

# Geospatial Analysis Of Primary Health Care Centres In Ughelli North And Warri South Local Government Areas Of Delta State, Nigeria

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## ABSTRACT

The mapping of primary health care centres in Ughelli North, Warri South Local Government Areas (LGA) of Delta State was carried out. The objective is to provide Geospatial information about the distribution and accessibility of the Primary Health Care Centres in the Local Government Areas. Germain GPS was used to capture the Co-ordinates of the Health Centres which was analysed using Arc Map 9.3 (ESRI) GIS software. The multivariate analysis showed that the nearest neighbour value for Ughelli North and Warri South LGAs  $R_n=0.9991144$  and  $R_n=0.665341$  respectively. This results showed random distribution rather than clustered pattern of distribution. The importance of primary health care centres to the grass root dwellers is discussed.

**KEYWORDS:** Ughelli North LGA, Warri South LGA, Primary Health Centre, Germain GPS.

## INTRODUCTION

The term Primary care is thought to date back to about 1920, when the Davison report was released in the United Kingdom. The “white Paper” mentioned primary care centres intended to become the hub of regionalized services in that country (Babara et. al, 2005). Institute of medicine (IOM) in their report defined primary Health care as provision of integrated accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs developing a sustained partnership with patients and practicing context of family and community (Donaldson et. al, 1996; IOM 1978).

The ultimate goal of Primary Health Care (PHC) is better health for all. This ideal model of health care was adopted in the declaration of the international conference on Primary Health Care held in Alma Ata in 1978 and became a core concept of the World Health Organization’s goal of Health for all WHO(1978)

To achieve the goal of health for all WHO has identified five key elements to achieving the goals.

- i. Reducing exclusion and social disparities in health (universal coverage reforms)

- ii. Organizing health services around people’s needs and expectations (service delivery reforms)
- iii. Integrating health into all sectors (Public policy) (leadership reforms)
- iv. Pursuing collaborative models of policy reforms dialogue (leadership reforms)
- v. Increasing stakeholder participation

In Nigerian, explicit consideration has not been given to the need for equity in the planning and distribution of health care facilities over the years. This has led to the emergence of many regions within the Country where both public and private health care facilities are sparsely provided. Often regions with difficult terrain and physical environment are neglected. One major region in Nigeria which has generated much interest internally and internationally is the petroleum – producing region of the country otherwise known as the Niger Delta (where the Local Government Area are located) (Onokerhoraye, 1999).

The objective of this paper is to carry out a Geographical Information System mapping of the primary health care centres and to use spatial statistics to describe their spatial distribution in Ughelli North and Warri South Local Government Areas of Delta state.

## MATERIALS AND METHODS

### STUDY AREA:

### WARRI SOUTH LOCAL GOVERNMENT AREA.

Warri South Local Government consist Warri main town on Geographic coordinates  $0.005.73333$  ( $^{\circ}$ E) and  $05.53352$  ( $^{\circ}$ N). The area is characterized by flat marshy swampy terrain, water bodies, river scenes and evergreen forest and the soil consist of the alluvial and hygromorphic soils (Ufua, 2002). There are some creeks in the area such as: Tori Creek, and the major river is the Warri River which is a tributary of the Forcados River, which discharges into the Atlantic Ocean (Fasona and Anosike, 2002). Warri South Local Government is one of the most densely settled areas in Delta state, Nigeria. Nigerian population commission census figure of 2006 gave a figure of three hundred and

four thousands as the population of Warri South Local Government Area.

### UGHELLI NORTH LOCAL GOVERNMENT AREA

Ughelli North Local Government area is one of the 25 Local Government Areas in Delta State and fall within the Delta Central senatorial district. It is approximately on 05°30'N and 005°59' E it is bounded to the North by Ethiope East, Patani to the South, Ughelli South to the west and Isoko North and south to the East. Ughelli North is 818 Km<sup>2</sup> in area.

The Population of Ughelli North published by National population commission in Census 2006 puts the population of Ughelli North at 321, 028.

#### DATA COLLECTION:

The main data for this study was a SPOT XS (Multi-spectral Image with Spatial Resolution of 5 metres, recorded in 3 spectral bands and radiometric resolution of 8 bits. The administrative and topographic maps used were collected from relevant government agencies. The geographic coordinates of the Primary Health Care Centres were taken and recorded with a hand held eTrex Garmain Global Positioning System (GPS).

#### DATA CONVERSION AND ANALYSIS

Data acquired were converted to make them compatible with the GIS software. The topographic maps were converted from analogue to digital format by scanning them with an AO (A ZERO) scanner and geo-referenced in Arc View to allow for integration with the remotely sensed data within ARCView. The spot XS multi-spectral data was already pre-processed and in digital format. Using the geo-referencing tool, the image was used to co-register the map by identifying ground control points on the image and in the map respectively. On screen digitizing was done to capture the various layer and theme relevant for the GIS analysis. A supervised classification was carried out on the image data to classify the image into six homogenous classes in order to generated the required spatial classes. The following classes were divided: built-up areas, cultivated lands, bare surfaces, water bodies, forests and wetlands. Supervised classification is the process of using samples of known identity to classify pixels of unknown identity. The samples of known identity are those pixels within the training areas identified during or through the analysis of fieldwork. The analyst therefore defined on the image. (Fabiya, 2001; Unueroh, 2011; Uluocha, 2007). The classes were carefully digitized on screen from the image into different layers, while town names and landmark features were digitized from the administrative and topographic maps of the study area. All these spatial data was integrated into

ARCView for manipulation and GIS analysis. Data integration functions of the GIS involve combining maps of the same geographical area at different scale, dates, coordinate and projections. It also entails the integration of digital map data with remote sensing data (satellite imagery). The capability of a GIS to overlay separate map layers of the same geographical area to produce a composite or new map of the study area combining the characteristics of the various map was explored in a GIS environment. In overlay analysis, the location is held constant and several other variables are simultaneously evaluated.

#### NEAREST NEIGHBOUR DISTANCE ANALYSIS

The basic statistical analysis used is the Nearest Neighbour Statistic ( $R_n$ ) defined as the ratio of the mean distance ( $D_n$ ) in the area under investigation to some expected mean distance usually under a random distribution ( $D_e$ ). This Statistic is defined as

$$R_n = \frac{D_o}{D_e} \quad (1)$$

In a purely random distribution of points, the expected mean distance  $D_e$  between each pair of points and its nearest neighbor is

$$D_e = \frac{D_o}{2\sqrt{p}} \quad (2)$$

and, the expression in equation (1) reduces to

$$R_n = 2D_o\sqrt{p} \quad (3)$$

$$\text{Or } R_n = 2D_o\sqrt{\frac{n}{A}} \quad (3a)$$

Where  $p$  is the density of points in the area under consideration,  $A$  is the area concerned and  $n$  the number of points. Density is defined as the number of points per unit area. On the other hand,

$D_o$  defined as  $\left( \sum_{i=1}^n \frac{d_i}{n} \right)$ , is the mean of the nearest

neighbor distances between one point and another. In applying this method, it is important that the area is measured in the same units as the density of points (map units or area units)

The general rule for applying the method is based on the fact that the nearest neighbor statistic  $R_n$  has a value that ranges between zero and 2.15. thus

$$0 < R_n < 2.15 \quad (4)$$

Furthermore, it is known that a random pattern is observed if the value of the statistic equals 1. Consequently, the rule of thumb is as follows;

$R_n = 1$  implies that the distribution is random  
 $R_n \rightarrow 0$  implies that the distribution is clustering  
 $R_n = 2.15$  implies that the distribution is regular  
 [Mitchel, 2005]

distance=0.5928, expected mean distance=0.1674503 while area of study =804.17km<sup>2</sup>. This indicates that the pattern is more random than clustered. The distribution of the health centres as shown in figure 4.1 indicates that PHC are located around settlements like: Otowodo, Ughelli town, Ekuigbo, Afiesere to mention a few; while General hospital is found in Orogun. The figure also, revealed that very few settlements do not have any health centres at their disposal. Also, distances between health centres are moderate as people do not necessarily need to travel far to make use of the facilities available at these health centres.

**SPATIAL DISTRIBUTION OF HEALTH CENTRE IN UGHELLI NORTH LGA**

Ughelli North has a total number of twenty three health centres sampled for the purpose of this research work. The spatial distribution of these health centres can be described to have observed a fairly even distribution pattern. The Nearest Neighbour Analysis shows that  $R_n=0.991144(R_n<1.0)$ ,  $N=22$ , observed mean

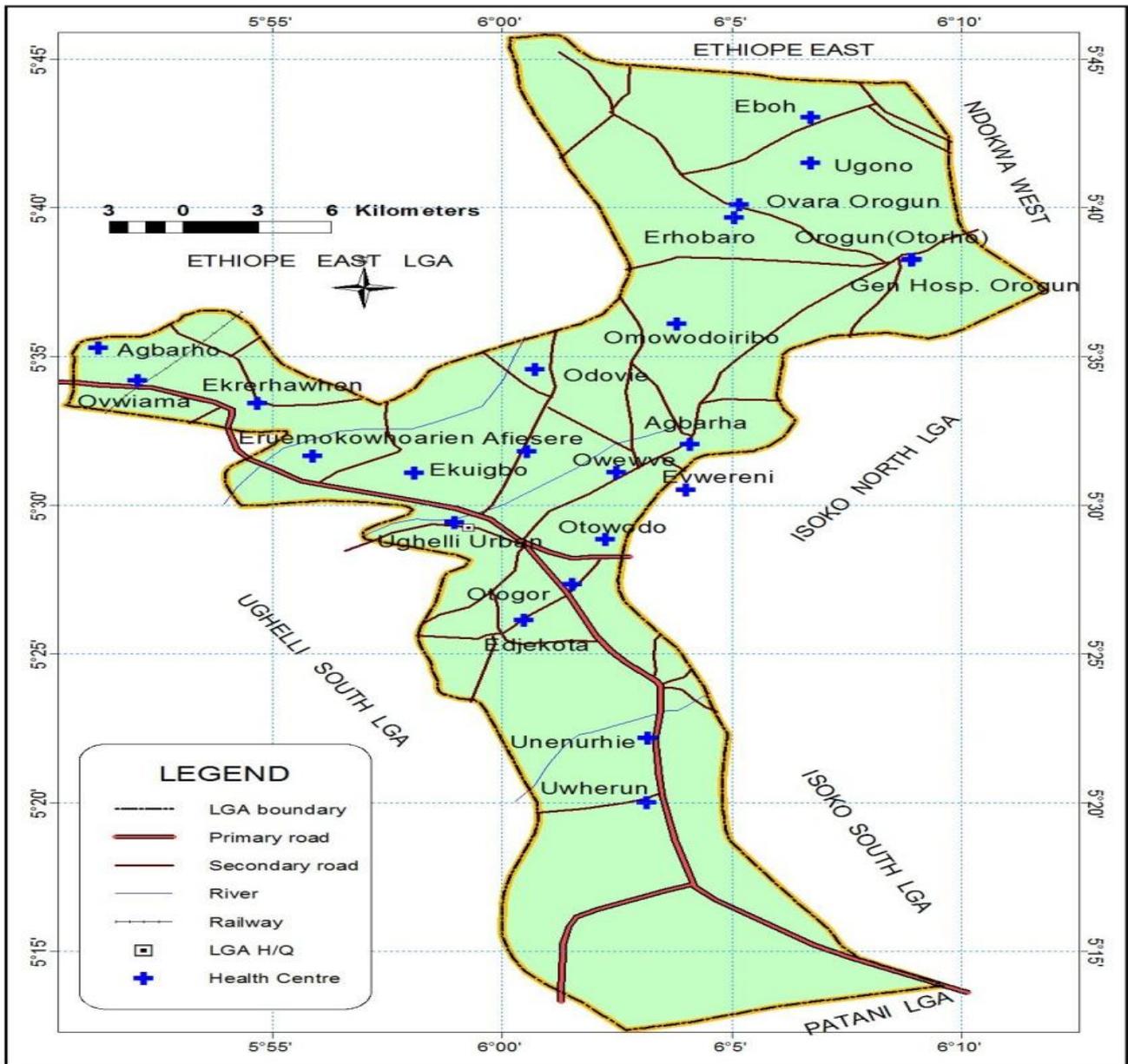


Figure 1: Spatial Distribution of Health Centre in Ughelli North LGA.

**SPATIAL DISTRIBUTION OF HEALTH CENTRES IN WARRI SOUTH LGA.**

Total number of twelve health centres coordinates were taken with the GPS. The nearest neighbour analysis of the PHC the observed mean distance of the centres is 0.22127km apart with expected mean distance 0.365529km. Study area is 550.66 km<sup>2</sup>, the  $R_n = 0.60534$  ( $0 \leq R_n \leq 1$ ) this implies clustering pattern in the distribution of the

PHC. The test significance,  $Z = 2.61544$  which shows the clustering is significant. Also it could be observed that the centres were clustered within certain portion of the Warri South LGA. The swamp terrain and physical environment could be a major factor in the distribution pattern of the PHC because white land is available for human settlement and usage.

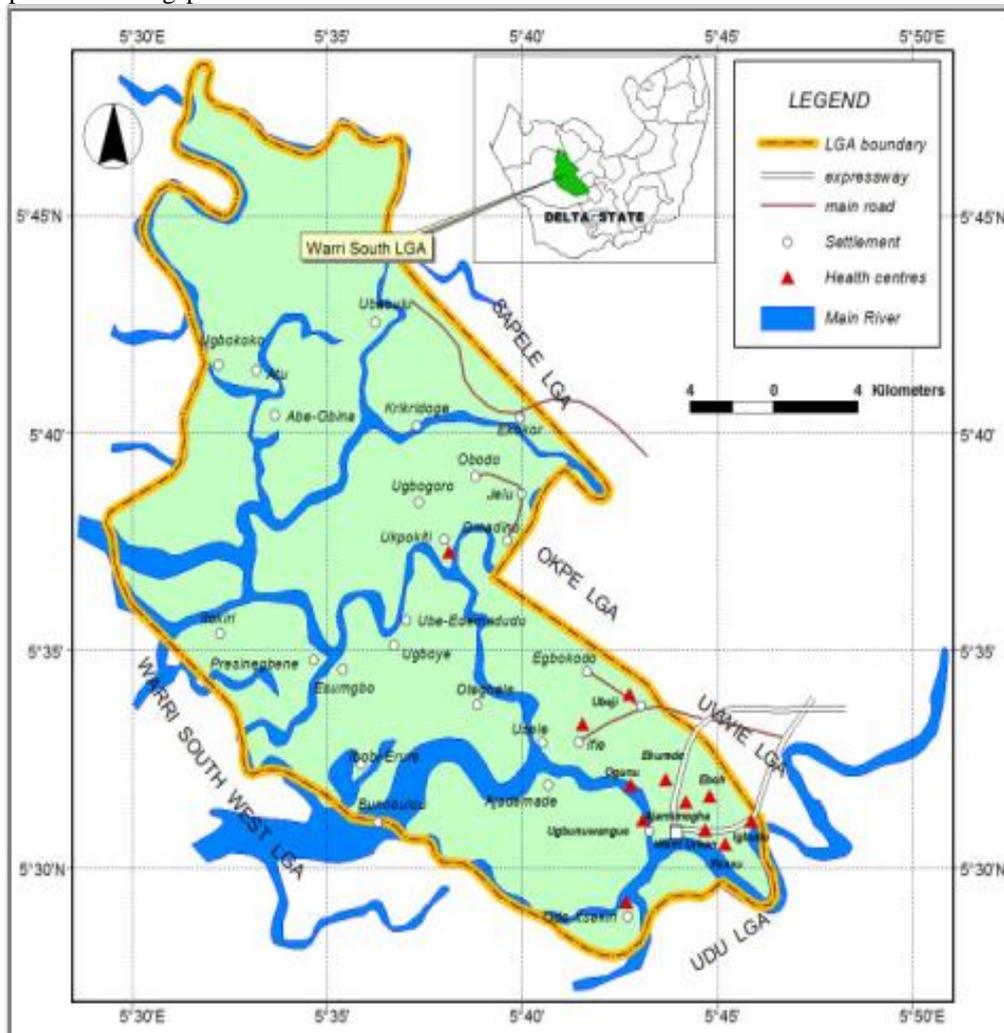


Figure 2: spatial distribution of health centre in Warri South LGA

**CONCLUSION**

We have used Geographic information system (GIS) and Geospatial statistics to study distribution patterns of the Primary Health Care Centres (PHC) in Ughelli North and Warri South LGAs of Delta State, Nigeria. This shows that the PHC distribution is clustered. The topography of the area (Swamp terrain) may be a major determining factor responsible for this pattern of distribution because majority of land mass (over sixty percent) for Warri South were not accessible for human settlement. The population ratio to PHC is between (12,000: 1;and 25,000:1). This is very inadequate if the goal of health for all as stipulated by world

Health organization is to be achieved. There is urgent need for local authority state government and Non-Governmental organizations to be fully involved in setting up of more functional, accessible health care centres. Health of the population will improve if mal distribution of PHC is corrected and emphasis is placed on functional PHC, this will help to lower the cost of care, improve health of the populace and reduce the inequities in the population health.

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