International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 8 Number 12 (2019): Pages 768-784
ISDS Article ID: IJDS18041601

Geographic information system assessment of the accessibility of public and private hospitals in delta state: A study of delta central senatorial district

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Abstract

This research is aimed at exploring the capabilities of Geographic Information System (GIS) in mapping and accessing public and private hospitals in Delta Central Senatorial District, Delta State, Nigeria. The study adopted the Socio-behavioural Model which is aimed at demonstrating the factors that leads to the use of health services. The instruments used for collecting data for this study include well-structured questionnaire and Global Positioning System (GPS). The data collected were analyzed using five statistical techniques namely Nearest-Neighbour Analysis, Index of Accessibility, Location Quotient, Pearson Product Moment Correlation Coefficient and Spatial Analysis in GIS environment. Descriptive statistics was also employed to analyze data acquired from the questionnaire. The Nearest-Neighbour Index of 0.05 obtained suggests that, spatial arrangement of the hospitals is extremely clustered. The Index of accessibility of the General Practitioners, bed complement or space and ambulances revealed that the hospitals in the region are inaccessible. The study revealed that Sapele, Udu, Ughelli North and Uvwie Local Government Areas with a Location Quotient value above 1.0 are marginally advantaged in the location of hospitals, while Ethiope East, Ethiope West, Okpe, and Ughelli South Local Government Areas with a Location Quotient value of less than 1.0 are marginally disadvantaged. Also, the study revealed a strong Correlation value of 99.9% relationship between the hospital distribution and the numbers of health workers. Furthermore spatial analysis of Overlay Operations, distance analysis and Spatial Queries were carried out. The study finally recommends that, existing health facilities should be refurbished and areas with large population should be considered when setting up new health facilities.

Keywords: GIS; Accessibility; Health; Health Care; Hospital; Private and Public

Cite this article as: Ejemeyovwi, O.D. (2019), "Geographic information system assessment of the accessibility of public and private hospitals in delta state: A study of delta central senatorial district", *International Journal of Development and Sustainability*, Vol. 8 No. 12, pp. 768-784.

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1. Introduction

Geographic Information System (GIS) tool and related spatial analysis methods provide needed environment for describing and understanding the changing spatial organization of health care, for examining its relationship its outcomes and access, and for exploring how the delivery of health care can be improved.

The use of Geographic Information System for the measurement of physical accessibility is well established and has been applied in many areas including retail site analysis, transport, emergency service and health care planning (Black et al., 2004).

Therefore, researchers have developed several means of evenly locating public facilities in such a way that the facilities will effectively benefit majority of people in the society. GIS is one of such techniques and tools used for accessibility measure (Abubakar and Aina, 2012). Access to health care is an important component of an overall health system and has a direct impact on the burden of disease that affects many countries in the developing world. Accessibility to healthcare is the ability of a population to obtain a specified set of health care service (Oliver and Mossialos, 2004).

Measuring accessibility to health care contributes to a wider understanding of the performance of health systems within and between countries which facilitates the development of evidence-based health policies. Geographic accessibility often referred to as spatial or physical accessibility is concerned with the complex relationship between the spatial separation of the population and the supply of health care facilities. The concept can also be extended to incorporate different types of health intervention. Although it is intuitive that the level of public health of a population may be affected negatively by the distance to health care services, there remains limited quantitative information regarding this impact (Guagliardo, 2004).

The World Health Organisation (2006) defined health as a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity. However, Onokohwomomo et al. (2011) define Public Health as the maintenance of the health of a community. They perceive public health as the maintenance of a clean environment. Thus, the service of the Public Health institution is provided by the government.

Most health system around the world and Nigeria in particular is characterized by mixed public and private financing and delivery of care. Bennett (1992) defines private health providers as those who fall outside the direct control of government. This refers to the involvement by business, charitable organizations or individuals. The private sector complements the public sector in the provision of effective health care system. The public sector is the first-mover and chooses its level of investment in the health sector. The private sector then observed the level of public investment and invests to meet the residual demand, which may be a function both of the quantity of services supplied in the public sector and the quality of those services (Bennett, 1992).

The spatial pattern of health care facilities is concerned with the arrangement of the facilities across a geographical space or entity. This could be in response to series of locational factors such as; easy access to/from other nearby settlement, availability of good roads, regular electricity supplies, water supply among others. The pattern could either be; dispersed where the facilities are scattered, linear (where they are located by two sides of important roads or nucleated (as crowded en-route centers are located in the study as observed in work of (Jimoh and Azubike, 2012).

The need for health care varies in space and so the organization of provision necessarily has a spatial component. Neither population totals nor population characteristics such as age, sex, income, occupation, fertility et cetera are uniform in space. In a like manner, the physical environment varies in characteristics from place to place and this invariably has implications for the pattern of demand for health care facilities. The spatial dimension is also important in utilization behaviour since accessibility is a major determinant of the use of health care facilities (Onokerhoraye, 1997).

GIS can act as a facilitating mechanism to allow appropriate integration and presentation of the database for health purpose. It is also used to investigate statistical relationships that may vary from place to place. These spatial analyses are valuable for identifying significant relationships among those variables that influence health outcomes at a range of aggregations from local to international data permitting. Thus, GIS can then be used to present results from the analysis (i.e., patterns in the data) in the form of visually appealing, high-impact maps (Candace et al., 2008). To this end, GIS has been used in the domains of environmental health, disease ecology, and public health as a tool for processing, analyzing, and visualizing data (Kistemann et al., 2002).

1.1. Statement of research problem

The tremendous benefits of GIS to the health care sector are being recently realized. Bryan (2007) asserted that, the issue of accessibility to essential public and private health facilities has gained worldwide attention in recent year, both public and private sectors are developing innovative to harness data integration and spatial visualization power of GIS. Over the last decade, Public health and development issues have become topics of international concern. Perhaps even more alarming is the facts that, while most illness are preventable or treatable with existing medicines, the World Health organization (WHO) estimates that over 1.7 billion people i.e. nearly one-third of the world's population, have inadequate or no access to these essential health facilities (Bryan, 2007).

Many factors affect a population's ability to access appropriate levels of healthcare. Some of these factors are accessibility to the health facility, unavailability and competency of health personnel, unavailability of spatial data, social and cultural factors, economic factor, distance travelled and poor emergency health care service.

Healthcare providers are therefore challenged to determine what resources (both structural and medical personnel) to be available, at what locations and when. Hence, facts show the existence of many health facilities scattered all over the state, mostly in the urban areas and many Central hospitals are crowded with patients that seek treatment on common illness that can be treated in their source location (Ewhrudjakpor, 2007). The availability and distribution of functional health facilities and other health infrastructure are unevenly distributed across Delta Central Senatorial District, and many Primary Health Care facilities are being built and wrongly sited. Majority of the public health facilities are in a state of disrepair, and are not functioning at optimal capacities in the provision of quality specialist care. Moreover, Private health institutions are located closed to the threshold population that is expected to use the health services and are inaccessible to the rural and poor health care facility users.

The ratio of health personnel to the population is an indicator of the geographical distribution of health workers in the region, which is very uneven, with fewer staff per person in developing nation like Nigeria. However, a great concentration of health workers in urban areas is at the detriment of rural dwellings.

Most health facilities are crowded with patients daily and there is insufficient bed space for in-door patients. There are cases where a patient that needs in-door treatment is rejected from some hospitals, because there are insufficient beds to admit such patient. Also, some patients would be discharged on time by the hospital before full recovery, to give room for new in-door patients.

The provision of every health facility both in the public and private health sector depends on the supply and demand side of the services rendered. Access to health service is determined by the ability to pay (Levesque et al., 2013). While the public health facilities are less economically accessible, the private sector is not accessible to the poor.

Emergency health care service is an important aspect of health care delivery in Delta Central Senatorial District. Some patients drive themselves or use public cabs even in crucial health level. Ambulances are thus not available in some hospitals, and even if it were, patients may not have financial position or even the contact to the hospitals and ambulance service. This is due to poor data base management system of the health sector and poor Emergency Management Information System (EMIS). It is therefore important to incorporate the use of GIS for effective spatial data generation for analyzing, storing and retrieving of geographical health data for research and policies in setting up public health facilities for disease prevention in the region.

1.2. Objectives of the study

This study explored the capabilities of GIS in mapping and accessing public and private hospitals in Delta Central Senatorial District. The specific objectives are to:

i. examine the spatial distribution of public and private hospital in Delta Central Senatorial District;
ii. examine the spatial location index of the population to the health institutions;
iii. determine the ratio of the population to the General Practitioners (GP) and bed space;

1.3. Hypotheses

In line with the objectives, the following null hypotheses are formulated:

H_{01}: There is no significant relationship between the pattern of distribution of the public and private hospitals in Delta Central Senatorial District.

H_{02}: There is no significant relationship between the hospital distribution and the types of health workers (doctors and nurses).

1.4. The study area

Delta Central Senatorial District is located in the Delta State. It lies between latitudes $5^{0}09^{1}$and $6^{0}03^{1}$ North of the Equator and Longitudes $5^{0}30^{1}$and $6^{0}12^{1}$ East of the Greenwich Meridian. It is bounded in the North by Edo

State, South by Bomadi and Patani, in the East by Warri South-West, Warri South, Warri North and Burutu and West by Ukwuani, Ndokwa West, Isoko North and Isoko South (Fig 1). The size of the region is about 3,700km^2. The population is estimated to be 2,032,707 people (Nigeria Population Census, 2007) and the region has eight (8) Local Government areas.

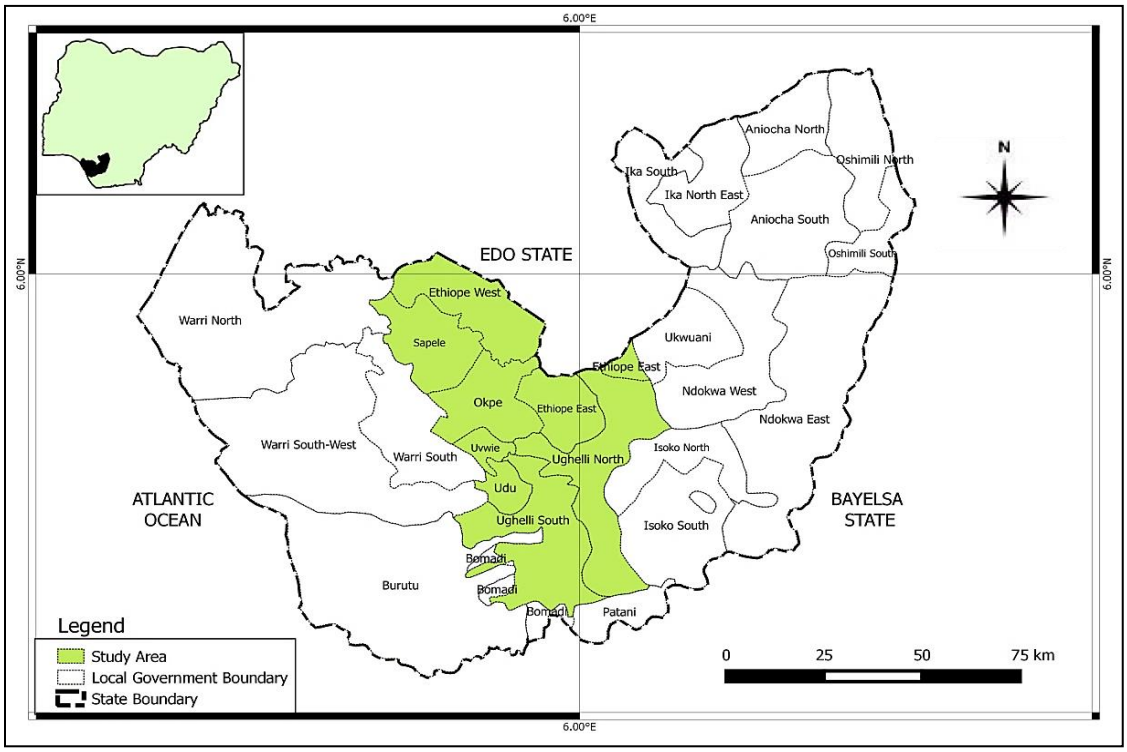

Figure 1. Map of Delta State Showing the Study Area (Source: Adapted from the Ministry of Land's Survey and Urban Development, Delta State, 2008)

1.5. Literature Review

There is a large volume of literature relating to the use of GIS for measuring physical accessibility to health care and a number of publications review the various methods used including Cromley and McLafferty (2002). Physical accessibility addresses the complex relationship between the distribution of the population and the supply of health care facilities (Ebener et al., 2005).

GIS has been used to examine spatial patterns of disease and in environmental correlation studies through techniques such as spatial clustering (Higgs, 2004). Higgs (2004) cited that these studies involve the use of standard GIS functionality such as buffering (e.g., generating catchments at physical or travel time distances away from doctors surgeries or hospitals), overlay analysis (e.g., examining the location of patients in relation to such areas) and network analysis (using characteristics of a network such as travel speeds or public transport availability to gauge how long it takes patients to access a facility).

Cromley and McLafferty (2002) asserted that majority of studies to date have used GIS to measure potential accessibility to both primary and secondary health services in order to examine spatial inequalities in health care delivery. However, Abubakar and Ibrahim (2013) from their study review that Geospatial analysis and environmental health interacts with each other due to advances in computing. The usefulness of this is in the ability to view maps and identify areas of prevalent diseases, pest breeding grounds, spatial population distribution for health studies, doctor-to-patient ratio and location of health facilities.

Malaria was studied and modelled, in Amazon area, using GIS in international research development centre of epidemic diseases. Objectives of this study were: comparing risk of being affected by Malaria in different social groups and in different environmental condition, studying effects of social and economic factors on prevalence of disease, understanding influences of environmental and economic factors on disease and perceiving general situation of Amazon agricultural regions from viewpoint of prevalence among people (Bretas, 1995)

GIS has been used in the mapping of snakebite incidences in Ghana and Nigeria, to identify the potential high-risk areas and inform health care decision making (Molesworth et al., 2003). This study describes a GIS approach to risk mapping that identifies marked seasonal and geographical variation in snakebite incident rates at a number of health facilities in northern Ghana and Nigeria. Furthermore, Abbas, Auta and Muhammad (2012) investigated the spatial distribution of Healthcare facilities in Chikun local government area of Kaduna State Nigeria by employing GIS and GPS to map exiting ones, evaluate adequacy based on World Health Organization standard and propose new ones.

1.6. Conceptual framework

The Health Care Utilization Model, also known as the Socio-Behavioural Model or the Andersen Health Behavioural Model (HBM) developed by Ronald Andersen in 1968 (Weller et al., 1997). The Health Care Utilization Model is aimed at demonstrating the factors that leads to the use of health services. Andersen's model views access to services as a result of decisions made by individuals constrained by their position in society and the availability of health care services.

2. Research methods

In this study, the Survey Design Technique was used, therefore questionnaires were administered to collect relevant data needed for the research and the Global Positioning System (GPS) used to generate coordinate points of the hospitals. 240 copies of questionnaire were distributed and retrieved from the respondents. A total of 30 questionnaires were administered in each of the 8 LGA. Also, data were collected from the 98 registered hospitals visited in the 8 LGA of the study area. Five methods of data analysis were adopted in this study. They are: Nearest-Neighbour Analysis, Index of Accessibility, Location Quotient, Pearson Product Moment Correlation Coefficient, and Spatial Analysis in GIS.

3. Analysis of data and discussion of findings

The 240 questionnaires distributed in the 8 Local Government Areas were successfully retrieved. The study identified the social factors affecting accessibility of hospitals in Delta Central senatorial District.

Table 1. Satisfaction derived from the health services

Level of Satisfaction	Number of Respondents	Percentage (%)
Strongly satisfied	69	29
Satisfied	94	39
Not satisfied	45	19
Cannot say	32	13
Total	**240**	**100**

Source: Field work, (2014)

Table 1 shows the level of satisfaction derived by the respondents from the use of hospitals in the region. 39% claimed they are satisfied with the services provided by the health provider. 29% says they are strongly satisfied, 19% says they are not satisfied while 13% could not mention their level of satisfaction derived from the use of health services. This thus implies that the respondents are more satisfied in the services provided by the hospitals in the region. Figure 2 clearly illustrate the information in table 1. However, strong satisfaction (69%) and satisfied (95%) derived from the use of a health facility indicates that such facility is adequately utilized by the patient as he or she accepts the services provided. The satisfaction is realized because of the patient's needs, resources and the availability of health services was translated into utilization.

Figure 2. A Line Graph showing the level of satisfaction derived by the respondents from the health services in Delta Central Senatorial District

3.1. Location index of the population to the health institutions

3.1.1. Near-Neighbour analysis

The Nearest Neighbour Analysis (NNA) is adopted and used to measure the degree of spatial distribution of the private and public hospitals in the region. This indicates if these hospitals are clustered, dispersed or randomly located in the region. The analysed method makes it possible to describe any point pattern in terms

of a single statistic Nearest Neighbour Index (RN) on a scale ranging from 0 to 2.15. At minimum RN value of 0, all the points are on the same place. When the RN value is between 0.1 - 0.2, then the points are clustered. The value greater than 2.15 presents a dispersed health facilities. Random distribution is however indicated with an index of 1.0. The NNA is therefore calculated by measuring the distance that separates each point from its nearest neighbour using the Quantum GIS 2.6.

It is expressed as:

The Mean Nearest-Neighbour Distance is derived from:

$$d = \frac{\sum d}{n} \quad \text{- - - - Equation (1)}$$

Where: d = Mean Nearest-neighbour distance

d = Nearest-neighbour distance

n = Number of spatial points

The Z value is positive, because 18 is greater than +/- 1.96 at 95% or 0.05 level of confidence. H_{o1} is rejected in hypothesis one. This means that, alternative hypothesis (H_1) is accepted and null hypothesis (H_0) is rejected. The alternative hypothesis states that 'there is a significant relationship between the pattern of distribution of the public and private hospitals in Delta Central Senatorial District. Since the RN value is between 0.1 - 0.2 the distribution of the hospital in the Delta Central Senatorial District is clustered.

This indicates that the setting up of health institutes in the region is distributed by a deliberate decision of health providers to reach the potential threshold population that seeks their services. Thus, the propelling factors that may prompt this spatial organization and Health care provider's decision may include political concentration, the availability of the population (health seekers) and the ability or opportunity of the health users to adequately access the available health institutions.

3.1.2. Index of accessibility

The Index of Accessibility computes the ratio of the health care services to the available population. Each of the projected population is used to divide the number of General Practitioners (Doctors and Nurses), bed complement or space and ambulances, and the result is computed. (See Appendix 1).

Figures 3, 4 and 5 show that health care delivery in Ughelli South is least accessible by the population. A ratio of 91,839 persons to one hospital is computed, and the ratio of 68,879 persons per Doctor, 17,220 persons per Nurse, 4,051 persons per Bed complement and 275,517 persons per Ambulance services. These values connotes that there is inaccessibility to the Health facilities as well as to the general practitioners.

The Health services in Uvwie are more accessible compared to other LGAs in the region. It shows a ratio of 3,431 persons per Doctor, 598 persons per Nurse, 441 persons per Bed complements and 15,438 persons per Ambulance as shown in the figures below. This means that Health care delivery in Uwvie is more accessible to the other LGAs. The Accessibility Index does not meet the World Health Organization (WHO) standard of 1:600

for Doctors to patient ratio. It almost correlates with the propose estimate of the Nigerian Ministry of Health ratio of 1:3500 for Doctor to patients (Onyebuchi, 2012).

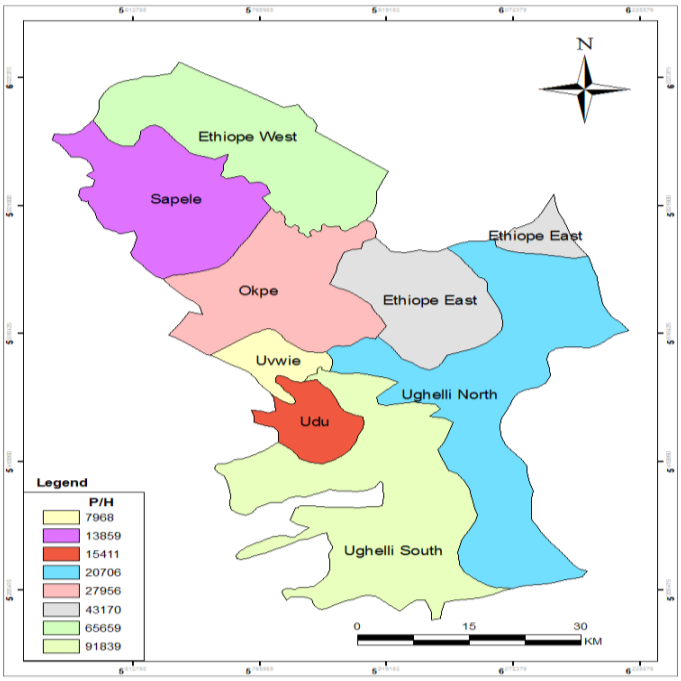

Figure 3. Accessibility Index of the Population to Hospital (P/H) Distribution in Delta Central Senatorial District (Source: Field Work, 2014)

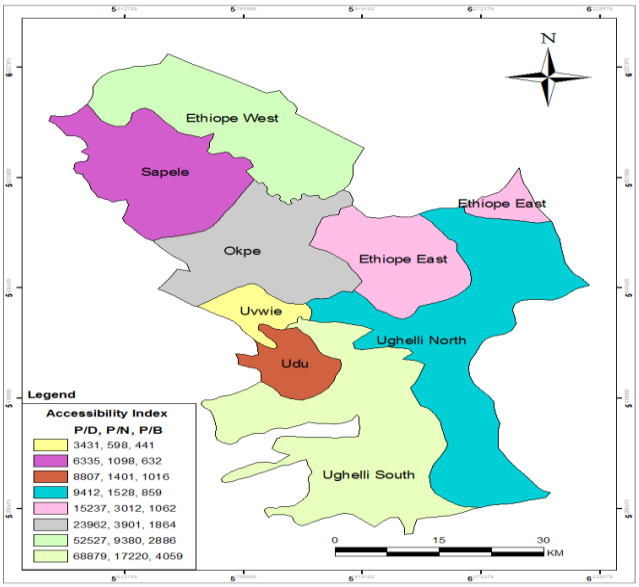

Figure 4. Accessibility Index of the Population to Doctors (P/D), Nurses (P/N) and Bedspace (P/B)

Distribution in Delta Central Senatorial District
(Source: Field Work, 2014)

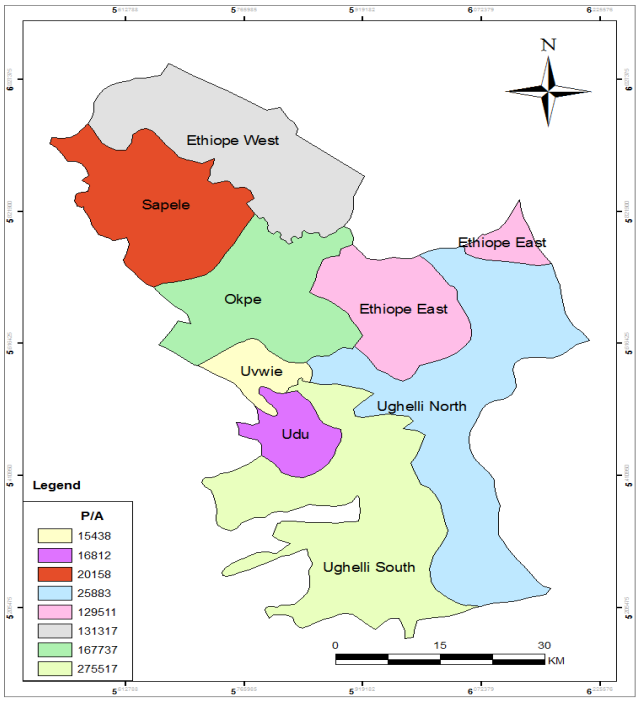

Figure 5. Accessibility Index of the Population to Ambulance in Delta Central Senatorial District (Source: Field Work, 2014)

Figure 5 shows that 15438 person will have access to 1 ambulance in Uvwie, and 16812, 20158, 25883, 129511, 131317, 167737, 275517 is the ratio of the population to 1 Ambulance in Udu, Sapele, Ughelli North, Ethiope East, Ethiope West, Okpe and Ughelli South respectively. These values, indicate that the Ambulance service is inadequate to serve the population

3.1.3. Location quotient index

In this study, the location quotient with values less than 1.0 signifies that the local government areas concerned are marginally disadvantaged in the location of Health facilities. Areas with values more than 1.0 signifies that the LGA concerned are marginally advantaged in the location of hospitals in the region. The Location quotient index is computed using the formula:

L.Q (X, A) = No. of Health Facilities in LGA (A) / No of Facilities in the Region

Population of LGA / Population of the Region

Where: L.Q (X, A) = The location quotient of health facilities in the LGA

The equation above was used to compute the table below.

Table 2: Location Quotient of Hospitals in Delta Central Senatorial District

S/N	LGA	Population Year 2006	Estimated Population Year 2014	Number of Hospital	Location Quotient	Marginally Advantage/ Marginally Disadvantage
1	Ethiope East	200792	259022	6	0.49	Disadvantage
2	Ethiope West	203592	262634	4	0.32	Disadvantage
3	Okpe	130029	167737	6	0.74	Disadvantage
4	Sapele	171888	221736	16	1.50	Advantage
5	Udu	143361	184936	12	1.35	Advantage
6	Ughelli North	321028	414126	20	1.0	Advantage
7	Ughelli South	213579	275517	3	0.23	Disadvantage
8	Uvwie	191472	246999	31	2.59	Advantage
	Total	1575741	2032707	98		

Source: Fieldwork (2014)

Table 2 shows the location quotient of hospitals in Delta Central Senatorial District. Ughelli South has an index of 0.23, and this implies that it is marginally disadvantaged in the provision of health facilities in the region, and the population will find it difficult to effectively use the available hospitals with lowest location index. Ethiope West, Ethiope East, and Okpe also have values below 1.0; it indicates that the regions are marginally disadvantaged in the distribution of hospitals in the region.

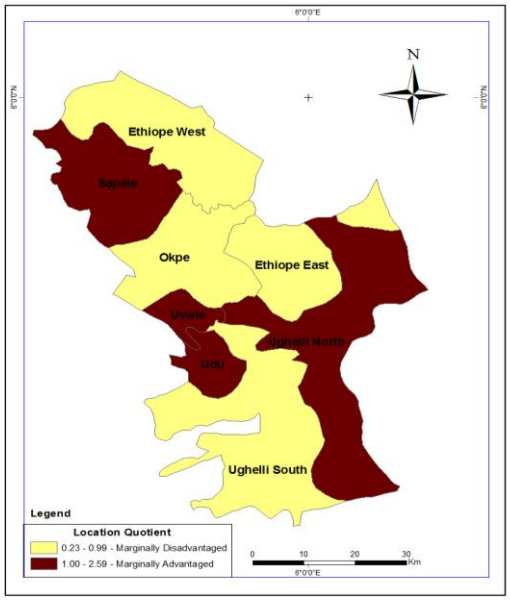

Figure 6. Location Quotient of Hospitals in Delta Central Senatorial District (Source: Field Work, 2014)

The Local Government Areas (LGAs): Sapele, Udu, Ughelli North and Uvwie have a value of 1.0 or greater than 1.0, which signifies that they are marginally advantaged in the location of hospitals in the region. Uvwie however has the highest location quotient using Fig 6 in the region with a value of 2.59. This value thus denotes

that there is more provision of hospital, and the threshold population will have more access to health facilities. The table also reveals that Ethiope East, Ethiope West, Okpe and Ughelli South whose value is less than 1.0 is marginally disadvantaged in the provision of health facilities in the region, and the population will find it difficult to effectively use the available hospitals. From the study, the variations in the spatial concentration of the hospital distribution reveal that Udu, Ughelli North, Sapele and Uvwie have fairly enough health facilities that will be able to serve the available population in the areas. Thus, Ethiope East, Ethiope West, Okpe and Ughelli South LGAs have few health facilities that would be able to cater for the available population. The figure below shows the location quotient of the area.

3.1.4. Pearson product moment correlation coefficient

The Pearson Product Moment Correlation Coefficient was used to determine the relationship between the hospital distribution and the General practitioners (Doctors and nurses). The equation is:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \times \sqrt{n\sum y^2 - (\sum y)^2}} \quad \text{- - Equation (1)}$$

Where:

r = Pearson Product Moment Correlation Coefficient

n = Number of observation

x = Sample of x

y = Sample of y

Since 0.999>0.787 we therefore reject the H_0 which states that 'there is no significant relationship between the hospital distribution and the health workers'. The alternative hypothesis that 'there is significant relationship between the hospital distribution and the health workers is accepted. This means that the distribution of the hospitals has some significant relationship with the Health workers in Delta Central Senatorial District.

This suggests that the relationship between the distribution of hospitals and the health workers is 99.9% strong and can be explained that the distribution of the health workers is determined by the availability of the hospitals, living about 0.1% to other factors that may influence the distribution of the hospitals in the region.

4. Spatial distribution of the public and private hospitals in delta central senatorial district

GIS is integrated for the spatial analysis of the hospitals being studied in this research. It is used to capture the location of the various hospitals visited, as well as for the creation of maps used for this study, analysing of the geographical data and the displaying of the data in visual presentation. The figure 7 shows the distribution of the hospitals in Delta Central Senatorial District.

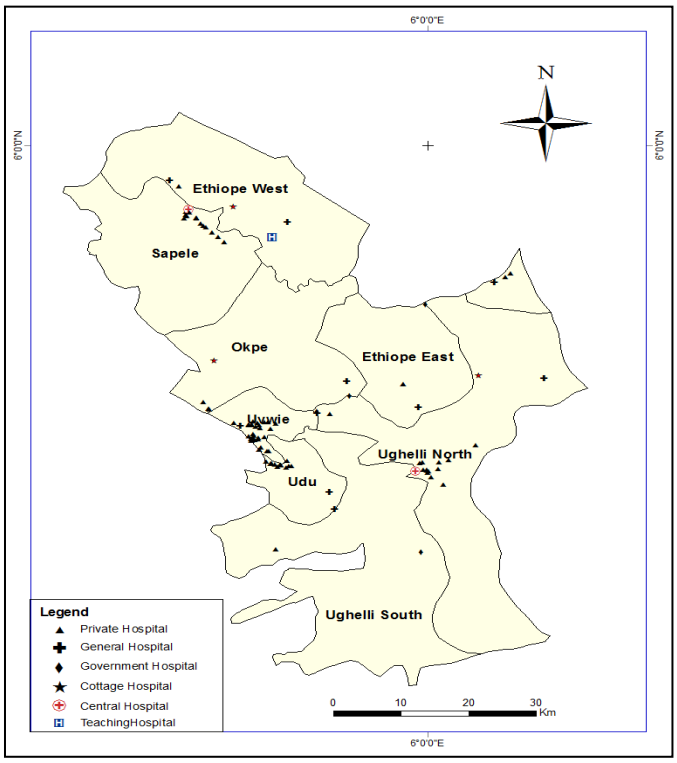

Figure 7. Spatial Distribution of Public and Private Hospitals in Delta Central Senatorial District (Source: Field Work, 2014)

The map shown in figure 7 shows the spatial distribution of Hospitals in the Delta Central Senatorial District. The map shows that large concentration of Hospitals in Uvwie LGA. There is only one public hospital and over 30 private hospitals. It is clear that more patients will be found clustered in the Public hospital as it is believed that public health facilities are cost effective for low income earners. Ughelli North has more hospitals situated in Ughelli town, the headquarters of the LGA. This also is the case of Sapele. The other local government areas have most of their hospitals located in areas where there are enough population to use them.

5. Findings

This study examined the capabilities of GIS in mapping and assessing the accessibility of Public and private hospital in Delta Central Senatorial District. The results of the study indicate that:

1- the observed spatial arrangement of hospital location in the region is extremely clustered, since the RN value of 0.05 is between 0.1-0.2. This suggests that, the pattern of the spatial distribution of the hospitals is not a random pattern, and indicates that the setting up of Health Institutes in the region are distributed by a deliberate decision of Health providers to reach the potential threshold population that seeks Health services.

2- 'there is significant relationship between the hospital distribution and the types of Health workers (Doctors and Nurses). It however connotes that the hospitals have some significant relationship

with the distribution of health workers in Delta Central Senatorial District. It suggests a strong relationship between the distribution of hospitals and the health workers (99.9%) and the distribution of hospitals determine the types of health workers distributed in the region.

3- the Location Quotient makes disparities between the areas which are marginally advantaged and marginally disadvantage in the location of hospitals in the region. Sapele, Udu and Uvwie are marginally advantaged in the location of hospitals. This value thus denotes that there is more provision of hospital, and the threshold population will have more access to health facilities. The Location Quotient of Ethiope East, Ethiope West, Okpe and Ughelli South whose value is less than 1.0 are marginally disadvantaged in the provision of health facilities in the region, and the population will find it difficult to effectively use the available hospitals.

4- a large number of the patients responded that they are satisfied with the services provided by the health care providers.

6. Conclusion

In this study, the researchers encountered some challenges especially during data collection and analysis. Some of the limitations to the study are high cost of GIS software and hardware; Poor power supply also slowed down the work in the course of this study, since electricity is an essential tool for GIS operation; high technical difficulties; problem of locating the health facilities; and generating data from the respondents, and health providers. Most health providers are reluctant to share information for the research.

In the course of the study, the health facilities were mapped using the GPS. It was observed that the pattern of distribution of the hospitals is clustered. The location quotient reveals that more Hospitals are situated in places with larger population, thus indicating that the setting up of health institution in the region is a deliberate decision of Health care providers to reach the potential threshold population that seeks the health services. Finally, it must be stated that for effective health care delivery system, there should be improved efficiency in the use of GIS in health care system in the region.

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APPENDIX 1

ACCESSIBILITY INDEX OF HOSPITALS IN DELTA CENTRAL SENATORIAL DISTRICT

S/N	LOCAL GOVERNMENT AREA	POPULATION (YEAR 2006)	ESTIMATED POPULATION (YEAR 2014)	HOSPITALS	POPULATION/HOSPITALS (P/H)	DOCTORS	POPULATION/DOCTORS (P/D)	NURSES	POPULATION/NURSES (P/N)	BED COMPLEMENT	POPULATION/' 0B' 0ED (P/B)	AMBULANCE	POPULATION/AMBULANCE (P/A)

1	Ethiope East	200792	259022	6	43170	17	15237	86	3012	244	1062	2	129511
2	Ethiope West	203592	262634	4	65659	5	52527	28	9380	91	2886	2	131317
3	Okpe	130029	167737	6	27956	7	23962	43	3901	90	1864	1	167737
4	Sapele	171888	221736	16	13859	35	6335	202	1098	351	632	11	20158
5	Udu	143361	184936	12	15411	21	8807	132	1401	182	1016	4	16812
6	Ughelli North	321028	414126	19	20706	44	9412	271	1528	482	859	16	25883
7	Ughelli South	213579	275517	3	91839	4	68879	16	17220	68	4051	1	275517
8	Uvwie	191472	246999	31	7968	72	3431	413	598	560	441	16	15438
	TOTAL	1575741	2032707	98									

Source: Field Work (2014)