Shortages and Inequalities in Geographic Distribution of Healthcare Workers in Katsina State, Nigeria

Hafiz Darda'u & Abubakar Umar

Department of Geography, Umaru Musa Yar'adua University Katsina

Email: hafizd200@gmail.com, abubakar.umar@umyu.edu.ng

Abstract

This paper examined shortages and geographical inequality in the distribution of healthcare workers in Katsina State. The Gini index and Lorenz curve were used to analyze data on healthcare workers in the study area. This is with a view to revealing the shortages of health workers or otherwise according to the criteria set by the World Health Organization (WHO). Finally coefficient correlation and determinant were used to establish whether or not there is significant association between population and distribution of healthcare facilities among the 34 Local Government Areas across the state. The findings of the study revealed that inequality really exist in the distribution of healthcare staff within the three zones of the state, the study confirmed that none of the three zones of the state has achieved the minimum requirement as stipulated by the WHO for critical shortage of 2.5/1000 population. In addition to inadequacy of health personnel in Nigeria and in Katsina State, there is a common understanding that this problem is more in Katsina state and is further exacerbated by geographic distributional inequalities that are even more severe in rural areas. On the other hand, the Lorenz curve has also depicted similar results as the curves are further away from the diagonal, which means there is high variation in the distribution of health care workers in the State. Based on the study findings, it is recommended that a more vigorous analysis should be carried out by the state ministry of health to ascertain the number of healthcare facilities as well as the required number of healthcare workers with a view to establishing the number of equipment available and facilities which may require upgrade for effectiveness. The actual access levels individuals and communities have to the health care facilities in Katsina State needs to be ascertained. Besides, the government should adopt population threshold as a yardstick for health care facility distribution as this is the only approach to ensure equality and social justice in distribution of health care workers and other basic facilities.

Keywords: Geographic distribution, Health workers; Inequalities; Katsina State.

Introduction

According to the World Health Organization (WHO) (2006), the public health sector is considered one of the driving forces of most developing countries' health systems, due to some of its core objectives of preventing, improving and providing health services to their populations. Although, the world health body defines human resources for health (HRH) as "all people engaged in actions, whose primary intent is to enhance health", however, this study is restricted to health workers in the public health sector. The Joint Learning Initiative (2004), estimated that there is a global deficit of HRH and it has to be above 4 million, if all countries have to achieve an average worker-to-population density of 2.5 per1, 000. According to the 2006 World Health Report, over 4.3 million more health workers are needed to

bridge the gap of health personnel globally, of which about 1.5 million (35%) are required in Africa alone (WHO, 2006).

The Global health work force (2013) identified 57 countries across the world facing a "critical deficiency" of health workers, out of which 36 are in Africa including Nigeria. This is more critical in the Sub-Saharan Africa (SSA), where the existing low densities in health workforce to population per1,000, have further strained their ability to cope with increasing health crisis and disease burden as compared to other regions in the world (Dovlo, 2005).

In addition to inadequacy of health personnel in the Sub-Saharan African (SSA) where Nigeria belongs, there is a common understanding that the region is further exacerbated by geographic distributional inequalities that are consequently even more severe in rural areas (Dovlo, 2005). However, one of the major limitations to this claim has been incomplete country data on their HRH profiles, as most studies have focused on the distribution of specific health cadres - physicians or nurses (Amani, 2010; Fongwa, 2002). Therefore the present study examines shortages and inequalities in geographic distribution of healthcare workers in Katsina State, Nigeria**.**

Study Area

Location Size and Population
Katsina State is located between latitude 11°08'N and 13°22'N and longitudes 6°52'E and 9°20'E, covering an area of 23,938 sq. km. The State is bordered to the north by Niger Republic, Jigawa and Kano States to the east, Kaduna State to the South and Zamfara State to the west. Based on the 2017 population projection, the total population size of Katsina State was put at Seven Million, Nine Hundred and Nineteen thousand, Four Hundred and Twenty Five (7,919,425). This figure comprised the males' population of Four Million Thirty Eight Thousand Nine Hundred and Six (4,038,906) and the females' population of Three Million Eight Hundred and Eighty Thousand Five Hundred and Eighteen (3,880,518). The Males' population constitutes 51% of the total population of the state, while that of the females constitute 49%.(Umar, 2019)

Figure 1.Diagram showing the study area

Study Methods
The secondary data used for this study were derived from sources in the Katsina state Ministry of Health, Health Services Management Board, as well as the National Primary Healthcare Development Agency, all in Katsina State. The population figures of the local government were obtained from the Katsina State office of the National Population Commission (NPC). Other secondary data used in this research include materials from both published and un-published works, relevant literature, textbooks and Journals.

Data analysis
The Gini index and Lorenz curve were used to analyze data on healthcare workers in the study area. This in order to reveal shortages of health workers or otherwise, according to the criteria set by the World Health Organization (WHO). The Gini index compares the percentage frequency of some attributes with the distribution of the 'distributional criterion' and it is one of the best known measures of inequality as it measures the extent to which a condition or activity is geographically localized or concentrated (Smith, 1975; Okafor, 1987 & 2007; Munga and Maestad, 2009; Adhami et al., 2014; and Tandi et al., 2015).

Gini coefficient is expressed thus;

$$G = \frac{n+1}{n} - \frac{2\sum_{1}^{n}(n+1-i)x_i}{n\sum_{1}^{n}x_i},$$

Hence, G is the Gini index, n is the number of observations and X_i the number of health personnel at *i*th location.

The Lorenz Curve is a graphical device for representing inequality and in plotting the graph, territories are ranked according to the ratios of their advantages, and the cumulative percentages of the health facilities (distributed phenomena) are plotted against the cumulative percentage of the population size (distribution criterion). A diagonal curve 45^0 is the line of perfect equality and, if the Lorenz curve overlaps with the diagonal, then there is perfect equality in the distribution of facilities. The further away of the Lorenz curve from the diagonal, the greater the difference.

Finally, the coefficients correlation and determinant were used in order to reveal whether there is significant association between population and distribution of healthcare facilities among the LGAs in the study area.

Result and Discussion

The Density of Health Workers to Population $^-1000$/ LGA, Gini index and Lorenz Curve

Table 1 provides a picture of general health workers' distribution in Katsina State. The table reveals that the aggregate density of health worker to population is 0.91 per 1000 which is less than the world Health Organization (WHO) recommended critical shortage threshold of 2.5 (i.e. 400 persons per health worker). However there is four-fold variation in the density of available health worker to population per 1000, which range from 4 to 0.5 across the state. As shown on Table 1, only Katsina LGA attained the WHO critical shortage threshold limit, 5 out of the 34 LGAs, therest have density of health workers less than 1.0. Among the different category of Health worker to population per 1000, the densities vary from 2.0 Nurses per 1000 to a low of 0.00, for Radiographer per 1000 as illustrated on Table 1. The result describes the degree of association between densities of doctors, nurses, paramedics and hospital beds vary across different LGAs of the State when population size is used as an index of need.

Table 1. The density of health workers to population per 1000 per LGA and Gini index per cadre

LGA	Doctors	Nurses	Dental Tech	Medical Lab Tech	Nutritionist	Radiographer	Pharmacy technician	JCHEW	SCHEW	Hospital Beds	General Health Workers
Daura	0.03	0.21	0.05	0.03	0.00	0.00	0.03	0.08	0.61	0.54	1.05
Baure	0.01	0.06	0.01	0.01	0.00	0.00	0.01	0.19	0.29	0.20	0.59
Mai'adua	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.35	0.07	0.53
Zango	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.33	0.14	0.53
Sandamu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.42	0.17	0.74
Dutsi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.59	0.25	1.21
Mashi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.48	0.15	0.86
Mani	0.02	0.16	0.03	0.03	0.00	0.00	0.02	0.18	0.27	0.39	0.71
Bindawa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.34	0.14	0.66
Ingawa	0.01	0.07	0.01	0.02	0.00	0.00	0.03	0.21	0.32	0.29	0.67
Kankia	0.02	0.14	0.03	0.00	0.00	0.00	0.03	0.15	0.54	0.54	0.92
Kusada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.41	0.26	0.59
Kaita	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.32	0.10	0.43
Katsina	0.73	1.97	0.04	0.13	0.06	0.01	0.08	0.14	0.32	2.86	3.47
Jibia	0.01	0.06	0.01	0.05	0.00	0.00	0.02	0.25	0.45	0.29	0.85
Batagarawa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.51	0.17	0.74
Batsari	0.01	0.06	0.01	0.01	0.00	0.00	0.01	0.16	0.33	0.30	0.60
Rimi	0.02	0.08	0.00	0.01	0.00	0.00	0.02	0.35	0.43	0.27	0.92
Charanchi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.31	0.24	0.56
Kurfi	0.03	0.11	0.00	0.02	0.00	0.00	0.03	0.36	0.31	0.33	0.86

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Dutsinma	0.03	0.15	0.03	0.04	0.00	0.00	0.03	0.26	0.3	0.48	0.85
Danmusa	0.02	0.12	0.01	0.01	0.00	0.00	0.03	0.36	0.36	0.51	0.92
Safana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.26	0.08	0.40
Matazu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.46	0.14	0.61
Musawa	0.01	0.09	0.02	0.03	0.00	0.00	0.02	0.13	0.30	0.30	0.60
Kankara	0.01	0.06	0.01	0.02	0.00	0.00	0.01	0.17	0.24	0.26	0.52
Malumfashi	0.06	0.31	0.03	0.04	0.00	0.00	0.04	0.26	0.53	0.88	1.28
Faskari	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.43	0.13	0.64
Funtua	0.05	0.33	0.03	0.03	0.00	0.00	0.03	0.27	0.52	0.61	1.26
Bakori	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	0.69	0.20	0.99
Dandume	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.47	0.13	0.73
Danja	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.63	0.20	1.04
Kafur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.41	0.15	0.75
Sabuwa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.47	0.13	0.76
Total	0.05	0.17	0.01	0.02	0.00	0.00	0.01	0.24	0.40	0.42	0.91
Gini Index	**0.90**	**0.86**	**0.75**	**0.77**	**0.93**	**0.97**	**0.69**	**0.20**	**0.18**	**0.57**	

Sources: Ministry of Health, 2018
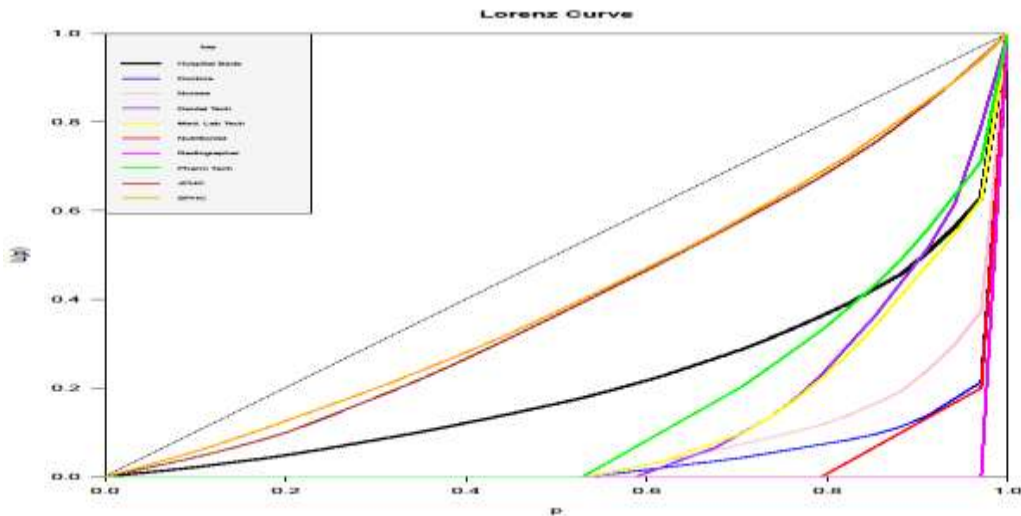
Figure 1: Distribution of health workers

Based on the population figures of LGAs as projected by the National Population Commission and the available health workers, the overall inter-state inequality has a Gini-coefficient of 0.903 (table 1) for the entire State, 0.86 for Nurse, 0.7476 for Dental technologist, 0.7647 for Medical lab technologist, and 0.9294 for Radiographer, 0.6889 Pharmacy technicians, 0.2 for JCHEW, 0.18 for SCHEW, and 0.5658 for Hospital Beds. Table 1 and Figure 2 illustrate the Gini Index and Lorenz curve for the distribution of health worker in Katsina State respectively. The result depicted by the Gini index and Lorenz curve (Table 1 and Figure 2) reaffirmed the first findings on healthcare facilities in the state, that Katsina State health care system is not only suffering from inequality in distribution of healthcare staff and facilities, but also shortages exist at various health workers cadre in the State's health system.

Moreover, on the distribution of healthcare workers in Katsina State, Gini coefficient, Lorenz curve and World Health Organization (WHO) recommended criteria of critical shortage threshold was used to analyze the data of health facilities staff. The findings of the study revealed that, not only do inequality exists in the distribution of healthcare staff in the three zones of the State (i.e. Katsina, Daura and Funtua zones), but also inadequacy of staff was detected, because in all the three zones of the state the minimum requirement as stipulated by the WHO for

critical shortage of 2.5/1000 population (i.e. 400 persons per health worker) has not been achieved.

On the other hand, the Lorenz curve which is the graphical representation of Gini index also depicted similar results as the curve runs further away from the diagonal which means there is high inequality in the distribution of health care staff in the three senatorial districts of the State. This finding corroborates studies conducted by Okafor (1987, 2007) Adamu and Mongunu (2009); Adamu and Uwais (2003); Darda'u (2011); As further proof of the disparity between population and healthcare facilities in Katsina State, a correlation analysis was carried out. A close-fit between population distribution and the distribution of health care facilities produced a high positive correlation coefficient. This means that local government areas with higher population have large numbers of health facilities and vice-versa. In addition, the correlation coefficient would help establish the importance or otherwise of population figures in the distribution of health care facilities in Katsina State. The correlation coefficient between population and the health care facilities are all positive and high (see Table 2).

Table 2: Coefficients of correlation and determination

Facilities	r	r²
Hospital Bed	0.634	0.4
Doctors	0.597	0.36
Nurses	0.623	0.39
Dental Technicians	0.629	0.4
Medical Lab Technologist	0.652	0.43
Nutritionist	0.578	0.33
Pharmacist Technicians	0.621	0.39
JPHC	0.133	0.02
SPHC	0.521	0.27

Field work 2019

This table shows that Correlation is significant at the 0.05 level (2-tailed) and that LGAs with higher population have more health care facilities than the ones with relatively lower population. Based on the fact that the coefficient is high and also significant, this makes conclusion reached in this case to be valid and is in tandem with the findings of Dar'dau (2011). Therefore, a close relationship exists between the distribution of population and the distribution of health care facilities in Katsina

State. The coefficient of determination on Table 2 also provides substantiation that the size population is a determining factor in the distribution of health facilities in Katsina State. Therefore, it can be concluded that population size determined the allocation of health workers in Katsina State with *p*-value at <0.005.

Moreover, correlation analysis was conducted to ascertain the relationship between population size and the provision of healthcare facilities worker. However the findings revealed a highly significant relationship, which indicates that in Katsina State, health workers are allocated to LGAs based on population size which is the index of need as stipulated by the National Health Policy (2016). This finding is however contrary to what Tandi *et al* (2015) and Adhami *et al.* (2014) revealed, in these studies they reported that population size and the allocation of health workers are not significantly correlated in their areas of study.

Conclusion and Recommendations
A critical look at the existing inequality of access and distribution of healthcare facilities and workers within the 34 LGAs in Katsina State has revealed a gap between the population and the number of health personnel per person, as well as how it has generated disparities in levels of productivity among individuals and communities, as a result of the existing correlation between health status of population and productivity. To this end, it is recommended that a more robust investigation be conducted tied to the existing healthcare facilities, particularly the primary healthcare facilities, so as to determine the availability of equipment or otherwise, in the healthcare facility, this will ultimately determine the quality of the hospitals. There is also the need to also establish the actual access that an individuals and communities have regards healthcare facilities in Katsina State. This with a view of reducing distance and stress a person will face before accessing a healthcare facility. In addition, the government should adopt the recommendation of WHO as cited in Adamu et al.(2009), where it suggested the use of population threshold as a yardstick for health care facility distribution to ensure equality and social justice in distribution of health care workers and other basic facilities.

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