Ethiopian Journal of Environmental Studies & Management 8(6): 650 – 661, 2015.
ISSN:1998-0507 doi: http://dx.doi.org/10.4314/ejesm.v8i6.4
Submitted: January 18, 2015 Accepted: August 14, 2015

A STUDY ON THE SERVICE RADII AND ACCESSIBILITY TO HEALTH FACILITIES IN SULEJA, NIGER STATE

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Abstract
Government policies over the years has centered on the provision and delivery of healthcare to all. Spatial distribution of health facilities is subject to a number of social and commercial influences and healthcare needs of the population. The objective of this paper analyzed the service radii and accessibility of health facilities to people in different neighborhoods in the study area. The location of all hospitals and clinics in Suleja were identified and mapped with the use of ARCGIS software. Furthermore 231 questionnaires were administered to both male and female patients in the thirty- seven (37) health facilities identified in the study area. Analytical method such as Lorenz curve was used to show the level of inequality between the population and available health facilities. Hospitals and Clinics showed evidence of clustering in Madalla and Kabula districts, the reason for this could be attributed to the disregard of locational issues and the consequences of adopting a particular spatial pattern of healthcare service delivery. Findings revealed that 34.35% of the respondents travelled less than 1km before accessing the hospitals and clinics of their choice, while only about 11% of the patients travelled far distances from their places of residence; covering over 4km before accessing the health facility of their choice. The research sought to proffer recommendations such as the strict adherence to established standards, ideal for minimum distances to health facilities and the proper consideration of health needs of the population when future provision for health facilities is embarked on.

Key Words: *Accessibility, Distribution health, Facility, Location, Spatial.*

Introduction

The World Health Organization at the Ottawa charter for Health Promotion in 1986 defines health as a resource for everyday life and not the objective of living. Oloyede (2011) further described good health as a prerequisite for global livability of man as it can be seen as a critical component of societal needs, hence the need for equitable distribution of health facilities as a factor sustaining the population of cities. Accessibility to health facilities for an individual in spatial perspective and the physical accessibility of a household member to health care facilities are of considerable importance, but it is however constrained by distance (Aregbeyan, 1992). Owoyele (2014) opined that most of the environmental health problems especially at the urban centre in the developing countries are due to the lack of access to health facilities. Therefore access to health facilities has many dimensions, and geographical accessibility, defined as the extent to which the population finds the distance, travel time

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and means of transport to healthcare services acceptable (World Health Organization, 1978).

The equitable distribution of health facilities is one of the indexes to achieve equal access to health services, however there are barriers to the attainment of this goal and they differ from place to place, with such barriers like: availability, accessibility, affordability, acceptability, and accommodation (Fox *et al*., 2005)

Following the increase in population, rapid rural-urban migration, and urbanization, and faced with massive problems of ill-health, the dissatisfaction with the state of health facilities in Nigeria has centered on its uneven spatial distribution and limited accessibility to them. A major cause of this trend is as a result of the haphazard location of the available health facilities where a great percentage of the populace has no access to.

Concept of Accessibility in Facility Location

Accessibility in facility location is fundamental, as the inability to physically reach a healthcare facility effectively nullifies any treatment which may otherwise be available (Sanders, 2006). Similarly, Funnel (1976) observed that the problem of accessibility may be minimized by allocating most services in administrative areas rather than to specific locations. The concept of healthcare accessibility has gained much attention in recent years, and as such recent studies on spatial accessibility by Maldzewski and Jackson (2000) cited that spatial accessibility fails to account for economies of scale and operating efficiency in the provision of facilities. Following the rapid advancement in technology of the 21st century, a well Geographic Information System (GIS) computer program has allowed researchers to address the geographical component to access healthcare via spatial statistics (Sanders, 2006). Similar to this view Mitchell (2005) pointed out that spatial statistics involves the use of maps to incorporate analysis of feature locations and spatial relationships alongside tables of attribute values.

However, the concept of spatial analysis is not only restricted to the use of maps like Mitchell rightly presented; it could also be manipulated by making use of inferential statistics and employing the randomization of null hypothesis. In an urban environment, hospital/clinic accessibility could be influenced by their geographic and social features. Therefore, measuring geographic accessibility to health facilities using GIS allows a juxtaposition of such features (geographic and social) against various outcomes. Shaping health facilities to be different, more equitable and effective in new ways is borne out of the need to develop an object oriented data representation of health services in Nigerian urban centres. The importance of the use of GIS in analyzing health facilities on space cannot be overemphasized as it encompasses the design, development and utilization of web-based tools for the description of health situations, epidemiological analyses and public management. Among the following as clearly presented by Premasudha (2010) are the areas where GIS can be used for spatial analysis of health facilities:

1. Spatial description of health events
2. Public health surveillance
3. Health pattern and situation analysis
4. Accessibility to health service
5. Planning and programming of health services and facilities.

Partson (1980) reported that ‘‘health services are required and consumed in order to prevent health problems, to

identify health problems when they occur, to intervene in natural cause of health problems towards recovery, and to alleviate the disabling effects of health problems." Thus, an assessment on the accessibility of health facilities, optimal location of hospitals/clinics and the relationship between existing locations and health care needs which this study seeks to establish is perceived to be worth investigating. The focus of this study is to examine the service radii and geographical accessibility of health facilities using GIS to build an application that can be used for the modeling process of hospital accessibility in Suleja. And also examine the level of inequality in the distribution of health facilities in the study area. The UN report in 2003 considered housing as the general single expenditure as well the significant source of wealth for the homeowners, owning to the fact of its importance, it is also a potential that could harm the health of the people. Owoyele (2014) concluded that there is relationship between neighborhood quality and diseases prevalence among the residence in Minna, He stated that, neighbourhoods with similar quality also have similar illnesses pattern. Thus clusters of neighbourhoods with high quality coincided with clusters of neighbourhoods with healthy population.

This study focuses at examining the service radii and accessibility to health facilities in Suleja, Niger State.

Study Area

The study area is Suleja, Niger State, it was formerly Abuja town and traditional emirate, Niger State situated on the Iku River, a minor tributary of the River Niger at the Abuchi Hills and lies at the intersection of several roads. Suleja Local Government was established by the Local Government reform of 1976 from the defunct Abuja native authority. The area lies between latitude 7˚ 31′N and longitude 7˚58′E. It shares an immediate boundary with Gurara and Tafa in Niger state and Gwagalada in FCT. Suleja is about 20km North of Abuja the Federal Capital of Nigeria and about 100km North East of Minna the administrative headquarters of Niger state (Aminu *et al*., 2003). The Local Government covers a land area of 153.4 Sq.km. According to the 1991 population census, Suleja Local Government had a figure of 151,300 persons, this figure rose to 174,638 persons in 1996. The 2006 provisional population census results showed that Suleja Local Government Area has an estimated population of 216,578 people with males recording 112,672, females 103,906 and a population density of 1,412km² (Niger State Facts and Figures, 2011).

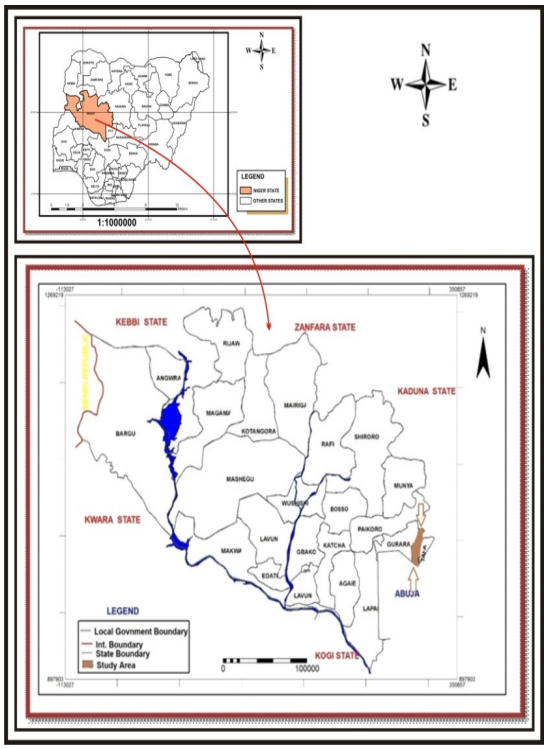


Figure 1: Map of Niger State;

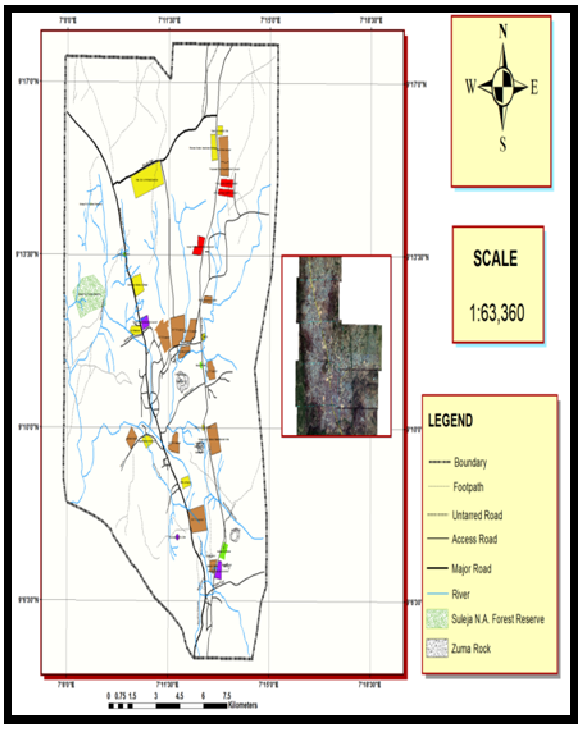


Figure 2: Map of Suleja and Environs

Methodology

The nature of the study involves primary data collection through comprehensive field survey of all existing health facilities. 244 questionnaires were designed in order to obtain information about patients travel distance, travel time, and means of transportation in accessing health facilities. **S**tratified random sampling was adopted to first divide the targeted population into two separate, for instance male and female patients. The Sample interval for the study was derived from the daily average population of patients in each of the hospitals and clinics divided by the sample size for the study. Systematic sampling was then eventually used to select the 5th male patient in every five (5) persons and the 1st female patient in every five (5) persons that were interviewed. These questionnaires were distributed on the following basis;

Six (6) questionnaires were administered to every private hospital based on their daily average number of out-patients i.e. every hospital with at least eight (8) out-patients.

Twenty percent of the patients out of the 150 average daily of out-patients in General Hospital were selected for questionnaire administration. This resulted in the administration of thirty (30) questionnaires in General Hospital Suleja.

Five (5) questionnaires each were also administered to the twelve (12) clinics in the study area. The yardstick for including and excluding a particular patient are given as follows;

Simple tables, attribute tables, maps, illustrative graphs, proximity analysis, Lorenz curve were employed in the analysis, presentation and interpretation of data.

Inequality and Proximity Analysis

Lorenz Curve was used to graphically display the level of inequality in the spatial distribution of hospitals and clinics in the study area. Also the stated objective of examining the service radii and

accessibility of the health facilities to people in different neighborhoods was achieved through GIS using ArcGIS. This was done by selecting one (1) hospital and clinic from each district in the study area. Figures 6 & 7 below shows the extent of the area where selected clinics and hospitals serves respectively.

Table 1: Questionnaire Administration Framework

S/N	Health Facility	No of Health Facility	No of Questionnaires administered	Percentage (%)
1	Government Hospitals	1	30	13.8
2	Private Hospitals	24	140	60.6
3	Government Clinics	5	25	10.8
4	Private Clinics	7	35	15.2
Total		37	231	100

The table 1 above shows the framework under which the number of questionnaires administered to every single patient in each of the health facility was carried out.

Data Base Query

After the creation of a multimedia database which provides detailed information on each of the health facility under studied, series of database query can be performed using ArcGis software (Ajobiewe, 2014). For this study however, a query on the average daily number of patients who had access to the health facilities understudied.

Results and Discussion

Distribution of Health Facilities

The study on the distribution of the health facilities covers the nine districts of Suleja as shown in Table 2.

Table 2: Distribution of Health Facilities and Respondents

S/N	District	Population	No of health facilities	No of questionnaires	Percentage
1.	Bagama	27,009	2	12	5.19
2.	Magajiya	26,174	1	5	2.16
3.	Wambai	31,947	2	10	4.33
4.	Kabula	25,088	6	35	15.15
5.	Maje & Kwamba	29,038	2	5	2.16
6.	Madalla	30,643	10	54	23.37
7.	Hashimi	24,072	7	42	18.18
8.	Kurmin Sarki	27,449	4	50	21.65
9.	Rafin Sanyi	32,242	3	18	7.79
Total		253,662	37	231	100.00

Table 2 gives an account of the percentage of questionnaires administered in each district of the study area in relation to their respective population, and the number of facility available in each of the ward.

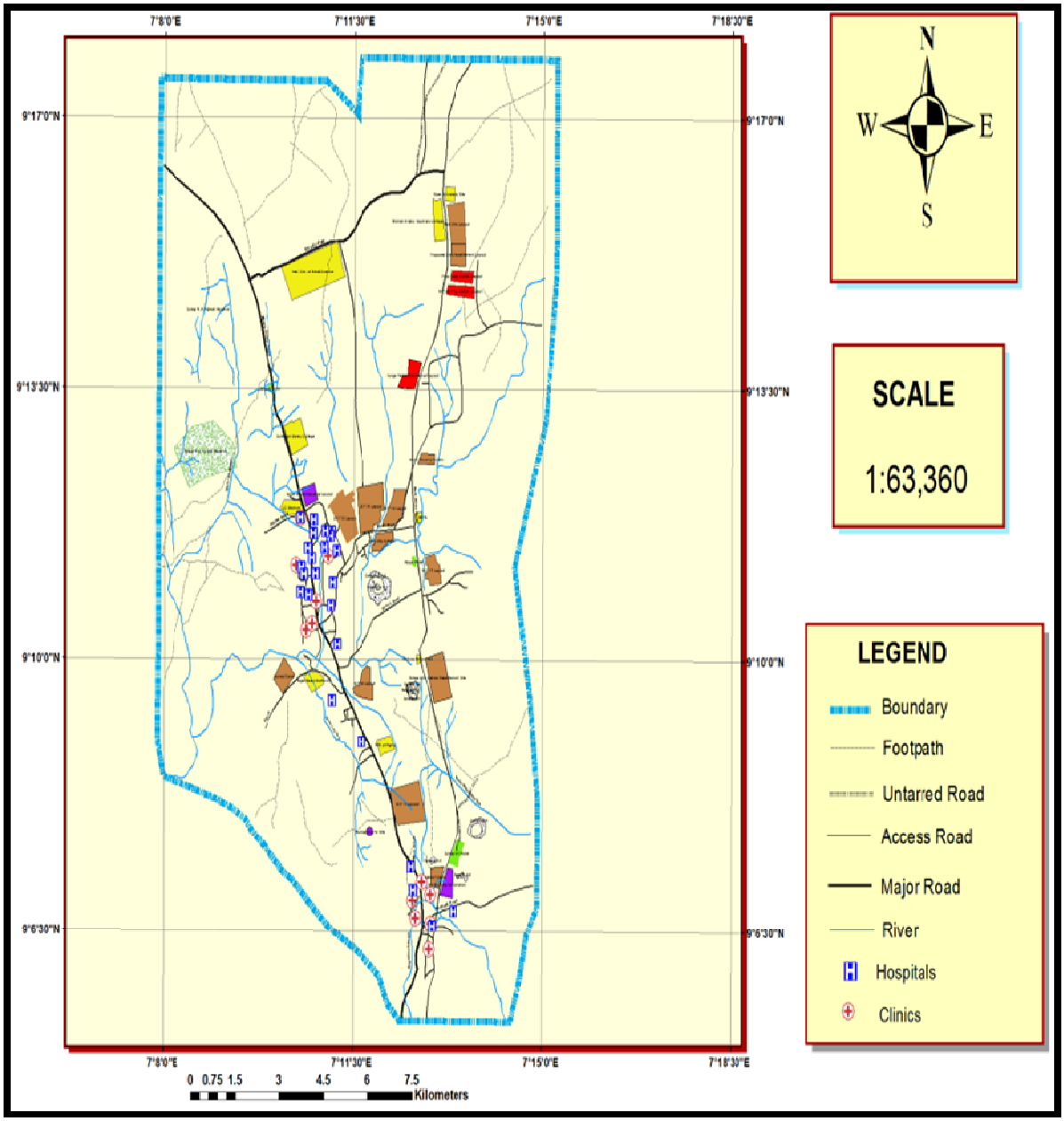
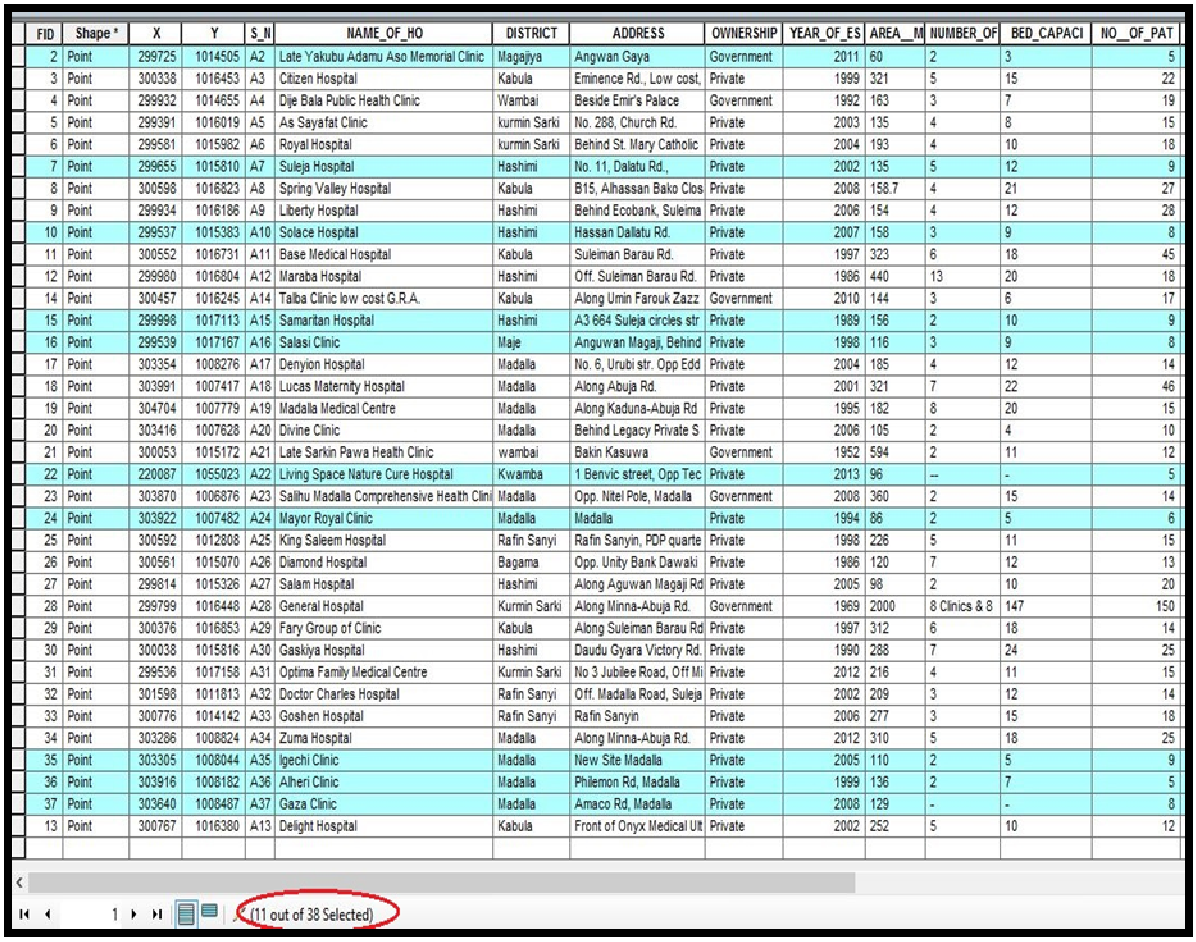


Figure 3: Distribution of health facilities in Suleja

This was performed by the selection of attributes as shown in Figure 4 below.



FID	Shape *	X	Y	S_N	NAME_OF_HO	DISTRICT	ADDRESS	OWNERSHIP	YEAR_OF_ES	AREA__M	NUMBER_OF	BED_CAPACI	NO__OF_PAT
2	Point	299725	1014505	A2	Late Yakubu Adamu Aso Memorial Clinic	Magajiya	Angwan Gaya	Government	2011	60	2	3	5
3	Point	300338	1016453	A3	Citizen Hospital	Kabula	Eminence Rd., Low cost,	Private	1999	321	5	15	22
4	Point	299932	1014655	A4	Dije Bala Public Health Clinic	Wambai	Beside Emir's Palace	Government	1992	163	3	7	19
5	Point	299391	1016019	A5	As Sayafat Clinic	kurmin Sarki	No. 268, Church Rd.	Private	2003	135	4	8	15
6	Point	299581	1015982	A6	Royal Hospital	kurmin Sarki	Behind St. Mary Catholic	Private	2004	193	4	10	18
7	Point	299655	1015810	A7	Suleja Hospital	Hashimi	No. 11, Dalatu Rd.,	Private	2002	135	5	12	9
8	Point	300598	1016823	A8	Spring Valley Hospital	Kabula	B15, Alhassan Bako Clos	Private	2008	158.7	4	21	27
9	Point	299934	1016186	A9	Liberty Hospital	Hashimi	Behind Ecobank, Suleima	Private	2006	154	4	12	28
10	Point	299537	1015383	A10	Solace Hospital	Hashimi	Hassan Dallatu Rd.	Private	2007	158	3	9	8
11	Point	300552	1016731	A11	Base Medical Hospital	Kabula	Suleiman Barau Rd.	Private	1997	323	6	18	45
12	Point	299980	1016804	A12	Maraba Hospital	Hashimi	Off. Suleiman Barau Rd.	Private	1986	440	13	20	18
14	Point	300457	1016245	A14	Talba Clinic low cost G.R.A.	Kabula	Along Umin Farouk Zazz	Government	2010	144	3	6	17
15	Point	299998	1017113	A15	Samaritan Hospital	Hashimi	A3 664 Suleja circles str	Private	1989	156	2	10	9
16	Point	299539	1017167	A16	Salasi Clinic	Maje	Anguwan Magaji, Behind	Private	1998	116	3	9	8
17	Point	303354	1008276	A17	Denyion Hospital	Madalla	No. 6, Uruibi str. Opp Edd	Private	2004	185	4	12	14
18	Point	303991	1007417	A18	Lucas Maternity Hospital	Madalla	Along Abuja Rd.	Private	2001	321	7	22	46
19	Point	304704	1007779	A19	Madalla Medical Centre	Madalla	Along Kaduna-Abuja Rd	Private	1995	182	8	20	15
20	Point	303416	1007628	A20	Divine Clinic	Madalla	Behind Legacy Private S	Private	2006	105	2	4	10
21	Point	300053	1015172	A21	Late Sarkin Pawa Health Clinic	wambai	Bakin Kasuwa	Government	1952	594	2	11	12
22	Point	220087	1055023	A22	Living Space Nature Cure Hospital	Kwamba	1 Benvic street, Opp Tec	Private	2013	96	--	-	5
23	Point	303870	1006876	A23	Salihu Madalla Comprehensive Health Clini	Madalla	Opp. Nitel Pole, Madalla	Government	2008	360	2	15	14
24	Point	303922	1007482	A24	Mayor Royal Clinic	Madalla	Madalla	Private	1994	86	2	5	6
25	Point	300592	1012808	A25	King Saleem Hospital	Rafin Sanyi	Rafin Sanyin, PDP quarte	Private	1998	226	5	11	15
26	Point	300561	1015070	A26	Diamond Hospital	Bagama	Opp. Unity Bank Dawaki	Private	1986	120	7	12	13
27	Point	299814	1015326	A27	Salam Hospital	Hashimi	Along Aguwan Magaji Rd	Private	2005	98	2	10	20
28	Point	299799	1016448	A28	General Hospital	Kurmin Sarki	Along Minna-Abuja Rd.	Government	1969	2000	8 Clinics & 8	147	150
29	Point	300376	1016853	A29	Fary Group of Clinic	Kabula	Along Suleiman Barau Rd	Private	1997	312	6	18	14
30	Point	300038	1015816	A30	Gaskiya Hospital	Hashimi	Daudu Gyara Victory Rd.	Private	1990	288	7	24	25
31	Point	299536	1017158	A31	Optima Family Medical Centre	Kurmin Sarki	No 3 Jubilee Road, Off Mi	Private	2012	216	4	11	15
32	Point	301598	1011813	A32	Doctor Charles Hospital	Rafin Sanyi	Off. Madalla Road, Suleja	Private	2002	209	3	12	14
33	Point	300776	1014142	A33	Goshen Hospital	Rafin Sanyi	Rafin Sanyin	Private	2006	277	3	15	18
34	Point	303286	1008824	A34	Zuma Hospital	Madalla	Along Minna-Abuja Rd.	Private	2012	310	5	18	25
35	Point	303305	1008044	A35	Igechi Clinic	Madalla	New Site Madalla	Private	2005	110	2	5	9
36	Point	303916	1008182	A36	Alheri Clinic	Madalla	Philemon Rd, Madalla	Private	1999	136	2	7	5
37	Point	303640	1008487	A37	Gaza Clinic	Madalla	Amaco Rd, Madalla	Private	2008	129	-	-	8
13	Point	300767	1016380	A13	Delight Hospital	Kabula	Front of Onyx Medical Ult	Private	2002	252	5	10	12

(11 out of 38 Selected)

Figure 4: Attribute Table showing average daily patients of Health Facilities in Suleja

Data on the average number of daily out-patients in all the health facilities was collected and coded into the database. Thereafter the computer was asked to search for health facilities with less than 10 daily out-patients and from the result eleven (11) health facilities recorded less than 10 average out-patients daily; among these facilities are Suleja Hospital, Igechi Clinic, Alheri Clinic to mention but a few.

Table 3: Cumulative Percentages of Population and Health Facilities

S/N	District	Population	Pop %	Cumulative Population	Health Facility	Percentage	Cumulative Frequency
1	Bagama	27,009	10.64	10.64	2	5.4	5.4
2	Hashimi	24,072	9.49	20.13	7	18.9	24.3
3	Kabula	25,088	9.89	30.02	6	16.2	40.5
4	Kurmin Sarki	27,449	10.82	40.84	4	10.8	51.3
5	Madalla	30,643	12.08	52.92	10	27	78.3
6	Magajiya	26,174	10.32	63.24	1	2.7	81
7	Maje & Kwamba)	29,038	11.45	75.69	2	5.4	86.4
8	Rafin Sanyi	32,242	12.71	87.4	3	8.1	94.5
9	Wambai	31,947	12.6	100	2	5.4	100
	Total	253,662		100	37		100

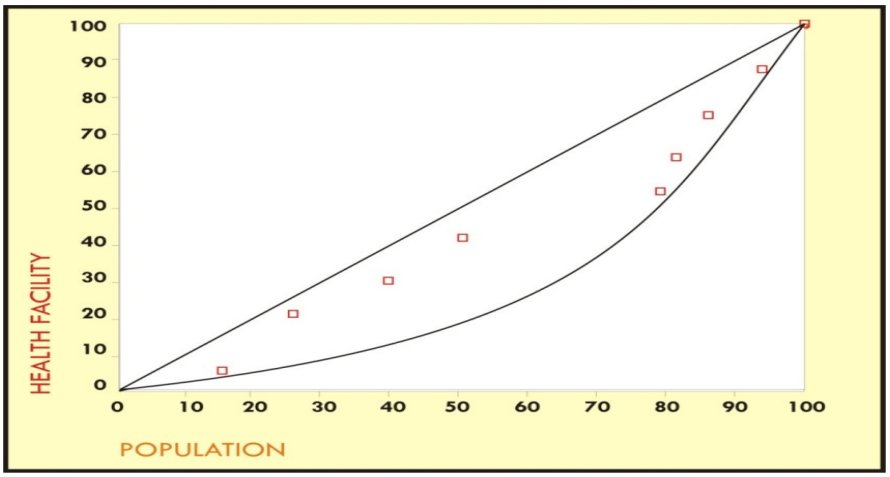


Figure 5**:** Lorenz Curve of Population and the Number of Health Facilities

The graph presented in Figure 4 reveals that in a situation where the numbers of health facilities provided were to be in consonance with the population, a perfect line i.e. the diagonal would have resulted. Therefore, the deviation between the set of values is shown in the area between the plotted curve and the diagonal line.

Service Radii for Health Facilities in Suleja

Figure 6 shows a kilometre service radii served by As-Safayat Clinic, Divine Clinic, Talba Clinic Low-Cost GRA, Late Yakubu Adamu Aso Memorial Clinic, and Salasi Clinic.

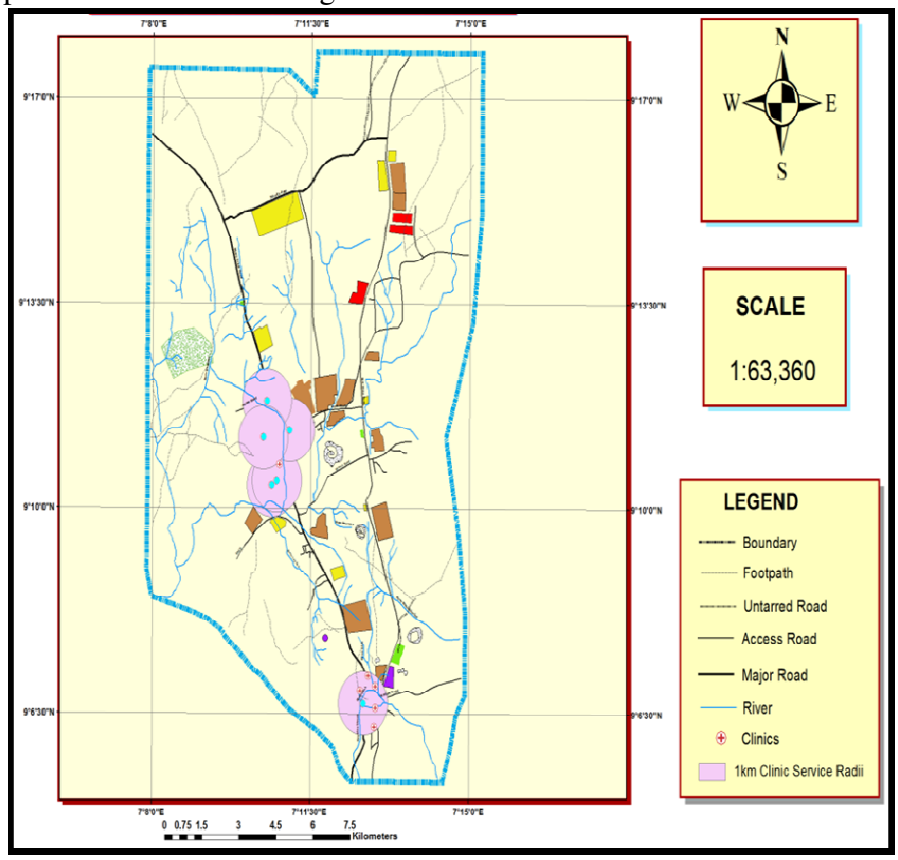


Figure 6: 1km Service Radii of Selected Clinics in Suleja LGA

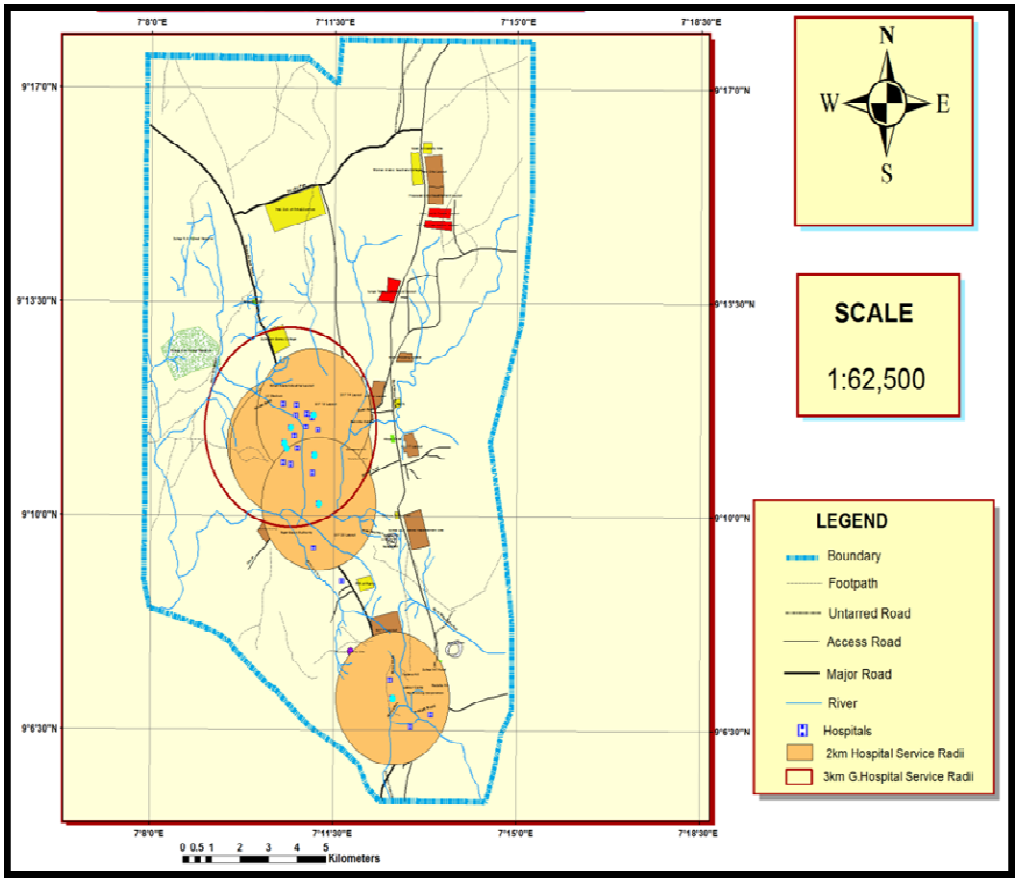


Fig 7: Service Radii of Selected hospitals in Suleja LGA

A 3km buffer was created to reveal the service area of the General Hospital Suleja, this can be seen in the red outlined circle from the map in figure 6 above. The General Hospital can be said to serve areas where private hospitals are clustered and located as it overlaps servicing areas of other selected hospitals among which are Suzan Hospital, Royal Hospital, Goshen Hospital, Suleja Hospital to mention but a few.

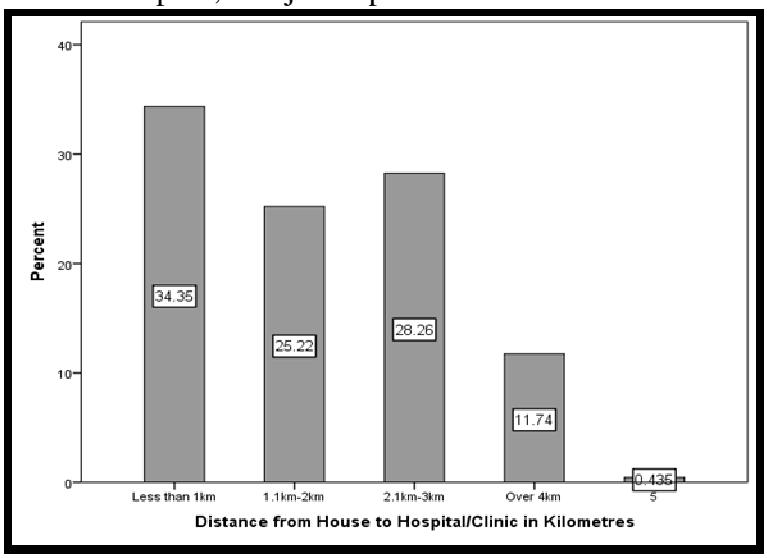


Figure 8: Travel Distance

Travel distance covered by patients seeking to access healthcare services as confirmed by the survey and shown by Figure 8; 34.35% of the population travelled less than 1km before accessing the hospitals and clinics of their choice, while only about 11% of the patients travelled far distances from their places of residence to places of healthcare facilities. These set of patients covered over 4km before accessing the hospitals and clinics of their choice.

Table 4: Travel Costs

S/N	Travel Costs	Frequency	Percentage (%)
1	Less than N100	78	33.8
2	N100-N300	83	35.9
3	N300-N500	19	8.2
4	N500-N700	3	1.3
6	Missing	48	20.8
	Total	231	100.0

From the table 4 above, 33.8% spent less than ₦100, 35.9% had to spend between ₦100-₦300 and 20.8% of the patients did not spend any money before accessing healthcare facilities; these set of patients travelled by foot to access healthcare services.

Discussion

The result shows that about 6 (six) of the clinic examine (As-Safayat Clinic, Divine Clinic, Talba Clinic, Low-Cost GRA, Late Yakubu Adamu Aso Memorial Clinic, and Salasi Clinic) are within the radii of 1km for the residence of Suleja. The General Hospital serves a wider coverage, even to the distance covered by the private clinics and hospitals in Suleja. Such hospitals include Suzan Hospital, Royal Hospital, Goshen Hospital and Suleja Hospital. The results implies that quite number of people (34.35%) travels for health services in a nearby clinic or the hospital, while, few numbers of people (11%) travels far distance of more than 4kilometers for the clinic of their choice. These also affect the travel cost of the people from their place of residence to the where the health facility is located as only 9.5% of the population examined can afford to spend about #500.00 (Five Hundred Naira) and above to the place of their health facility. However, the majority of the residence in Suleja assessed the clinics and hospital closer to them for any health challenges, but on a special reference to the General Hospital.

Conclusion

Findings gathered from the research show that there are inequalities in the spatial location/distribution of health facilities (hospitals and clinics) within the study area i.e. more than half of the sampled districts have less than a fair share distribution of hospitals/clinics within the study area, which basically implies that some districts are having inadequate healthcare delivery, while others have excess healthcare facilities clustering around few neighborhoods.

Conclusively, future location of health facilities can be vigorously pursued by using GIS tools. Similarly, government and private owned health establishments must live up to expectation by ensuring better healthcare delivery in all its facets, aspects and ramifications.

Recommendations

In view of this research, there is need to advise and suggest possible ways to solve the problems identified from the study.

The established standard, ideal for minimum distances for health facility should not be more than 1km for health clinic, 2km for maternity homes and 3-4km for a General hospital. (Onokerhoraye, 1981). A consideration of these set standards will go a long way to resolving

the present situation where hospitals and clinics are clustered in some districts (Madalla and Kabula districts) and sparsely located in others (Magajiya and Wambai districts).

Apart from established standards, it is expedient that health facilities are located at travel distances of at least 20 minutes from residential areas.

As contained in the vision 3:2020 of Niger state, an implementation of policies contained in the document should be expressly pursued by the state government. This will make it possible to plan for development of districts disadvantaged in terms of healthcare delivery, therefore reducing the discrepancy in the development of the local government area.

When locating health facilities, it is necessary to consider methods that take into account spatial hindrances in terms of availability and accessibility

References

Ajobiewe T.O. (2014). 'Spatial Analysis of Health Facilities in Suleja, Niger State, Nigeria.' Being an Unpublished B.Tech Thesis submitted to the Dept. of Urban and Regional Planning Federal University of Technology, Minna.

Aminu, Z., Yakubu, M., Mohammed, A.A. and Niranjan, K. (2013). 'Impact of Land Use on Soil Quality in Suleja, Niger State.' *Indian Journal of Science*, 2(2): 1-7.

Aregbeyan, J.B.O (1992). 'Healthcare Service Utilization in Nigeria Rural Communities, A focus on Otuo Community and Environs in Edo state.' NISER Monograph series, Ibadan.

Fox, N.J., Ward, K.J. and O'Rourke, A.J. 2005). 'The 'Expert Patient: Empowerment or Medical Dominance? The Case of Weight loss, Pharmaceutical Drugs and the Internet.' *Social Science and Medicine*, 60(2): 1299-1309.

Funnel, D.C. (1976). "The Role of Small Service Centers in Regional and Rural Development" with reference to Eastern Africa. pp 73-93.

Maldzewski and Jackson (2000) 'Multi – Criteria Spatial Allocation of Education Resources' An overview.' Social Economic Planning Sciences pp 218–237. In http//:www.elsevier.comhacate/ dsw

Mitchell, A. (2005). 'The ESRI guide to GIS analysis': Spatial measurements & statistics Vol. 2. Redlands, California: ESRI Press.

Niger State Facts and Figures (2011) pp 22-30.

Oloyede, M.A. (2011). 'Towards Sustainable Distribution of Health Centers using GIS: A case Study for Nigeria. *American Journal of Tropical Medicine & Public Health,* 1(3): 130-136.

Onokerhoraye, A.G. (1982). 'Spatial Aspect of Healthcare Problem in Nigeria. 'A Case Study of Kwara State. *The quarterly Journal of Administration,* 12: 241-255.

Owoyele G.S. (2014). Assessment of the Relationship between Neighbourhood Quality and Human Health in Minna, Niger State. An unpublished PhD Thesis submitted to the Dept. of Urban and Regional Planning Federal University of Technology, Minna.

Partson, G. (1980), Planners Politics and Health Services, New York Institute of Medicine pp88.

Premasudha, B.G (2010). 'Visualization and Spatial Analysis of Healthcare Services of Tumkur City. An Unpublished PhD Thesis submitted to Computer Applications Dept. Dr

M.G.R Educational and Research Institute University)

Sanders, L.J. (2006). 'A Spatial Analysis of the Geographic Distribution of Musculoskeletal and General Practice Healthcare Clinics in Auckland, New Zealand.' An Unpublished Master of osteopathy thesis submitted to Unitec Institute of Technology, New Zealand.

UN-Habitat (2003). The Challenges of Slum: Global Report on Human Settlements. Nairobi: UN-Habitat

World Health Organization (1978) 'Primary Health care. Report of the International Conference at Alma Alta, World Health Organization, Geneva, Switzerland.