Geospatial Analysis and Distribution of Records of Sicknesses/Diseases (Malaria, Diabetes, Sickle Cell Disorder, Typhoid Fever)

(A Case Study of the General Hospitals in Lagos State, Nigeria.)

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ABSTRACT

The paper deals with the application of GIS in the analysis and distribution of records of sicknesses/diseases (malaria, diabetes, sickle cell disorder, typhoid fever) in Lagos State General Hospitals. It presents and discusses the basic principles, potential benefits and major limitations of GIS in the health sector. The Data used in this project were collected from the office of the Lagos State Health Service Commission and comprises both attribute and spatial data. This project has been organized mainly on ArcGIS 9.2 and Microsoft Excel software. The ArcGIS 9.2 software provides a user with menu to see the organized information. Also an interactive query shell is provided to the user as a decisions making tool. The strong point of the GIS system is that it allows the simultaneous spatial display of the integrated tabular data (attribute) and the spatial data, thus, depicting the ground reality of the integrated data. The results obtained from the various queries performed depict the distribution of diseases (Malaria, diabetes, sickle cell disorder and typhoid fever) in Lagos state. The mortality rate is also gotten for both male and female incoming and outgoing patients in the various general hospitals. For example General Hospital Ikorodu had the highest rate of typhoid and paratyphoid fever cases in 2005. Geographic Information System (GIS) is an innovative technology, ideal for generating data suitable for analysis (both with respect to space and time). The application of GIS as a tool in monitoring disease is one that will improve the speed, quality, access and use of Health Management information.

Keyword: Geographic Information System (GIS)-(50).

INTRODUCTION

The social, economic, political and physical environments in which people live are changing, as activities to encourage better health and reduce disease are being promoted. Geographic information science (GIScience) has the potential to bring rich information databases, linked to methods of spatial analysis, to determine relationships between geographical patterns of disease distributions and social and physical environmental conditions. As the core of a decision support system, GIScience also has the potential to change the way in which geographical resource allocations are made to facilitate the establishment of preventive health services and to control the burden of disease in patients.

AIMS AND OBJECTIVES OF THE PROJECT

The aims and objectives of the study are as follows;

- Creation of a database showing the distribution in the records of diseases in Lagos state general hospitals.
- To measure the impact of the population growth on the land use changes in the study area.
- To provide relevant information relating to various diseases such as the death rates.
- To create charts showing the distribution of malaria, sickle cell, typhoid and paratyphoid fever and diabetes.
- To perform various queries.

STATEMENT OF PROBLEM

The interpretation of medical data gotten from hospitals has been a problem in the Nigerian health sector. It has created a hindrance in the planning and design of a functional health care system in the country.

With the use of Geographic Information Systems (G.I.S) such problems can be readily resolved. The advances in GIS and mapping technologies coupled with the increased awareness level has created new opportunities for public health administrators and the government at large to enhance planning, analysis and monitoring capabilities. Such information when readily available with a high degree of reliability can be used by government or health administrators to do the following: design a functional health care and administrative service, monitor the health status and service required, assist in setting priorities for the allocation of health care resources, assist in the identification of environmental, socio-economic and other risk factors capable of influencing health and many more.

These decisions need to be taken based on the observations made and available data. As the data relates to public health covering the whole state, the data is voluminous and hence it is extremely difficult to understand the real content. The data needs to be presented in a way that the temporal and spatial nature of the problem can be brought out in a focused way. In short, the availability of statistical and other information in spatially referenced form and the functions provided by a GIS could allow analyses that were previously too expensive or impossible to perform.

METHODOLOGY

Methodology refers to the various stages/processes involved in the generation of the required results.

1. First a database showing the coordinates of the general hospitals, the disease pattern, the hospital names, and total cases of both incoming and outgoing patients as well as their death was created. Also a database showing the Demarcation of Lagos state Local Government Areas and the Population (2006) of Lagos state was created. These processes were achieved using Microsoft Excel 2007. Both databases created where saved as DBF files to enable them to be exported to the Arc View GIS 9.2.
2. The data inputted in Microsoft excel was imported into ArcGIS environment by running the X/Y plot script from the existing spreadsheet file where the data was stored. This converts the data into a temporal graphical representation called an event, this event is then exported into a Shapefile format for actual storage and for later processing.

A Shapefile is a vector data storage format, invented and published by ESRI for storing the location, shape, and attributes of geographic features. A Shapefile is stored in a set of related files and contains one feature class. Shapefiles are widely used for data interchange among heterogeneous GIS systems.

RESULTS/ANALYSIS

The Geographic Information System (GIS) is distinguished from other information systems by its unique spatial analysis functions. These functions help to answer some questions, called queries, in the GIS environment about the real world. Generally, geographic or spatial analysis allows us to study real world processes by developing and applying

models. These models may be used to determine new or previously unidentified relationship within the GIS database or between different databases hence enhancing our understanding and knowledge of the real world. Data analysis is one of the important features of the ArcGIS 9.2 software used in this project work.

Some of the queries performed are illustrated as follows;

Query One:

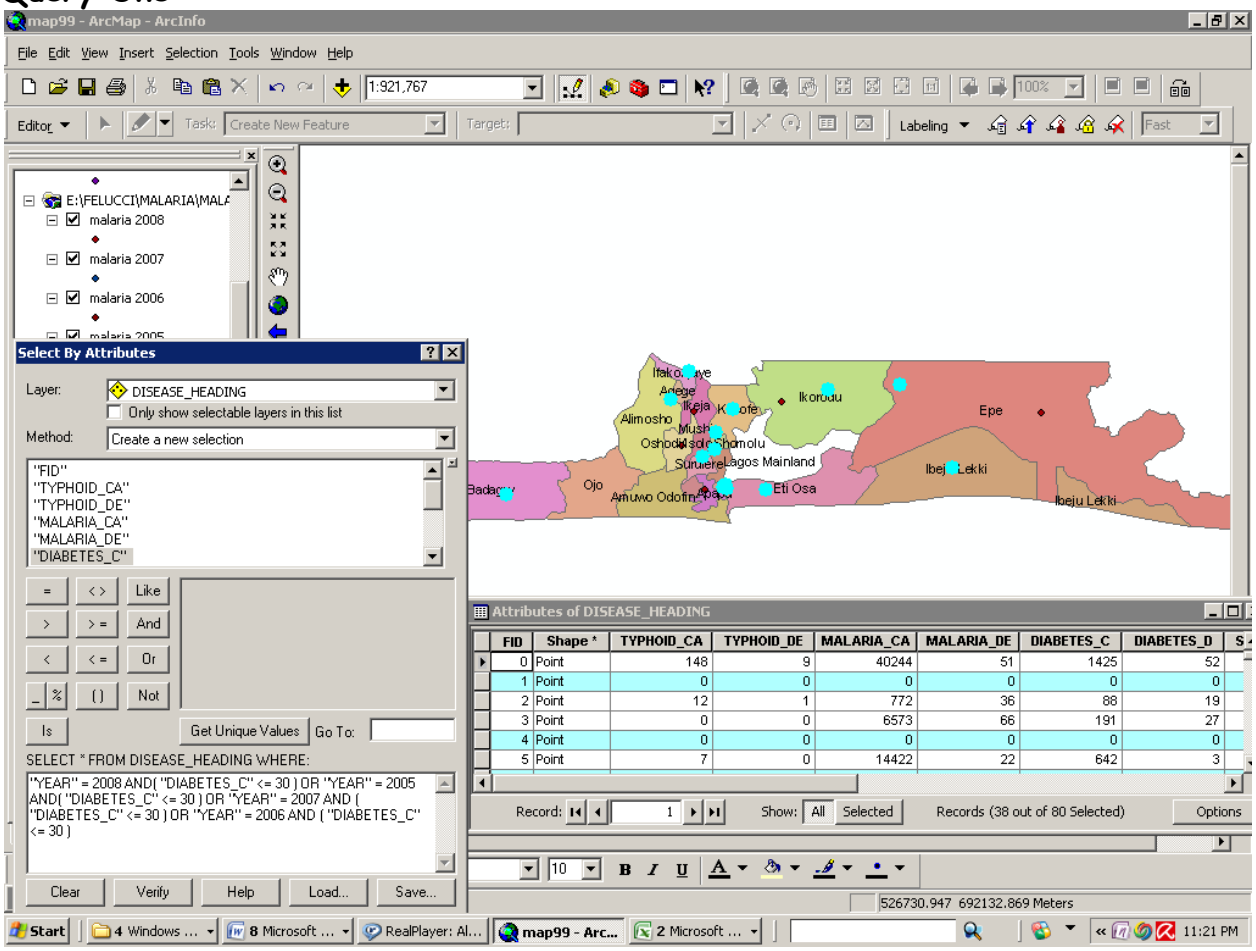


Fig 1: figure showing first query performed

Query syntax: "Year"=2008 and ["Diabetes_C"<=30] or "Year"=2007 and ["Diabetes_C"<=30] or "Year"=2006 and ["Diabetes_C"<=30] or "Year=2005 and ["Diabetes_C"<=30]

The figure above shows the multiple query analysis, which highlights each general hospital that are located within the local government area

along with the attribute table giving the diabetes case of patient not more than 30 in each year.

The general hospitals that satisfy the above query are depicted in blue in the figure shown above.

Query Two:

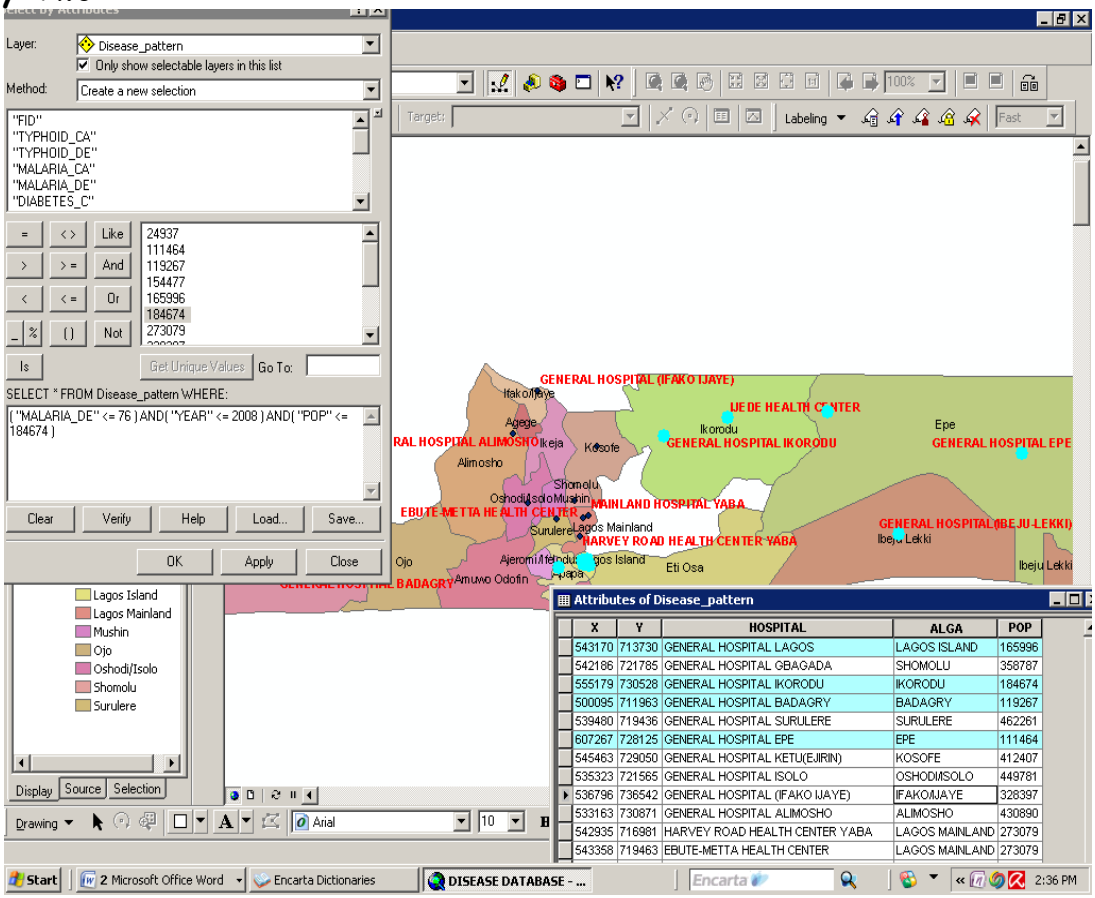
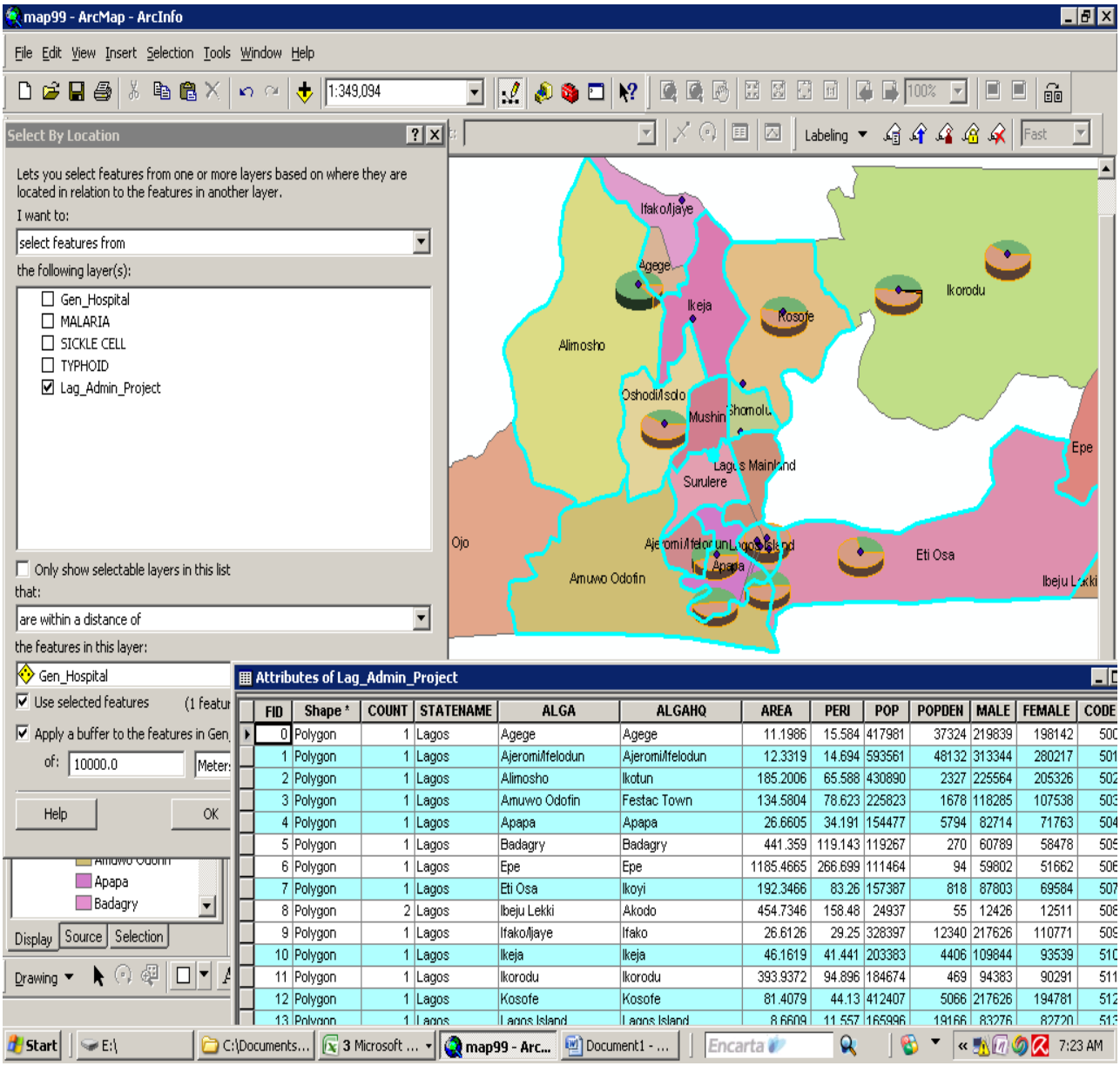


Fig 2: Query Syntax: ("Malaria_DE"<=76) and (Year <=2008) and ("POP<=184674)

The figure above shows the multiple query analysis performed showing the number of general hospitals that have malaria death cases of not more than 76 people in a local government of not more than 184,674 people.

The general hospitals depicted are shown in the attribute table of Disease pattern used for the querying operation.



FID	Shape *	COUNT	STATENAME	ALGA	ALGAHQ	AREA	PERI	POP	POPDEN	MALE	FEMALE	CODE
0	Polygon	1	Lagos	Agege	Agege	11.1986	15.584	417981	37324	219839	198142	500
1	Polygon	1	Lagos	Ajeromi/Ifelodun	Ajeromi/Ifelodun	12.3319	14.694	593561	48132	313344	280217	501
2	Polygon	1	Lagos	Alimosho	Ikotun	185.2006	65.588	430890	2327	225564	205326	502
3	Polygon	1	Lagos	Amuwo Odofin	Festac Town	134.5804	78.623	225823	1678	118285	107538	503
4	Polygon	1	Lagos	Apapa	Apapa	26.6605	34.191	154477	5794	82714	71763	504
5	Polygon	1	Lagos	Badagry	Badagry	441.359	119.143	119267	270	60789	58478	505
6	Polygon	1	Lagos	Epe	Epe	1185.4665	266.699	111464	94	59802	51662	506
7	Polygon	1	Lagos	Eti Osa	Ikoyi	192.3466	83.26	157387	818	87803	69584	507
8	Polygon	2	Lagos	Ibeju Lekki	Akodo	454.7346	158.48	24937	55	12426	12511	508
9	Polygon	1	Lagos	Ifako/Ijaye	Ifako	26.6126	29.25	328397	12340	217626	110771	509
10	Polygon	1	Lagos	Ikeja	Ikeja	46.1619	41.441	203383	4406	109844	93539	510
11	Polygon	1	Lagos	Ikorodu	Ikorodu	393.9372	94.896	184674	469	94383	90291	511
12	Polygon	1	Lagos	Kosofe	Kosofe	81.4079	44.13	412407	5066	217626	194781	512
13	Polygon	1	Lagos	Lagos Island	Lagos Island	8.6609	11.557	165996	19166	83276	82720	513

Fig 3: A buffer performed showing LGA within 10000 meters of Surulere general hospital

The above figure shows the buffering performed depicting the local government areas within 10000 metres of Surulere General Hospital. The local government areas around the hospital are Ajeromi/Ifelodun, Alimosho, Amuwo Odofin, Apapa, Eti Osa, Ikeja, Kosofe, Lagos Island, Oshodi/Isolo, Lagos Mainland and Shomolu. Also bar charts and pie charts were created showing the distribution of the diseases. Some of such charts are illustrated below.

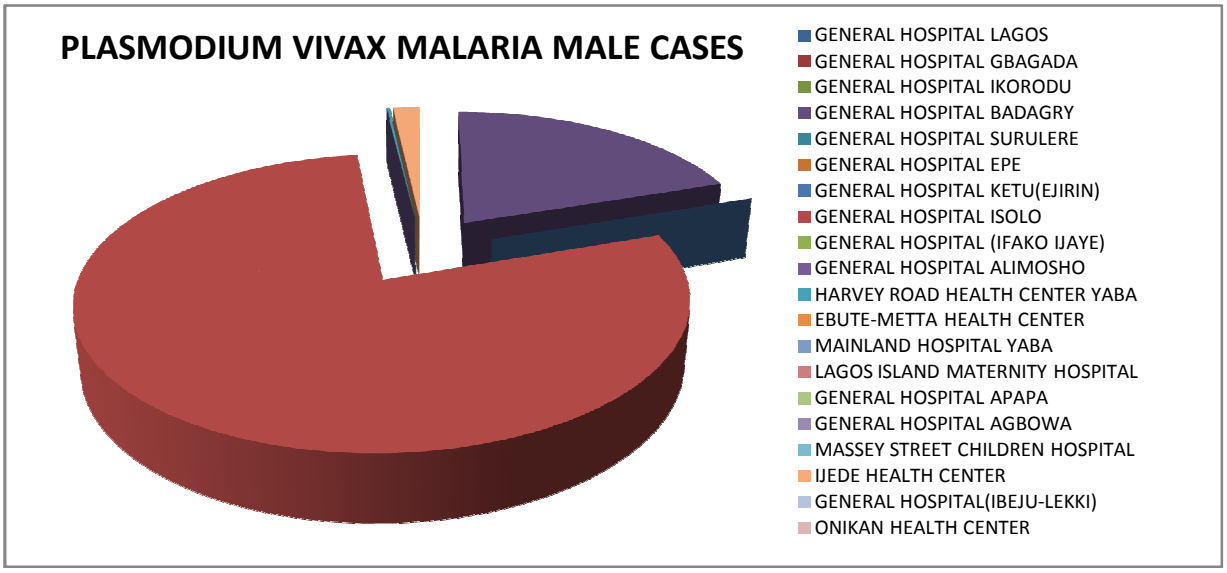


Figure 4: Pie Chart Showing the Distribution of Male *Plasmodium vivax* Malaria Cases in Lagos State General Hospitals in 2007.

From figure 4.11 it can be observed that General Hospital Isolo had the highest number of male *Plasmodium vivax* MALARIA cases in Lagos State General Hospitals in 2007.

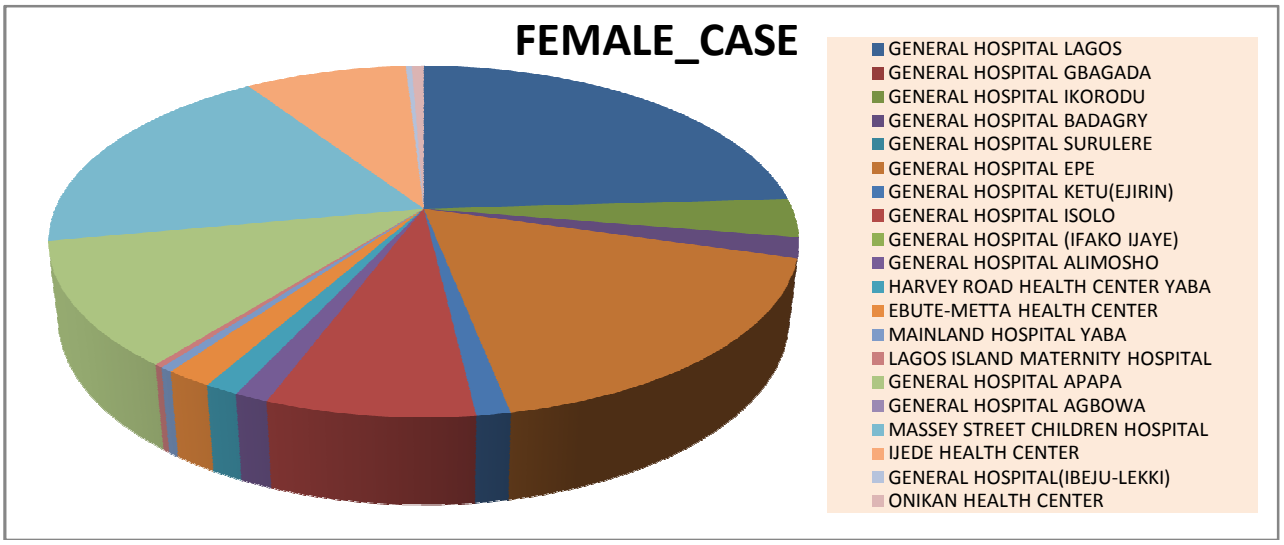


Figure 5: Pie Chart Showing the Distribution of Female Sickle Cell Cases in Lagos State General Hospitals in 2008.

From the pie-chart it can be observed that General Hospital Lagos had the most number of female sickle cell cases in the year 2008.

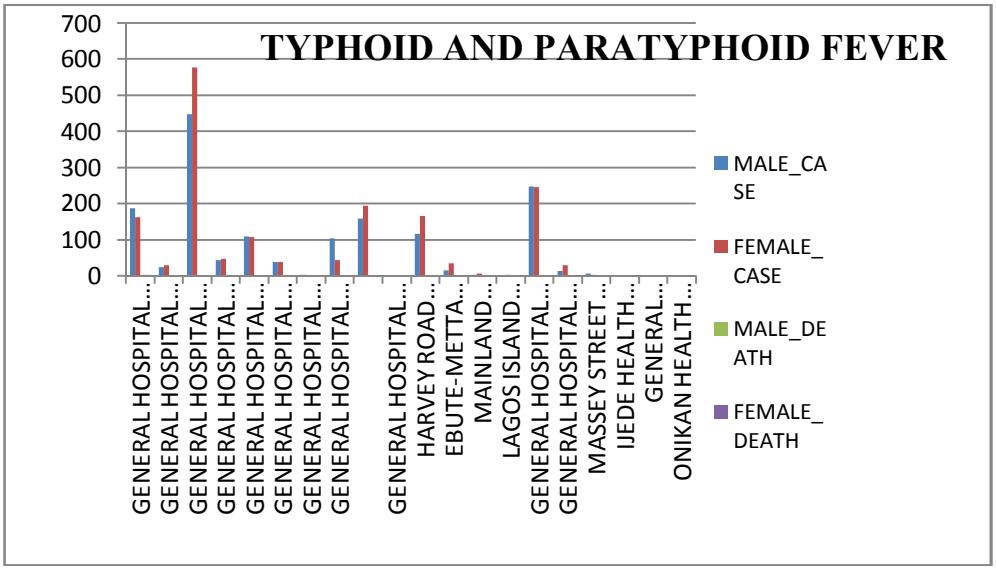


Fig 6: Bar Chart Showing the Distribution of Typhoid and Paratyphoid Fever Cases in Lagos State General Hospitals in the Year 2005.

It is observed from the chart that General hospital Ikorodu had the highest number of male and female typhoid cases in 2005, the number of female cases being more than that of the male. Death cases were barely recorded in all the general hospitals. This is due to the low mortality rate of typhoid and paratyphoid fever brought about by better treatment of the disease.

CONCLUSION

Based on the queries performed, it can be deduced that General Hospital Ikorodu featured prominently in many of the results obtained. Hence it can be said that it is one of the general hospitals with the highest influx of people to it. Also based on the buffer performed, general hospital Surulere is situated quite close to several of the other local government areas.

RECOMMENDATIONS

- This project may be adopted and used as a source for planning and management in the distribution of diseases in Lagos state general hospitals

- There should be further improvements in the nature of such projects.
- More general hospitals could be provided in all Local governments to enable quicker accessibility of people to medical care.
- The use of GIS as a tool in the analysis of data should be promoted, with more awareness programs carried out to educate people on its usefulness as an analytical tool.
- Good institutional framework should be established at all levels of governments down to individual who will be coordinating the affairs of producers and users of geo-spatial data.
- There should be further improvements on this project by inculcating pollution data or other forms of data to the project work. This would allow for better analysis to be performed.

Reference to this paper should be made as follows Omogunloye O.G. *et al.,* (2013), Geospatial Analysis and Distribution of Records of Sicknesses/Diseases (Malaria, Diabetes, Sickle Cell Disorder, Typhoid Fever) (A Case Study of the General Hospitals in Lagos State, Nigeria.), *J. of Medical and Applied Biosciences, Vol.5, No.1, Pp. 75-83.*