Locational Analysis of Primary Health Facilities in Ikorodu Local Government Area of Lagos State using Multimedia GIS Approach

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ABSTRACT

Health care services deal with diagnosis and treatment of disease or the promotion, maintenance and restoration of health. The locational analysis of Primary Health Centres in Ikorodu Local Government Area of Lagos State was examined using Multimedia GIS approach. The study adopted GIS and Remote Sensing methods to look into the locations of these Primary Health care centres spread across the local government area. Geospatial database of the facilities was designed and created from where analyses were performed. Primary and secondary data types were used. The primary data are the X,Y coordinates of the Primary Health Centres while the secondary data were the administrative maps of the study area. The analyses included spatial queries, attributes queries and hyperlink that involved linking the spatial data with the pictures and audio files in the database done with ArcGIS 10.3. The spatial query showed that 5 wards have no PHC, 10 wards have 1 each, 5 wards have 2 each and 1 ward has three PHCs. The attribute query showed that 9 PHCs are located via good roads, 8 via fair roads and 6 via bad roads. Linking the picture and audio files were possible by using field-based hyperlinks and defining a dynamic hyperlink using the Identify tool. The aim and objectives of the study were achieved and recommendations were made in line with the findings. The wards without PHCs should be given urgent attention or mobile clinics brought to the people in these wards; the roads should also be given the attention it needed and finally the research results should be looked into and used as policy document by the Lagos State Health Management Board in particular and Lagos State Government in general.

Keywords: Locational, Health, Facilities, GIS and Multimedia

1.0 Introduction

World Health Organization (WHO) described primary health care as a philosophy, a level of care and a set of services to achieve health for all based on the five pillars. The five pillars are Universality, Quality, Equity, Efficiency and Sustainability.

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Health care services deal with diagnosis and treatment of disease or the promotion, maintenance and restoration of health. Primary health care became a core policy of World Health Organization with the declaration of Alma-Ata on primary health care in 1978 and the subsequent development of the global strategy for the commitment to global improvements in health, especially for the most disadvantaged populations [1].

In terms of level of care, primary health care is the first point of contact for service users within an organized health care system. This point of contact may be at the level of the health centre, the polyclinic or hospital ambulatory care. The health system based on primary health care focuses on improving the overall health of the population rather than just the treatment of disease. The original eight primary health care elements considered essential were immunization, health education, nutrition, safe water and basic sanitation, maternal and child health care including family planning, prevention and control of

locally endemic diseases, appropriate treatment of common diseases and injuries and provision of essential drugs. Nowadays different names are given to the concept of primary health care, such as basic benefit package, core package, essential core services. These terms are mainly used because they reflect an emphasis on cost of services or health insurance premiums [1].

The provision of health care centres in Nigeria has been the responsibility of the three tiers of government and the system is referred to as tertiary, secondary and primary health care for the federal, state and local governments respectively. Federal government is responsible for the coordination of university teaching hospitals, medical centres while state government coordinates general hospital and the local government focuses on dispensaries which are regulated by the federal government [2].

World Health Organization believes in making health care available and accessible for all and accessibility to health care facilities is a major indicator of development. However, the locational pattern of medical facilities can determine the level of utility and their spatial distribution can also be determined. The closer a health facility is to the people, the greater is its utility and benefits and this can also be connected to how they are distributed over Ikorodu Local Government Area of Lagos State. The provision of quality health care services in some areas in developing countries is a big challenge including Ikorodu Local Government Area and explicit considerations are not given to the need for equity in the planning and spatial distribution of health care facilities. Hence, the aim of the study is to apply Multimedia GIS in the Locational analysis of Primary Health Facilities in Ikorodu Local Government Area of Lagos State. The following sets of objectives were followed to achieve the aim of the study:

i.   To acquire and process primary and secondary datasets within the study area;
ii.   To perform spatial and attribute queries to show the locational distribution of the Primary Health Centres in the study area; and
iii.   To create a Health facility database for spatial analyses.

[3] while working on the accessibility of vital registrations in Ikorodu Local Government Area of Lagos State observed that service area of the facilities, distance from various villages and towns to the registration centers and adequate information to the people where these registration centers are located are key to a successful location of facilities in an area.

Ikorodu Local Government Area of Lagos State is bounded in the South by the lagoon; it shares common boundary with Ogun State in the north and also a common boundary in the east with Agbowa-Ikosi, a town in Epe division of Lagos State. It lies between latitudes 06° 37′ 28.50′′ N and 06° 37′ 40.05′′ N and longitudes 03° 33′ 33.94′′ E and 03° 33′ 51.90′′ E. The local government area has a land mass of about 345 kilometre square. This is shown in Figure 1.
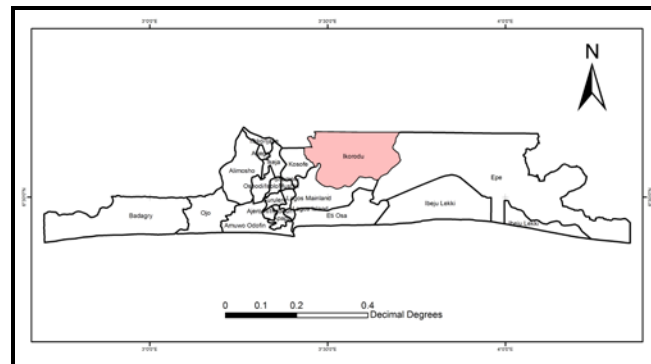

Fig. 1. Map of Lagos State showing the Study Area (Ikorodu LGA)
(Source: Zonal Office of Surveyor-General, Ikorodu, Lagos State)

The main industries in the town are trading, farming and manufacturing. Nearby major towns include Imota, Ijede, Igbogbo and Bayeku, all of which constitute their own Local Council Development Area with their own traditional rulers (Obas). Ikorodu is the fastest growing exurb near the Lagos metropolis, owing in part to the influx of people from Ikorodu surrounding towns and villages attracted by the town's proximity to Lagos. At the 2006 census according to [4], the population was 527,917 comprising of 268463 males and 259454 females. The last known population projection as at 2015 is 706,100. This was 0.388% of total Nigeria population. If population growth rate would be same as in period 2006 - 2015 (+8.84%/year), Ikorodu LGA population in 2017 would be 836,510. Lagos State Polytechnic, Ikorodu owned and run by the Lagos State Government and Caleb University, a private university are located in Ikorodu Local Government Area. It is made up of 21 political wards (Figure 2).
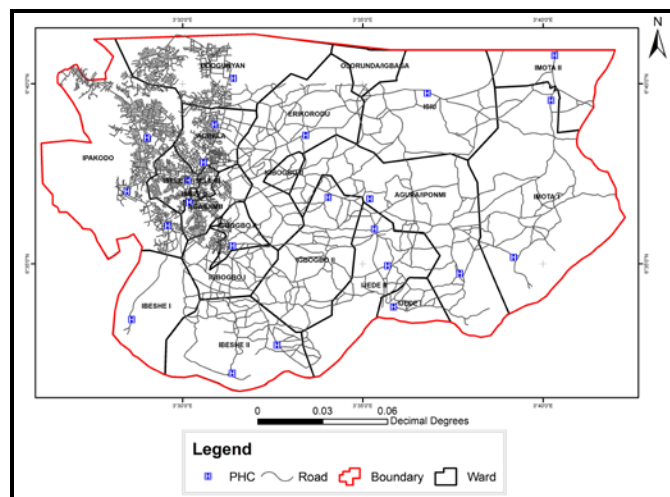
Fig. 2. Map of Ikorodu LGA showing the political wards

2.0 Materials and Methods
2.1 Materials

The materials acquired for the successful conduct of this work were both from primary and secondary sources. The primary data were sourced from the field directly by the authors. The data are the locations of the Primary Health Centres scattered across the local government area. It was done by using Etrex GPS with an accuracy level of 3m. The secondary data were sourced from statutory organisations in Lagos State. The administrative map of Lagos State in analogue format, the imagery of the Local Government were from the Zonal Office of the Surveyor-General of the State, Ikorodu Office.

2.2 Methods

The design of a geospatial database was carried out and database of the Primary Health facilities created. The analogue map provided was scanned using A3 size scanner and the scanned image was imported into ArcGIS 10.3 where it was georeferenced; and the boundary, wards and the linking roads digitized. The Primary Health Centres coordinates were entered into Microsoft Excel. The excel sheet was added into the ArcGIS 10.3 as X,Y data and was subsequently converted into a shapefile so that it can be processed in the implementation software with the other data from other sources. This is one of the advantages of GIS over other Information Systems like Management Information Systems (MIS) because of the ability of GIS to link geospatial data with attribute data. This is buttressed by [5] when they submitted that the theoretical framework in GIS is not software dependent but the transformation of geospatial data into spatial information. The transformation should follow the Cartographic principles of relationships between spatial data and maps. [5] argued that regardless of the definitional scope, GIS have the distinct capability of providing users with functions that facilitate spatial analysis. This capability makes GIS different from other map-drawing systems, even though both share some similar functions, such as displaying spatial maps. On the other hand, MIS and GIS are similar in their functionality of storing, analyzing, and retrieving attribute data. However, only GIS have the analytical functionalities that use both the spatial and attribute data. Hence, GIS could provide distinct tools for making spatial decisions, not found in other support systems [5].

3.0 Analyses Performed

3.1 Spatial query

The spatial query performed is to show the locational distribution of the Primary Health Centres within Ikorodu Local Government Area of Lagos State. The query issued was to extract from the database those wards in the study area without Primary Health Centre. The syntax is given as

SELECT * FROM 'Ward' WHERE 'No of PHC' = 0. The search returned 5 wards.
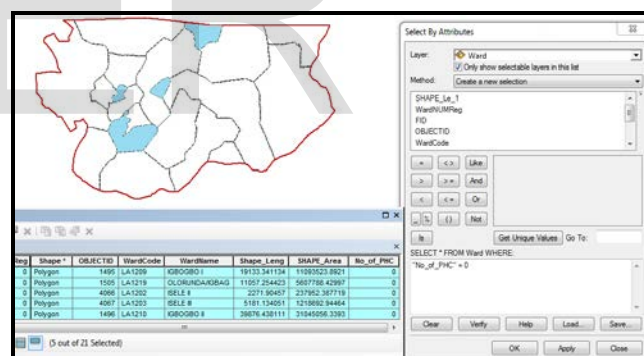

Fig. 3. Query showing Wards without any Primary Health Centre

Figure 3 shows that 5 out of the 21 wards have no Primary Health Centres. The wards are Igbogbo I, Igbogbo II, Olorunda/ Igbaga, Isele II and Isele III. It revealed that wards existed without Primary Health Centres which is an indication of unequal distribution across the study area. The formatted map is shown in Figure 4. The wards without any PHC are shown in the map.
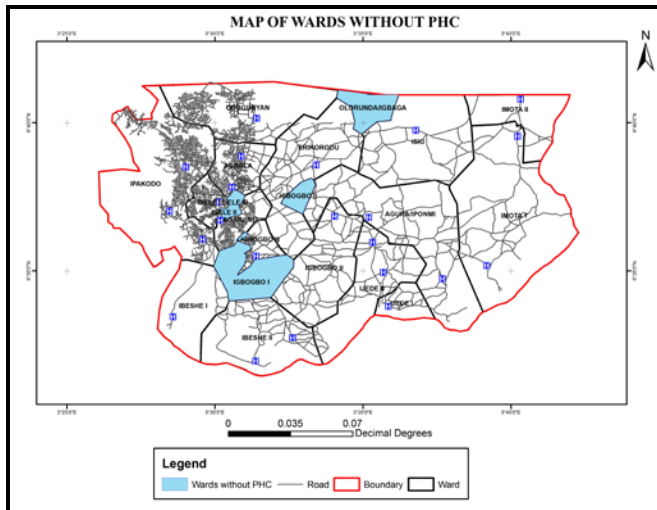
Fig. 4. Map showing Wards without any Primary Health Centre

The summary of the distribution of the PHCs is shown in Table 1. The table shows the number of PHCs in the wards, the number of wards that fall in each of the categories and the names of the wards in Ikorodu Local Government Area of Lagos State which clearly shows uneven distribution in the locations of the PHCs.

Table 1. PHCs allocations to the Wards in the Study Area

S/N	Number of PHCs in a Ward	Number of Wards	Names of the Wards
1	0	5	Igbogbo I, Igbogbo II, Olorunda/ Igbaga, Isele II and Isele III
2	1	10	Aga/Ijimu, Erikorodu, Ibeshe I, Igbogbo I, Igbogbo II, Ijede I, Imota II, Isele I, Isiu and Odogunyan.
3	2	5	Ijede II, Agbala, Imota I, Ibeshe II and Agura / Iponmi
4	3	1	Ipakodo

3.2 Attribute query

This query was based on the conditions of the roads that lead to the Primary Health Centres in Ikorodu Local Government area. The conditions are categorised into Good, Fair and Bad considering the ease of passage on those roads.

3.2.1 Primary Health Centres served by Good Roads

Figure 5 shows that 9 out of the 23 Primary Health Centres in the study area are accessed by good roads. This is about 39.13% of the total number of Primary Health Centres in the study area. The Health Centres are Addis Ababa PHC, Ita Elewa PHC, Ijede PHC, Agbala PHC, Oke Eletu PHC,

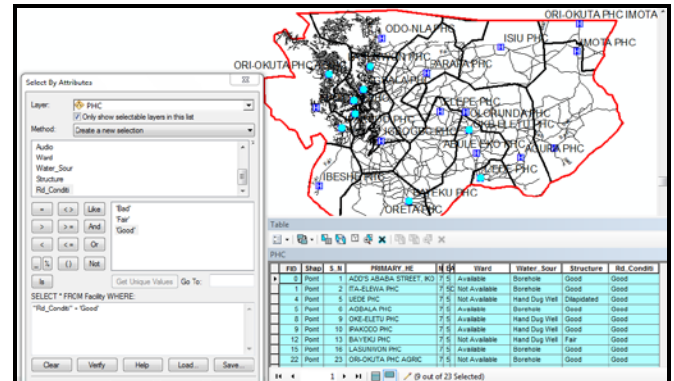Ipakodo PHC, Bayeku PHC, Lasunwon PHC and Ori-Okuta Agric PHC.

Fig. 5. Diagram of PHCs served by good roads

3.2.2 Primary Health Centres served by Fair Roads

Figure 6 shows that 8 out of the 23 Primary Health Centres in the study area are accessed by roads that are in fair condition. This is about 34.78% of the total number of Primary Health Centres in the study area. The Health Centres are Elepe PHC, Igbogbo PHC, Ibeshe PHC, Majidun PHC, Parafa PHC, Olorunda PHC, Imota PHC and Ori-Okuta Imota PHC.
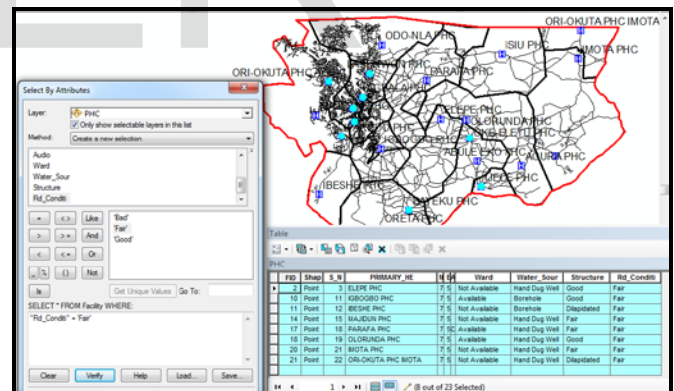

Fig. 6. Diagram of PHCs served by fair roads

3.2.3 Primary Health Centres served by Bad Roads

Figure 7 showed that 6 out of the 23 Primary Health Centres in the study area are accessed by roads that are in bad condition. This is about 26.09% of the total number of Primary Health Centres in the study area. The Health Centres are Igbalu PHC, Agura PHC, Abule Eko PHC, Oreta PHC, Odo-Nla PHC and Isiu PHC. Table 2 shows the summary of the number of PHCs according to the roads' conditions that are used to access them.
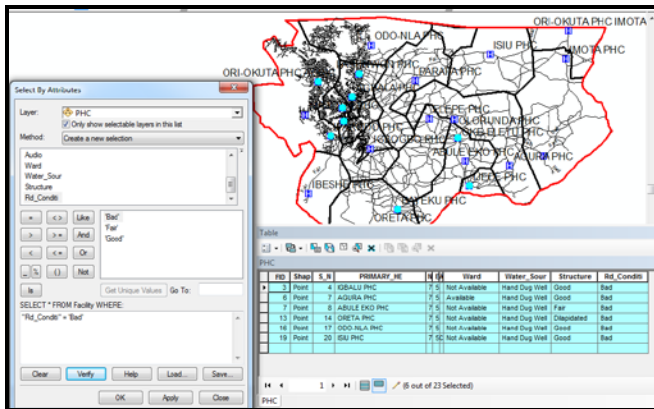
Fig. 7. Diagram of PHCs served by bad roads

Table 2. Table showing PHCs served by different road conditions

S/N	Road Condition	Number of Primary Health Centres	Percentage of Total
1	Good	9	39.13
2	Fair	8	34.78
3	Bad	6	26.09
	Total	**23**	**100**

3.3   Hyperlink

Hyperlinks allow you to access documents or web pages related to features. These hyperlinks can be accessed for each feature using the Hyperlink tool on the Tools toolbar. Hyperlinks have to be defined before you use the Hyperlink tool, and they can be one of three types: Document, URL or Script. You can define a hyperlink for the features in a layer either by using field-based hyperlinks or defining a dynamic hyperlink using the Identify tool [6]. Document type of hyperlink was used and Field-based hyperlink was adopted for this study because one of the fields in the database was used to store the storage path of the file to be used in the hyperlink.

3.3.1   Hyperlink (Picture File)

This section describes how to set and use hyperlink properties for a map layer. Isiu PHC picture was taken and hyperlinked to the locational data in the software (Figure 8). The figure demonstrates how Isiu PHC picture was linked to the database created using field-based method. The hyperlink tool is picked on the tools bar of

ArcGIS 10.3; it is then used to touch the location of the health centre in the data view to pop up the image of the facility.
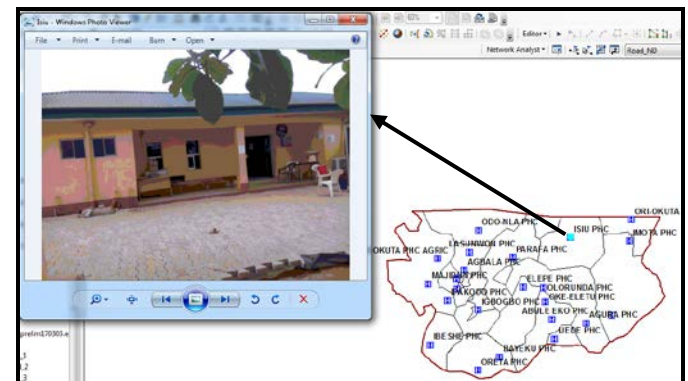

Fig. 8. Hyperlink of Isiu PHC picture using field-based method

The other way of using the hyperlink is to insert the picture through a path set from the Insert menu of the software (ArcGIS 10.3) used for the study as shown in Figure 9 which brought the whole picture into the data view. This gives a better view but will not display any other information in the data view.
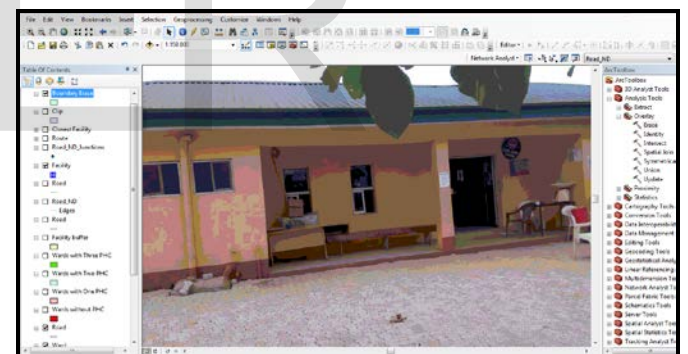

Fig. 9. Hyperlink of Isiu PHC picture using insert menu method

3.3.2   Hyperlink (Audio File)

Figure 10 shows an audio file hyperlinked with the database displaying an audio interface and when the PHC is picked with the hyperlink tool, it automatically plays the audio recorded and linked it with the particular PHC in the database. The audio file about the attributes of the PHC was recorded by the author as voluntereed by the Head of the facility. Figure 10 shows the capability of Hyperlink to accept an audio file. Audio recording of information about Ita Elewa was gotten from the health centre and attached with the database using the field-

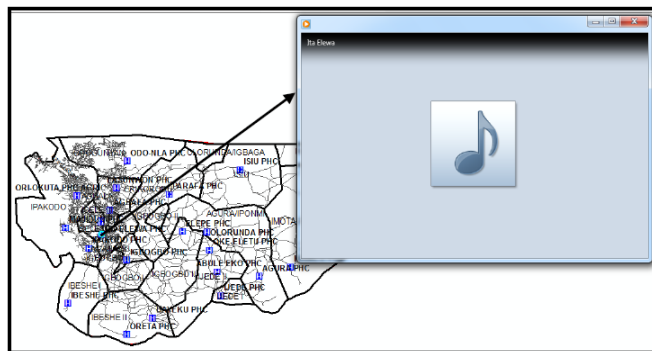based method. It is not possible with the Insert Menu Method because it cannot work with an audio file.

Fig. 10. Hyperlink of Ita Elewa PHC audio file using field-based method

4.0   Conclusion

Geographic Information System, Remote Sensing and other related technologies adopted for this study have proven beyond reasonable doubt that geospatial problems can be solved using these technologies. Having acquired geospatial and attribute data, designed and created a geospatial database for the Primary Health facilities in Ikorodu Local Government Area of Lagos State, the ability of the digital database to analyze geographic data and geo-visualization of information were demonstrated, and hence, the set aim and objectives of this study were achieved.

5.0   Recommendations

With the various stages of the study and experiences during the study, the following are recommended:

1. The Lagos State Health Management Board should give the 5 wards without Primary Health Centres in the study area urgent attention. They are Igbogbo I, Igbogbo II, Olorunda/ Igbaga, Isele II and Isele III. Lagos State Health Management Board can as a matter of urgency put in place new health facilities or mobile clinics to cater for the health needs of the people in those areas.

2. The conditions of the roads in the study area calls for urgent attention. This is because emergency situations may arise and when the roads connecting the users to the facilities are in bad shape, lives can be lost in traffic when there is gridlock on the roads. The ones that are

in good condition should be monitored and properly maintained so that they do not degenerate into bad conditions.

3. Finally, the research should serve as a Decision Support System for the Lagos State Health Management Board for the management of health facilities in Ikorodu Local Government Area in particular and Lagos State in general.

References

[1]   World Health Organization (2003). Primary Health Care: 25 Years after Alma-Ata. Technical paper prepared by Regional Committee for the Easter Mediterranean.

[2]   Abbas I. I., Auta S. Z. & Na'iya, M. (2012). Health Care Facilities Mapping and Database Creation Using GIS in Chikun Local Government, Kaduna State, Nigeria. *Global Journal of Human Social Science, Geography & Environmental Geosciences*. **12** (10)

[3]   Oloyede-Kosoko, S.O.A; Amusa, I.A; Adetimirin, O.I; Imuwahen Priscilla & Adeola, E.F.**:** Vital Registration of Births and Deaths in Ikorodu Local Government Area of Lagos State. *World Scientific News*. **31** (2016), 47-70

[4]   National Population Commission (NPC) Data (2006). Population Commission Office, Minna Office, Police Headquarters, Federal Secretariat, Dutsen Kura, Minna

[5]   Jarupathirun, S. & F. M. Zahedi (2001). A Theoretical Framework for GIS-based Spatial Decision Support Systems: Utilization and Performance Evaluation. Proceedings from *Seventh Americas Conference on Information Systems*. Accessed on 29 April, 2018 from http://aisel.aisnet.org/amcis2001.

[6]   Environmental Systems Research Institute (2016). ArcGIS 10.3 Instruction Manual.