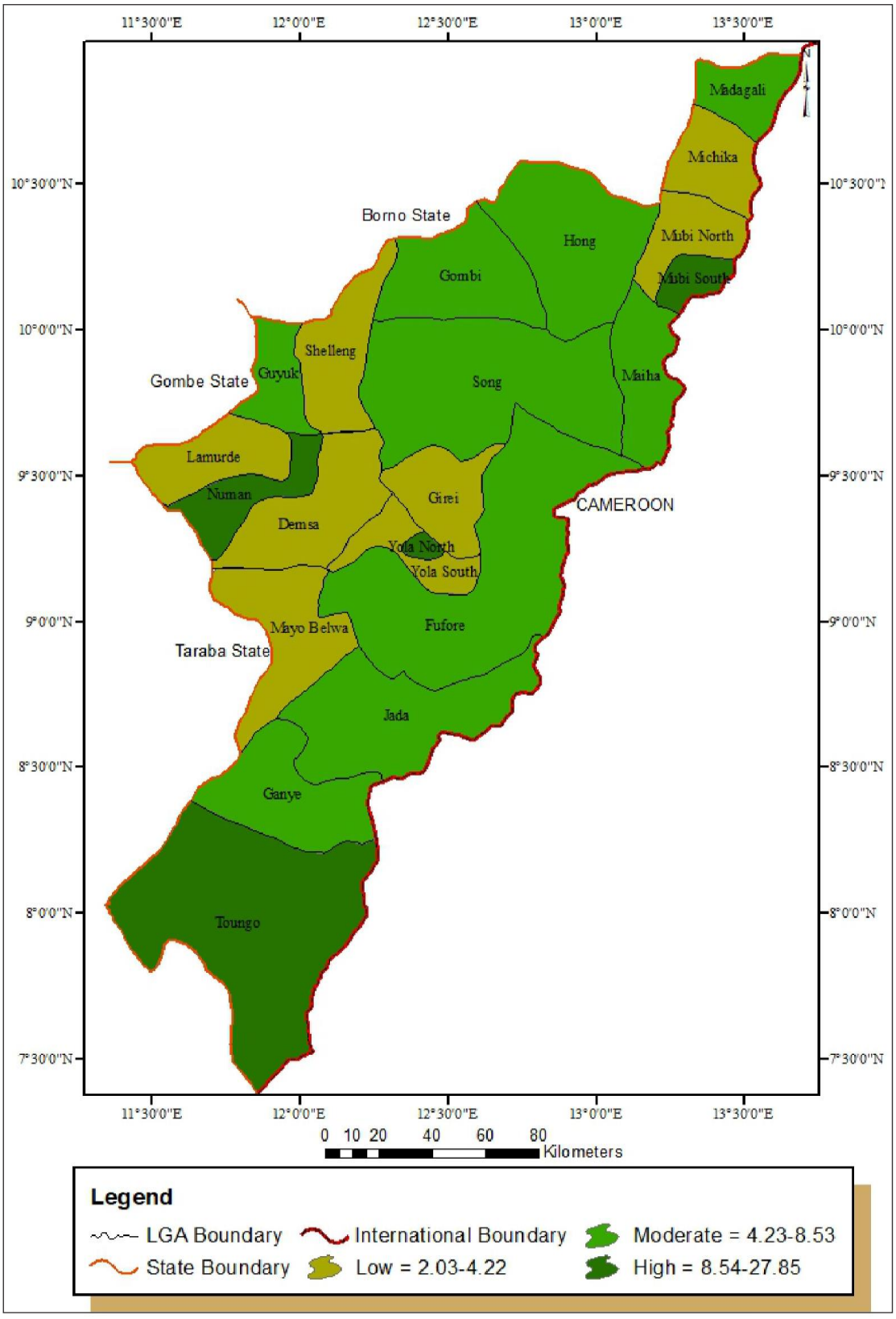

Figure 2: Spatial concentration of public health variables in Adamawa State
Source: Field work (2018)

4.0 Conclusion

This study was conducted on spatial pattern of public healthcare facilities and personnel in Adamawa State. Specifically, the study appraises the number, spatial distribution, and concentration pattern of public health facilities and personnel in Adamawa State. In terms of spatial distribution, there is evidence of uneven distribution of public healthcare facilities and personnel across the state. The distribution pattern of public health facilities greatly favours few LGAs such as Song LGA with 9.40% of the public health centers and Yola North LGA with 21.55% of the beds in public health centers. Also, Yola North LGA has most of the medical doctors (51.85%), pharmacists (33.33%) and nurses and midwives (21.55%), and followed by Mubi South LGA (11.11% medical doctors and 11.71% of the nurses and midwives). On the spatial concentration of public health facilities and personnel in Adamawa State, unarguably, the location quotient analytical test result showed evidence of skewedness in the spatial concentration pattern of the few provided public health facilities and personnel in Adamawa State. Most of the assessed health facilities and personnel were found to be highly concentrated in six (6) LGAs, namely, Yola North (27.88), Toungo (13.75), Mubi South (13.34), Numan (12.93), Gombi (8.53) and Madagali (7.60) LGAs. However, the concentration pattern of each of the assessed facility still varies among the advantaged LGAs. Also, the ratio of health facilities and personnel to population such as medical doctors (1:82,785), nurses and midwives (1:7,788) and Pharmacists (1:298,000) among others was found to be short of World Health Organization [WHO] recommendation. Consequently, in some communities and International Committee of the Red Cross (ICRC)-supported clinics, headship of health centers often rest on National Youth Service Corps (NYSC) member doctors, community health extension workers and ICRC-hired staff (especially midwives). Residents of the LGAs with fewer public healthcare facilities and/or personnel such as Demsa, Shelleng and Lamurde LGAs are often forced to either patronize private health facilities including Hospitals, Clinics, Patient Stores and Maternities, etc which are often expensive, or embark on risky journeys to other LGAs to seek affordable healthcare services.

5.0 Recommendations

Based on the findings of this study, the following recommendations are made:

Due to the acute shortage of public health facilities and personnel in the State, Adamawa State Government needs to provide more health facilities, recruit more health personnel, and ensure fair and balanced spatial distribution of such facilities and personnel especially to the disadvantaged LGAs such as Mubi-North, Mayo-Belwa, Michika, Girei, Shelleng, Yola-South, Lamurde and Demsa.

The use of NYSC medical doctors as head of public healthcare centers in some of the disadvantaged LGAs should be discouraged especially due to the fact that they (NYSC medical doctors) are fresh university graduates with little medical experiences. Rather, government appointed medical doctors with vast experience should head public health centers. Appointing permanent medical doctors with substantial experience to head public healthcare facilities would not only enhance effective planning in public health sector but it would as well enhance better running of healthcare centers, results in better treatment outcomes for patients, and reduce cost of accessing affordable

healthcare services especially by rural dwellers.

References

Abdulkarim, I.A., Danbuzu, L.A.S., Dardau, H. and Umar, A. A. (2017). Spatial distribution of healthcare facilities in Bichi Local Government Area, Kano State, Nigeria. *Katsina Journal of Natural and Applied Sciences*, 6(1), 75 – 82.

Adabayo, A. A (2020). Introduction. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Adebayo, A. A. and Zemba, A. A. (2020). Climate. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Adebayo, A. A. and Umar, A. S. (2020). Hydrology and water resources. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Adewoyin, Y., Chukwu, N. A. and Sanni, L. M. (2018). Urbanization, spatial distribution of healthcare facilities and inverse care in Ibadan, Nigeria. *Ghana Journal of Geography*, 10(2), 96– 111. DOI: https://dx.doi.org/10.4314/gjg.v10i2.7

Akosim, C., Tella, I. O. and Jatau, D. F. (2020). Vegetation and Forest Resources. I*n* A. Adebayo, A. L. Tukur. and A. A Zemba (Eds.), *Adamawa state in Map.* Yola, Paraclete.

Balogun, G. F. (2009). *Analysis of the spatial distribution of accredited hospitals of the national health insurance scheme (NHIS) in Kaduna metropolis.* Unpublished Master's Thesis, Nigerian Defence Academy, Kaduna.

Balogun, G. F. (2018). *Spatial Inequalities in socio-economic development in Kogi state, Nigeria*. Unpublished Doctoral dissertation, Ahmadu Bello University, Zaria.

Bashir, A. (2012). *Regional development and public policy in the Gongola region, Nigeria: An empirical study of spatial patterns and processes.* U.S.A. Lambert Academic Publishng.

Craig, M. W (2019). *What is "healthcare?"*. Retrieved on 1st June 2021 from https://www.medicaleconomics.com/view/what-healthcare

Elijah, M. (2015, January 27). Shortage of medical personnel: Tougher times ahead for Nigerians (1). Retrieved on 24th December 2019 from https://www.vanguardngr.com/2015/01/shortage-medical-personnel-tougher-times-ahead-nigerians-1/

Eriki, P., Oyo-Ita, A., Odedo, R., Udoh, A., Omaswa., F. and Kadama, P. (2015). Surgical workforce in Nigeria: stock and flow of medical and dental practitioners in Nigeria, with special focus on health workforce training in Cross River state. *African Centre For Global Health and Social Transformation.* Retrieved on 15th March 2020 from https://www.who.int/workforcealliance/031616NigeriaCaseStudyweb.pdf

Fakuade, G. (2020). Ethnicity and language. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Makinde, O., Sule, A., Ayankogbe, O. and Boone, D. (2018). Distribution of health facilities in Nigeria: implications and options for universalhealth coverage. *International Journal of Health Planning and Management*, 33(4), 1179 -1192. doi: 10.1002/hpm.2603. Epub 2018 Aug 9. PMID: 30091473.

Manortey, S. and Acheampong, G. K. (2016). A spatial perspective to the distribution of health facilities and health personnel in the eastern region of Ghana. *Open Access Library Journal*, *3*(8), 1-13.

Mansour, S. (2016). Spatial analysis of public health facilities in Riyadh Governorate, Saudi Arabia: A GIS-based study to assess geographic variations of service provision and accessibility. *Geo-spatial Information* Science, *19*(1), 26-38.

Mukhtar, K. U., Ahmed, A., Musbahu, J. A., Aminu, H., Suleman, M. and Samir, S. D. (2018). Spatial analysis of health care facilities in Babura local government area of Jigawa State, Nigeria. *International Journal of Geography and Environmental Management*, *4*(5), 18-29.

National Population Commission cited in National Bureau of Statistics Official Gazette (FGP 71/52007/2, 500(OL24), (2006): Legal notice on publication of the detailed of the breakdown of the national and state provisional totals 2006 census.

Nwakeze, N. M. and Kandala, N . B. (2011). The spatial distribution of health establishments in Nigeria. *African Population Studies*, *25*(2), 67-75.

Obu, J. I., Obienusi, E. A., Ozoemene, M. L. and Iwu, E. O. (2015). Spatial inequality in development: a case study of Anambra state, Nigeria. *International Journal of Physical and Human Geography, 3*(4), 1-26.

Ogirima, M. (2018, March 29). NMA raises alarm over low ratio of doctors to patients. Retrieved on 24th December 2019 from www.theeagleonline.com.ng

Raman, K. and Ranabir, P. (2018). India achieves WHO recommended doctor population ratio: A call for paradigm shift in public health discourse. *Journal of family medicine and primary care*, 7(5), 841–844. DOI: 10.4103/jfmpc_218_18.

Sadiq, Y., Balogun, G. and Anjorin, O. (2016). Spatial distribution of socio-economic factors in Kogi state, Nigeria: development issues and implication(s). *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, *10*(11), 3582-3589.

Tali, J. A., Divya, S. and Nusrath, A. (2017). Spatial distribution of health centers: a study of district Pulwama (Jammu and Kashmir). *International Journal of Health Sciences and Research*, 7(11), 64-70.

Tukur, A. L. and Mahmud, M. B (2020). Landforms. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Ujoh, F. and Kwaghsende, F. (2014). Analysis of the spatial distribution of health facilities in Benue state, Nigeria. *Public health research, 4*(5), 210-218.

World Health Organization, (2006). *Constitution of the world health organization-basic documents, forty-fifth edition supplement.* Retrieved on 11th May 2018 from www.wikipedia.org

W.H.O World Health Report (2000) Health systems: improving performance. Retrieved on 1st June 2021 from https://www.who.int/whr/2000/en/whr00_ch1_en.pdf?ua=1

Zemba, A. A; Tukur, A. L. and Ezra, A (2020). Basic geographic information on Local Government Areas. In A. A. Adebayo, A. L. Tukur and A. A. Zemba (Eds.), *Adamawa state in Maps.* Yola, Paraclete.

Zheng , Z., Xia, H., Ambinakudige, S., Qin, Y., Li, Y., Xie, Z., Zhang, L. and Gu, H (2019). *Spatial Accessibility to Hospitals Based on Web Mapping API: An Empirical Study in Kaifeng, China. Sustainability*, 11, 1160; 1-14., doi: https://doi.org/10.3390/su11041160