

Geospatial Distribution and Utilization of Dental Facilities in Lagos State

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Abstract

The provision and use of facilities in all spheres of human needs have attracted the interest of stakeholders and other social scientists. The reason for this interest lies in the importance of public facilities like schools, hospitals fire stations, clinics and others, on the development of the area. The utilization of health facilities in general and dental facilities in particular promotes health living. In oral health education, it is necessary to inculcate a habit of visiting dentist frequently. The purpose of the research is to examine the spatial distribution and utilization of dental clinics in Lagos State. The methodology adopted in this study was to investigate the spatial distribution and utilization of dental clinics in Lagos state, Geographic Information Systems (GIS) technique was used in creating a distributional map. The administrative map, information on the number and addresses of the dental clinics acquired from the state ministry of health and the coordinates of the dental clinics obtained using Global Positioning System (GPS) in the study area were integrated in the GIS environment and analyzed using Arc Map 9.2 software. The study reveals that there were eighty-one 81 dental clinics in the study area with the entire 81 (100%) being private dental clinics. The study also reveals the pattern of distribution of the dental clinics within the study area and the level at which the clinics are exploited. Data was also generated from primary and secondary sources. Four dental clinics were selected from the three senatorial districts of Lagos State.

Findings of the study revealed that majority of the respondents were well-educated, high-income earners and also mostly female. The study also revealed that there is uneven distribution in the availability of dental clinics. The spatial pattern of dental clinics is found to be clustered. The study also revealed that socio-economic status of users play a significant role in the utilization pattern of these facilities. The study concluded that government should establish dental clinics outside the general hospitals across every Local Government Area to provide a spatially even distribution in the location and utilization of dental clinics in Lagos state.

Keywords: Dental; Oral health; Local Government; Lagos State; GIS; Clinics

Introduction

Background of study

Public facilities have of late started to attract the attention of stakeholders due to the importance of public facilities such as schools, hospitals, fire stations, and others on the development of our environment. Dental care utilization is the percentage of the population who access dental services in a given period of time while the measures of actual dental care utilization is the percentage of the population who has seen a dentist during a specified periods of time, [1-4]. Dental disease, a severe public health problem affects all age groups and it's universally distributed, yet, only a few seek dental care. Thus a wide gap is created between the actual dental needs of the population and the demand for dental care.

Locker (1978) [5], in his conceptual model of oral health, defines health as not merely an absence of disease but also includes functional aspects, social and psychological wellbeing thus focusing on optimal functioning and social role. Oral health was also described as a comfortable and functional dentition that allows individuals to continue their social role. Oral health is achieved through several measures and activities, which include maintenance of good oral hygiene, non-harmful dietary practices as well as utilization of available facilities. Central also to achieving oral health is a well-planned and structured oral health care system.

A survey conducted in the United States in 1995 Canadian Dental Association, (2010) [4] reported that 69% of the respondents had visited a dentist during the previous 12 months. In 1997, another study reported that 75.5% of the population who are 25 years of age

or older who had a dentist indicated that they had visited a dentist in the preceding year, [6-10]. These reports of dental care utilization rates are higher than the 1993 numbers reported in the National Health Interview Survey and the dental care utilization rates reported by Eklund and colleagues [11], indicating that more Americans are visiting dentists. Neither population total nor population characteristics such as age, sex, income, and occupation are uniform in space. Likewise, the physical environment varies in characteristics from place to place and this invariably has implications for the pattern of demand for dental health facilities.

The World Health Organization (2004), describes GIS as "an excellent means of analyzing epidemiological data, revealing trends, dependencies and interrelationships that would be more difficult to discover using traditional tabular approach". However, it is generally agreed that utilization of dental clinics is a function of accessibility and that accessibility is a factor affecting or influencing utilization of dental clinics. Although there are physical and non-physical factors, which are geographical distance (physical factors), while age, sex, income, religion, literacy level, nature of service, population size and structure among others (non-physical factors). The strength of access therefore

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provides the link between utilization and distribution in context Olumoyegun, 2006.

For several reasons, the shortage of information is particularly acute in urban areas, where the majority of people live. First, explicit definitions and conceptualization of dental care access have not been widely used to guide research. An additional barrier to progress has an overwhelming concern about affordability of dental care, which has garnered the majority of attention and resources. In Nigeria, explicit consideration has not been given to the need for equity in the planning and distribution of dental clinics. This has led to the emergence of many regions within the country where both public and private dental care facilities are sparsely provided.

The phenomenal mass movement of people from the rural areas to urban areas/centers has continued to pose increasing health hazards on the urban populace. Hence, increasing urban population has substantial pressure on social services and has greatly increased the need to provide adequate facilities to cope with basic services need of the ever-growing population. Also due to the spatial arrangement of the city center, which is largely dominated by low-income earners and characterized by competitive bidding for land, there is hardly a space for locating a public facility that requires a large expanse of land. Of all the various health care facilities, a relatively small space of land is required for the establishment of dental clinics.

This study investigates a seldom-mentioned or measured aspect of the issue on the spatial distribution of dental clinics in Lagos State, Nigeria. A second component of this inquiry is to determine if the demand from Lagos patients for dental care has expressed itself spatially on the urban landscape of Lagos State. This study focuses on the spatial distribution of dental care facilities in Lagos state with a view to studying the location pattern and utilization of the existing dental care facilities in the study area. The frequencies for the utilization of dental care facilities were coded as above 4 times a year as (frequently), 1-4 times a year as (occasionally), while less than once a year as (rarely).

Statement of problem

In Nigeria, explicit consideration has not been given to the need for equity in the planning and distribution of dental clinics. This has led to the emergence of many regions within the country where dental care facilities are sparsely provided. The creation of a spatial reference system and mapping of the utilization level of dental facilities would reveal what should be done in regard to maximum usage and effective distribution of these facilities.

The problem lies in how to get the populace aware of the accessibility, functionality and necessary pull to utilize them on one hand, and on the other hand, to equitably deployed these dental clinics with reference to population in a given environment.

AIM

The aim of the research is to examine the spatial distribution and utilization of dental clinics in Lagos State.

Objectives

- Data acquisition.
- To use GIS to identify the exact location of the Dental facilities in Lagos State.
- Analyze the data acquired on a GIS environment to examine the locational pattern of the clinics in Lagos State and perform necessary queries.

- Describe the socio- economic characteristics of the user population and how it affects the level of utilization of the dental clinics.
- Identify the factors, draw a conclusion and recommend, how the distribution and utilization of dental facilities can be bettered.

Significance of study

The study seeks to know the location-pattern of the dental clinics and create a sustainable database of the dental clinics with a detailed record as to their:

- a) The geographical coordinate (longitude and latitude).
- b) Physical addresses (street address).
- c) Local Government area.
- d) Senatorial district.
- e) Type of facility (Private or Public)

It also seeks to determine the relationships between their level of utilization/ location as well as their level of utilization/ various socio-economic characteristics of the populace using the neighborhood criteria concept.

Scope of study

This study was carried out in Lagos State, Nigeria by selecting one dental clinic from a local government area of every five local government area under the three senatorial districts of Lagos State. A total of four different dental clinics from different local government areas (Alimosho, Kosofe, Ikeja and Surulere) were selected.

Patients' data were collected for the year 2013 subject to the condition given by these clinics. This study was based on the level of utilizing dental clinics, socio-economic characteristics of patients and spatial distribution of available dental clinics in Lagos State. This study also reviewed available past and present works done on spatial distribution and utilization of dental clinics and other health facilities locally and internationally.

Study area

Lagos State has a landmass of about 3,577 square kilometers or 358,862 hectares. According to the 2006 National Population Census of Nigeria, Lagos state has a total population of 9,010,534 persons. Lagos State is divided into 5 Administrative Divisions; Badagry Division, Epe Division, Ikeja Division, Ikorodu Division, Lagos Division, which are further divided into 20 Local Government Areas or LGAs: Agege, Ajeromi-Ifelodun, Alimosho, Amuwo-Odofin, Apapa, Badagry, Epe, Eti-Osa, Ibeju-Lekki, Ifako-Ijaiye, Ikeja (capital of Lagos State), Ikorodu, Kosofe, Lagos island, Lagos Mainland, Mushin, Ojo, Oshodi-Isolo, Somolu, and Surulere which are sub-divided into three (3) senatorial districts, which are; western senatorial district, central senatorial district and eastern. Senatorial district, as depicted in Figure 1.

Limitation of study

In studies of this nature, it is not impossible to encounter problems in the process of collecting data hence; few problems were encountered in the area of primary data acquisition. Some of the respondents although well-educated did not cooperate enough as some of them

serve an area. Conversely, if a particular dental clinic has a very small catchment area then we shall need many of such facilities to cover a given area. For example, Lagos State University Teaching Hospital (LASUTH), which has the whole of Lagos State as its catchment area, attracts patients from all over the state. Conversely, if a particular dental care facility has a very small catchment area then we shall need many of such facilities to cover a given area (dental clinics). The frequency of need as well as the level of dental services rendered therefore determines the locational pattern of the dental facilities.

Dental clinic facilities serve mostly people from immediate environment of the facilities because they provide rudimentary services for which people are not willing to travel long distance and the lack of even distribution of dental clinics would lead to a “friction of distance” which describes the force that creates distance decay.

Concept of distance decay effect

Places are interrelated with other places in structured and comprehensive ways. A basic law in geography tells us that in a spatial sense everything is related to everything else but that relationships are stronger when things are near one another. Thus, interaction between places diminishes in intensity and frequency as distance between them increases. Places are interrelated with the other in structured and comprehensible ways. In describing the processes and patterns of spatial interaction, geographers add the effect of distance on spatial interaction.

The distance decay effect states that the interaction between two locales decline as the distance between them increases [12] Forbes, 1968. Once the distance is outside of the two locales activity space, their interactions begin to decrease. Related terms like “Friction of distance” describes the force that creates distance decay. Tobler’s first law of geography states that, “All things are related, but near things are more related than far things” [13].

Distance decay is graphically represented by a curving line that swoops concavely downwards as distance along the x-axis increases. It can also be evident in town and city centers as shown in Figure 2.

Figure 2 shows how most people observe distance. For each activity, critical distance is distance beyond which the intensity of contact declines, if distance is the measuring rod. For the distance up to the critical distance, a frictionless zone is identified in which considerations of time or distance do not effectively figure into the trip decision. This should be located in a way that minimizes cost or time so that the people that are supposed to use these services can utilize them effectively.

Hagget, (1977) [14] noted that a concerted attempt at identifying the distance ranges, which delimit these levels of interaction and incorporate them into an interaction model’s constraints structure,

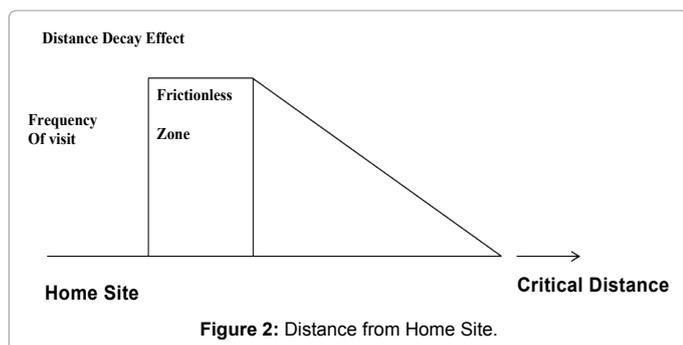


Figure 2: Distance from Home Site.

would definitely improve the model’s representation of the system. In this context, it is also safe to assume that as one moves from imposing a trip-length constraint on the whole system, each-origin increased prediction-accuracy, can be realized. In general, the tighter the interaction model is constrained, the better the model’s predictive powers becomes.

Thus, the effect of distance on cultural or spatial interactions is highly significant, as the higher the distance between available dental clinics and their nearest neighbor reduces the level of interaction between two locales. Suffice to say; their interactions begin to decrease once the distance is outside of the two locales’ activity space.

Literature review

The study of regional variations in the distribution of social services (like dental clinics) has captured the interest of various stakeholders because of their general interest in the spatial variation of phenomena on the earth’s surface. In particular, the question of access to sources of satisfaction of human need or want, stresses the importance of location and distance.

Conventional focus of empirical studies on facilities usually, is on the link between distance and patronage pattern of such studies on the role of spatial factors. The impacts of following three broad sets of factors on overall accessibility are examined:

- The spatial configuration and characteristics of the health delivery system alongside a broad range of quality measures related to particular services.
- The role of the transport system in bringing individuals to these destinations, as well as the respective importance of private and public transport in different socio-cultural context.
- The characteristics of individuals utilizing health services or, in general, the characteristics of the areas in which they reside based on relevant census data.

Past studies had partly been concerned with applying quantitative approaches to measuring accessibility to services [15]. In the health sector, studies have been concerned with assessing variations in the locations of, for example, doctor’s surgeries at a variety of spatial scales in order to know potential inequalities in relative accessibility of such services. Fortney et al. [16] have compared the accuracy of methods of calculating availability and accessibility of services using a range of alternative measures, by using a sample of patients and medical providers and mental health specialists in Arkansas.

Their findings suggest that the “measurement accuracy can be substantially improved by using a GIS”. Khan (2013) [17] has reviewed the approaches taken to calculating potential access measures in a health context and provides a useful typology, which acknowledges the dichotomy between potential and realized (revealed) spatial measures. The most basic measures compare the supply of facilities such as, numbers of general practitioners and dentists. Many studies of dental service utilization have been conducted on various consumer groups and using different dimensions. That is, doctors-patient relationships, accessibility and availability of dental services. The following studies focused on university students as a major group of users of the modern dental facility in order to provide information on utilization and measure the degree of satisfaction with the services provided.

Previous studies: A survey of the utilization of dental services among university students in Helsinki [3] Bamise, 2008 showed that

59% of the students during the previous 12 months had had a dental appointment, mostly on their own initiative. The dental utilization rate, generally, was higher among females; it increased with income and educational level, and decreased with age. Various methods have been applied in assessing the adequacy of patients' utilization of health services.

Secondly, a study was carried out at Obafemi Awolowo University, Ile-Ife, in the southwestern part of Nigeria which provides residence for about nine thousand students. The outpatient unit of the Obafemi Awolowo University Teaching Hospital is situated on campus and provides dental care for the University community (staff and students on campus), Ile-Ife town, and residents in the surrounding area. The aim of the work was to make available information about utilization and satisfaction of residential students with the dental services provided by the outpatient clinic of the Teaching Hospital's dental department.

In this study at Obafemi Awolowo University, Bamise (2008), shows very low (7.8%) utilization of the dental services by the undergraduate students in contrast to the high rates in highly industrialized countries, where more than 60% of 25-year-olds and above had visited a dentist within a year. Similarly utilization in the Nigerian university was also lower than reported for university students in Helsinki, where within 12 months, 59% of the students had a dental appointment. The relationship between dental service utilization and the main demographic variables; such as location of residence, income, wealth, education, occupation and age, were less relevant in the study. However, their findings show equal utilization of dental service among males and females, in contrast to the higher rate of utilization by female students reported in Helsinki. Conclusively the dental service utilization among the students was found to be low. Oral health awareness campaigns, improving the quality of the services, and shortening the waiting time are anticipated to increase service utilization and satisfaction. It is the first research on Dental facilities at the Department of Surveying University of Lagos.

Utilization of dental clinic facilities: Findings in literature suggest that the utilization of dental clinic facilities can be affected by many factors among which are long waiting time which has been described as a natural outcome of insufficient personnel and facilities in the face of high demand for services, too little awareness of the importance of dental health care, expectation of painful dental treatment, costly charges, and being too hectic for a visit ranked highest among the factors causing reluctance to seek dental treatment [10].

Though dentists concur that regular dental visits are necessary for maintaining good oral health, national studies estimated that only 41-50% of all Americans in the United States visit the dentist each year. In Nigeria, Savage and Arowojolu reported that 24 (31.58%) of the 76 subjects investigated, perceived it as being normal for them to bleed from the gum. Therefore, they have no reason to seek dental care for this apparent pathological condition. They fail to realize that dental care is part and parcel of primary health care and not just for aesthetics, which most people view as a luxury.

Utilization of health services are an important policy concern in most developing countries, reflecting both efforts to improve health outcomes and to meet international obligations to make health services broadly accessible. Early policy and research initiatives focused on the need to improve physical access through an expansion of the network of facilities. However, a growing literature on health care demand has pointed out that individuals are not passive recipients of health services, but make active choices about whether or not to make use of provided services. Actual utilization of health services will differ in accordance

with demand factors such as income, cost of care, education, social norms and traditions, and the quality and appropriateness of the services provided. Hence, if we are interested in not merely providing physical access, but also ensuring that effective and appropriate health services are used by the population, we need to understand what factors affect health care decisions, and why low levels of utilization persists among certain socioeconomic groups or geographic regions.

In geography the relationship between activity rates and accessibility is known as 'distance decay'. Hence, almost all form of human activity is reduced in frequency by distance or travel time [13]. St. Clair et. al. (2002) [18] noted that age and sex structure to a large extent also influences the utilization of health care facilities in the sense that the need for health care is very high among the young and old than other age groups. The aforementioned studies support the notion that accessibility impacts probability of contacts with the health care system.

Spatial distribution of dental clinic facilities: Socio economic standard of a given population to a large extent influences the composition of dental care facilities. Due to this factor, dental care facilities are most likely to be located in urban centers compare to the rural regions. For instance, [19] Rimlinger et. al., 1963 found out that per capita income and higher population, which is correlated closely at the country level, was the main attraction forces in the location of physicians. In a follow up study, they found out that the challenges in location of physicians were affected by the regional degree of urbanization and the increase in population Rimlinger, 1964.

Penchansky et al. (1981) [20] defined accessibility as the relationship between the location of supply and the location of clients taking into consideration the clients transportation resources, travel time, distance and cost. Dental care as being a part of medical health care, which is perhaps the most basic of all services and questions of access to it, are generally viewed with utmost importance. Access though is a concept that can be broadly or narrowly interpreted. It can be used in all embracing sense to describe the way in which need for health care is translated into successful health outcome through the use of a medical service or in a narrow sense to characterize "individual barriers to successful satisfaction of needs" [21].

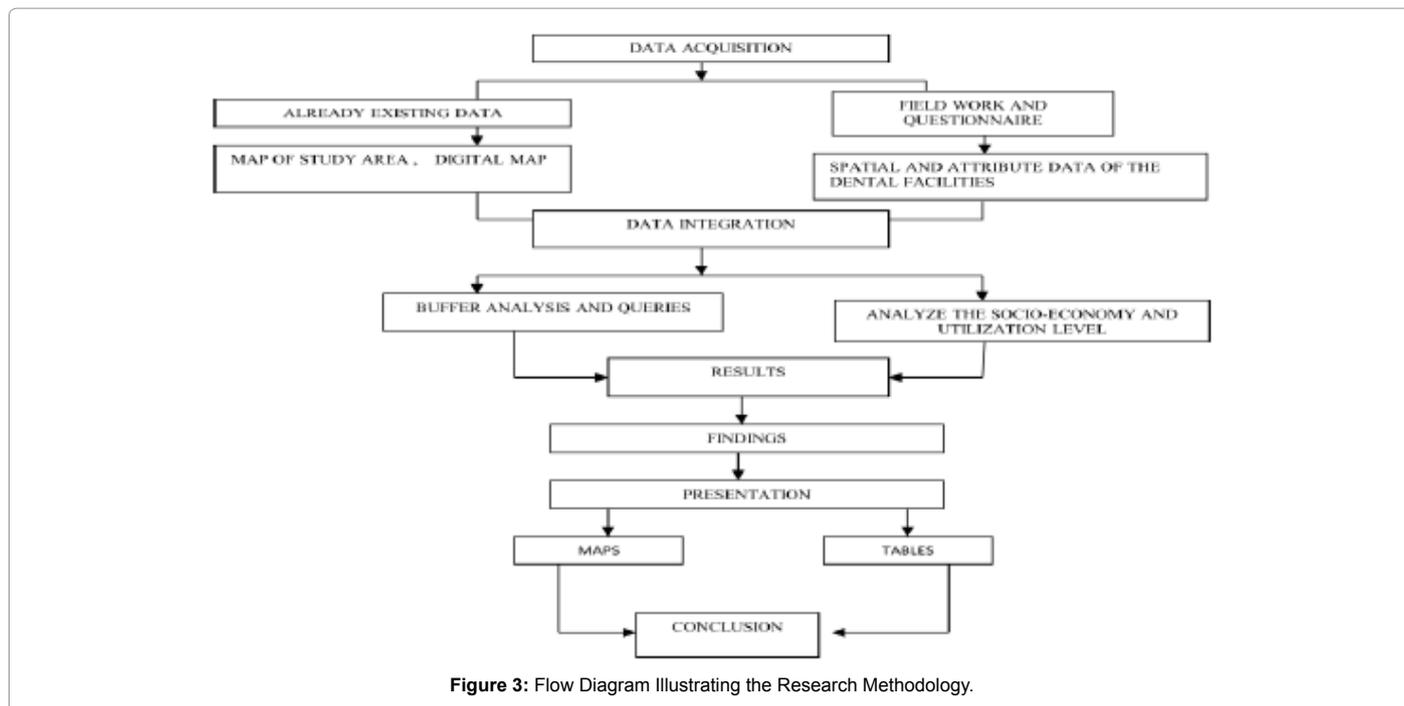
The question of access to dental clinics should be of utmost importance, although the concept of access can be broadly or narrowly interpreted. It can be used in all embracing sense to describe the way in which need for health care is translated into successful health outcome through the use of a medical service, or in a narrower sense to characterize individual barriers to successful satisfaction of needs [21] Andersen, 1967. The aforementioned studies support the notion that accessibility impacts probability of contacts with the dental care system.

Methodology

The method used in this study comprises three main stages namely Data collection, Data automation, Data analysis and presentation (Figure 3).

Methods of data collection

Sources of data: Both primary and secondary data were used in this study. The Primary data was generated by questionnaires administered to patients who visited dental clinics. The stratified random sampling method was adopted to select the clinics across three senatorial districts of Lagos State. Lagos State is divided into three



S/N	Senatorial Districts	Local government areas
1.	WEST SENATORIAL DISTRICT	Agege, Ajeromi-Ifeلودun, Alimosho, Amuwo-Odofin, Badagry, Ifako-Ijaye, Ikeja, Mushin, Ojo, Oshodi-Isolo.
2.	CENTRAL SENATORIAL DISTRICT	Apapa, Eti-Osa, Lagos-Island, Lagos-Mainland, Surulere.
3.	EAST SENATORIAL DISTRICT	Epe, Ibeju-Lekki, Ikorodu, Kosofe, Somolu.

Source: Reclaim Naija; Incident Reporting System (<http://www.reclaimnaija.net/cms/electionguide/know-your-senatorial-districts>) Year: 2013.

Table 1: Table Showing Local Government Areas under Each Senatorial Districts of Lagos.

senatorial districts, namely; the western senatorial district which has ten (10) local government areas, the central senatorial district with five (5) local government areas and the eastern senatorial district also has five (5) local government areas (Table 1).

The questionnaire was divided into two sections. The first section was designed to collect information on the socio-economic and demographic characteristics of the respondents. The second section of the questionnaire was designed to collect information on the main objectives of the study, which is the utilization of dental clinic facilities and preference for the dental facilities among others (see appendix vi).

Patients who came to receive treatment at the dental clinics were the study population. A total of 280 questionnaires were administered at selected dental clinics across four local government areas of approximately equal population density, with two (2) local governments selected from the western senatorial district which consists of ten (10) local governments, one local government from the central senatorial district which consists of five (5) local governments and one local government from the eastern senatorial district which consists of five (5) local governments. Suffice to say; for every five local government areas, one local government was selected in Lagos State. A hand held Geographic Positioning System (GPS) was used to acquire data based on the information from the secondary data. These coordinates were registered and stored in Microsoft Excel, then exported as database format and imported into the ArcGIS to produce a map showing the locational pattern of dental clinics across Lagos State. The map was used for the nearest neighbor analysis. Secondary data was collected

from the Lagos State Ministry of Health on the number and physical location address of dental clinics.

Software used

The method that would be used in this research work would comprise of three main stages namely Data collection, Data automation, Data analysis and presentation. Basically, the software's listed below were used for this project;

- Arc GIS 10.0 was used for the mapping of the facilities and also for the generation of the study area maps.
- Microsoft word was used basically for data processing and presentation of the research findings.
- Microsoft Excel was used in creating the attribute tables.
- IBM SPSS Statistic 20 was used to analyze the data from the questionnaire and create charts.

Mapping of dental clinics

The mapping of the dental clinics was carried out by first going to the field to collect additional data of the clinics, which is the XY coordinates using a handheld GPS. The coordinates are tabulated along with existing data collected from the Lagos State Ministry of Health on Excel, and then it was converted to DBF IV for the recognition by the Arc GIS Software. The coordinates were then plotted on an existing Lagos State map in shape file format on ArcGIS.

Method of data analysis

For the purpose of this research work several methods have been used to achieve the outlined objectives.

- Descriptive Statistics.
- Nearest Neighbor Analysis.
- Buffer Analysis.
- Database Functionality and Querying.
- Inferential Statistics.

Descriptive statistics: The descriptive statistic was used to provide simple summary about the sample and about the observation that have been made in the research work. It was use in describing the;

- Locational Pattern of the Dental Clinics.
- Availability and Location of Dental Clinics in Lagos State.
- Availability and Location of Dental Clinics in the three Senatorial Districts of Lagos State.
- Availability of Dental Clinics to Population Ration in the twenty Local Government Areas of Lagos State.
- These descriptions are drawn from the existing data tabulated against each other; such data are landmass of each local government area in Lagos State, population of each local government area in Lagos State, number of dental clinics of each local government area in Lagos State and the senatorial district of Lagos State.

Nearest neighbor analysis: In the quest to determine the spatial pattern of the dental clinics the nearest neighbor analyzer was used to determine it.

The basic statistical analysis used is the Nearest Neighbor Statistic (R_n) defined as the ratio of the mean distance (r^A) in the area under investigation to some expected mean distance usually under a random distribution (r^E). This Statistic is defined as

$$R_n = r^A/r^E \quad (1)$$

$$r^A = d/n \quad (2)$$

$$r^E = 1/\sqrt{2} r^A \quad (3)$$

$$R_n = 2 r^A \sqrt{n/A} \quad (4)$$

Where;

R_n = nearest neighbor

r^A = observed mean of nearest neighbor

r^E = expected mean distance of nearest neighbor

d = distance

n = number of locations

A = area

$R_n = 1$ implies that the distribution is random $R_n > 0$ implies that the distribution is clustering $R_n = 2.15$ implies that the distribution is regular Mitchel, 2005.

The Nearest Neighbor Analysis was also carried out on ArcGis 9.3 using the statistical toolbox then choosing tools and moving on to Average nearest Neighbor (Spatial Statistics). The required fields are

filled by imputing the feature class as required which is the Dental Clinic Shape file and specifying the distance method, the option to display output graphically is then set to be true.

Buffer analysis: To identify if Lagos state has adequate dental clinic services the Buffer analysis was use at a radius of 2km. Using the Proximity toolset then choosing Buffer Analysis in ArcGis 10.1, the required fields are filled appropriately by imputing the featured layer, the Dental Clinic shape file and the output on the Lagos State shape file then selecting a the desired distance of 2km. The option to buffer into round shape is require so the proximity can be well seen and that was used to generate the proximity of services rendered by the Dental Clinics.

Database functionality and querying: In essence to select certain features on the generated map, the database is being queried by either using the Select by Attributes Tool or Select by Location tool in the Selection toolbox, in ArcGis 10.1.

Steps for using the Select by Attributes codes in the ArcGis environment:

1. Click Selection > Select by Attributes to open the Select by Attribute dialogue box.
2. Choose the layer to perform the selection against.
3. Create a query using the expression building tools.
4. Validate the query expression by clicking Verify.
5. Click Ok or Apply to execute the selection expression.
6. Save the query expression for later reuse before closing this dialog box.

Steps for using Select by Location codes in the ArcGis environment:

- Click Selection > Select by Location to open the Select by Location dialog box.
- Choose the type of selection that you want to make. Click the drop-down arrow to see your choices.
- Identify the target layer(s) from which features will be selected and check them on.
- Choose the spatial relationship rule that will be used for selection.
- Specify the source layer that will be used to select features from the target layer.
- To complete your Select by Location specification, you can optionally specify if you want to (1) Use selected features in the source layer to identify the features to select or (2) Use a buffer distance in your search (buffer distances are only used with some selection options). Both selection types were used to query the research-generated map to get desired selections.

Inferential statistics: For the most part of the research, statistical inference were used to make propositions about populations, using data drawn from the questionnaire of interest via some form of random sampling.

To make basic analysis on the following;

- Economic characteristics of respondents such as age of patients, gender characteristics of patients, marital status of patients,

educational level of patients, occupation structure of patients and income of patients.

- Pattern of utilization of Dental Clinics by considering the level of utilization, spatial factors, socio economic factors, education and utilization of Dental Clinics, occupation and utilization of Dental Clinics and the last of them, Income and utilization of Dental Clinics.

Results and Analysis

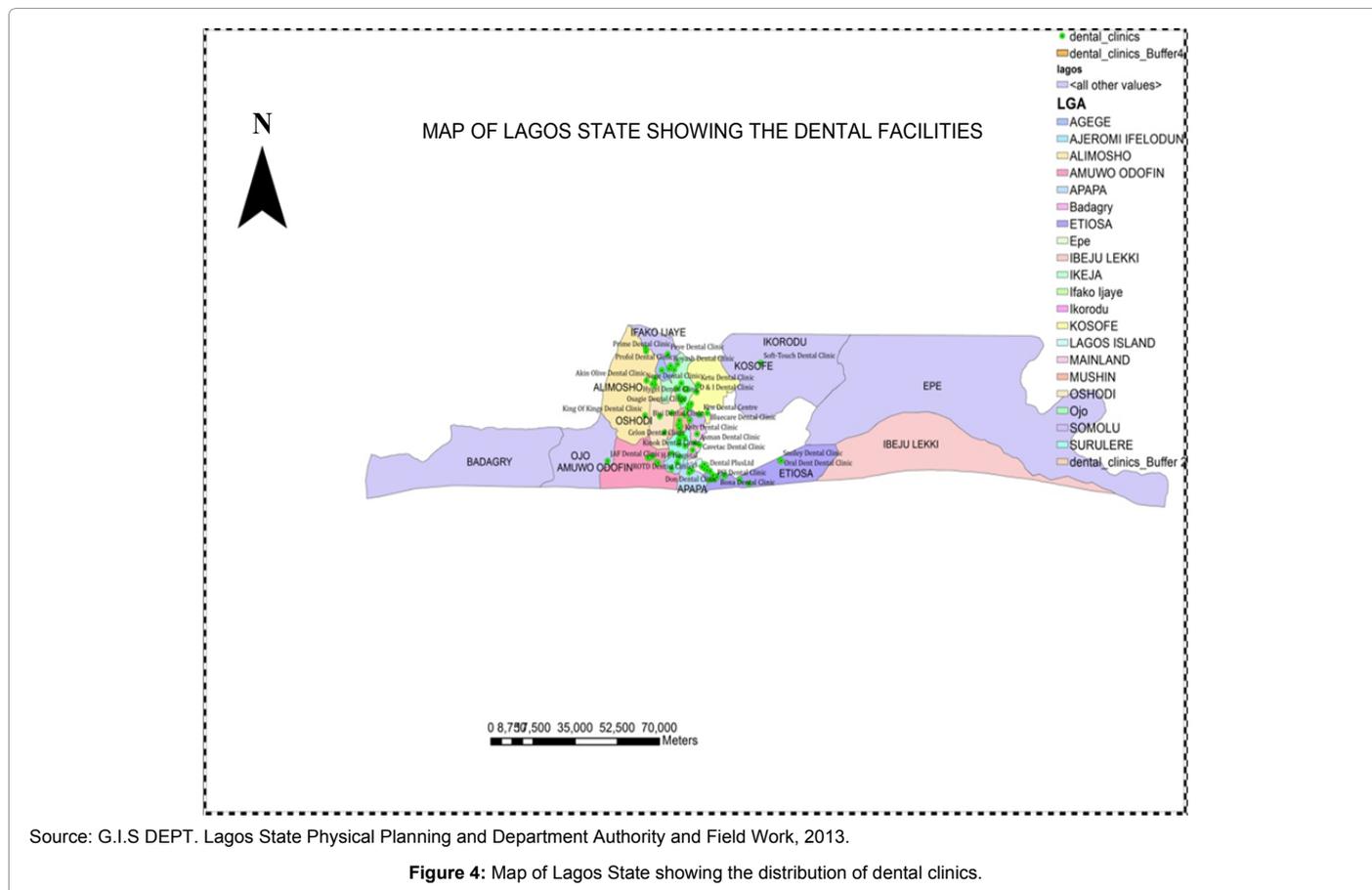
The major task in this chapter includes analysis of socio-economic characteristics of respondents as well as the location pattern of the dental clinics in Lagos State. The decision of locating social or public facilities such as health care services should be made in the best interest of the population they are meant to serve. Private service providers give preference to providing services mainly for high-income groups with the aim of maximizing profit while the location of public facilities are aimed at minimizing cost and maximizing utility.

Locational pattern of dental clinics in lagos state

The typical scenario in the location of dental clinics in Lagos State is mostly based on the personal decisions of the private owners, as they own all the dental clinics covered in this study. No publicly owned dental clinic was located outside of the government's general hospitals and teaching hospitals. The data in (appendix i) shows the detailed location of the available dental clinics in Lagos State [22]. The analysis of the level of availability and location of dental clinics in Lagos State is presented in Figure 4.

Availability and location of dental clinics in lagos state: Data in Table 2 shows the level of availability and location of dental clinics in Lagos State. Table 2 shows that Lagos State is divided into three senatorial districts (west, central and east) which are further divide into twenty Local Government areas with ten Local Government areas to the west, five in the central and five to the east. The total numbers of dental clinics available are eighty-one across a total land mass of 4, 247.74 sq km to serve a total population of 9,010,534 people in Lagos State. Ikeja, Eti-Osa and Surulere Local Government Areas have the highest number of dental clinics. Each of the three Local Government Areas has ten dental clinics. The Local Government Areas with the fewest number of dental clinics are Alimosho with six dental clinics Lagos West, Amuwo-Odofin with five dental clinics in Lagos West, Lagos-Island with seven in Lagos Central and Kosofe with six dental clinics in Lagos East. Some Local Government Areas have no dental clinics they are Badagry in Lagos West, Epe in Lagos East and Ibeju-Lekki in Lagos East. The uneven distribution of the available dental clinics can be seen in each Local Government Area as Local Government Areas such as Ikeja in the western senatorial district; Eti-Osa and Surulere in the central senatorial district each have ten dental clinics which is the total sum of dental clinics available in the whole of the western senatorial district. Factors that could be responsible for this outcome is that Ikeja is the capital of Lagos State and places like Surulere and Eti-Osa are central business districts. Outskirts such as Epe and Ikorodu amongst others characterize the eastern senatorial district [23-26].

Availability and location of dental clinics in the three senatorial districts of lagos state: The western senatorial district has the highest number of population (5,565,680), followed by the eastern senatorial



S/N	West Senatorial District L.G.A	Land mass (km ²)	Population	Number of Dental Clinics
1	Agege	26.61	459,939	3
2	Ajeromi-Ifelodun	26.66	684,105	2
3	Alimosho	26.61	1,277,714	6
4	Amuwo-Odofin	46.16	318,166	5
5	Badagry	441.36	241,093	0
6	Ifako-Ijaye	26.61	427,878	3
7	Ikeja	185.2	313,196	10
8	Mushin	26.66	633,009	3
9	Ojo	158.16	589,071	1
10	Oshodi-Isolo	46.16	621,509	4
Sub Total		1,010.19	5,565,680	37
S/N	Central Senatorial District L.G.A	Land mass (km ²)	Population	Number of Dental Clinics
11	Apapa	26.66	217,362	3
12	Eti-Osa	192.35	287,785	10
13	Lagos-Island	192.35	209,437	7
14	Lagos-Mainland	11.55	317,720	4
15	Surulere	26.66	509,975	10
Sub Total		449.57	1,542,279	34
S/N	East Senatorial District L.G.A	Land mass (km ²)	Population	Number of Dental Clinics
16	Epe	1,185.47	181,409	0
17	Ibeju-Lekki	1,185.47	117,481	0
18	Ikorodu	393.94	535,619	1
19	Kosofe	11.55	665,393	6
20	Somolu	11.55	402,673	3
Sub Total		2,787.98	1,902,575	10
TOTAL		4,247.74	9,010,534	81

Table 2: Available Dental Clinics in Each Local Government Area/Senatorial Districts of Lagos State.

S/N	SENATORIAL DISTRICT	Land mass (km ²)	Population	Number of Dental Clinics
1.	WEST SENATORIAL DISTRICT	1,010.19	5,565,680	37
2.	CENTRAL DISTRICT	449.57	1,542,279	34
3.	EAST SENATORIAL DISTRICT	2,787.98	1,902,575	10
TOTAL		4,247.74	9,010,534	81

Source: Lagos State Ministry of Health and fieldwork, 2013.

Table 3: Availability of Dental Clinics in the Three Senatorial Districts of Lagos State.

district (1,902,575) and then the central (1,542,279) as shown in Table 3. Of all the three senatorial districts the smallest in land mass is the central with 449.57 sq km, and then the western with 1,010.19 sq km and the largest in land mass is the eastern senatorial district with 2,787.98 sq km. The landmass size notwithstanding, the eastern senatorial district accounts for the lowest number of dental clinics with ten followed by the central with thirty-four and the western senatorial district accounts for the highest number of dental clinics with thirty-seven, thus making a total of eighty-one dental clinics in the three senatorial district of Lagos State as shown on Table 2. The map of the location of dental clinics in Lagos State is shown in Figure 4, Table 4.

Availability of dental clinics to population ratio in the twenty local government areas of lagos state: The availability of dental clinics in Lagos State shows that the level of availability varies within the state from one Local Government Area to another. The population and

dental clinic ratio shows the average number of people in an area to the number of dental clinics available in a place. The population-dental clinic ratio for Lagos State is 1:111,241. This means that one (1) dental clinic is available for 111,241 people on the average in Lagos State. This ratio is high compared to the figures of 1:766 populations per dentist for Greece in 2007 and 1:1,745 populations per dentist for Canada in 2009. The higher the number of people per one dental clinic, the higher the level of competition, as shown on Table 4, the senatorial district with the highest number of human population per on dental clinic is the east accounting for a ratio of 1:190,258 followed by the west with a ratio of 1:150,424 and the senatorial district with the least level of competition is the central accounting for a ratio of 1:45,361. The Local Government Area with the highest population per dental clinic is Ojo Local Government Area with a ratio of 1:589,071 and the Local Government Area with the lowest population per dental clinic is Eti-Osa with a ratio of 1:28,779.

Spatial pattern of dental clinics in lagos state: In order to determine the spatial pattern of the facilities in the study area, the technique of the nearest neighbor analysis was used. The nearest neighbor statistics [R_n] defined as the ratio of the mean distance [r^A] in the area under investigation to some expected mean distance [r^E]. This statistics measures the extent of deviation from a purely random

S/N	West Senatorial District L.G.A	Population	Number of Dental Clinics	Population/ Dental Clinic Ratio
1	Agege	459,939	3	1:153,313
2	Ajeromi-Ifelodun	684,105	2	1:342,052
3	Alimosho	1,277,714	6	1:212,952
4	Amuwo-Odofin	318,166	5	1:63,633
5	Badagry	241,093	0	—
6	Ifako-Ijaye	427,878	3	1:142,626
7	Ikeja	313,196	10	1:31,320
8	Mushin	633,009	3	1:211,003
9	Ojo	589,071	1	1:589,071
10	Oshodi-Isolo	621,509	4	1:155,377
Sub Total		5,565,680	37	1:150,424
S/N	East Senatorial District L.G.A	Population	Number of Dental Clinics	Population/ Dental Clinic Ratio
11	Apapa	217,362	3	1:72,454
12	Eti-Osa	287,785	10	1:28,779
13	Lagos-Island	209,437	7	1:29,920
14	Lagos-Mainland	317,720	4	1:79,430
S/N	West Senatorial District L.G.A	Population	Number of Dental Clinics	Population/ Dental Clinic Ratio
15	Surulere	509,975	10	1:50,998
Sub Total		1,542,279	34	1:45,361
S/N	Central Senatorial District L.G.A	Population	Number of Dental Clinics	Population/ Dental Clinic Ratio
16	Epe	181,409	0	—
17	Ibeju-Lekki	117,481	0	—
18	Ikorodu	535,619	1	1:535,619
19	Kosofe	665,393	6	1:110,899
20	Somolu	402,673	3	1:134,224
Sub Total		1,902,575	10	1:190,258
TOTAL		9,010,534	81	1:111,241

Source: Lagos State Ministry of Health and fieldwork, 2013.

Table 4: Population and Dental Clinic Ratio in Lagos State.

pattern. It is calculated by measuring the mean distance between points and their nearest neighbor comparing this figure with random distribution value (Table 5).

R_n = nearest neighbor

r^A = observed mean of nearest neighbours

r^E = expected mean distance of nearest neighbours

d = distance

n = number of locations

A = area

Nearest Neighbor values for locational pattern determiners;

**Random = 2.15, Clustered = 0, Regular = >0 or <2.15

$R_n = r^A/r^E$

$r^A = d/n$

And $r^E = 1/\sqrt{2} r^A$; $R_n = 2 r^A \sqrt{n/A}$

$r^A = d/n$, A = 3,577sqkm, n = 4, d = 1.7km

$r^A = 1.7 / 4 = 0.425$

$R_n = 2 (0.425) \times \sqrt{4} / 3,577$

$R_n = 0.85 \times 2/3,577$

= 0.85 x 0.00055913

$R_n = 0.00047526$.

The nearest neighbor statistics [R_n] was 0.0005 (Table 4), which shows that the distribution pattern is clustered and not random. This means that the spatial pattern of dental clinics in Lagos State is clustered. Figure 5 shows the clustered nature of the location of dental clinics in Lagos State using ArcGIS to analyze the Average Nearest Neighbor.

One can easily see that the concentration is in the Central Senatorial District with Ikeja, Surulere, Mushin and Lagos Island local government area vividly seen as well packed with Ikorodu and Ojo local government area barely having a taste of the distribution from the displayed figure below.

Buffer analysis: From Figure 6 below it can be observed that at a radius of 2km around each hospital for example, their zone of influence greatly intersect at various points which is a major characteristic of availability. But in this case one can observe that not all Local Governments are covered totally as seen in the case of Ikorodu, Epe,

S/N	Dental Clinic	Local Government Area	Nearest Neighbor	Distance (Km)
1.	Jooly Diagnostic Medical Service.	Alimosho (EGBEDA)	Ipaja	0.3
2.	V-Vine Dental Clinic.	Ikeja (GRA)	Maryland	0.5
3.	Ketu Dental Clinic	Kosofe (KETU)	Ojota	0.4
4.	Spectrum Dental Surgery	Surulere (AGUDA)	Orile-Iganmu	0.5
Total distance				1.7

Source: Fieldwork, 2013.

Table 5: Nearest Neighbor Analysis.

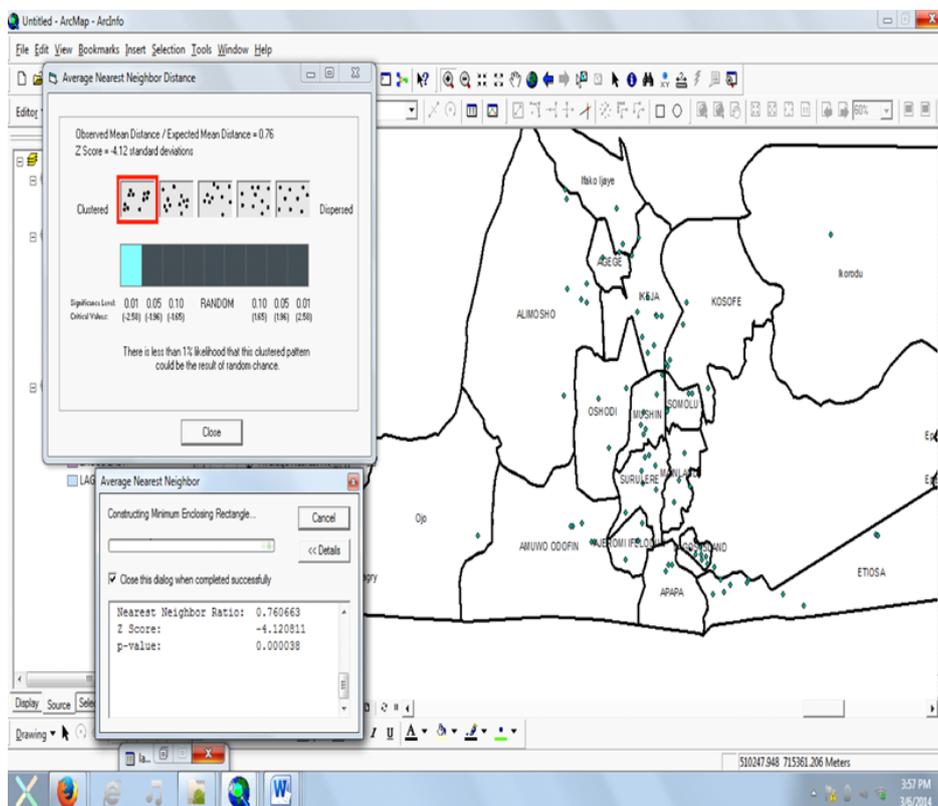
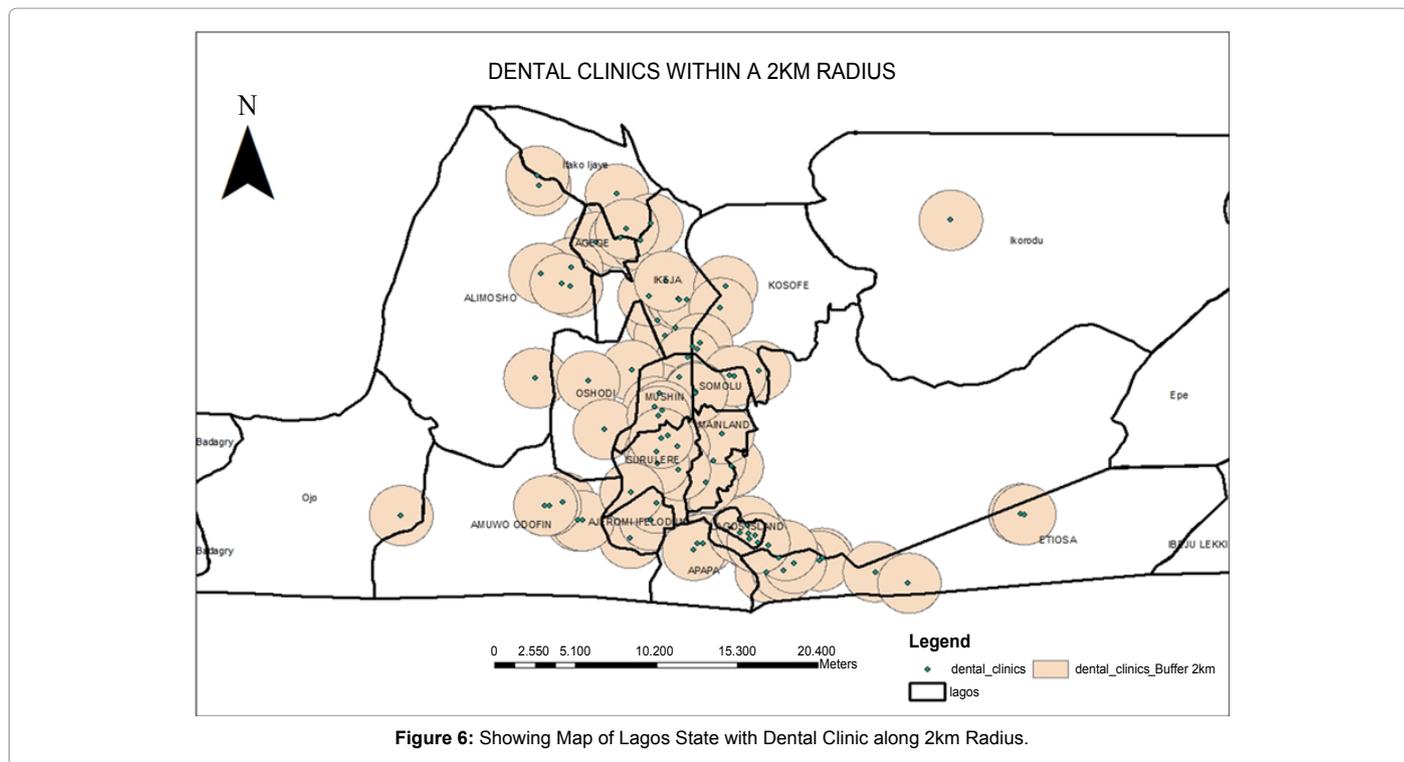


Figure 5: Showing the Clustered Distribution of the Dental Facilities Using the Nearest Neighbor to Analyze the Distribution.



Badagry, Ojo and Ibeju Lekkie, where it is seen that there are a few underserved areas and services do not intersect at all. This result may explain why these areas may be determined low influenced area and low utilization because there will be minimal awareness here [27-30].

Database functionality querying: The essence of spatial database development is to make selection of features within the database as well as the base map easy. The database also aids easy execution of various GIS analysis, since the information required can be inputted from the database. A functional database enhances the accessibility of specific information within the system; this is usually achieved by executing a structural query within the database with a specific Structural Query Language (SQL) with respect to the unique identifier of the attribute information. The easier it is to execute structural query within the database the better the database functionality.

Below are images representing various structural queries executed within the database to test its query functionality?

Query 1: SQL: "Dental_Cli" = '0'

The query selects by location local government area where the attribute value for number of dental clinics is '0'. Figure 7 show the query has selected 3 local government areas: Epe local government area, Ibeju Lekki local government area and Badagry local government amongst all local government area with.

Query 2: SQL: "Dental_Cli" = '1' OR "Dental_Cli" = '5'

The selection by attribute query indicates LGA's with 1 or 5 Dental Clinics in Lagos State. Looking at the map and the attribute table Ikorodu local government area was selected having just one Dental Clinic i.e. Soft Touch Dental clinic at 11, Imose Street off Sagamu road. It also selected Ojo local government area having just one Dental Clinic at 20, Badagry Express Way, Opposite Lasu, Ojo Campus that is JAF Dental Clinic and finally selecting a local government area with 5

Dental Clinic, Amuwo Odofin with Dental Clinics namely (Figure 8); Rabboni Dental Clinic, Lancet Dental Clinic, H F Hospital, Akin-Olu Dental Clinic and ROTD Figure 8: Local Government area with 1 or 5 Dental Clinics in Lagos State.

Dentist Clinic

Query 3: SQL: "LGA" = 'Amuwo-Odofin'

The selection by attribute query Selects Dental Clinics in Amuwo Odofin showing the attributes of the said clinics, information such as their names, addresses and senatorial district can be retrieved. It selects all 5 clinics in the Amowu-Odofin local government area as it can be seen in Figure 9.

Socio-economic characteristics of respondents

Age of patients: Age structure of the respondents is presented in Table 6a and Figure 10a, the result shows the highest number of those respondents falling below the age group of 31 - 40 years. They formed about 30.7% of the total number of respondents. Those in age group of 51 - 60 years were 21.8%. The lowest percentages of the respondents were those in the age group below 21 years, accounting for 7.9% of the total respondents.

Gender characteristics of patients: The gender characteristics of patients show a higher percentage of female. Of the total number interviewed, 75.7% were female while 24.3% were male. This is shown in Table 6b and Figure 10b.

Marital status of patients: Of all the respondents 64.6% of the respondents are married while 21.8% are single, 6.4% are widowed while 7.1% were divorced. This analysis is shown on Table 7 and Figure 11.

Educational level of patients: The results show that the highest percentage of patients has post-secondary education accounting for

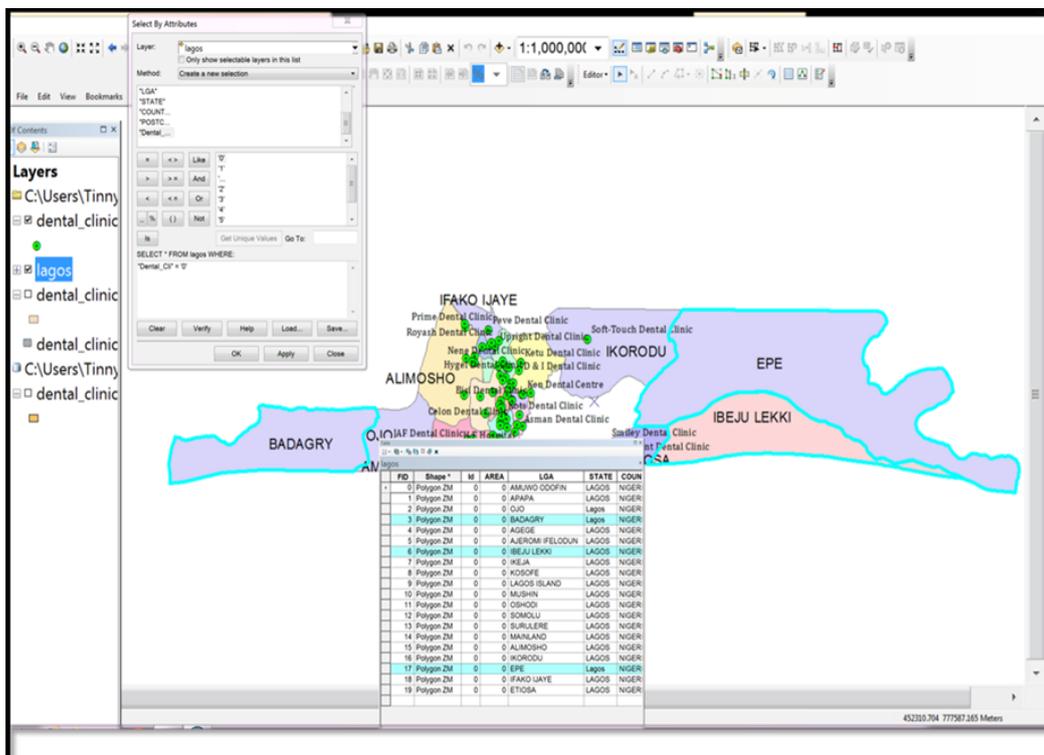


Figure 7: Local Government Area without Dental Clinic Facility.

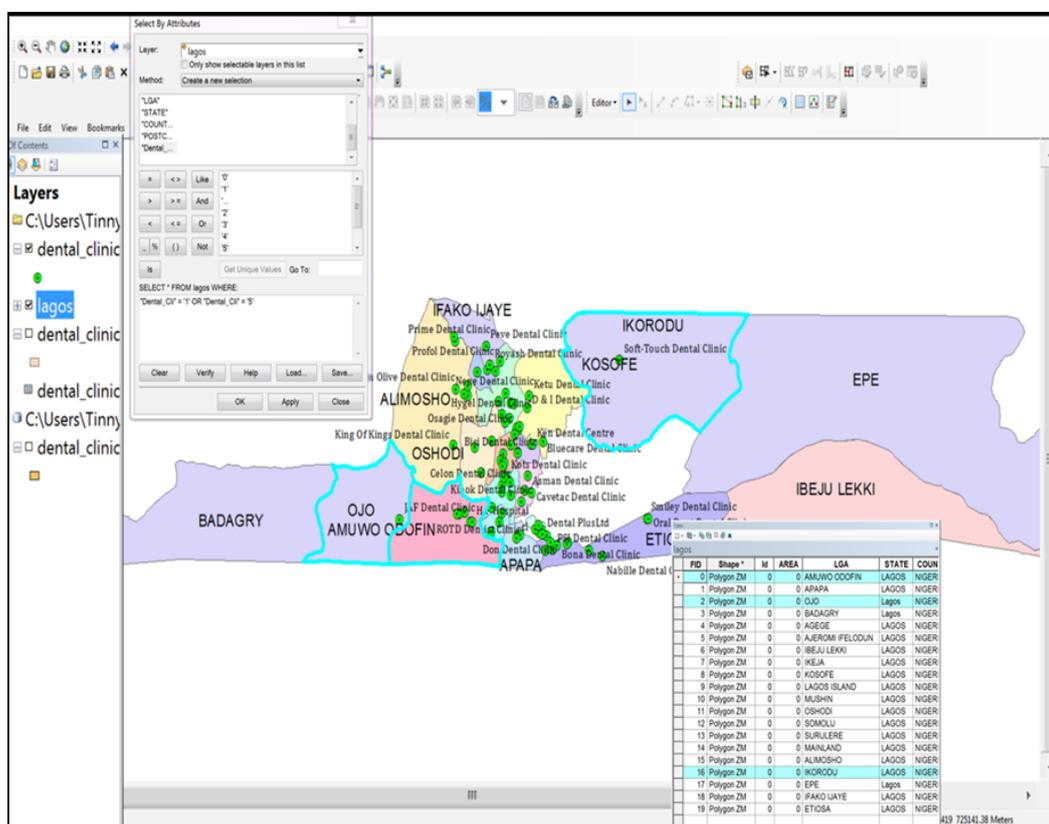


Figure 8: Local Government Areas with 1 Or 5 Dental Clinics in Lagos State.

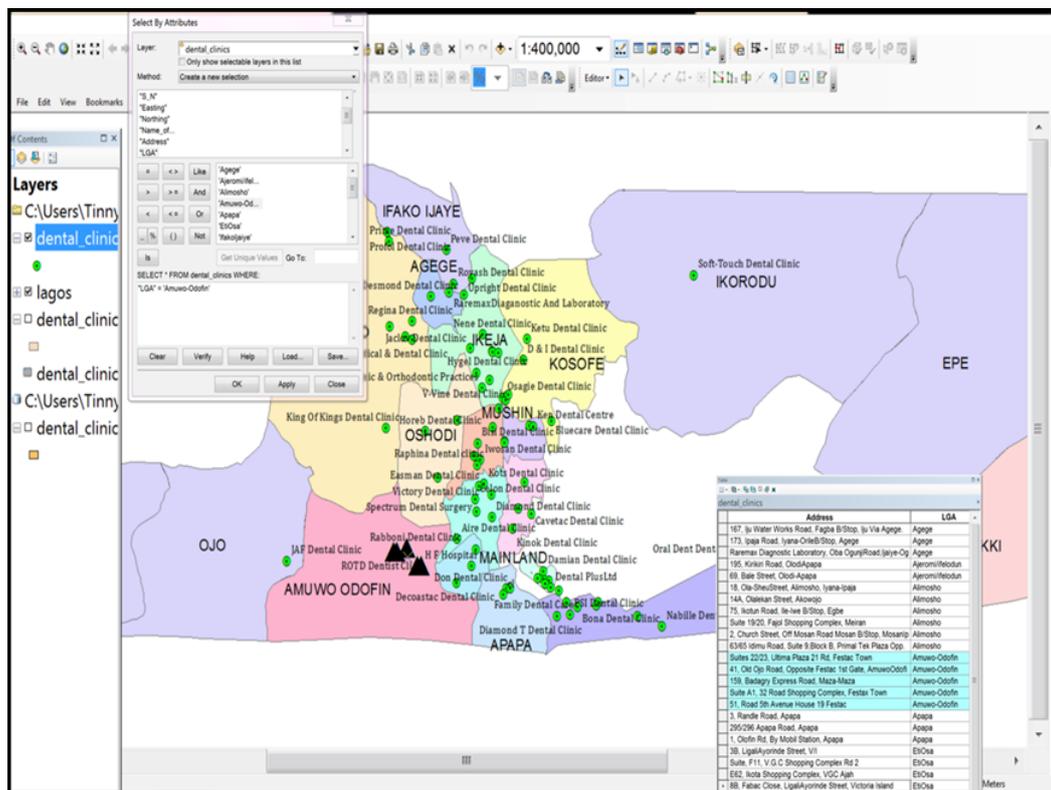


Figure 9: Dental Clinics in Amuwo Odofin Local Government Areas (Dental Clinics).

Age	Frequency	Percent	Cumulative Percent
Below 21	22.0	7.9	7.9
21-30	36.0	12.9	20.7
31-40	86.0	30.7	51.4
41-50	47.0	16.8	68.2
51-60	61.0	21.8	90.0
Above 60	28.0	10.0	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013.

Table 6a: Age structure of patients.

90.0% of the patients, followed by those with secondary education with 7.1% then primary education accounting for 2.9%, none had any formal education. This is presented on Table 8 and Figure 12.

Occupational structure of patients: On Table 9 and Figure 13, it was observed that 64.6% of respondents interviewed engaged in civil service. This was followed by those engaged in banking with 15.7%. Those in the trading sector constituted 11.8% of the total respondents, 7.9% were students, while none was unemployed.

Income of patients: Though income level in Nigeria has appreciated, but it is still very low when compared to income level in developed countries of the world. Of the 280 respondents interviewed 11.4% earned above N100, 000; a high percentage of 73.6% earned N50, 001- N100,000; 7.1% earned N30,000 – N50,000. This result is shown in Table 10 and Figure 14.

Pattern of utilization of dental clinics

This section describes the pattern of utilization of dental clinics

by the patients and the effect of distance on the level of utilization by the patients. Utilization is examined in terms of socio-demographic and economic characteristics of the patients. This is done to achieve the objective of the study which includes analysis of the locational pattern of dental clinics, and the utilization of dental clinics by people of different socio-demographic and economic status.

Level of utilization of dental clinics: The patients were asked about how often they utilized dental clinics in their area. Their responses are as presented in Table 11 and Figure 15. The frequencies here were coded as above 4 times a year (frequently), 1-4 times a year (occasionally), less than once and a year (rarely). This is graphically represented in Figure 4.

Tables 4 above reveals that the largest proportion of respondents makes use of the dental clinics rarely - basis account for 92.9% of the respondents. These were followed by those who used the dental clinics occasionally consisting only 6.8%. Only 0.4% of the respondents said they utilize the dental clinics frequently. Thus, majority of the respondents utilize dental clinics rarely.

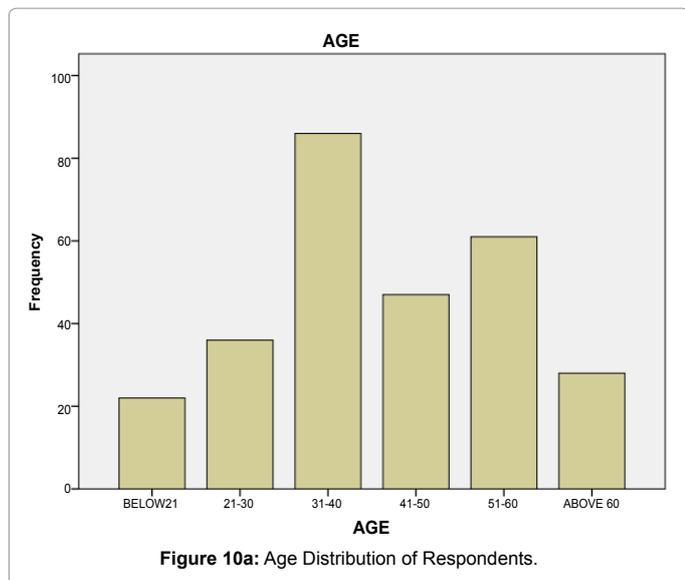


Figure 10a: Age Distribution of Respondents.

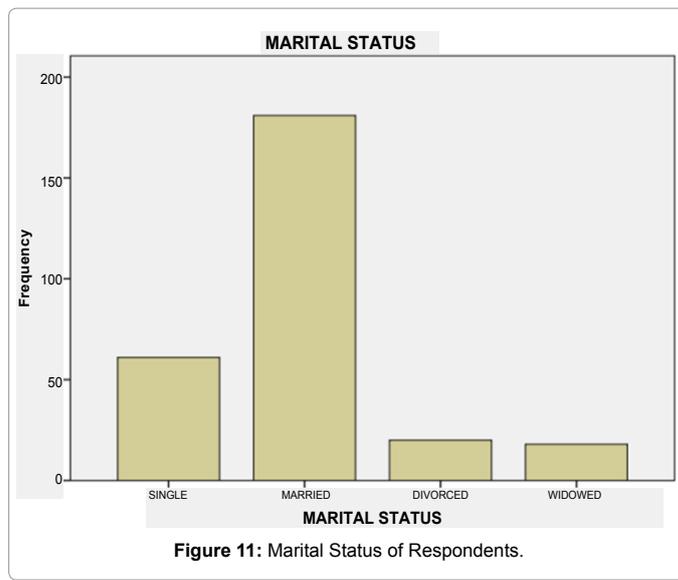


Figure 11: Marital Status of Respondents.

Gender	Frequency	Percent	Cumulative Percent
Female	212.0	75.7	75.7
Male	68.0	24.3	100.0
Gender	Frequency	Percent	Cumulative Percent
Total	280.0	100.0	100

Source: Fieldwork, 2013.

Table 6b: Gender Characteristics of Patients.

Level of Education	Frequency	Percent	Cumulative Percent
Primary	8.0	2.9	2.9
Secondary	20.0	7.1	10.0
Post-secondary	252.0	90.0	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013.

Table 8: Level of Education of Patients.

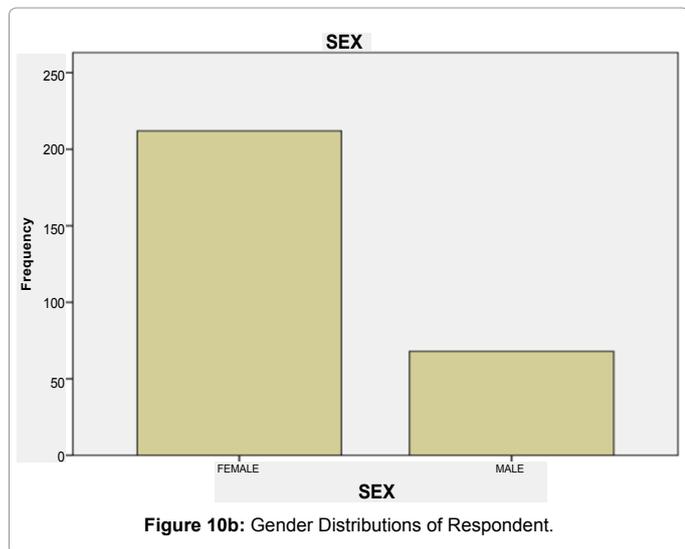


Figure 10b: Gender Distributions of Respondent.

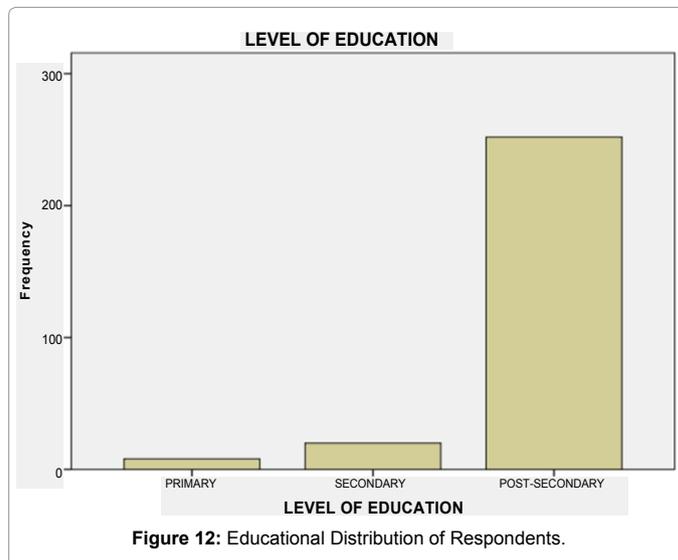


Figure 12: Educational Distribution of Respondents.

Marital Status	Frequency	Percent	Cumulative Percent
Single	61.0	21.8	21.8
Married	181.0	64.6	86.4
Divorced	20.0	7.1	93.6
Widowed	18.0	6.4	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013.

Table 7: Marital Status of Patients.

Determinants of utilization of dental clinics

The factors that affect utilization of dental clinics are usually grouped into two namely: spatial factors and non-spatial (aspatial) factors. The spatial factors are firstly considered in this section while the non-spatial factors that is age, sex, education, marital status, occupation and income of the patients is considered in the sub-sequent section. The spatial factor is the effect of distance on the utilization of dental clinics.

Spatial factors: The significance of distance in the utilization of

Occupation	Frequency	Percent	Cumulative Percent
Trading	44.0	15.7	15.7
Civil service	181.0	64.6	80.4
Student	22.0	7.9	88.2
Others	33.0	11.8	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013. Table 4.6: Gender characteristics of patients. Contd. Source: Fieldwork, 2013.

Table 9: Occupation of Patients.

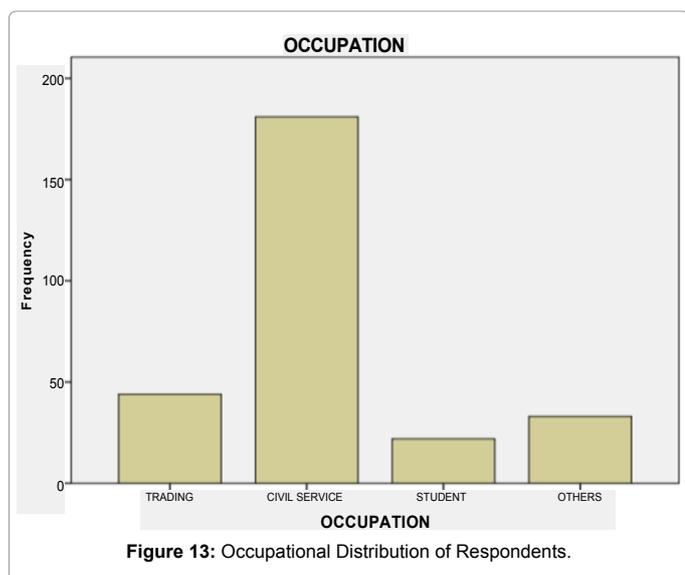


Figure 13: Occupational Distribution of Respondents.

Monthly Income	Frequency	Percent	Cumulative Percent
Below 10,000	22.0	7.9	7.9
30,001-50,000	20.0	7.1	15.0
50,001-100,000	206.0	73.6	88.6
Above 100,000	32.0	11.4	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013.

Table 10: Monthly Income of Patients.

facilities and dental clinics in particular cannot be over emphasized. In both theoretical and most practical terms, the effect of distance in the utilization of facilities has quite shown an inverse relationship of distance decay. This section describes the relevance of distance decay theory to this study.

Distance is a very crucial factor in the interaction of people and places. Primarily, the main concern is in terms of cost of overcoming space barrier. Besides, in the location of public services, proper locational decisions should be made at ensuring optimality [31].

The relationship between distance and frequency of utilizing dental clinics is shown in Table 12. From Table 4, it is clear that, of the 280 respondents that utilized these clinics, 92.5% are living within 500 meters away from the clinics. This constituted the highest number of people utilizing these clinics. 7.5% of the users live within 1 kilometer, away from the clinics. The overall result shows that activity reduces with increase in distance.

With 92.5% of respondents leaving within 500m of the various dental clinics, they were asked if they had alternative dental clinics which they visited from time to time which could see them travelling farther away from their area of residence and they all answered no.

Socio-economic factors: The three socio-economic factors examined in terms the utilization of dental clinics across Lagos State are education, occupation and income.

Education and utilization of dental clinics: The literacy level is also an important determinant in the utilization of dental clinics. Most of those interviewed were well learned with post-secondary education

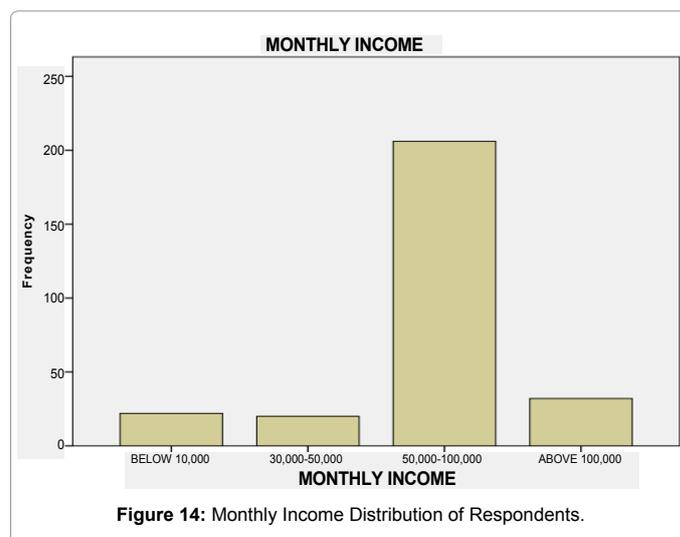


Figure 14: Monthly Income Distribution of Respondents.

Dental Clinic Utilization	Frequency	Percent	Cumulative Percent
4 times a year (frequently)	1.0	0.4	0.4
1-4 times a year (occasionally)	19.0	6.8	7.1
Once a year (rarely)	260.0	92.9	100.0
Total	280.0	100.0	

Source: Fieldwork, 2013.

Table 11: Frequency of Dental Clinic Utilization.

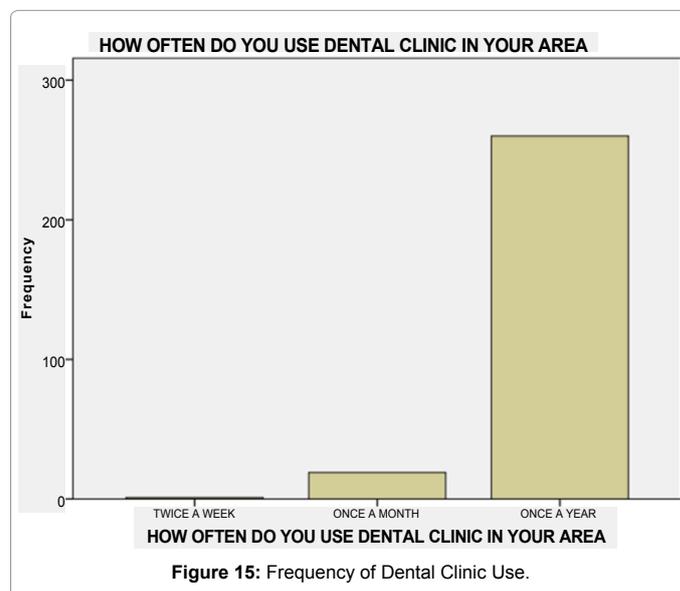


Figure 15: Frequency of Dental Clinic Use.

Distance from home to dental clinic	How often do you use the dental clinic in your area?			Total
	Frequently	Occasionally	Rarely	
Below 500M	1.0	18.0	240.0	259.0 (92.5%)
500M-1KM	0.0	1.0	20.0	21.0 (7.5%)
1-2KM	-	-	-	-
Above 2KM	-	-	-	-
Total	1.0	19.0	260.0	280.0 (100%)

Source: Fieldwork, 2013.

Table 12: Distance and Dental Clinic Utilization.

Level of education of patient	How often do you use the facilities in your area			Total
	Frequency	Occasionally	Rarely	
Primary	1.0	1.0	6.0	8.0(2.9%)
Secondary	0.0	0.0	20.0	20.0(7.1%)
Post-secondary	0.0	18.0	234.0	252.0(90.0%)
Total	1.0	19.0	260.0	280.0(100%)

Source: Fieldwork, 2013.

Table 13: Educational Level and Frequency of Utilization.

while some had secondary education. This contributes to the level of utilization of dental clinics. The result is shown in Table.13.

From the Table 4, of all the level of education, those with post-secondary education utilize dental clinics much more than other categories. Those with post-secondary education accounted for 90% of respondents utilizing the dental clinics, 7.1% had secondary education while those with primary education accounted for 2.9% of the total respondents.

Chi-square was also used to test if there is a significant difference in the level of education with utilization of dental clinics. A chi-square value of 36.174 was obtained against the calculated value of 9.488 with a degree of freedom at 0.05 confidence level and was found to be highly significant. (See appendix v). Which means that the dental clinics users are highly educated?

Occupation and utilization of dental clinics: The result of the findings is shown on the Table 14. Data in Table 14 shows that 64.6% of the respondents utilizing dental clinics are civil servants, 15.7% are businessmen and women (trading), 7.9% are students while other forms of occupation accounted for 11.8%. This revealed that civil servants accounted for the highest number of respondents utilizing dental clinics while none of the respondents were unemployed.

Chi-square was used to test if there is a significant difference in the level of utilization among occupational groups with the utilization of dental clinics. A chi-square value of 13.049 was gotten as against the tabulated value of 12.592 with 6 degree of freedom at 0.05 level of confidence and was found to be significant, (See appendix ii). Which means that occupation is a relevant factor for the use of dental clinics?

Income and utilization of dental clinics: Though the per capita income in Nigeria has appreciated, it is still low when compared to those of the developed countries of the world. Analysis of income with health care utilization is shown on Table 15.

Table 15, shows that the high-income earners utilizes the Dental Clinic the most Of the 280 respondents that utilized the facilities, 7.9% earned less than N10, 000, while 7.1% earned between N30,000-N50,000. It could be said that most of the respondents are high income earners as majority earned between N50, 001 – N100, 000, accounting

for 73.6% and 11.4% earned above N100, 000. Explanation for this is due to the fact that private companies who have the basic intention of making profit render the dental clinic services in all the cases. Most of the users pay directly from their pocket except for few who are covered by their insurance companies.

To test if there is a significant difference among different income groups in the level of utilization, chi-square test was used. A chi-square value of 12.399 was obtained as against the tabulated value of 12.592 at 0.05 level of confidence with 6 degree of freedom. This was found to be insignificant. (See appendix iii). This means that of the various level of income of the respondents there was no difference in the level of dental clinic utilization.

The analysis of frequency of dental clinic utilization with selected socio-economic factors above shows the difference in the utilization of the facilities.

The chi-square test further confirmed the significance of the observed difference in the utilization of dental clinics with regards to the selected socio-economic variables. All the results of the analysis were found to be significant at 0.05 level of confidence except that of level of education with utilization of dental clinics.

Conclusions and Recommendations

Summary

This study was carried out to examine the locational pattern and utilization of dental clinics in Lagos State. As described in the recent World Oral Health Report (2003), oral diseases had a considerable impact on individuals and communities, such as pain, suffering, impaired functioning and reduced quality of life. Most Nigerians do not regard dental hygiene as a necessity. Dental clinics were not evenly distributed across Lagos State as the government has no dental clinic established outside the general and teaching hospitals. The main aim of the established clinics by private business owners is to make maximum profit, which was achieved by locating such clinics in high income earners environs. This subsequently has led to a higher number of availability of these facilities in some Local Government Areas while some are totally lacking. Thus, the economic constraints, socio factor

Occupation of patient	How often do you use the facilities in your area?			Total
	Frequently	Occasionally	Rarely	
Trading	0.0	4.0	40.0	44.0 (15.7%)
Civil service	0.0	13.0	168.0	181.0(64.6%)
Student	1.0	1.0	20.0	22.0 (7.9%)
Others	0.0	1.0	32.0	33.0 (11.8%)
Total	1.0	19.0	260.0	280.0 (100%)

Source: Fieldwork, 2013.

Table 14: Occupation and Utilization of Dental Clinics.

	How often do you use the facilities in your area?			Total
	Frequently	Occasionally	Rarely	
Below N10,000	1.0	1.0	20.0	22.0 (7.9%)
N30,001-N50,000	0.0	1.0	19.0	20.0 (7.1%)
N50,001-N100,000	0.0	14.0	192.0	206.0(73.6%)
Above N100,000	0.0	3.0	29.0	32.0 (611.4%)
Total	1.0	19.0	260.0	280(100%)

Source: Fieldwork, 2013.

Table 15: Income and Frequency of Dental Clinic Utilization.

and travel time played a major role in the utilization of available dental clinics.

The aim of this study was to examine the spatial distribution and utilization of dental clinics in Lagos State. The steps taken to achieve this aim were to look into the locational pattern of dental clinics in Lagos State, analyze the level of utilization of dental clinics, describe the socio-economic characteristics of the user population, and identify the factors influencing utilization of dental centers.

Both primary and secondary data were used in this study. The Primary data was generated by questionnaires administered to patients who visited dental clinics. The stratified random sampling method was adopted to select the clinics across three senatorial districts of Lagos State, namely; the western senatorial district which has ten (10) local government areas, the central senatorial district with five (5) local government areas and the eastern senatorial district also has five (5) local government areas.

The questionnaire was divided into two sections. The first section was designed to collect information on the socio-economic and demographic characteristics of the respondents. The second section of the questionnaire was designed to collect information on the main objectives of the study, which is the utilization of dental clinic facilities and preference for the dental facilities among others.

Patients who came to receive treatment at the dental clinics were the study population. A total of 280 questionnaires were administered at selected dental clinics across four local government areas of approximately equal population density, with two (2) local governments selected from the western senatorial district which consists of ten (10) local governments, one local government from the central senatorial district which consists of five (5) local governments and one local government from the eastern senatorial district which consists of five (5) local governments. Suffice to say; for every five local government areas, one local government was selected in Lagos State. A hand held Geographic Positioning System (GPS) was used to acquire data based on the physical address of the location of dental clinics sourced from Lagos State Ministry of Health. These coordinates were registered and stored in Microsoft Excel, then exported as database format and imported into the ArcGIS to produce a map showing the locational pattern of dental clinics across Lagos State. The map was used for the nearest neighbor analysis.

Secondary data was collected from the Lagos State Ministry of Health on the number and physical location addresses of dental clinics.

The inferential and descriptive statistical techniques were employed for the analysis.

Chapter four covered the discussion on the socio-economic characteristics of the respondents, locational pattern, availability of dental clinics, spatial pattern of dental clinics and pattern of utilization of dental clinics and determinants of utilization of dental clinics in Lagos State.

Conclusions

- The study observed that majority of the respondents were well-educated, high-income earners and also mostly female.
- The findings of the study showed that 30.7% of the total patients interviewed were between the age group of 31-40 years, majority were female accounting for 75.7% of all the respondents 64.6% of respondents are married most of which

were highly educated with 90.0% of post-secondary education and 64.6% engaged in civil service.

- Further findings of this study also revealed that there is uneven distribution in the availability of dental clinics. Some areas are not served at all while other areas have relative higher number of such clinics at their disposal.
- The spatial pattern of the dental clinics as seen in section 4 of this study was found to be clustered with a nearest neighbor value of 0.0005. According to Tobler's "first law of geography", "everything is related to everything else, but near things are more related than distant things" Tobler, 1979. Spatial distribution could indicate patterns of underlying process that gave rise to such distribution. In this study, factors that affected the spatial distribution of the dental clinics were found to be the ownership of dental clinics by private bodies who located facilities for the main purpose of maximizing profit, as well as the lack of publicly owned dental clinics outside the general hospitals and teaching hospitals. The cluster pattern of dental clinic was formed geographically on the central part of Lagos State map, which is mostly occupied by people of high to medium economic class.
- It was observed that, people living in areas without the dental clinics utilize the nearest dental clinic. Users close to the clinics utilized them so as to minimize the cost involved in overcoming friction of distance.
- The findings of this study have both theoretical and practical implications. In theoretical terms, it reveals that in consonance with Walter Christaller's central place theory, low range facilities only attract users from their immediate vicinity. In other words, users are not ready to travel long distance to utilize dental clinic. Hence, there is a decline in the volume of users with increase in distance from the facilities.
- The analysis also revealed that socio-economic status of users played a significant role in the utilization pattern of these facilities. This analysis further revealed that those with high socio-economic status utilize the clinics more than those with low socio-economic status. Thus civil servants and people with post-secondary education use the dental clinics the most.
- The findings showed that a major factor of dental clinic utilization among the respondents was distance; it shows that there was no utilization beyond the distance of one kilometer.
- Finally all the available dental clinics are privately owned.

Recommendations

- Policy makers are therefore enjoined to consider locating numerous dental facilities to the reach of the users who need them most for optimal use.
- There is the need for government owned dental clinics to be established in various local government areas of the State to facilitate access to dental clinics by the people of various socio-economic levels and ensured even distribution of dental clinics across Lagos State and Nigeria as a whole.
- The government should create public awareness on the need for oral health, as most people, especially men, view it as aesthetics. Similarly Government must enlighten the uneducated people on the value of oral health.

- The Lagos State government should establish dental clinics that offer dental services at a subsidized rate, so as to allow the low-income earners access and utilize these services. The findings of the study and the recommendations had also provided a window for spatial even distribution and utilization of dental clinics in Lagos state.
- It is necessary to adopt the equity principle in the distribution of social amenities and resources so as to foster an even and rapid development of the society.

Recommendations for further studies

For further studies GIS can be deployed to integrate more information to the existing data to enhance more querying options for various selection preferences. Road network data should be incorporated so as to give swift directions for patient seeking for directions to dental facility.

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