
SPATIAL DISTRIBUTION OF PRIMARY HEALTHCARE FACILITIES IN ABI LGA OF CROSS RIVER STATE-NIGERIA

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ABSTRACT

This study examines the spatial distribution of Primary Healthcare Facilities within Abi LGA using Geographic Information System (GIS) approach. The study used the field survey and survey research design to acquire geometric and attribute data respectively. Geometric data (coordinates of healthcare facilities) were acquired using handheld GPS (Garmin 76 CSX handheld GPS recorder) and ArcGIS 9.3, Geocal for coordinate conversion, Micro software 2013, Microsoft Excel 2010, attribute data (staff strength), hardcopy of administrative map of Abi LGA, population figure and overview information of the study area were also sourced. The results revealed that location of health facilities satisfy the National Health Policy on Primary Healthcare. However, these healthcare facilities lack the needed equipment and manpower to function effectively. Bias in the distributions of healthcare facilities (Ebom/Ebijakara ward with 34,709 population has three (3) health facilities, while Adadama ward with 17,409 population has six (6) health facilities-2006 census figure projected to 2018). It was recommended that among other things, the state government should retrain and redeploy staff to manned facilities as well as equip these facilities.

Keywords: Geographical Information System, healthcare, facilities, spatial, distribution.

1. INTRODUCTION

Quality health is globally seen as the priority of the citizenry and it is also considered as the bed right of the citizens of any nation. So, the need for the government to improve and make provision for healthcare facilities in their area of jurisdiction is significantly important. More so, that the goal of Primary Health Care (PHC) is better health for all. This ideal model of health care was adopted in the declaration of the international conference on Primary Health Care held in Alma Ata in 1978 and became a core concept of the World Health Organization's goal of Health for all (WHO, 1978). Records have it that 137,000 maternal death and other death related illnesses occurred in rural areas of Africa which its causes were traceable to poor accessibility and management of the existing health care facilities (WHO, UNICEF and UNFPA, 2000). These

alarming maternal health and other death related illnesses triggers the Alma Ata convention of the world health organization (WHO) agenda on health and the Millennium Development Goals (MDGs) of the world leaders on health, to introduced modern health care facilities to put an end to the incessant high mortality rate and other vulnerable diseases prevalent in Africa and the world at large, this was further emphasized with the introduction of Sustainable Development Goals (SDGs).

Available statistics from UNICEF, (2015) showed that, death rate is relatively still high in Nigeria and Cross River State in particular, especially during an epidemic outbreak and other health cases. It was reported that women deliver babies on bare floor in Cross River State hospital (Unah, 2018) Doctors in Obubra Local Government of the state were seen attend to pregnant women without gloves, syringes and other indispensable tools in Obubra General Hospital, Obubra, Cross River State.

However, in spite of the government effort in providing accessible, equitable, efficient, affordable and basic healthcare needs for the people at the rural and urban areas, the people of Abi local Government are yet to feel the impact of the existing health care facilities. It is on this note that, the study to assess the distribution of primary healthcare facilities, to see if there are equitably distributed and efficiently managed in Abi Local Government Area of Cross River State is imperative.

The healthcare system in sub-Saharan Africa has always been the subject of discussion of most African Government. This is because it faces an increasing, verse, diverse and complex health problems, rapidly growing population and scarce resources. As a result of this, expensive hospital-based health care system is normally protected by strong vested interest, while primary healthcare are normally slow in progress. According to (Oranga, 2010), in sub-Saharan African, health care management and the use of health information at local level are restricted by highly centralized decision making process. Similarly, Kibon and Ahmed, (2013) viewed access to health care as an important component of an overall health system. Access and utilization of health facilities by the public is determined largely by availability of health care facilities, location and perception of the significance of health. Political influence has dominated other factors in the choice of the location of government projects, which healthcare facilities are not insulated against. Health facilities are supposed to be located according to the population distribution of the areas.

The challenges in Abi Local Government Area is lack of planning and inequitable distribution of public primary health care facilities. This has resulted to the inability of populace to access and utilize the health facilities. Also, this has affected health sector in combining various data sources in meaningful manner.

Apart from the challenges of planning and equitable distribution of the public Primary health care facilities in the study area, there are no available maps showing primary health care facilities and a comprehensive database showing the list of public Primary health care facilities within the study area that can be used in the estimation of government expected revenue and utilization of these facilities.

2.AIM AND OBJECTIVES

The aim of the study is to assess primary healthcare facilities distribution within Abi Local government area using GIS Approach.

The objectives pursued are:

1. To acquire the hard copy map of Abi LGA and digitized it
2. To identify and acquire both geometric and attribute data sets of health facilities in Abi LGA,
3. To create a Geospatial database of public primary healthcare facilities within Abi LGA
4. To develop spatial and attribute queries related to public healthcare facilities in the study area.
5. To proffer recommendation based on the range of service and threshold population in the study area

3.THEORETICAL FRAMEWORK

Central Place Theory: It is possible to use the central place theory as a basis for the explanation and provision of activities in space in which the location of health care facilities cannot be left behind. Although the central place theory developed by Christaller (1933) aims at the study of marketing function of settlements in relation to its location, it can also be applied to the location and spacing of service centres such as municipal solid micro waste disposal sites, healthcare facilities, schools among others. The theory was developed based on the following assumptions;

1. There is an isotropic surface with equal movement and ease in any direction.
2. There is uniform distribution of population and purchasing power.
3. There is a uniform terrain and resource endowment.

Besides the foregoing, there are some sub-assumptions based on the Economic- rationality of man. These assumptions include:

- a. Individuals will tend to utilize the closet facilities to them.
- b. If the threshold for a particular goods or services is available, the goods or services will be provided. The central place theory focuses on the concept of tributary areas which can also be described as catchment area.

4.LITERATURE REVIEW

According to Longley, (2007) Geographic Information System (GIS) is a system for managing, storing, analyzing, modeling and visualizing spatial information. Since Geographic Information System (GIS) and health care planning are two relevant fields that depend upon spatial data. With Geographical Information System (GIS) locational decisions and database construction on spatial phenomenon such as primary health care facilities have become more efficient and robust. Similarly, (Kibon, and Ahmed, 2013) said health care planning and GIS are two relevant fields that depend upon spatial data. Location of health facilities, patient distribution and characteristics are example of spatial data that are dealt with during local health planning. It is obvious that the use of GIS and spatial representation of various health issues make professionals to arrive at result in a faster and better way in the field of health and decision making (Taylor, 2013). Since GIS has the can provide information relating to many issue and also aid correctly the decision making process. They can provide information regarding the distribution of health

facilities/services. Taylor, (2013), GIS can contribute to public health in many ways especially that information is the key to its operation. With information health professionals can easily identify the difficulties and disparities regarding the accessibility to health services, and so they are able to cope with the current situation. Furthermore, trends and correlation would be difficult to be understood with traditional ways of processing and imaging of these data (Najafabadi, 2009).

Agaja, (2012) carried out a Geographical Information System mapping of the primary health care centres in Ughelli North and Warri South Local Government Areas of Delta state. It was discovered that in Nigerian, explicit consideration has not been given to the need for equity in the planning and distribution of health care facilities over the years. Earlier on, Okarfor, (2007) analyzed the spatial distribution and efficiency of health centres in the old Bendel (now Edo and Delta) State. He created a data base of all the health centres in Benin and found that there were discrepancies between the population distribution and the distribution of health centres. Olajuyin, (1997) investigated the effect of location on the utilization of health care centres in irewole local government area of Osun State, Nigeria and found that health centres were unevenly distributed among the settlements and that distance was a paramount factor.

Effiong (2010) analyzed the health care delivery system in Oyo East Local Government Area. It showed that PHCFs in Oyo East LGA were unevenly distributed and their accessibility depends on their geographical location in the LGA. GIS application might be applied towards strategic planning research and Evaluation, emergency preparedness and both response and location of health care services (Smith, 2007). Hence, health care provider may direct quickly and efficiently the patient to suitable health care services (Najafabadi 2009), since GIS provide us with the exact location of specific medical facilities and the route to gain the fastest access to it.

5. MATERIALS AND METHODS

The Study Area

The study area is Abi Local Government Area of Cross River State, Nigeria. It is one of the eighteen (18) local government areas in Cross River State. It is located politically within the central senatorial districts of the state, bounded in the north and west by Ebonyi state, to the east; it is bounded by Yakurr Local Government Area and to the south by Biase Local Government Area of Cross River State. The study area lies approximately between latitude $5^{\circ} 45' 47''$ N and $6^{\circ} 00' 58''$ N of the equator and longitude $7^{\circ} 54' 39''$ E and $8^{\circ} 06' 47''$ E of the Greenwich meridian as shown in figures 1, 2 and 3

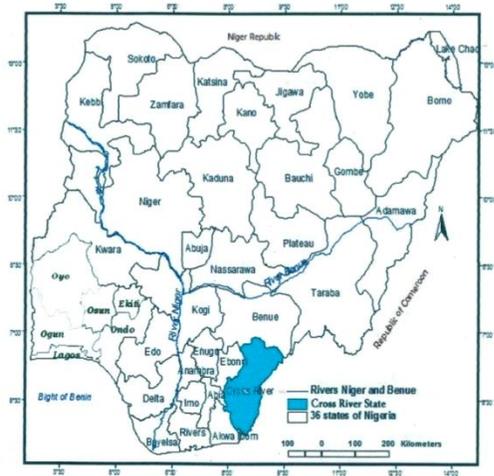


Fig. 1: Map of Nigeria Showing Cross River State

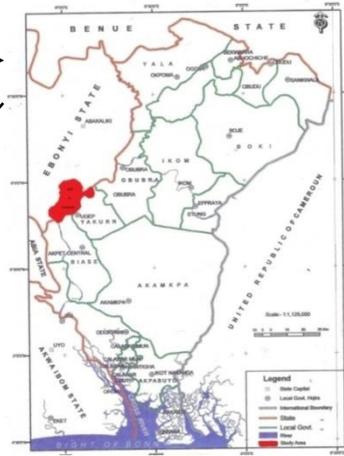


Fig 2 Map of Cross River State showing the location of Abi LGA

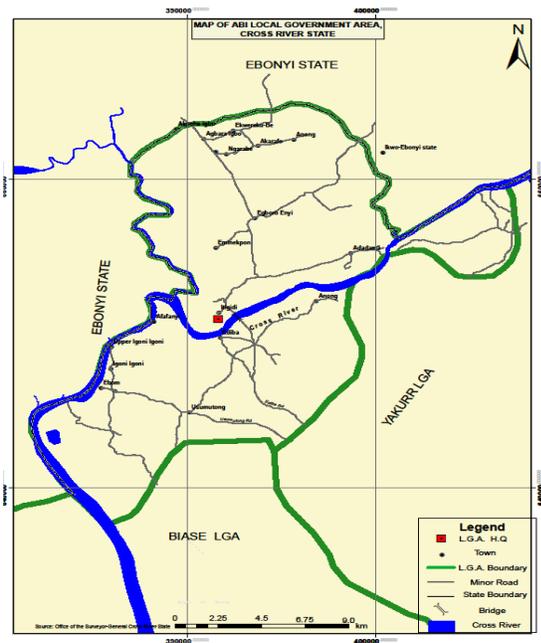


Fig. 3 Abi LGA Showing the Various Communities.

Abi Local Government Area consists of three clans (Agbo, Bahumuno and Igbo-Imabana). It comprised of ten (10) council wards (Adadama, Afafanyi/Igoni goni, Ebom/Ebijakara, Ediba/Anong, Ekureku I, Ekureku II, Imabana I, Imabana II, Itigidi and Usuutong/Abeugo. Abi local government area has a population of 144,317 people with 73,077 males and 71,240 females (NPC,2006), with a land mass of 334.52 sq.km. The population density is 43/sq.km. It is blessed with both natural and human resources, as well as some aesthetic scenery that are tourism potential (Refome Lake and Ujam Lake in Ebom, Agba and Adama cave, etc.).

The people are predominately engaged in farming as the most important economic activities in the area, other economic activities include fishing, boat making, growing of food and cash crops and rearing of livestock. The economic activities is largely influenced by the presence of fertile soil and natural water bodies (rivers, swamps and lakes) that are abound in the local government area. The local government headquarter also play host to Songhai farm, a mechanized system of agriculture fashioned after Songhai – Mali.

The Local Government Area, by its latitudinal position enjoys the tropical equatorial climate, which is characterized by heavy rainfall and high temperature throughout the year. The rainy season starts from April and last till November and has two peaks (double maxima) in July and September months, with only a little break in August. The mean annual rainfall is between 2000mm and 4000mm. the climate is strongly affected by two main air masses. The tropical maritime which is a moisture laden air mass that originates from the Atlantic Ocean blowing on shore. It moves generally southwest to northeast direction. The tropical continental air mass is developed over the Sahara desert and is therefore warm, dry, and dusty which blows from the opposite direction of northeast to southwest bringing along with it the dry season and a dry dusty wind (harmattan) from November to March/April. The area also experiences annual relative humidity of about 90. The temperature is about 28/29 degree centigrade during the rainy season and it is about 32 degree centigrade during the dry season.

Abi Local Government Area falls within the forest zone (the rain forest). This luxuriant forest that is typical of rainforest has been tampered due to the occupation of the inhabitants which is mainly Agriculture. Although, the mineral resources of Abi Local Government have not been fully investigated and exploited, the area possesses a rich reserve base including very fertile soil, forest products, extensive sand bands, beaches for subsistence and commercial purposes, enormous clay deposits, lakes, swamps, and river.

6.DATA COLLECTION

Research data was gathered from primary and secondary sources. Data were gathered through Ground-Truthing Observation (GTOs) in the field, identification and location of health care facilities in Abi LGA with Garmin 76CSX hand held GPS to obtain the coordinates of the health care facilities. Attribute data which includes non-spatial descriptive information of the area were obtained and digitized. Pictures of sites of interest using a digital camera were captured.

Secondary sources of data were obtained from existing literature on primary health care distribution from textbooks, internet, journals and magazines. Information was also sourced from the Ministry of Lands and Surveys Calabar, Ministry of Health Calabar, Primary HealthCare

Department, Abi LGA and Calabar office of the National Population Commission (NPC) were demographic data was collected

Hardware and Software used

- a. Omatek laptop used for typing, serving retrieving and manipulating amongst others.
- b. AUTOCAD 2010 software for drawing.
- c. Arc GIS 9.3 software handles multiple tables and relate them to each other with care and allows query using appropriate commands
- d. Microsoft word 2013 software
- e. Handheld GPS (Germin 76CSX).

7.RESULT

Table 1. Shows the list of public health care facilities within the study area with their respective acquired GPS coordinates.

Table 1: List Of Public Health Institution In Abi Local Government Area With Their Gps Coordinates.

S/N	NAME OF COMMUNITIES	TYPES OF HEALTH FACILITIES	EASTING	NORTHING	POLITICAL WARD
1	Adadama	PHC	399434.883	655291.963	ADADAMA
2	Ibalebo	HP	400271.971	655347.104	ADADAMA
3	Isoninyang	HP	394745.891	652425.028	ADADAMA
4	Ekpon	HP	398501.034	654927.129	ADADAMA
5	Eminkwo	HP	400392.121	654729.029	ADADAMA
6	Imina	HP	398556.880	654110.150	ADADAMA
7	Afafanyi	PHC	389023.956	650195.015	AFAFANYI/IGONIGONI
8	Igonigoni	HP	386001.135	648796.094	AFAFANYI/IGONIGONI
9	Bazohure	HP	385942.850	647537.050	AFAFANYI/IGONIGONI
10	Ezomezom	HP	388308.036	650879.926	AFAFANYI/IGONIGONI
11	Abenyi-Uso	HP	386104.021	649121.150	AFAFANYI/IGONIGONI
12	Abetete Nkita	HP	386143.221	648747.812	AFAFANYI/IGONIGONI
13	Ebom	PHC	386085.976	646593.961	EBOM/EBIJAKARA
14	Egbezum	HP	385788.039	646468.899	EBOM/EBIJAKARA
15	Fonavai	HP	385482.036	646641.135	EBOM/EBIJAKARA
16	Ediba	PHC	392078.890	648936.931	EDIBA/ANONG
17	Umaru Ahmed CHC Ediba	CHC	393478.964	649048.139	EDIBA/ANONG
18	Anong – B	HC	393617.895	649184.869	EDIBA/ANONG

19	Enugwehuma	HP	391705.875	649653.137	EDIBA/ANONG
20	Enusokwe	HP	391668.940	649459.111	EDIBA/ANONG
21	Ezono	HP	391571.120	649092.905	EDIBA/ANONG
22	Akpan	HP	392571.222	649198.505	EDIBA/ANONG
23	Anong Ezeke	PHC	393853.043	661570.890	EKUREKU
24	Akarafor	HC	392290.925	662682.909	EKUREKU
25	Ekureku- Be	HP	391587.992	662542.041	EKUREKU
26	Anong Lekafor	HP	392886.150	663018.126	EKUREKU
27	Anong Likpo	HP	394358.940	662343.917	EKUREKU
28	Akpoha	HP	390976.923	662394.116	EKUREKU
29	Ingarase	PHC	392399.111	661617.980	EKUREKU II
30	Agbara	HC	391601.868	661457.858	EKUREKU II
31	Egboronyi	HC	393292.963	657246.916	EKUREKU II
32	Itigeve	HP	394508.127	652211.998	EKUREKU II
33	Emin-Ekpon	HP	391717.039	655485.052	EKUREKU II
34	Imabana	MPHC	405803.052	656501.952	IMABANMA I
35	Ilike	HC	407221.996	656442.976	IMABANMA I
36	Igbor	HP	407180.880	656906.136	IMABANMA I
37	Egada	HP	407120.915	657104.916	IMABANMA I
38	Ikpalaegwe	PHC	402497.881	655910.124	IMABANMA II
39	Lehangha	HC	405728.920	658679.064	IMABANMA II
40	Ebor	HP	406768.888	656724.961	IMABANMA II
41	Itigidi	PHC	391510.115	650783.014	ITIGIDI
42	Ikamine	HP	391445.953	650320.011	ITIGIDI
43	Agba	HP	391823.893	650315.050	ITIGIDI
44	Levechiel	HP	391598.000'	650394.064	ITIGIDI
45	Lepache	HP	391631.067	650135.116	ITIGIDI
46	Usumutong	PHC	NIL	NIL	USUMUTONG/ABEUGO
47	Abeugo	HP	389671.945	649864.945	USUMUTONG/ABEUGO
48	Enokpore	HP	NIL	NIL	USUMUTONG/ABEUGO
49	Ebokwo	HP	NIL	NIL	USUMUTONG/ABEUGO
50	Dimond Hill	HP	NIL	NIL	USUMUTONG/ABEUGO

Source: Field survey 2017

From table (1) it is gathered that out of the fifty (50) primary health facilities present in the study area forty six (92%) of these facilities had their coordinates picked, while four (8%) could not be accessed due to hostilities in the area at the time of field survey. The spatial distribution of health facilities in ABI LGA is as shown in figure 4.

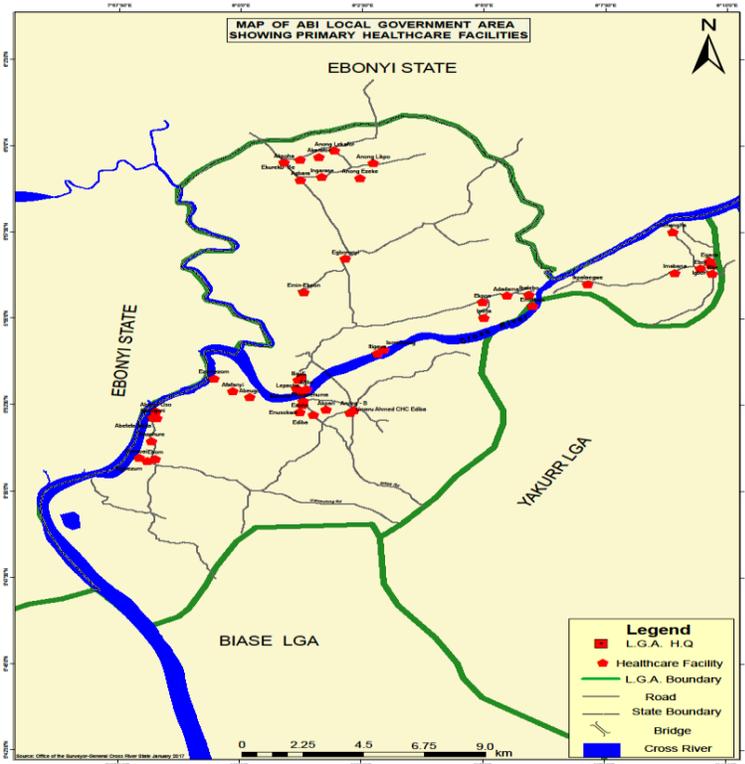


Figure 4: Showing spatial distribution of health facilities

Source: ArcGIS analysis, 2017.

Table 2: Political Wards Population And Health Facilities

S/N	POLITICAL WARD	MALE	FEMALE	TOTAL	NO. OF PRIMARY HEALTHCARE FACILITIES
	ADAMA	706	593	1309	
	FANYI/IGONIGONI	956	779	1735	
	M/EBIJAKARA	5276	3433	8709	
	BA/ANONG	644	2166	2810	
	REKU I	559	9002	9561	
	REKU II	3242	3176	6418	
	BANA I	3470	3731	7201	

BANA II	38	161	699
IDI	219	791	010
MUTONG/ABEUGO	375	096	471

Source: Field survey, 2017

Table 2, shows the ten political wards in Abi LGA, Their projected population to the year 2018, as well as the numbers of health care facilities present in each ward. Ediba/Anong ward has the highest population of 42,532 with 7 Primary Health Care Facilities, while Adadama ward is the least population of 16,892 and having 6 Primary Health Care Facilities (See table 2).

Table 3: Types Of Primary Healthcare Facilities Per Ward

S/N	WARD	HP	HC	CHC	PHC	MPHC	NUMBER	%
1	ADADAMA	5	-	-	1	-	6	12
2	AFAFANYI/IGONINI	5	-	-	1	-	6	12
3	EBOM/EBIJAKARA	2	-	-	1	-	3	6
4	EDIBA/ANONG	4	1	1	1	-	7	14
5	EKUREKU I	4	1	-	1	-	6	12
6	EKUREKU II	2	2	-	1	-	5	10
7	IMABANA I	2	1	-	1	1	4	8
8	IMABANA II	1	1	-	-	1	3	6
9	ITIGIDI	4	-	-	1	-	5	10
10	USUMUTONG/ABEUGO	4	-	-	1	-	5	10
TOTAL		33	6	1	9	1	50	100

Source: Field survey, 2017

It is reveal from table 3 that out of the fifty (50) primary healthcare facilities in the study area, thirty three (33) are Health Post (HP), six(6) are Health Centres (HC), one (1) Comprehensive Health Centre (CHC), eight (8) Primary Health Centre (PHC) and one (1) Multipurpose Health

Centre (MPHC). The health post account for 66%, health centres 12%, comprehensive 2%, primary health centre 18% and multipurpose 2% respectively.

8. DISCUSSION

This research was carried out in Abi LGA with the aim to analyze the spatial distribution of health care facilities within Abi L.G.A using GIS with a view to promote effective management, and utilization of these facilities in Abi Local Government Area.

It was discovered that, even when Ebom/Ebijakara is ranked fourth in terms of population size (34,709), the level of health infrastructure is in contrast as they rank the least with just three (3) health post same as Adadama ward which is the least in terms of population of 17,409 (2006 census figure projected to 2018).

Buffering Analysis

Buffer analysis of 5 kilometres was adopted for the study to know the trek able distance zones of healthcare facility in the study area as stipulated by the National Health Policy on Primary Health Care (PHC). It was discovered that most of the communities are within the five (5) Kilometres radius, except farm lands. (See figure 5)

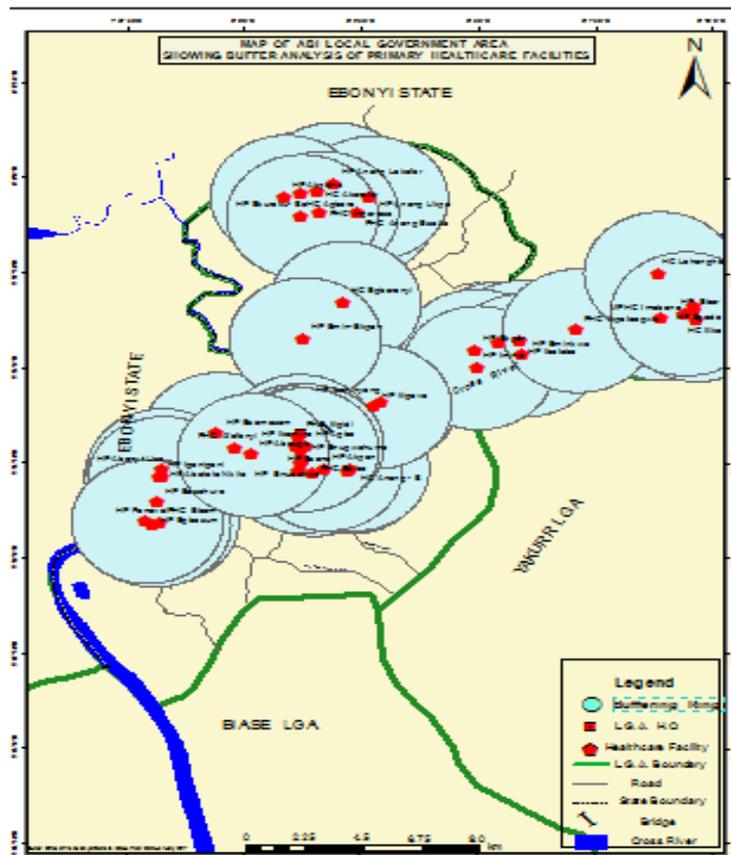


Figure 5: Buffer Analysis result of healthcare facilities in Abi LGA
Source: ArcGIS analysis. 2017

Buffer analysis was done in order to know the range/radius distance of health care facilities within the study area. The result of analysis (figure 5) satisfied location criteria of National Health Policy on Primary Health Care which stipulates five (5km) radius distance, but these facilities are in dilapidated state as shown in figure 6.



Figure 6: Images of the healthcare building at Emini-Ekpon-Abi LGA,,
Source; GIS Analysis, 2017

Ediba/Anong with a population of 43,810 (2006 Census figure projected to 2018), has seven (7) Primary Health Care centres, while Ebom/Ebijakara ward with a population of 34,709 (2006 Census figure projected to 2017) and Imabana II ward with a population of 19,699 (2006 Census figure projected to 2017) has the least number of Primary Health Care facilities, with each ward having three centres.

Query Analysis

It is a GIS analysis procedure to provide solutions/answers to questions about specific entity in the study area extracted from the data-base created. Basic queries can be either single or multiple criterions. Single bring out one field result. Multiple criteria bring out more than one field to generate results. Queries were used in the study to solve/answers some specific questions about one or more field in the database. Specific questions like where is? How many PHC? Which ward? Was answered. The results to the queries is displayed as shown in figure 7. The researcher query three fields of the database which include: Names of health institution with category 3

health facilities and community with category < 3 health facilities in Abi LGA. The analysis was done in order to know the number of health post within the study area. The result of the analysis showed that there are 31 communities with category 3 and <3health facilities (Health Post) within Abi LGA. See figure 7.

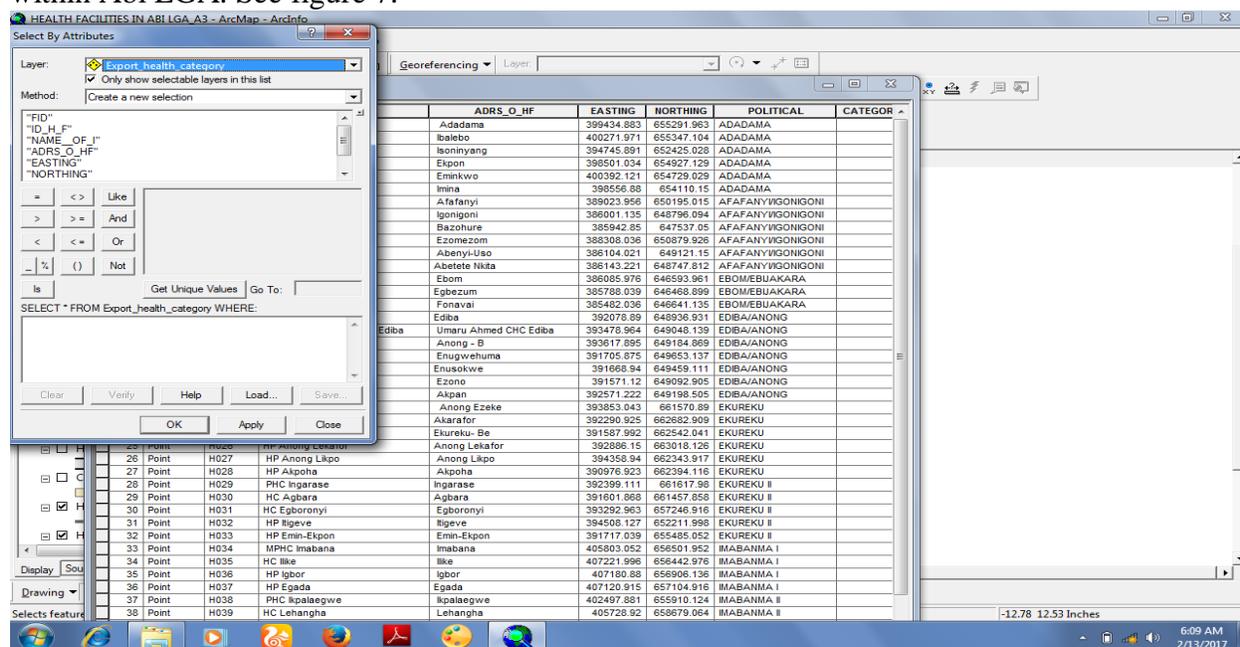


Figure 7 Query Analysis showing select by attribute Health facilities in Abi LGA. Source: ArcGIS analysis, 2017

10. CONCLUSION

The present study explored both existing hard copy maps of Abi LGA (which were digitized) and ground verification data. A GIS database of public Primary health care facilities in Abi LGA were created, queries and buffering analysis were demonstrated to show the potentials of the GIS database in the effective location analysis of health facilities and chart were created from attribute tables of the some of the theme for analysis and decision making. All these have been developed using ArcGIS 9.3 software. The database provides the researcher with a working environment for facilities location. It also allows efficient query of information needed for primary health building. The result revealed that spatial location of health facilities in Abi Local Government Area satisfies the National Health policy on Primary Health care. However, these facilities lack the needed equipment and man power to function effectively.

In order to proffered solutions on the variables under investigation recommendation below are made based on the findings of this study.

- (1) The State government should create departments which will be responsible for data collection and analysis. This will help to checkmate the lopsided distribution of primary health care facilities

(2) The State Government should redeployed, retrained staff to such new departments that will be created in order to implement concepts of Information Technology (IT) and Geographic Information System GIS.

(3) Implementation of new data sharing and exchange policies along with appropriate standards and guideline should be made paramount. There is urgent need for local authority (Abi LGA), Cross River State Government (CRS) and Non-Governmental Organizations (NGO) to be fully involved in setting up of more functional, accessible health care facilities. The health of the populace will improve if mal distribution of Primary Healthcare Facilities is corrected and emphasis is placed on functional Primary Healthcare Centres, as this will help to lower the cost of health care, improve health of the populace and reduce the inequalities in the distribution of healthcare facilities

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