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Development Of A Geospatial Database Of Public Healthcare Facilities In Uruan Local Government Area Of Akwa Ibom State, Nigeria

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Abstract

Health represents one of the most basic human needs and has no doubt a profound impact on the welfare and productivity of the individuals, hence attempt was made by three ties of government to provide adequate health facilities particularly at the grass root to meet the aspiration of the general public. This study aimed at developing a geospatial database of Public Healthcare facilities in Uruan Local Government Area of Akwa Ibom State, with a view to ensure effective utilization and qualitative planning and decision support system in the area. The objectives included: acquiring primary and secondary dataset of the study area, to create a Geographic Information System (GIS) database of Public Healthcare facilities in the area; developing spatial and attribute queries to aid the Geospatial mapping of healthcare facilities; and developing a Geospatial map of Public Healthcare facilities in the study area. The methodology applied included: collection of data of all criteria associated with developing a Geospatial map of Public Healthcare facilities and the production of the final evaluation map. Data was collected through ground visits and via downloads through earth explorer. The Data choice was guided by the literature review conducted using GIS processes. The result of the study shows that only one secondary health facility is located in the area which is not able to serve her teeming population. The study recommends building of more secondary health facilities in the area, a geospatial upgrading of facilities in health centers and updating of the available information.

Key Words— ***Development, Geospatial, Database, Healthcare, Remote Sensing.***

1.0 INTRODUCTION

1.1 Background to the Study

A healthcare facility is an establishment or location where health services are provided, encompassing a wide range of settings from clinics and hospitals to specialized health centres. These facilities play a crucial role in delivering medical care, including emergency, routine and specialized services, and their availability and quality are often indicators of a region's health and wellbeing. Olubadewo-Joshua and Ugom (2018) has noted that access to health care is an important component of an overall health system and a major indicator of growth, and that Health care planning and Geographic Information System (GIS) are two relevant fields that depend upon spatial data. Health facilities is made up of all public, private, non-governmental and community-based health facilities in which general health services are provided.

Healthcare is a significant indicator of social development and access to the health facility is an important component in the overall healthcare system which has a direct impact on the burden of disease that encumbers health conditions in many developing countries (Islam and Aktar, 2011). The spatial distribution of health facilities is of paramount importance to urban and regional planners as well as the government. The inequitable distribution of these healthcare facilities over human settlement is of concern. This has given rise to the issue of provision and effective utilization of the facilities. According to Olubadewo-Joshua and Ugom (2018), access to health care is an important component of an overall health system which has a direct impact on the burden of diseases that affect many countries in the developing world. In investigating the level of provision of central facilities (like healthcare), emphasis has shifted from mere provision to the degree of accessibility of people to these facilities.

However, the provision of adequate and equitable basic health care facilities is becoming increasingly difficult due to rapid population growth, rising poverty levels and lack of available resources, and thus needs government effort for improvement (Tope and Akintoye, 2024). Bello and Dogara (2025), has observed that in Nigeria, public policy on healthcare provision over the years addresses the distribution and spatial equity question mainly at the regional level while neglecting the distribution of such facilities within a given Local Government Area (LGA). On the contrary, Shaba *et al* (2023), has a different view with the opinion that because Nigeria operates a mixed economy, private providers of medical health care have a visible role to play in health care delivery, where the federal government's role is mostly limited to coordinating the affairs of the university teaching hospitals, federal medical centres (tertiary health care) while the state government manages the various general hospitals (secondary health care) and the Local Government focuses on dispensaries (primary health care) which are regulated by the federal government.

According to Macharia *et al* (2025), adequate healthcare service provision, planning and management is a function of the geolocated up-to-date and comprehensive health facility database available to fully meet a population's healthcare needs. Tope and Akintoye (2024) has also pointed out that the progress in GIS and increased awareness about it has provided numerous opportunities for health care administrators and government at all levels to improve their monitoring and evaluation capabilities. Health facilities can be seen in qualitative and quantitative term. Thus, the quality of care and accessibility to health care delivery within a community can be weight by the quality of physical, technological and human resources available within the period. While the physical structure comprises the building and other fixed structures within the health care environments, the technological aspect deals with the available equipment specifically meant for hospital use.

The healthcare infrastructure in Uruan LGA varies widely, with a mix of government-operated and private health facilities. These include primary healthcare centers, maternity clinics, and a few specialty clinics. However, the distribution of these facilities may not adequately cover all communities, leading to accessibility issues for many residents, particularly those in more remote areas. They typically offer basic medical services, maternal and child healthcare, vaccination, and treatment for common ailments. However, there are significant challenges related to the quality of services provided, often due to shortages of medical supplies, inadequate facilities, and a lack of specialized medical personnel. The geographical layout of Uruan, combined with poor road infrastructure, poses significant challenges in accessing health facilities, especially during emergency situations and for routine health checks.

The local and state governments have initiated several projects to improve healthcare in Uruan LGA, such as upgrading facility infrastructure, providing training programs for medical staff, and

improving the supply chain for essential drugs and equipment. Additionally, there are efforts to incorporate more comprehensive data management systems to better track health trends and resource allocation.

Some indicators of healthcare need are being developed using Geographic Information System (GIS), which is also being used to map and investigate regional variations in the need for health services. GIS is a computerized information system and a tool for capturing, storing, accessing and manipulating, retrieving and applying of information that is spatially based.

GIS has the ability to acquire spatially referenced data from a variety of sources, change it into useful formats, storing it, retrieving and manipulating it for analysis, and generating the output required. Digital method of map production makes it easier to avoid mistakes and inaccuracies in handling results of measurements and for keeping records. Seghieri (2023), has rightly opined that GIS-based medical resource evaluation is a powerful tool that can be used to improve healthcare planning and decision making. By collecting and analyzing spatial data, healthcare providers can identify the best locations for healthcare facilities, track disease outbreaks, and allocate medical resources more effectively. In support of this, Jamal *et al* (2025) has pointed out that manual healthcare record management system cannot provide necessary support for healthcare growth, as it is operationally and financially expensive to manage health information using manual record management system due to inadequate security for data and information, exposed to unauthorized modification, inadequate access control to data and difficulties in data compilation using the manual operations.

According to Seghieri (2023), GIS-based medical resource evaluation has a wide range of applications in healthcare including; Healthcare facility location planning (where GIS can be used to identify the best locations for healthcare facilities based on factors such as population demographics, accessibility, and existing healthcare facilities. This can help healthcare providers to ensure that they are providing medical services in areas where they are most needed); Disease surveillance and outbreak management (where GIS can be used to track the spread of diseases and identify areas that are most affected. This can help healthcare providers to take proactive measures to prevent the spread of diseases and manage outbreaks effectively. GIS can also be used for emergency response planning); Identification of areas that are most vulnerable to emergencies such as natural disasters or pandemics (which can help healthcare providers to allocate medical resources effectively and respond quickly to emergencies); and Resource allocation (where GIS can be used to identify areas where medical resources are most needed and allocate resources accordingly, which can help healthcare providers to ensure that medical resources are being used effectively and efficiently).

1.2 Statement of Problem

Healthcare system in Uruan Local Government Area of Akwa Ibom state is faced with increasing diverse and complex problem; rapidly growing population, outbreak of epidemics, severe resources constraint and pressure on available infrastructure, types of healthcare services available and location of the various healthcare facilities among others.

The locations of healthcare facilities should be such that the general public can easily access them. But this is not so in the area. The government is in charge of allocating public health facilities; the finest has an impact on how they are distributed spatially. To optimize their use, closeness to the population and ability to meet all of the needs of Uruan residents, a map of the distribution of the current healthcare facilities in the Uruan area council is required.

Health systems with poor planning, management, and location will have high mortality rates and a shortage of human resources. Even the sick finds it challenging to locate hospitals in much of the Uruan Areas Council due to the dispersion of small settlements around the council. There are no map showing the distribution of public healthcare facilities and database showing the services offered at each facility and necessary data that can be used in decision making by the authority concerned.

1.3 Aim and Objectives of the Study

The aim of the study is to develop Geospatial database of Public Healthcare facilities in Uruan Local Government Area of Akwa Ibom State, Nigeria to help in the planning of healthcare delivery. This was achieved through the following objective; Assessing the spatial distribution and pattern of health facilities in the study area, conducting spatial query and accessibility to health facilities in Uruan Local Government Area, designing a spatial database system, determining the proximity from settlement to health facilities, and production of a digital map showing health facilities in the area.

2.0 THE STUDY AREA

The study area is Uruan Local Government Area which extends from latitude 40 52’ to 50 08' N of the equator and longitude 70 55' to 80 10’ E of the Greenwich Meridian. Uruan is located in the southern part of Nigeria and is a Local Government Area of Akwa Ibom State.



Figure 2.1: Map of Uruan Local Govt. Area

It is bounded on the East by Odukpani Local Government Area in Cross River State, on the South by Okobo Local Government Area, on the West by Nsit Atai and IbesikpoAsutan Local Government Areas and on the North by Itu Local Government Area. Uruan Local Government Area was created in 1988 from the Uyo Local Government Area. It covers an approximate land mass of 449 km^2.

The Capital City of Uruan Local Government is Idu (The area lies in the rain forest belt with extensive arable land and the region abounds with the wildlife, raffia palm and timber). The rich coastal plains support the cultivation of crops such as cassava and maize. Uruan people speak the Uruan language. (dbpedia.org).

As of the 2006 census, the population of Uruan LGA was recorded to be 164,000 people. Since then, population estimates have varied, reflecting natural growth. Current estimates suggest a significantly higher population, accounting for natural growth over the years. The area is predominantly inhabited by the Ibibio ethnic group, who speak the Ibibio language.

Uruan enjoys a tropical climate with a significant amount of rainfall throughout the year, even in the driest months. The area experiences two major seasons yearly including the rainy (March to October) and the dry season (November to February).

The LGA is characterized by a lush green landscape typical of the tropical rainforest zone. This vegetation supports a variety of flora and fauna, making it rich in biodiversity. The fertile soil and abundant rainfall make the area ideal for agriculture, which is a major part of the local economy.

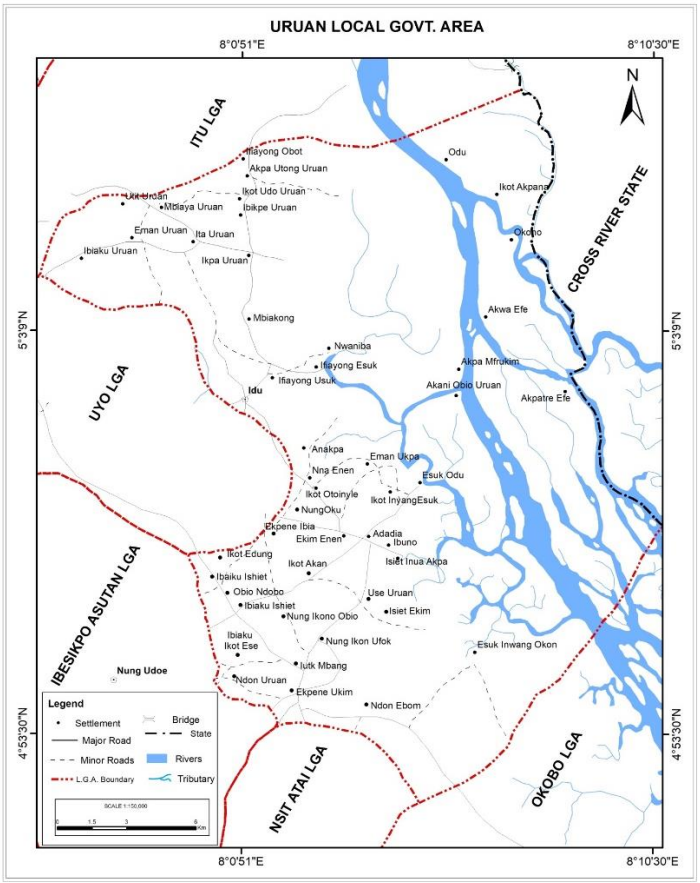


Figure 2.2: Map of Uruan showing the Neighbouring LGAs

Economically, Agriculture is the predominant economic activity in Uruan, with crops such as cassava, yams, and oil palm being widely cultivated. Fishing is also significant, due to the area's extensive water bodies. There are emerging opportunities in tourism, driven by the natural landscapes and cultural heritage of the local communities.

In terms of infrastructure, Uruan LGA is experiencing gradual development. There are educational institutions, healthcare facilities, and a road network that connects different parts of the LGA to Uyo and other neighboring areas. However, like many parts of rural Nigeria, there are ongoing needs for improved infrastructure and more comprehensive economic development to enhance the standard of living for residents. (dbpedia.org).

3.0 MATERIALS AND METHOD

This section describes the detailed data and step by step process that was adopted in achieving the set objective in this research. It also shows the data used and sources, processes, manipulation and analysis involved in this study.

Table 3.1: Data required and sources

S/N	Name	Type/ Format	Scale/ Resolution	Date	Source	Process
1	Administrative map of Uruan LGA	Analogue	1:50,000	1990	Office of the State Surveyor General, Uyo Akwa Ibom State	➢ Add to GIS ➢ Geo-reference ➢ Creation of Geodatabase ➢ Digitize ➢ Shape files
2	Points location coordinates using Survey123	Digital		Varies	Field Work in Study area	➢ Input to Excel ➢ Convert to Dbase Table ➢ Set spatial reference ➢ Convert to points map
3	list of Health Facilities	Analogue			Ministry of Health Akwa-Ibom, State.	➢ Identification of health facilities locations and addresses.
4	Google earth imagery	Digital		2024	Global Globe	➢ Spatial Overlay of GPS points ➢ Identify the facilities for rectification.
5	Road network map	Digital	1:50,000/	2022	Google earth	➢ To run road network analysis.

3.1 Data Processing

The primary data involved direct collection of information on the field, traffic counts, oral interview and GPS observations. The secondary data involves sourcing information from existing

records. Such data include images and street guide maps. The location data was acquired with the use of Survey123. A form was created in survey 123 software for the available types of health facilities such as health centre, Health post, Primary health centre, etc in Uruan Local Government Area. The program was chosen for this project due to its ability of holding large amount of data, smartness, accuracy and mobile friendly.

3.2 Data Processing

At the completion of field operations, the data collected were processed to produce the required information in the form specified. The processes include conversion of hard copy records into softcopy, data input, creation of database, georeferencing, digitizing and determination of secondary attributes from the primary ones collected from the field and data integration, etc.

3.3 Creation of the Spatial Database

Google Earth was acquired from Global Globe which the location of study falls at UTM Zone 32N. The shape file of the area was used to clip out the extent of the area from the image. Administrative map and Road Network of the study area was obtained from the office of the surveyor general, department of Geospatial Information System and Cartography, Akwa Ibom State. The map and image were imported to ArcGIS 10.8 for further processes, manipulation and analysis.

3.4 Georeferencing

Geo referencing involves assigning real world coordinates to a number of reference points on the Map. That is, establishing its location in terms of map projections or coordinate systems. The term is used both when establishing the relation between raster or vector images and coordinates, and when determining the spatial location of other geographical features. To establish the relationship between an image coordinate system and a map (x, y) coordinate system, the data has to be geo-referenced. The georeferencing was performed using four known ground control coordinates obtained at the map grid intersection. The root means square error obtained is 0.0003. A File geodatabase was later created in Arc Catalog for the storage of all the feature class such as road, facilities and junctions identified on the street guide map and the image.

3.5 Digitizing

Digitizing is the process of encoding the geographic features in digital form as x, y coordinates. It was carried out to create spatial data from existing data. Road network and Facilities were manually extracted using onscreen digitizing from Quick-bird Image using ArcGis 10.8 and it extension software. The attribute of the various roads and other features (name, address and type) were rendered into the system manually as the digitizing was in progress. The digitizing errors were corrected through topology rules.

3.6 Integration of Data

Survey123 form data was exported to Microsoft Excel file and data was added to the Arcmap drawing space and displayed by right clicking on the data table and selecting “display XY data”. The correct columns were selected for the X, Y and Z data and the correct coordinate system was selected before clicking “ok” on the “display XY data” dialogue box. To allow for query, the displayed point

events layer was exported to save it as a shapefile by right clicking on it, selecting Data and selecting export from the resulting menu. From the export data dialogue box the coordinate system and output feature class file path and name was set before clicking "ok" to save. The feature class was added to the layer's panel and displayed in the map view window. Labels were associated by right clicking on the feature class, selecting properties and clicking on the label tab on the layer properties dialogue box. The label field was changed to the owner's name field and "ok" was clicked on. Back on the layers panel, the feature class was right clicked on and label features selected to display the owner's name besides each point event. Shape files were created to hold the different types of high rise structures and the respective type of high rise structures were edited as polygons by drawing lines joining their footprints using the polygon construction tool in the create features panel. A name field was added to each of the attribute tables and the owner's name was typed into them. This field was used to label the features and regular map symbols were used to symbolize them replacing the polygons that were displayed on the screen.

3.7 Spatial Query and Accessibility to Health Facilities

i. Assembling of the data required to achieve this objective range from administrative map / information, popular places (such as schools, Market, Banks Churches etc), location of each health facility and street guide map.

ii. The data was used to analyze using both nearest neighbor analysis, spatial query and proximity analysis. ArcGIS environment was used to perform the mentioned analysis, as the Arcgis software is capable of performing complex analysis. Location, number of health facility in study area and the total area were used to determine the pattern of distribution in the study area using nearest neighbor index. Settlements, roads, facilities location, number of public health facilities were used to generate the result.

4.0 RESULTS AND DISCUSSION

The results of the study were presented in form of Maps and Tables. Thus, this section shows the maps and tables describing the outcome of the study.

4.1 Maps

The maps of Healthcare facilities produced as a result of this research are shown in Fig 4.1 and Fig. 4.2. The maps were created using ArcGIS 10.8 software.

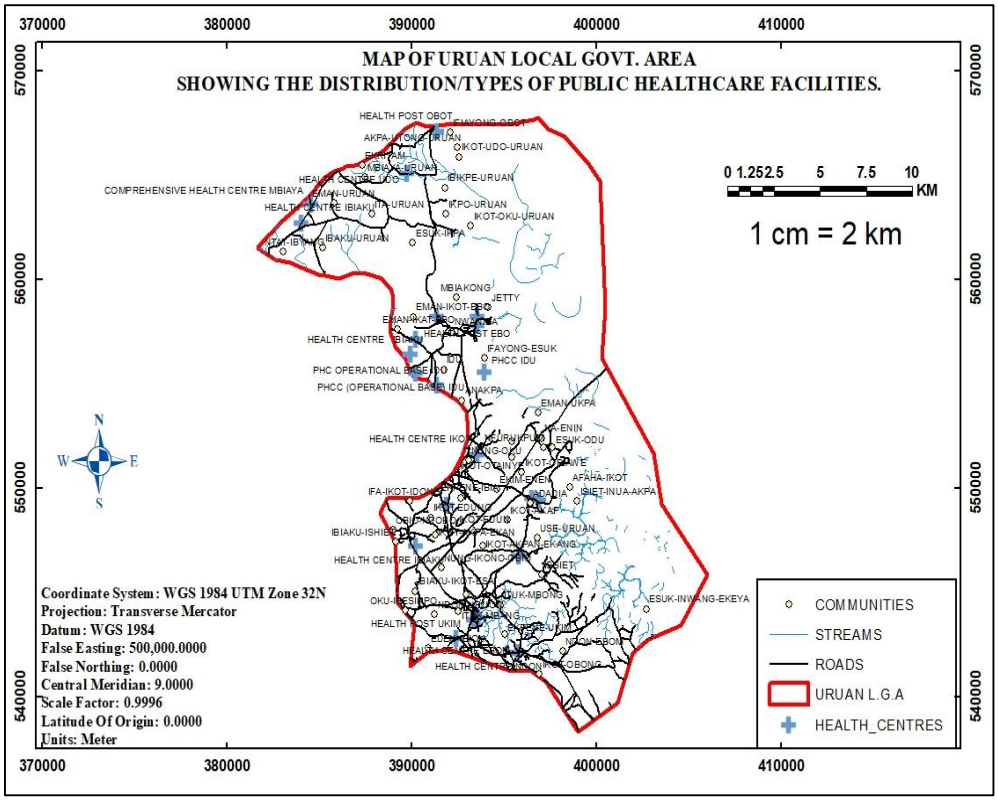


Figure 4.1: Map of Uruan LGA showing the distribution of Public Healthcare Facilities.

The figure. 4.1 shows a map of Uruan L.G.A. showing the distribution of public Healthcare facilities. It shows that there are twenty-Four (24) public healthcare facilities in the study area. It also shows that the public healthcare facilities are not evenly distributed in the study area.

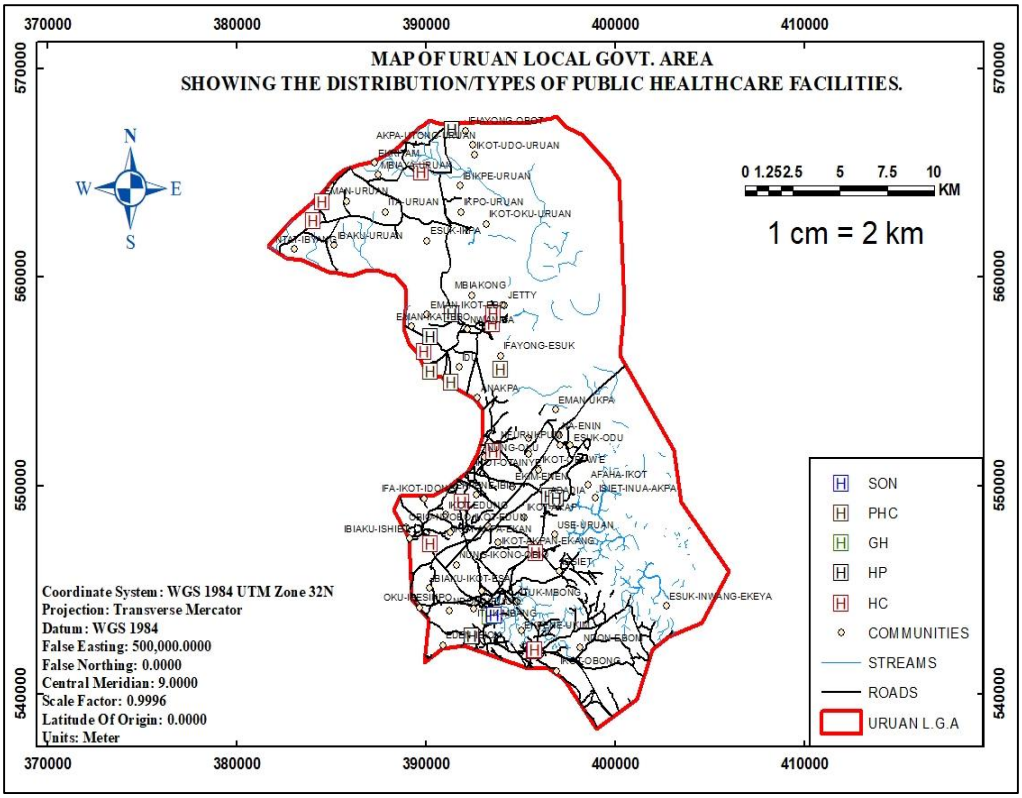


Figure 4.2: Map showing the Distribution/types of Public Healthcare Facilities in Urauan LGA

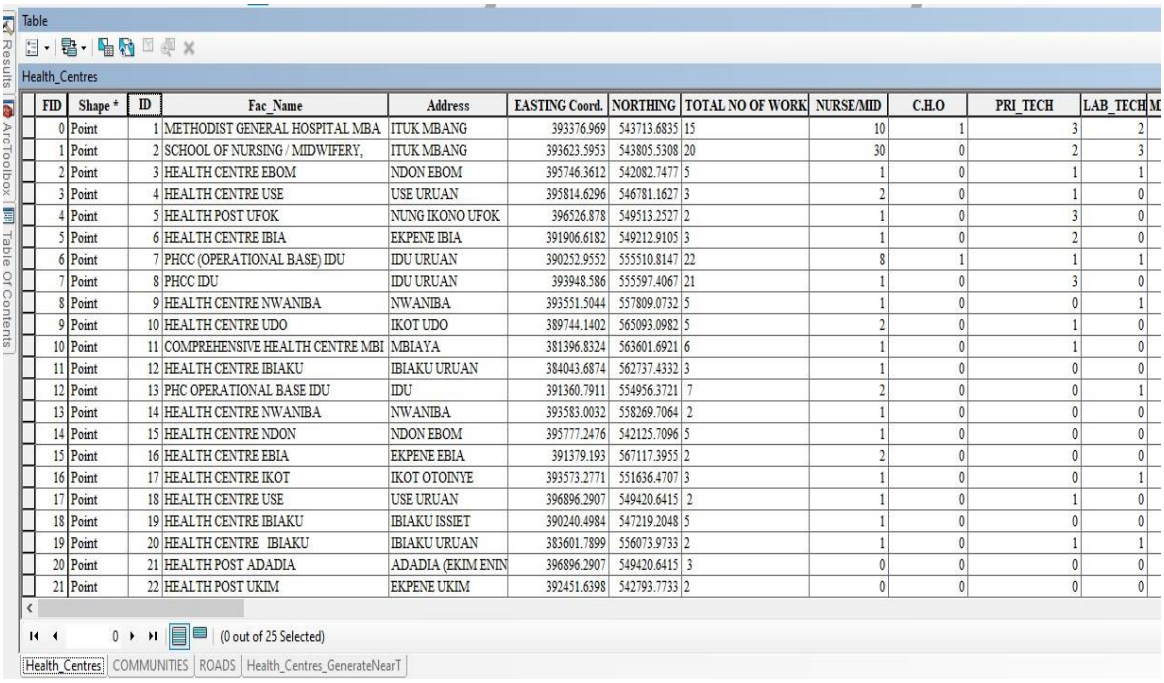
The figure 4.2 presents the map of Uruan L.G.A. showing the distribution/types of public Healthcare facilities. It shows that there are twenty-Four (24) public healthcare facilities; One (1) General Hospital (GH), One (1) School of Nursing (SON), Three (3) Primary health centers (PHC), Six (6) Health Post (HP), Thirteen (13) Health centers (HC) in the study area.

4.2 Tables

Tables were also generated using attribute information about each of the public health facility. These tables were linked to the geographic data in order to create the database. This process of populating the database with attributed information is called database implementation. This was done to ensure that the database can answer relational queries from multiple tables.

Fig. 4.3 shows the screen print of the attributes of public health care facilities in the study area (sheet 1). It shows the name, address, and coordinates of the twenty-four public healthcare facilities in the study area, Total number of workers, Nurse/Midwife, Community health officer, Primary Technician, Lab Technician.

Fig. 4.4 shows screen print of the attributes table of public health care facilities in the study area which include Medical Record Technician (MED_REC_TECH), Community Health External Worker (COMM_HE), Environmental Health officer/ Technician (ENVI_H. O), Health Educator (Health EDU), Health Services offered by each health facility (H_SERVICES), Type of Health facility (Type). Figure 4.5 on the other hand shows Screen Print of the attributes table of public health care facilities in the study area including type of Facility, Consultancy, Outpatient and Inpatient.



Table

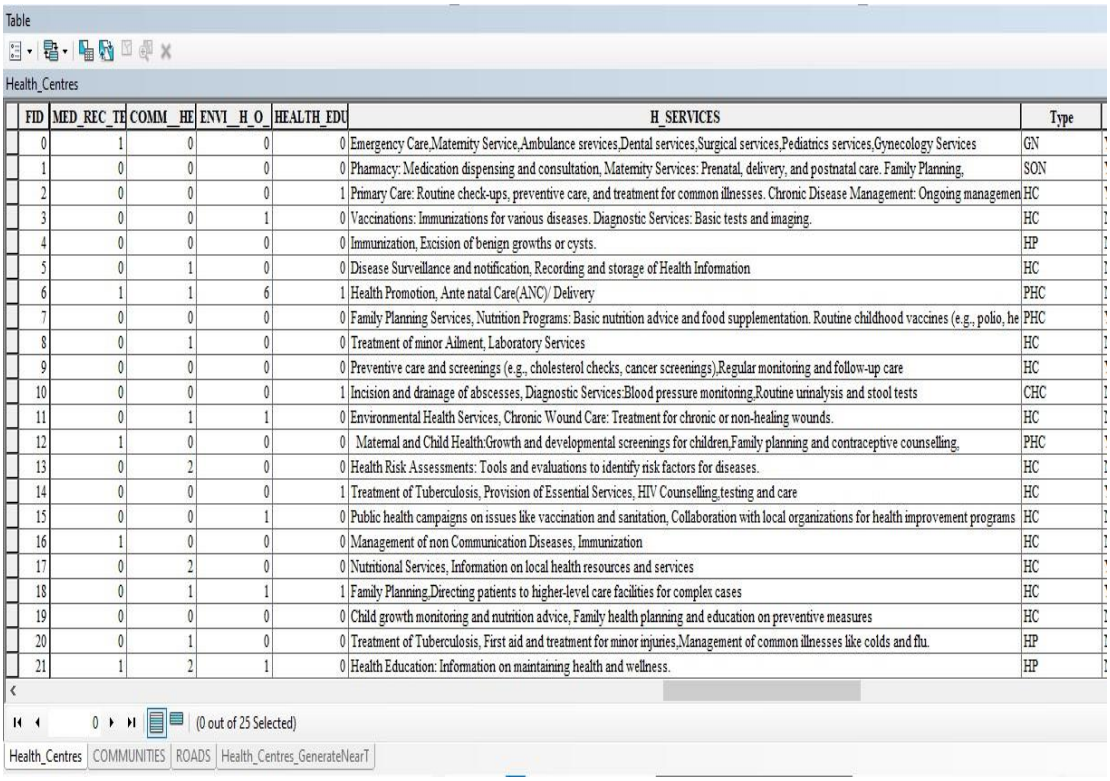
Health_Centres

FID	Shape *	ID	Fac_Name	Address	EASTING Coord.	NORTHING	TOTAL NO OF WORK	NURSE/MID	C.H.O	PRI_TECH	LAB_TECH
0	Point	1	METHODIST GENERAL HOSPITAL MBA	ITUK MBANG	393376.969	543713.6835	15	10	1	3	2
1	Point	2	SCHOOL OF NURSING / MIDWIFERY,	ITUK MBANG	393623.5953	543805.5308	20	30	0	2	3
2	Point	3	HEALTH CENTRE EBOM	NDON EBOM	395746.3612	542082.7477	5	1	0	1	1
3	Point	4	HEALTH CENTRE USE	USE URUAN	395814.6296	546781.1627	3	2	0	1	0
4	Point	5	HEALTH POST UFOK	NUNG IKONO UFOK	396526.878	549513.2527	2	1	0	3	0
5	Point	6	HEALTH CENTRE IBIA	EKPENE IBIA	391906.6182	549212.9105	3	1	0	2	0
6	Point	7	PHCC (OPERATIONAL BASE) IDU	IDU URUAN	390252.9552	555510.8147	22	8	1	1	1
7	Point	8	PHCC IDU	IDU URUAN	393948.586	555597.4067	21	1	0	3	0
8	Point	9	HEALTH CENTRE NWANIBA	NWANIBA	393551.5044	557809.0732	5	1	0	0	1
9	Point	10	HEALTH CENTRE UDO	IKOT UDO	389744.1402	565093.0982	5	2	0	1	0
10	Point	11	COMPREHENSIVE HEALTH CENTRE MBI	MBIAYA	381396.8324	563601.6921	6	1	0	1	0
11	Point	12	HEALTH CENTRE IBIAKU	IBIAKU URUAN	384043.6874	562737.4332	3	1	0	0	0
12	Point	13	PHC OPERATIONAL BASE IDU	IDU	391360.7911	554956.3721	7	2	0	0	1
13	Point	14	HEALTH CENTRE NWANIBA	NWANIBA	393583.0032	558269.7064	2	1	0	0	0
14	Point	15	HEALTH CENTRE NDON	NDON EBOM	395777.2476	542125.7096	5	1	0	0	0
15	Point	16	HEALTH CENTRE EBIA	EKPENE EBIA	391379.193	567117.3955	2	2	0	0	0
16	Point	17	HEALTH CENTRE IKOT	IKOT OTOINYE	393573.2771	551636.4707	3	1	0	0	1
17	Point	18	HEALTH CENTRE USE	USE URUAN	396896.2907	549420.6415	2	1	0	1	0
18	Point	19	HEALTH CENTRE IBIAKU	IBIAKU ISSIET	390240.4984	547219.2048	5	1	0	0	0
19	Point	20	HEALTH CENTRE IBIAKU	IBIAKU URUAN	383601.7899	556073.9733	2	1	0	1	1
20	Point	21	HEALTH POST ADADIA	ADADIA (EKIM ENIN	396896.2907	549420.6415	3	0	0	0	0
21	Point	22	HEALTH POST UKIM	EKPENE UKIM	392451.6398	542793.7733	2	0	0	0	0

(0 out of 25 Selected)

Health_Centres | COMMUNITIES | ROADS | Health_Centres_GenerateNearT

Figure 4.3: Screen Print of the Attribute table of public health facilities (Sheet 1)



Table

Health_Centres

FID	MED_REC_TE	COMM_HE	ENVI_H_O_	HEALTH_EDU	H_SERVICES	Type
0	1	0	0	0	Emergency Care,Maternity Service,Ambulance srevices,Dental services,Surgical services,Pediatrics services,Gynecology Services	GN
1	0	0	0	0	Pharmacy: Medication dispensing and consultation, Maternity Services: Prenatal, delivery, and postnatal care. Family Planning,	SON
2	0	0	0	1	Primary Care: Routine check-ups, preventive care, and treatment for common illnesses. Chronic Disease Management: Ongoing managemen	HC
3	0	0	1	0	Vaccinations: Immunizations for various diseases. Diagnostic Services: Basic tests and imaging.	HC
4	0	0	0	0	Immunization, Excision of benign growths or cysts.	HP
5	0	1	0	0	Disease Surveillance and notification, Recording and storage of Health Information	HC
6	1	1	6	1	Health Promotion, Ante natal Care(ANC)/ Delivery	PHC
7	0	0	0	0	Family Planning Services, Nutrition Programs: Basic nutrition advice and food supplementation. Routine childhood vaccines (e.g., polio, he	PHC
8	0	1	0	0	Treatment of minor Ailment, Laboratory Services	HC
9	0	0	0	0	Preventive care and screenings (e.g., cholesterol checks, cancer screenings),Regular monitoring and follow-up care	HC
10	0	0	0	1	Incision and drainage of abscesses, Diagnostic Services:Blood pressure monitoring,Routine urinalysis and stool tests	CHC
11	0	1	1	0	Environmental Health Services, Chronic Wound Care: Treatment for chronic or non-healing wounds.	HC
12	1	0	0	0	Maternal and Child Health:Growth and developmental screenings for children,Family planning and contraceptive counselling,	PHC
13	0	2	0	0	Health Risk Assessments: Tools and evaluations to identify risk factors for diseases.	HC
14	0	0	0	1	Treatment of Tuberculosis, Provision of Essential Services, HIV Counselling,testing and care	HC
15	0	0	1	0	Public health campaigns on issues like vaccination and sanitation, Collaboration with local organizations for health improvement programs	HC
16	1	0	0	0	Management of non Communication Diseases, Immunization	HC
17	0	2	0	0	Nutritional Services, Information on local health resources and services	HC
18	0	1	1	1	Family Planning,Directing patients to higher-level care facilities for complex cases	HC
19	0	0	0	0	Child growth monitoring and nutrition advice, Family health planning and education on preventive measures	HC
20	0	1	0	0	Treatment of Tuberculosis, First aid and treatment for minor injuries,Management of common illnesses like colds and flu.	HP
21	1	2	1	0	Health Education: Information on maintaining health and wellness.	HP

(0 out of 25 Selected)

Health_Centres | COMMUNITIES | ROADS | Health_Centres_GenerateNearT

Figure 4.4: Screen Print of the Attribute table of public health facilities (Sheet 2)

Table

Health_Centres

FID	Type	Consultanc	Outpatient	Inpatient
0	GN	YES	YES	YES
1	SON	YES	YES	YES
2	HC	YES	YES	NO
3	HC	NO	YES	NO
4	HP	NO	NO	NO
5	HC	NO	YES	NO
6	PHC	NO	YES	NO
7	PHC	YES	YES	NO
8	HC	NO	YES	NO
9	HC	YES	YES	NO
10	CHC	NO	YES	YES
11	HC	NO	YES	NO
12	PHC	YES	YES	NO
13	HC	NO	YES	NO
14	HC	YES	YES	NO
15	HC	NO	YES	NO
16	HC	NO	YES	NO
17	HC	YES	YES	NO
18	HC	YES	YES	NO
19	HC	NO	YES	NO
20	HP	NO	NO	NO
21	HP	NO	NO	NO

(0 out of 25 Selected)

Figure 4.5: Screen Print of the attributes table of public health care facilities in the study area including type of Facility, Consultancy, Outpatient and Inpatient.

4.3 Query Analysis

Spatial queries were used in the study to solve and answer some specific questions about one or more fields in the database. Spatial queries used are both single and multiple criterions. This is to ensure that unique results are acquired. The queries performed in the study and their respective screen prints are presented in Queries 1-5 as follows;

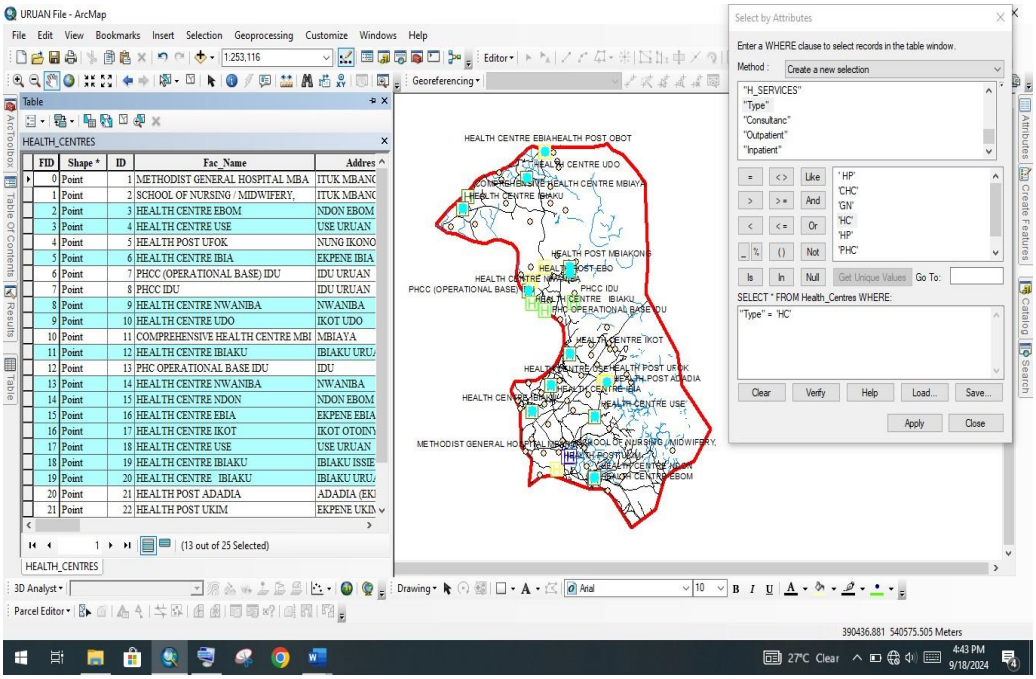


Fig 4.6: The Thirteen (13) Health centers (HC) in Uruan LGA

Query 1: All Public Health Centers (HC) in Uruan LGA

The syntax is SELECT FROM Health_Centres WHERE Type =''HC''. This is a single criterion.

Discussion: The analysis was done to determine the number and spatial distributions of Public health centers within Uruan LGA. The result shows that there are Thirteen (13) Health centers (HC) in the study area. (Fig 4.5 and 4.6).

Query 2: Shows General Hospital in Uruan LGA

The syntax is SELECT FROM Health_Centres WHERE Type =''GH''. This is a single criterion.

Discussion: The analysis was done to determine the spatial distribution of General Hospital within Uruan LGA. The result of the analysis shows that there is only one General Hospital which is a Secondary Healthcare Facility (Methodist General Hospital, Ituk Mbang) within Uruan LGA and it's not situated at the center of the study area. This is shown in Fig 4.7.

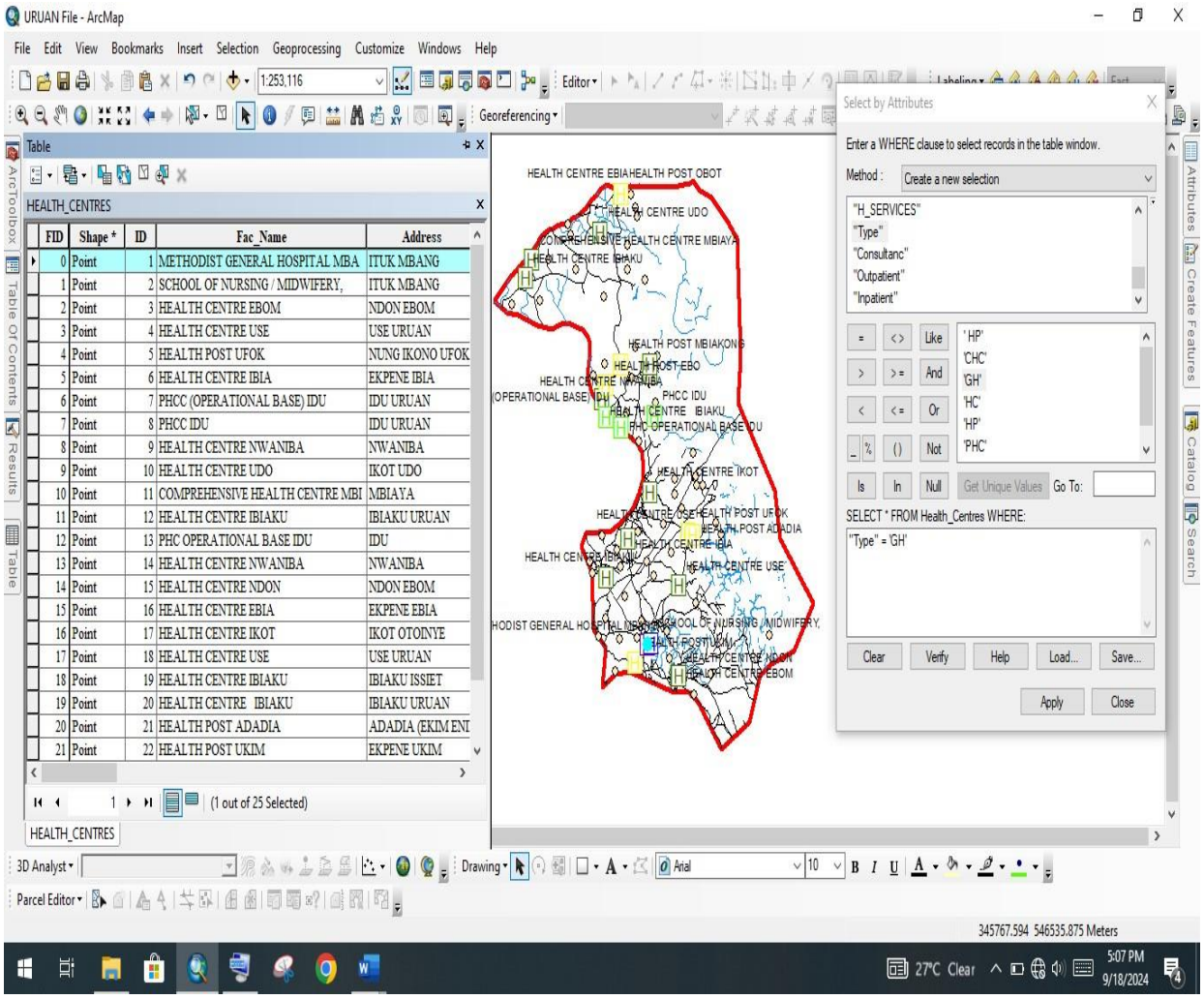


Fig 4.7: Methodist General Hospital, Ituk Mbang within Uruan LGA

Query 3: Public Health Facilities with Laboratory Technician

The syntax is SELECT FROM Health_Centres WHERE "LAB_TECH" > 0. This is a single Criterion.

Discussion: The analysis was done to determine the spatial distribution of health facilities equipped with Laboratory Technician for efficient service/ Purpose of each facility to the community.

The result shows that its only Nine (9) health facilities in the study area that has Lab technician by name; Methodist General Hospital Mbang, School of Nursing / Midwifery Ituk Mbang, Health Centre Ebom, Phc (Operational Base) Idu,Health Centre Nwaniba, Phc Operational Base Idu, Health Centre Ikot, Health Centre Ibiaku, Health Post Mbiakong which implies that other 15 health facilities cannot solve Laboratory related health Problems (Fig 4.8).

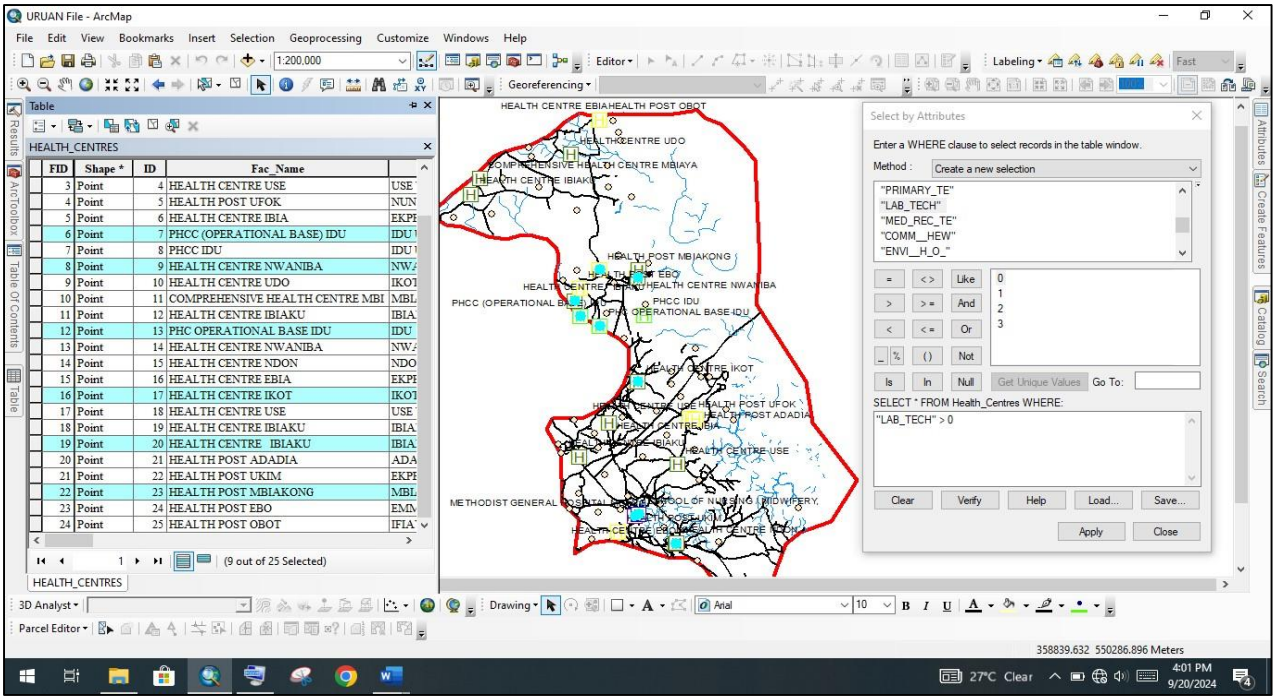


Fig 4.8: Public Health Facilities with Laboratory Technician within Uruan LGA

Query 4: Public Health Facilities with Health Educator

The syntax is SELECT FROM Health_Centres WHERE "HEALTH_EDU" > 0. This is a single Criterion.

The analysis was done to determine the spatial distribution of health facilities equipped with Health Educator to ensure efficient health Awareness in each health facility to the community. The essence of this analysis is to determine the level of health awareness that can be acquired from each heath facility.

Discussion: The result shows that its only Five (5) health facilities in the study area that has Health Educator by name; Phc (Operational Base) Idu, Health Centre Ebom, Comprehensive Health Centre Mbiaya, Health Centre Ndon, and Health Centre Ibiaku. This is seen in Fig 4.9.

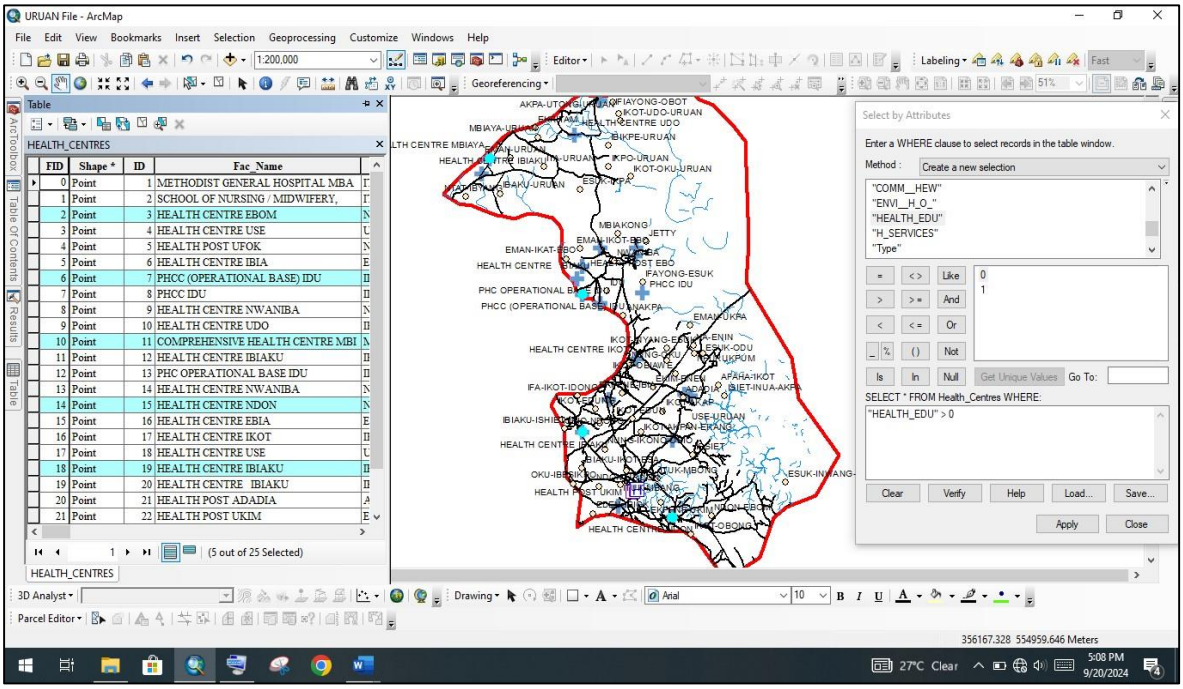


Fig 4.9: Public Health Facilities with Health Educator within Uruan LGA

Query 5: School of Midwifery/ Nursing in Uruan LGA

The syntax is SELECT FROM Health_Centres WHERE Type =''SON''. This is a single Criterion.

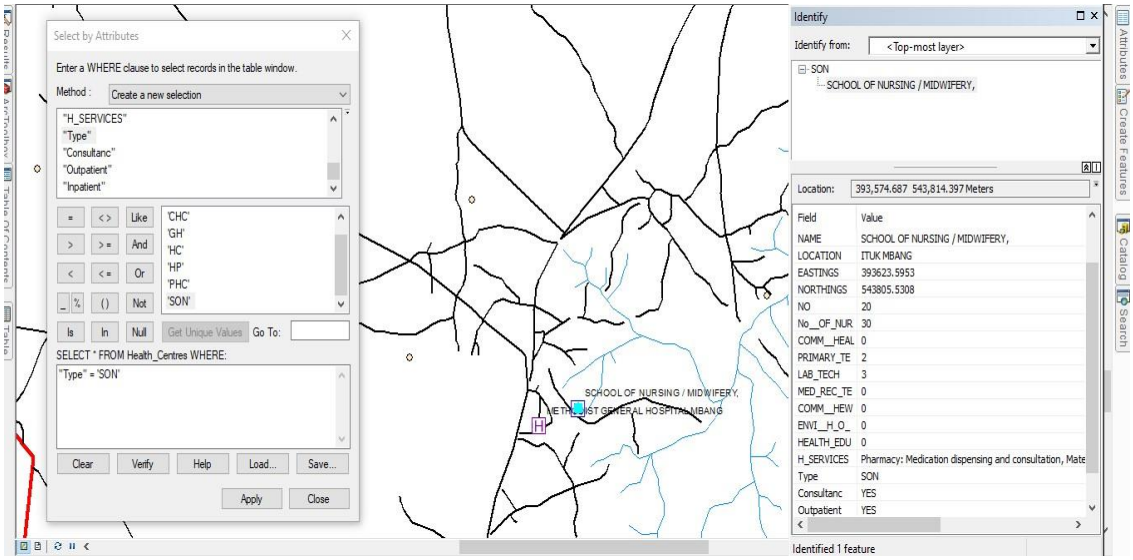


Fig 4.10: School of Midwifery/Nursing Ituk Mbang and other Attributes associated with the Health Facility in Uruan LGA.

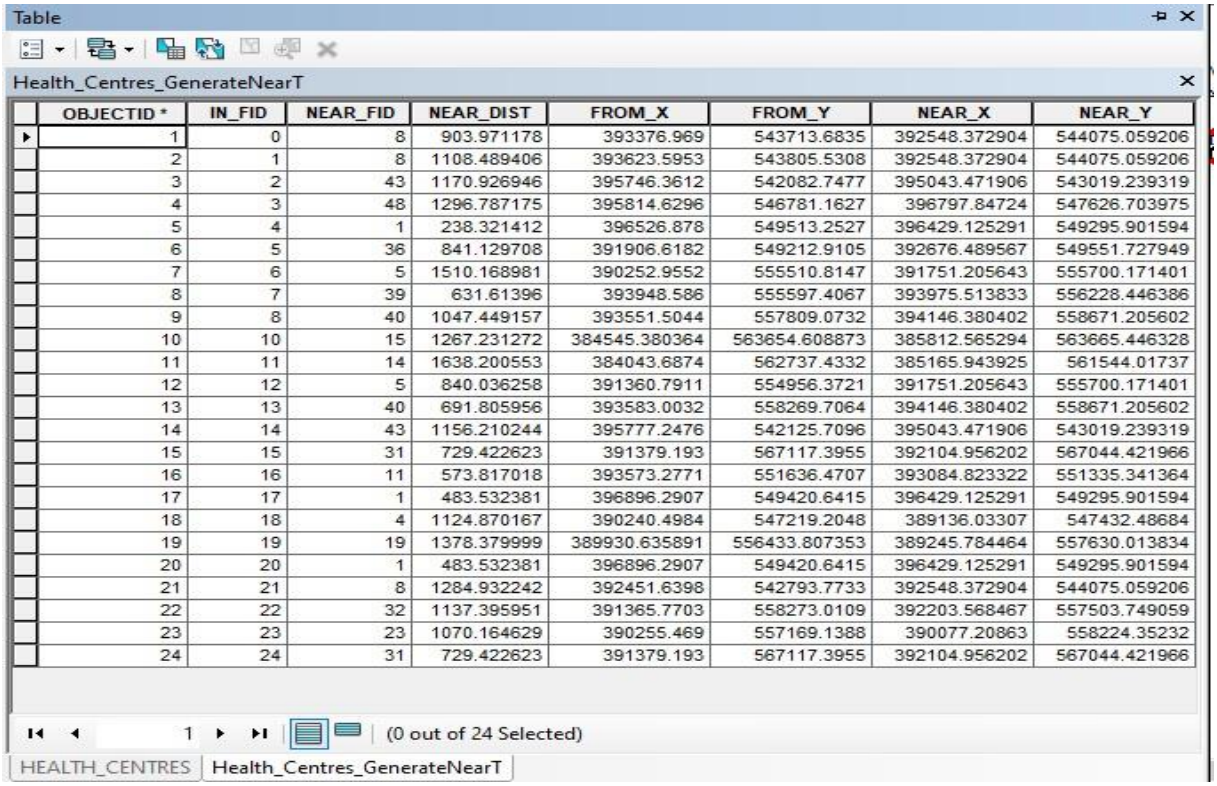
Discussion: The analysis was done to determine the spatial distribution of School of Midwifery/ Nursing within the study area. The result of the analysis shows that there is only one School of Midwifery/Nursing (School of Nursing/Midwifery, Ituk Mbang) within Uruan LGA and its not situated at the center of the study area (Fig 4.10).

4.4 Buffering Analysis

In this Project, two buffer analysis were carried out, which included:

i) Buffer carried out on individual healthcare facilities

ii) Buffer carried out on the General Hospital



Table

Health_Centres_GenerateNearT

OBJECTID *	IN_FID	NEAR_FID	NEAR_DIST	FROM_X	FROM_Y	NEAR_X	NEAR_Y
1	0	8	903.971178	393376.969	543713.6835	392548.372904	544075.059206
2	1	8	1108.489406	393623.5953	543805.5308	392548.372904	544075.059206
3	2	43	1170.926946	395746.3612	542082.7477	395043.471906	543019.239319
4	3	48	1296.787175	395814.6296	546781.1627	396797.84724	547626.703975
5	4	1	238.321412	396526.878	549513.2527	396429.125291	549295.901594
6	5	36	841.129708	391906.6182	549212.9105	392676.489567	549551.727949
7	6	5	1510.168981	390252.9552	555510.8147	391751.205643	555700.171401
8	7	39	631.61396	393948.586	555597.4067	393975.513833	556228.446386
9	8	40	1047.449157	393551.5044	557809.0732	394146.380402	558671.205602
10	10	15	1267.231272	384545.380364	563654.608873	385812.565294	563665.446328
11	11	14	1638.200553	384043.6874	562737.4332	385165.943925	561544.01737
12	12	5	840.036258	391360.7911	554956.3721	391751.205643	555700.171401
13	13	40	691.805956	393583.0032	558269.7064	394146.380402	558671.205602
14	14	43	1156.210244	395777.2476	542125.7096	395043.471906	543019.239319
15	15	31	729.422623	391379.193	567117.3955	392104.956202	567044.421966
16	16	11	573.817018	393573.2771	551636.4707	393084.823322	551335.341364
17	17	1	483.532381	396896.2907	549420.6415	396429.125291	549295.901594
18	18	4	1124.870167	390240.4984	547219.2048	389136.03307	547432.48684
19	19	19	1378.379999	389930.635891	556433.807353	389245.784464	557630.013834
20	20	1	483.532381	396896.2907	549420.6415	396429.125291	549295.901594
21	21	8	1284.932242	392451.6398	542793.7733	392548.372904	544075.059206
22	22	32	1137.395951	391365.7703	558273.0109	392203.568467	557503.749059
23	23	23	1070.164629	390255.469	557169.1388	390077.20863	558224.35232
24	24	31	729.422623	391379.193	567117.3955	392104.956202	567044.421966

1 (0 out of 24 Selected)

HEALTH_CENTRES | Health_Centres_GenerateNearT

4.11: The Screen Print of Near table generated

4.4.1 Analysis of the Buffer carried out on Individual Healthcare Facilities

This analysis was majorly carried out to indicate the proximity of the Healthcare facilities not just to the communities but also to one another. The analysis using the radius of 250m and 500m showed that most of the Healthcare facilities has very close proximity to each other and most importantly to the community. This will help in bridging communication gap among the Healthcare facilities and ensure effective access of health services by the communities. This will also help in efficient planning and citing of Healthcare facilities in future projects. The Near table generated for this analysis is shown in the screen prints in Fig.4.10, while the map presenting this proximity analysis is shown in Fig.4.11.

4.4.2 Buffer carried out on the General Hospital

This analysis was majorly carried out to indicate the proximity of the General Hospital not just to the Communities but also to School of Midwifery. The analysis which used the radius of 2000m showed that the General Hospital has very close proximity to School of Midwifery and too far away from most of the communities which will limit access to some critical health services like Surgery which can only be offered by the General Hospital. The analysis also shows the General Hospital has an access road connected to it (Fig 4.12 and Fig.4.13).

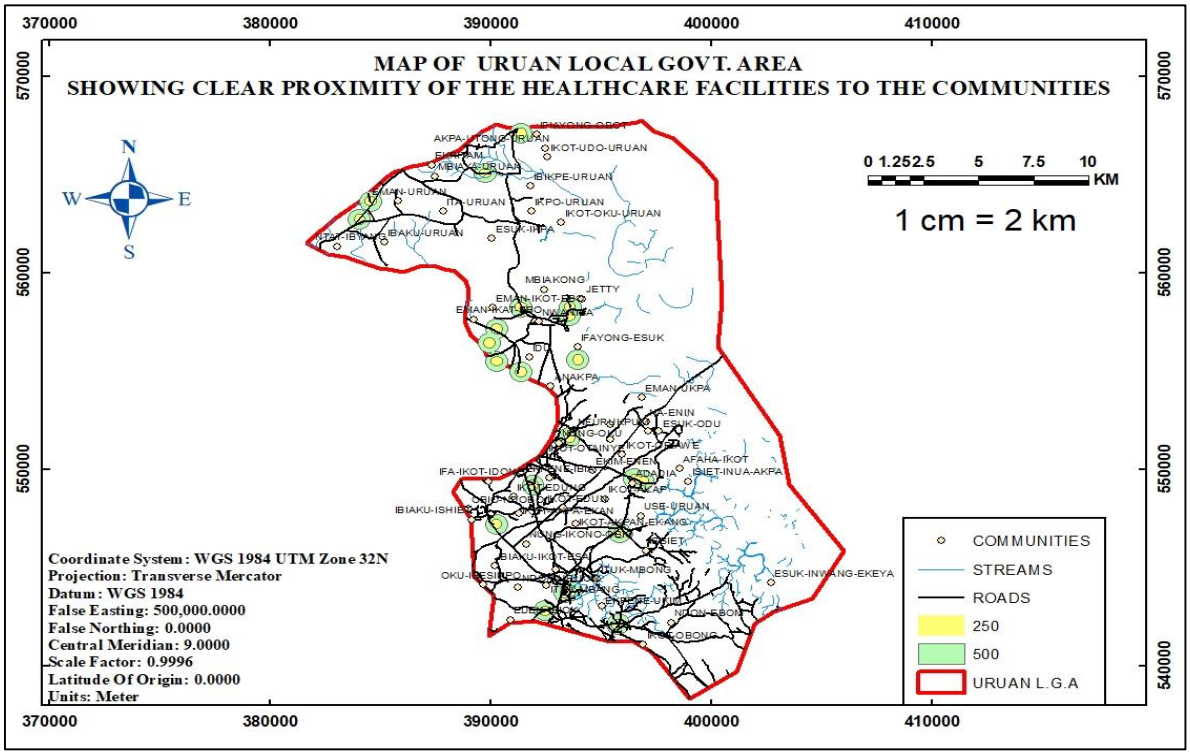


Fig 4.12: Clear Proximity of the Healthcare Facilities to each other and the Communities

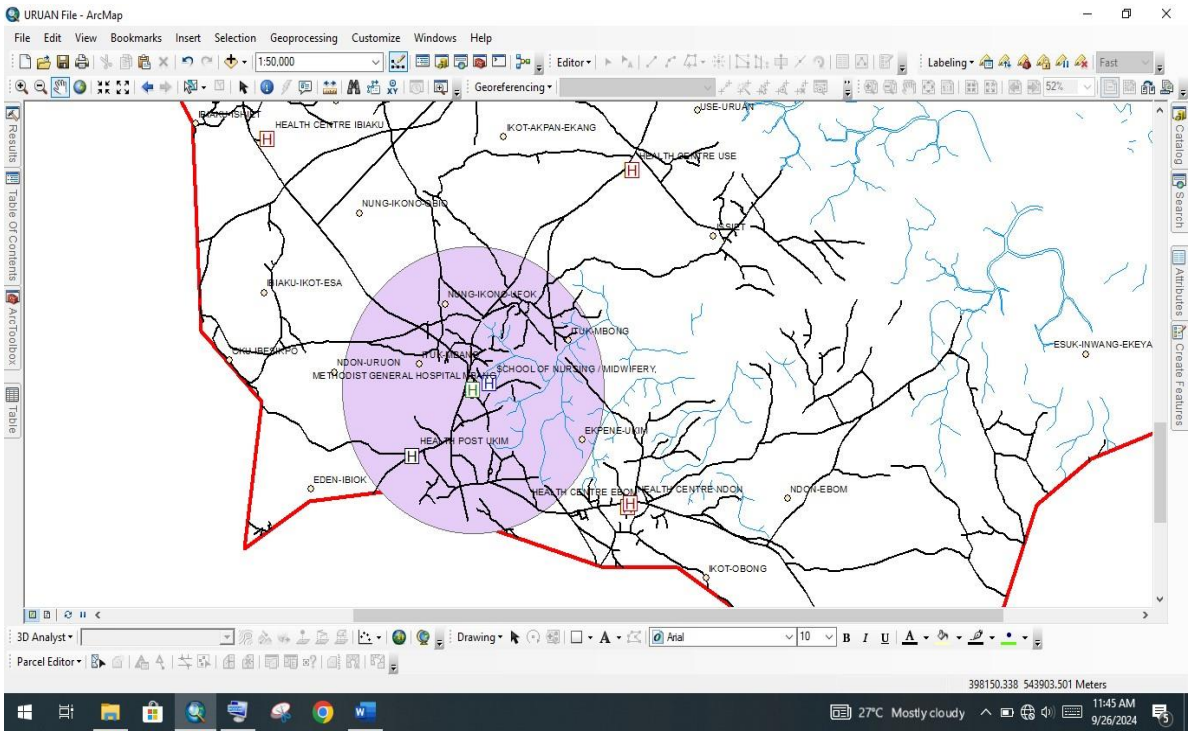


Fig 4.13 Screen Print of the Buffer of the General Hospital with very close proximity to the School of Midwifery.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

It is pertinent to state here that the purpose of this research study which is to develop a Land information system for Health facilities in Uruan LGA was duly achieved. Uruan LGA which constitutes the study area is a beehive of many topographical and geophysical earth features which interacts and controls human activities. The spatial data were organized in a logically manner with respect to their attributes. The purpose of this study commenced with the acquisition of the requited and necessary data such as the road network data, spatial and aspatial data of the health facilities and also a field visit of all the health facilities within the study area thus determine the proximity of the facilities within the study area. These data acquired were analyzed and manipulated using the capable and efficient GIS techniques.

Findings from the study show that there are thirteen (13) Health centers (HC), one General Hospital, nine (9) health facilities in the study area that has Lab technician, five (5) health facilities that has Health Educator, and only one School of Midwifery/Nursing in the area. This result shows insufficiency in the availability of health facilities to meet the population of the area. Lack of required skill and knowledge in handling GIS software and Computer is a big problem militating against the use of GIS in the management of Public Health facilities especially in Uruan L.G.A.

5.2 Recommendations

Based on the findings of this study, some recommendations to improve the situation includes;

1. Updating of the available information: The available health care information in the area should be updated. Thus, the data gathered by this study should be made available for public utilization. Such should include the updated maps.
2. Secondary health facilities: It was discovered that only one Secondary health facility is located in the area which is not able to serve the teeming population of the L.G.A. It is therefore recommended that more Secondary health facilities be sited in the area.
3. Upgrading of facilities in health centers: Services were offered based on the available facilities in each health facility. It is therefore recommended that the government should equip the available health facilities to improve their service delivery.
4. Employment/ Training of GIS Expert: It is true that data in softcopy are easily accessible and managed than data in hardcopy. Database can only be implemented and managed by GIS trained personnel for optimum result. It is therefore recommended that GIS expert by employed to offer the service of training health workers on how to implement and managed database of health facilities in the area.
5. GIS and the Computer: In order to solve most of the identified problems, problem special training in GIS and the Computer should be organized for the various arms of Government and organizations that are responsible for planning, designing, execution and allocation of resources to the Public Health sector in study area.

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