

The Use of Location Quotient (L.Q) to Determine the Spatial Concentration of Health Care Facilities in Relation to Population in Gombe State

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Abstract - Health care facilities are generally unevenly distributed in many parts of the world, especially in developing countries where the available facilities are inadequate in relation to the potentially health seeking population. This paper aimed to study the spatial distribution of public health care facilities in Gombe State. The study therefore, focused on understanding the availability, location and spatial distribution and concentration of public healthcare facilities in Gombe State. Secondary data of public healthcare facilities was obtained from Gombe State Primary Health Care Development Agency (GSPHCDA); Location Quotient and GIS techniques were applied to identify areas with surplus and deficit public healthcare facilities in the state in relation to population. The results show that, five (5) Local Government Areas (Akko, Funakaye, Gombe, Nafada and Yamaltu Deba) are deficient in primary healthcare facilities provision, while other six (6) Local Government Areas (Balanga, Billiri, Dukku, Funakaye, Gombe and Kwami) are deficient in secondary healthcare facilities provision. Further results show that only two (2) Local Government Areas (Kaltungo and Shongom) have sufficient healthcare facilities to support their population. Hence, the following recommendations were made: Government and other stakeholders should provide more healthcare facilities in places where there are none or are in short supply and expert contribution in provision and distribution of healthcare facilities is always encouraged.

Indexed Terms: Location quotient (LQ), G.I.S, spatial distribution, health care facilities,

I. INTRODUCTION

People health can improve through fair distribution and allocation of better healthcare facilities and services, as well as through government and individual will and comitment toward healthcare delivaries. Availability, proper allocation and improve healthcare facilities and services are the panacea of high mortality and ill society. Peoples' health is an asset to the socio-economic development of any community or society.

Hence, Government and other stakeholders are saddle with the responsibility to see that, healthcare facilities and health workers are available, accessible and affordable to the populace, (Abdullahi, Abdullahi, Abbas, Bibi, and Bara, 2019).

Many health care policies were established in Nigeria in different years such as that of 1988, 2004 and 2016 national policies on health systems, all these were done with the purpose to strengthen and improving the performance of the health systems in the country, (National Health Policy, 2016). However, with all the above efforts of Nigerian Government, proper health care provision and deliveries are far below standard.

Population is one of the vital factors to be used in distributing resources among people in different communities, but the irony is that; government, stakeholders and planners do not give kin interest in that aspect especially in developing world, this lead to improper allocation of resources, especially the allocation of health care facilities. Abdullahi, Abdullahi, Abbas, Bibi and Bara, (2019), conducted study in the six geopolitical zones of Nigeria, and it shows that Gombe State among the sampled states in North Eastern Nigeria is faced with unequal distribution and insufficient of health care facilities and some healthcare personnel. Another research conducted by Abdullahi, Abbas, Abdullahi and Philip, (2019), stated that there is uneven distribution of health care facilities in Akko Local Government Area, Gombe State, which could be as a result of not including population expert in allocating and distributing health care facilities, or as a result of political influence. A lot of researches were conducted on the allocation, distribution and accessibility of health care facilities among which are:

Nwakeze and Kandala, (2011); Ujoh, Kwaghsende (2014); Babatimehin, Ayanlade, Babatimehin and

Yusuf, (2011), revealed that health care facilities are not evenly distributed base on population of a regions, this means some regions have more health care facilities than others without considering the magnitude of their population. Ni, Qian, Xi, and Wang, (2016), show that private hospitals are more evenly distributed than public hospitals and pharmacy stores tend to cluster around hospitals along the road network. Rai and Nathawat, (2016), Analyse health care facilities using G.I.S and G.P.S. Buffering techniques of 10km radius which indicates that maximum rural populace of the region depends on the existing government health centres. Oyinloye, (2014), examines the location of health facilities in Akure and their proximity to residential houses in the surrounding neighbourhood. The results revealed that poor people are at the disadvantage side in accessing basic health facilities. Olusesan, Abayomi, Olayinka and David (2018), studied the distribution of health facilities in Nigeria. They found that, there are more Primary health facilities in Nigeria than secondary and tertiary health facilities and there are more government-owned health facilities than privately owned health facilities in the country.

However, in view of the above, Location issues of health care facilities in relation to their population in Gombe State little was discussed and address by population and health researchers using Location Quotient techniques in the eleven (11) L.G.As in the state. Most of the effort usually focus on describing and analysing social and economic determinants of health care systems. However, this study is worth undertaking in this region because this is the region in which government and other stake holders do not give much concern on the fair distribution of healthcare facilities in relation to their population especially in the rural areas and this leads to some part of the region having more health facilities whiles other parts having less healthcare facilities and this will directly affect people's health.

This study therefore aimed at studying the geographical distribution and concentration of public health care facilities in Gombe state. This study therefore, focused in understanding the absolute location of healthcare facilities, their distribution and concentration in relation to population, this enabled the researcher to know areas with surplus and deficit

healthcare facilities and prefer solutions for the areas that are deficient in the study area in order to improve rural people access to health facilities.

II. METHODOLOGY

This research involves the use of both qualitative and quantitative data. The qualitative data involves the names of all eleven (11) Local Government Areas in Gombe State, using purposive sampling techniques. While the quantitative data were numbers of healthcare facilities and their coordinates, population of Gombe and the eleven (11) Local Government Areas in Gombe State using Nigerian Population and Census Data, (2006) as base population which were projected to 2018 at 3.3% growth rate using exponential formula $P_2 = P_1 \times e^{(r \times t)}$ for the projections, Where:

- "P₂" represents the future population.
- "P₁" is the population at the beginning time.
- "e" is the base of the natural logarithms (2.71828), and is a constant value.
- "r" is the rate of increase (natural increase divided by 100).
- And "t" represents the time period involved.

Secondary data that include boundary data (shapefile) was downloaded from DivaGis. Other secondary data such as Geo-located data of public healthcare facilities was obtained from Gombe State Primary Health Care Development Agency (GSPHCDA). The data was joined with boundary data using joins and relates extension in ArcGis volume 10. Further analysis was done using Location Quotient (L.Q) formula. The Location Quotient Formula and its interpretation are presented below:

$L.Q. (X, A) = \frac{\text{Number of Commodity X in Local Government (A)}}{\text{No of Commodity X in the State}}$

$\frac{\text{The population of Local Government (A)}}{\text{Population of the State}}$

Where L.Q (X, A) = the location quotient of commodity X in State A. The following points below are use to interpret the results obtained from the L.Q computation:

- If $L.Q > 1$, the results indicates high spatial concentrtrion of public healthcare facilities in a L.G.A compared to the average share of each L.G. A i.e. they have more than a fair share of the facility or the facilities are more than sufficient enough to meet the local demand of the population.
- If $L.Q = 1$, they have fair share of facility involved inrelation to a population. Therefore, the facilities are equal to the demand of the population.
- If $L.Q < 1$, they have less than a fair share of the facility, this means the healthcare facilities are not sufficient to meet the local demand of the population.

III. STUDY AREA

Gombe State occupies a total land area of about 20,265 sq. km. It is made up of eleven (11) Local Government Areas which include: Dukku, Nafada, Bajoga, Kwami, Akko, Yamaltu deba, Kaltungo, Billiri, Shongum, Balanga and Gombe L.G.A. The State is located between latitudes $9^{\circ} 30'$ and $12^{\circ} 30'$ North and longitudes $8^{\circ} 45'$ and $11^{\circ} 45'$ East. It shares boundaries with Yobe in the north, Borno State in the east, Adamawa and Taraba States in the south and Bauchi State in the west (Abbas, 2014). According to National Population and housing census, (2006), Gombe State had 2,365,040 people, but the projected population of Gombe State 2019 at 3.3% growth rate stands as 3,631,992. Thus the ethno – linguistic composition of Gombe State include, amongst others, the Fulbe, the Bolewa, the Tera, the Tangale, Tula, Waja, Wurkum, Jara, Dadiya, Cham, Awak, Pero, Kamo, Kushi and Bangunji, (Abba, Shehu and Abba, 2000). Below is a map showing the eleven L.G.A's in Gombe State.

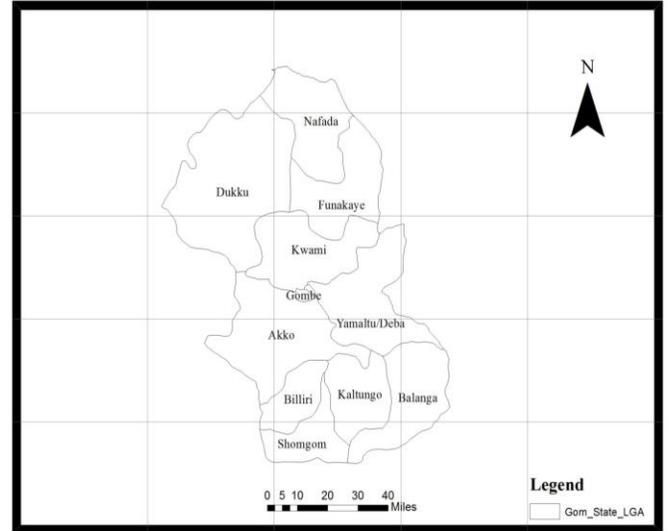


Figure 1: Map of Gombe State.

Source: Geographic Information System Laboratory, Federal University Kashere, 2019

IV. RESULTS AND DISCUSSION

Absolute Locations of Health Care Facilities in Gombe State

Healthcare facilities are spatially distributed across each Local Government in Gombe state, below is a dot map showing the distribution.

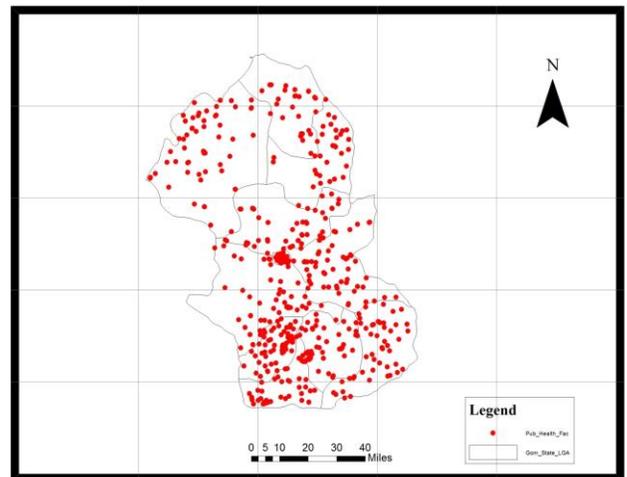


Figure 2: Absolute Location of Health Care Facilities in Gombe State

Source: Geographic Information System Laboratory, Federal University Kashere, 2018

Figure 2 shows high density of healthcare facilities in South Eastern Gombe, while Gombe North, central and western part of the state have relatively low-density population of healthcare facilities in the state. This shows that there are more healthcare facilities in Gombe South than in the other parts of the state. The results above is in agreement with the research conducted by Abdullahi, Abdullahi, Abbas, Bibi and Bara, (2019), that shows high density of healthcare facilities in South Eastern Gombe State.

Location Quotient of Healthcare Facilities in Gombe State

Location quotient (LQ) is a method that is used to relate the spatial concentration of facilities or jobs relative to the region or nation. It is a valuable method of quantifying how concentrated or dispersed a particular facility or phenomena is in a region compared to state or nation. In this study, we used LQ to analyze the locational pattern of healthcare facilities and compared the clustering of healthcare facilities in each L.G.A in Gombe State relative to the state.

Table 1 Location Quotient of Healthcare Facilities in Gombe State

| LGA | PH CF & SH CF | PH CF | SH CF | Projected Population (2018) | PH CF L.Q | SH CF L.Q | PH CF & SH CF |
|----------|---------------|-------|-------|-----------------------------|-----------|-----------|---------------|
| AKKO | 80 | 78 | 2 | 501395 | 0.93 | 1.21 | 0.93 |
| BALANGA | 57 | 56 | 1 | 314253 | 1.00 | 0.89 | 1.00 |
| BILLIRI | 75 | 74 | 1 | 301162 | 1.33 | 0.89 | 1.33 |
| DUKKU | 61 | 60 | 1 | 308559 | 1.11 | 0.89 | 1.11 |
| FUNAKAYE | 43 | 42 | 1 | 353179 | 0.70 | 0.80 | 0.70 |
| GOMBE | 60 | 59 | 1 | 396504 | 0.82 | 0.73 | 0.82 |
| KALTUNGO | 58 | 57 | 1 | 238327 | 1.29 | 1.14 | 1.29 |
| KWAMI | 57 | 57 | 0 | 288257 | 1.13 | 0 | 1.13 |
| NAFADA | 33 | 32 | 1 | 208301 | 0.83 | 1.33 | 0.83 |
| SHONGOM | 53 | 52 | 1 | 224294 | 1.33 | 1.33 | 1.33 |

| | | | | | | | |
|--------|-----|-----|----|-----------|-------|-------|-------|
| Y/DEBA | 59 | 57 | 2 | 379983 | 0.82 | 1.55 | 0.82 |
| TOTAL | 636 | 624 | 12 | 3,514,214 | 11.27 | 11.14 | 11.27 |

Source: Authors, (2019).

Based on the criteria set in the methodology about the range of L.Q values that shows inadequacy or sufficiency of health care facilities, the above results in table 1 clearly inferred that, there is a serious variation in allocation and distribution of health care facilities in the State. This means some parts of the state have more healthcare facilities than the other parts, and this is in concurrent with the research conducted by Nwakeze and Kandala, (2011); Ujoh, Kwaghsende (2014); and Babatimehin, Ayanlade, Babatimehin and Yusuf, (2011) which show that, there are uneven distribution and allocation of healthcare facilities across various regions relative to their population size. Table 1 shows Five (5) L.G.A’s (Akko, Funakaye, Gombe, Nafada and Y/deba) in the state are deficient in allocation of primary health care facilities, with L.Q values of 0.93, 0.70, 0.82, 0.83 and 0.82 respectively.

This means that, the five (5) L.G.As above have insufficient number of healthcare facilities to support their population because the L.Q values are all bellow 1 point, and this is dangerous for the general health of the people of those regions because they don’t have enough primary health facilities to support the population. Further results show that six (6) L.G.A’s (Balanga, Billiri, Dukku, Funakaye, Gombe and Kwami) are deficient in allocation of secondary health care facilities with L.Q values of 0.89, 0.89, 0.89, 0.80, 0.73 and 0 respectively, which are all bellow 1 point. This simply means they have less than a fair share of secondary health care facilities or the secondary healthcare facilities are not sufficient enough to meet the demand of people of the L.G.As. Based on the above analysis therefore, insufficiency of healthcare facilities in a region means people in that place have to travel long distance to seek for medical help in other places that have enough and in a case of crucial condition someone may lose his life.

However, the general analysis of both primary and secondary healthcare facilities shows insufficiency of healthcare facilities in places like: Akko, Funakaye, Gombe, Nafada and Yamaltu Deba, with L.Q values

of 0.93, 0.70, 0.82, 0.83 and 0.82 respectively. All this four (4) L.G.As that shows insufficiency of healthcare facilities are located in Gombe North and Gombe Central but all the L.G.As located in Gombe South shows enough or availability of healthcare facilities. This shows that L.G.As located in the southern part of the state have more healthcare facilities because none of them have L.Q value of less than 1 point. The above results is supported by the argument in figure 2 that healthcare facilities are more densely populated in the Southern part of Gombe than in the Northern or central Gombe State and also in concurrent with the research conducted by (Abdullahi, Abdullahi, Abbas, Bibi and Bara, 2019), which stated that there are more healthcare facilities in South Eastern Gombe State.

Further analysis shows that Kaltungo and Shongom have the highest concentration of health care facilities among the eleven L.G.A's in the state, because all the L.Q values in those L.G.As in all the types (primary and secondary) of health care facilities indicated more than a fair share of health facilities; meaning the health care facilities in the regions are more than enough to meet people health care delivery needs. But on the other hand Funakaye and Gombe L.G.A are the least in health care facilities provision, because they have less than a fair share in all the types of health facilities, meaning the health facilities in the regions are not sufficient to meet people demand, this will make people to suffer in accessing healthcare services and make them travel to long distance places for medical assistance.

The above results have negative implication on the people of those L.G.A's that are deficient in health care provision. Because effective and well serviced health care facilities have direct correlation with people's good health and prosperity, but lack or shortage of health care facilities leads to people ill health and suffering.

V. CONCLUSION

Spatial analysis of health care facilities among regions is of great importance for government, policy makers and philanthropist, because it enables them to know those regions that are deficient in health care provision. This research therefore clearly shows unequal provision of health care facilities in Gombe

State among the various L.G.A's, this agreed with Abdullahi, Abdullahi, Abbas, Bibi and Bara, (2019); Nwakeze and Kandala, (2011); Ujoh, Kwaghsende (2014); Babatimehin, Ayanlade, Babatimehin and Yusuf, (2011) and Abdullahi, Abbas, Abdullahi and Philip, (2019) which states that, there is a variation in health care facilities provision among different regions. Analysis had shown that five (5) Local Government Areas have shortages of primary health care facilities while six (6) of the Local Government Areas are deficient in secondary health care facilities. Further results show that only two (2) Local Government Areas have sufficient healthcare facilities (both primary and secondary healthcare) which are Shongom and Kaltungo. Hence, this research profound the following recommendations to solve or ameliorate the situation in the state:

- 1- Government and other well wishers of Gombe are encouraged to provide more primary health care facilities in the following L.G.A's: Akko, Funakaye, Gombe, Nafada and Y/deba. This will greatly improve the standard of health of people of the region.
- 2- Government and all stake holders in Gombe should encourage the provision of more secondary health care facilities in the following L.G.A's: Balanga, Billiri, Dukku, Funakaye, Gombe and Kwami. Because this will reduce the congestion in the available ones and reduce people suffering for traveling with their patience to other places where those secondary services could be obtained.
- 3- Population and Geographic Information Systems expert needs to be consulted in the provision and allocation of health care facilities; this will solve the problems of over or under allocation of resources.

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