SPATIAL VARIATION IN DIARRHOEA PREVALENCE AMONG CHILDREN IN KADUNA STATE

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Abstract

This study was carried out to map the spatial variation in diarrhoea prevalence and their attendant causes among children in Igabi, Zaria and Zangon Kataf Local Government Areas of Kaduna State. The data used included were from hospital records and questionnaire survey, of 477 respondents. Qualitative data from in depth interviews and Focus Group discussions were also used. The data for disease prevalence was aggregated within GIS environment to produce the disease maps and Chi square was used to determine the relationship between economic and sociodemographic characteristics of mothers, and diarrhoea prevalence in their children. The incidences of diarrhoea is most prevalent in Zaria with 50% of the cases, followed by Igabi(30%) and lastly Zangon- Kataf(20%) LGAs. Socioeconomic attributes of the mothers of the sick children had influence on the occurrence of diarrhoea in the children. Some of these included: educational attainment ($p=0.029$); the method of excrement disposal (0.025) and source of drinking water ($p=0.007$). To help manage diarrhoea prevalence, recommendations include the practice of disease preventive measures such as better sanitary environment, adequate nutrition of children, improved hygiene and education of mothers to at least secondary level. In conclusion, mapping childhood diseases such as diarrhoea present a better way of understanding variation in diseases and provide location-specific management measures.

Key words: Childhood, Diarrhoea, Drinking Water, Excrement disposal, Geographic Information Systems (GIS), spatial variation.

1. Introduction

According to United Nations Children's' Emergency Fund 'UNICEF' (2010), diarrhoea is the second largest killer of children, causing as many as 17% of the deaths of those under the age of five. This is largely a result of unsafe water and poor hygiene. About 4 billion cases of diarrhoea are annually reported with resultant death of 1.7 million people, most of who are children under the age of five (UNICEF, 2010). Diarrhoea is defined as having loose or watery stools at least three times per day, or more frequently than normal for an individual (UNICEF/WHO, 2009). Though most episodes of childhood diarrhoea are mild, acute cases can lead to significant fluid loss and dehydration, which may result in death or other severe consequences if fluids are not replaced at the first sign of diarrhoea. About 46% of deaths due to diarrhoea occur in Africa alone, and Nigeria happens to record mortality cases due to diarrhoea, at a staggering figure of 151,700 annually (UNICEF/WHO,2009).

Children with poor nutritional status and overall health, as well as those exposed to poor environmental conditions, are more susceptible to severe diarrhoea and dehydration than healthy children. Children are also at greater risk than adults of life-threatening dehydration since water constitutes a greater proportion of children's bodyweight. Young children use more water in a day given their higher metabolic rates, and their kidneys are less able to conserve water compared to older children and adults.

Reducing childhood diarrhoea requires interventions to make children healthier and less likely to develop infections that lead to diarrhoea; clean environments that are less likely to transmit disease; and the support of communities and caregivers in consistently reinforcing healthy behaviours and practices over time.

El Samani *et al* (1989) studied the predictors of diarrhoea in children under five in Sudan; they collected data on 445 children under the age of 5 and categorised them according to their weight for age. A strong association between malnutrition and diarrhoea was observed. It was also discovered that undernourished children had close to twice the risk of diarrhoea of well nourished children. Gascon *et al* (2000) studied the prevalence of diarrhoea in children under five years old in Ifakara, Tanzania. Data were collected on a total of 103 children suffering from acute diarrhoea, with watery stool presentation at least 24 hours to the time information was collected. Conditional logistic regression was used to evaluate how the risk of having a case of disease varied for different risk factors and pathogens. The analysis was performed using Stata statistical software, and the results showed that lesser distance to water source, open latrines and non exclusive breastfeeding of children above six months were associated with a higher risk of diarrhoea.

Furthermore, Girma *et al,* (2008) studied the environmental determinant of diarrhoea infection among under five children in Western Ethiopia. A community based study and data were collected randomly from 407 mothers/caregivers of children less than five years of age. The results showed that a number of risk factors including distance from drinking water sources,

availability and ownership of the latrine, refuse disposal, the presence of faeces around the pit-hole and presence or absence of pit-hole cover and faeces seen in the compound were significantly associated with under-five childhood diarrheal morbidity.

Some cases of diarrhoea are prolonged, with the child continuously passing loose and watery stool for more than seven days. Many children in this critical state end up adding to mortality figures if not managed with utmost care. Ekanem *et al* (1994) investigated diarrhoea incidence among 628 children a semi urban area of Lagos State and the results showed that a significantly high risk of prolonged diarrhoea was found among children who were fed maize pap as the main diet. Children who were fed with food purchased from food vendors were also significant sufferers of prolonged and persistent diarrhoea, with frequent exposure to the illness, exacerbated by low energy and low nutrient meals like pap. Other studies were that of Oni (1996) and others. Most of the studies were outside Kaduna State, the non-availability of study that compare variation in diarrhoea incidence in Kaduna State is long overdue because of the peculiarity of the mixed cultural and socioeconomic attributes of mothers in the area.

This study is focused on mapping diarrhoea incidence in Kaduna state. This study is important in Kaduna state, as there had been an unacceptably high mortality rate and burden of the disease in the state (PATHS, 2006). This research would reveal areas of high prevalence of diarrhoea among children, due to certain factors, thereby helping to provide a strategy for effective management for the disease in the state.

The aim of this research is a purposeful analysis of the spatial variation of diarrhoea prevalence among children in Kaduna State. The key objectives are therefore to: determine the prevalence of diarrhoea in the study area, analyse the probable causes of diarrhoea prevalence in children, and produce a map showing the spatial variation of diarrhoea in Kaduna state.

The underlying hypotheses are that
1. There is no spatial variation in prevalence of diarrhoea in children in Kaduna State and
2. Sanitary conditions do not affect the prevalence of diarrhoea in children in Kaduna State

2. Materials and methods

A reconnaissance survey was carried out for getting acquaintance with the study area, and ground truthing was also done to verify the features on ground, as noticed in the satellite imagery. Primary sources of data were satellite imagery of Kaduna State, obtained from National Research and Space Development Agency, (NARSDA) Abuja; field survey whereby questionnaires and structured interviews were administered at homes and health facilities to mothers of children under the age of 5 years, and medical personnel using systematic random sampling method. Every 5^{th} house was selected for questionnaire administration.

Kaduna State has a population of 6,066,562 (NPC, 2006). It comprises of twenty three (23) local government areas, grouped into three senatorial districts. Three local government areas were selected for the study. The selections of these three LGA's were based on the following criteria:

i. Their location in each of the senatorial districts. One was chosen from each of the three senatorial districts, to ensure adequate spatial coverage of the study.

ii. The LGA with the highest population of females in each of the senatorial districts in Kaduna State.

Based on the criteria stated above, the three LGAs chosen for study were Zaria, Igabi and Zangon-Kataf. With reference to table 1, the number of copies of the questionnaire administered was based on the population size. The total female population in the selected LGAs was 556,550, of which 0.1% was used as sample for the questionnaire administration. This percentage is adequate, as it surpasses the required sample size prescribed by research advisors (2006), for the administration of questionnaires within a population. The copies of the questionnaire administered were 556, distributed among the mothers and caretakers of children under five years of age in the selected LGAs.

Table 1: Distribution of Female Population in the selected LGA's, and questionnaire administration

Selected LGA	Population of females	No of questionnaires administered per LGA
Zaria	196,090	196
Igabi	213,339	213
Zangon-Kataf	157,121	157
Total	556,550	556

Source: Adapted from NPC (2006)

Three Focus Group Discussions (FGD's) were carried out, to obtain attitudinal data and information on culture, myths and other sensitive issues relevant to the research, which the questionnaire may not have captured. A FGD session was done in each LGA, comprising of 10 women between the ages 15-45 years. Secondary data were from hospital medical records from selected hospitals.

Data from field survey were analysed using both descriptive and inferential statistics. The descriptive statistical analysis was adopted for the summarization of data in tables and percentages. In establishing the relationship between childhood diarrhoea prevalence and causative factors, the chi square analysis was used. This revealed the statistical influence of some of the socioeconomic factors on incidence of diarrhoea in children, using the SPSS 12 statistical package. Out of the 556 questionnaires administered, 477 valid questionnaires were recovered from the respondents and analysed

3. Results and discussion

3.1 Factors responsible for diarrhoea incidence

3.1.1: Source of Drinking Water and Prevalence of Diarrhoea

Table 2 shows the different sources of drinking water in the study area. On the average, 34.5% of the respondents get their potable water from tap. This is followed closely by the respondents who rely on well (32.0%). Borehole as a source of potable water is for 24.5% respondents as it

seems to be more reliable in terms of safety and supply, while only 0.7% of respondents sourced their drinking water from rivers and streams.

Table 3 show that all of the respondents whose major source of drinking water was tap, had children with diarrhoea. This may be an indication that the pipe borne water is contaminated either from source or storage before consumption.

3.1.2: Excrement disposal and prevalence of diarrhoea

With reference to table 4, the method of excrement disposal affects the health of children in many ways. On the average, of all the methods of human waste disposal in the study area, 47.0% use the pit latrine. This figure is followed closely by the water closet at 46.3%. The open field/bush serve 1.9% of the respondents, while 0.7% use the bucket/pan. Lastly, the public toilet is utilised by 3.3%.

In all the three LGAs, the commonest method of excrement disposal is pit latrine and water closet. Interestingly however, while majority (74.4%) of the respondents in Zaria LGA utilize the water closet system, Zangon Kataf has 42.6% usage and Igabi only 22% usage. This spatial difference could be due to the status of each of the LGA's with regards to their urban settings. Zaria LGA being the most urbanize followed by Zangon Kataf LGA and lastly Igabi LGA.

Table 5 shows that about 59% of the respondents' children who have suffered diarrhoea utilise the pit latrine; 3.3% use the bucket/pan. The chi square result reveals a calculated value of 9.319, with 3 degrees of freedom and a P value of 0.025 to indicate a statistically significant relationship between method of excrement disposal and in prevalence of diarrhoea in children. This could be an indication of greater exposure to germs in the pit latrine compared to other forms of excrement disposal.

3.2 Spatial variation in Diarrhoea incidence in Kaduna state.

With reference to Table 6, Igabi LGA reveals a statistically significant result with a calculated Chi square value of 0.75, with 3 Degrees of freedom and a P- value of 0.001; Zaria LGA on the other hand also had a statistically significant result with a calculated Chi square value of 0.75, with 3 Degrees of freedom and a P- value of 0.001;The result in Zangon Kataf however shows a non significant Chi square relationship with a calculated value of 66.7 at 5 degrees of freedom and p value of 0.070. This shows that in the locality, the method of excrement disposal has no influence on diarrhoea prevalence in children.

With reference to Table 7, the spatial variation in the Chi square results across the three LGAs indicates a statistically significant relationship in Igabi and Zaria LGAs, with a p value of 0.009 and 0.010 respectively. A non significant relationship as indicated by a p value of 0.069 in Zangon Kataf LGA with a shows that drinking water does not influence the prevalence of diarrhoea in the locality.

Table 2: Distribution of respondents by sources of drinking water

Variables	Igabi LGA		Zaria LGA		Zangon Kataf LGA		Total LGA	
Source of Drinking Water	Number of Respondents	%	Number of Respondents	%	Number of Respondents	%	Number of Respondents	%
No response	0	0	0	0	4	2.7	4	0.9
Tap/pipe borne	53	26.5	49	38.0	58	39.2	160	34.5
Tanker/water vendor	6	3.0	15	11.6	2	1.4	23	5.3
Well	112	56.0	9	7.0	49	33.1	155	32.0
Borehole	25	12.5	51	39.5	32	21.6	108	24.5
River/stream	1	0.5	1	0.8	1	0.7	3	0.7
Total	200	100	129	100	148	100	477	100

Source: Field Survey,2012

Table 3: Source of drinking water and prevalence of Diarrhoea

Prevalence of diarrhoea	Total					
	Drinking water					
	Tap/pipe borne	Tanker/ Vendor	Well	Borehole	Others	Row total
Yes	23(100.0)	2(50.0)	16(84.2)	8(57.1)	1(100.0)	50(100.0)
No	0(0.0)	2(50.0)	3(15.8)	6(42.9)	0(0.0)	11(100.0)
Column total	23(37.7)	4(6.6)	19(31.2)	14(22.9)	1(1.6)	61(100.0)
Calculated X^2 value = 13.947; Degree of freedom= 4; P- value= 0.007; Remark= Significant						

Source: Field Survey,2012

Table 4: Distribution of Respondents by method of Excrement Disposal

Variables	Igabi LGA		Zaria LGA		Zangon Kataf LGA		Total LGA	
Excrement Disposal								
No response	0	0	0	0	4	2.7	4	0.9
Water closet	44	22.0	86	66.7	63	42.6	193	40.5
Pit latrine	145	72.5	39	30.2	68	45.9	252	52.8
Bucket/ pan	0	0.0	1	0.8	2	1.4	3	0.6
Public toilet	8	4.0	2	1.6	6	4.1	16	3.4
Bush/field	3	1.5	1	0.8	3	2.0	7	1.5
Others	0	0.0	0	0.0	2	1.4	2	0.4
Total	200	100	129	100	148	100	477	100

Source: Field Survey, 2012

Table 5: Excrement disposal and prevalence of Diarrhoea

Prevalence of diarrhoea	Total				
	Excrement disposal				
	Water closet (%)	Pit latrine (%)	Bucket/pan (%)	Public toilet (%)	Row total (%)
Yes	22(36.1)	36(59.0)	2(3.3)	1(1.6)	61(100.0)
No					
Column total	22(36.1)	36(59.0)	2(3.3)	1(1.6)	61(100.0)
Calculated X^2 value = 9.319; Degree of freedom= 3; P- value= 0.025; Remark= Significant					

Source: Field Survey, 2012

Table 6: Spatial variation in excrement disposal and prevalence of Diarrhoea

Igabi LGA				
Variables	Observed X^2 value	Degree of freedom	P- value	Remark
Excrement disposal and Diarrhoea incidence	0.75	3	0.001	Significant
Zaria LGA				
Excrement disposal and Diarrhoea incidence	0.26	4	0.001	Significant
Zangon-Kataf LGA				
Excrement disposal and Diarrhoea incidence	66.7	5	0.070	Not significant

Source: Field Survey, 2012

With reference to Figure 1, the children in Zaria LGA suffered the highest prevalence of diarrhoea (40.1%). Igabi has 32.78% of total diarrhoea cases, while the least number of cases are found in Zangon Kataf LGA with 29.51% of total incidence. Reports from various studies show that, lack of excreta disposal facility, the presence of excreta within the residential yard, lack of latrines and absence of refuse disposal pit are associated with higher diarrhoea morbidity (Getaneh *et al*,1997; Root,2001).

Source of drinking water is also linked to the prevalence of diarrhoea. The main sources of drinking water in the study area generally are tap water, well and borehole. The highest number of respondents that patronised water vendors for drinking water is found in Zaria LGA. This may be a reason why the prevalence of diarrhoea is high in Zaria LGA. Feeding practices such as the feeding of infants with semisolid cereal pap has also been linked to diarrhoea in children (Ekanem *et al*, 1994).

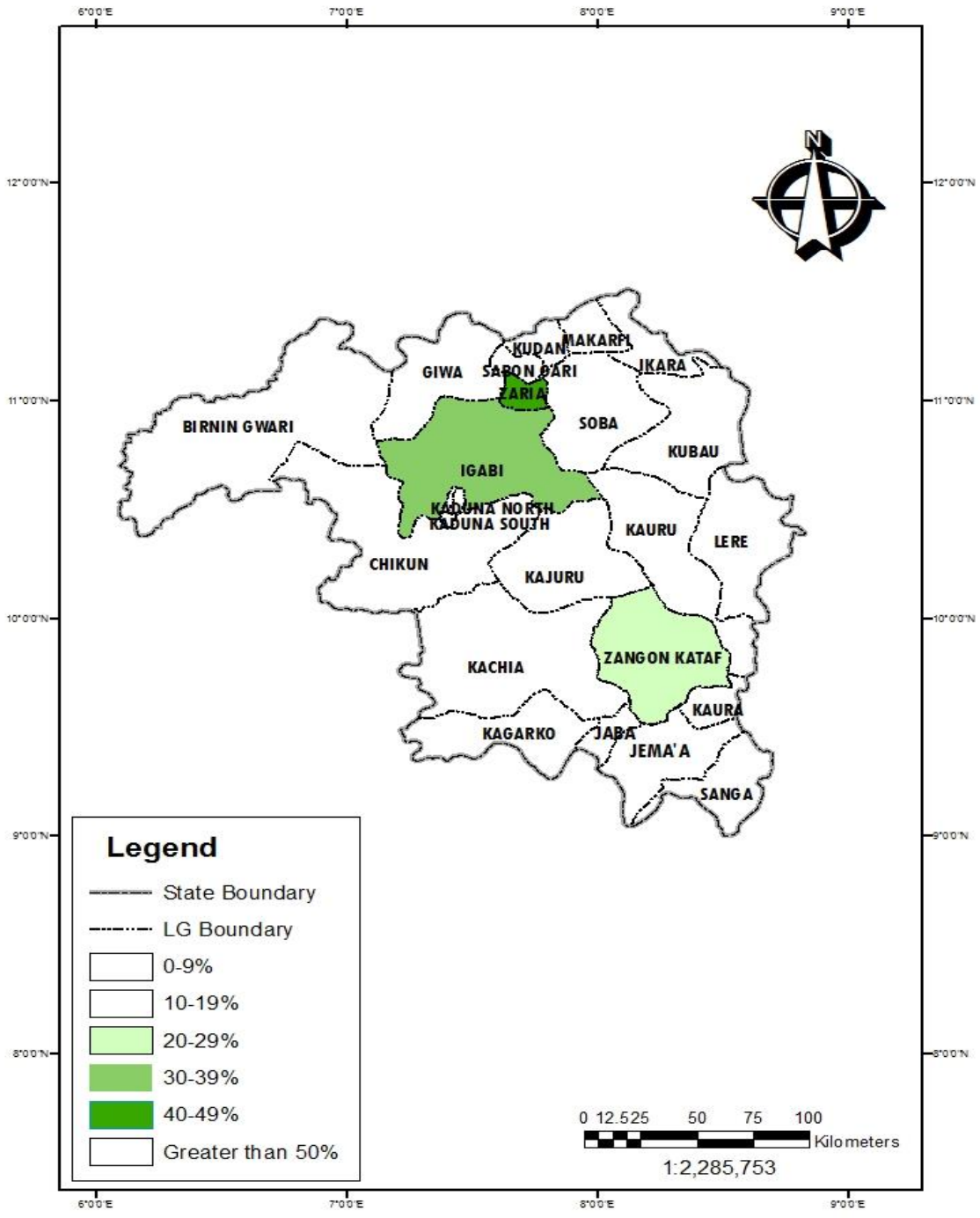

Fig 1: Diarrhoea Prevalence in the Study LGAs

Source: Authors' field survey, 2012

Table 7: Spatial variation in source of drinking water and prevalence of Diarrhoea

Igabi LGA				
Variables	Observed X^2 value	Degree of freedom	P- value	Remark
Drinking water and diarrhoea prevalence	11.640	3	0.009	Significant
Zaria LGA				
Drinking water and diarrhoea prevalence	13.313	4	0.010	Significant
Zangon-Kataf LGA				
Drinking water and diarrhoea prevalence	3.555	2	0.069	Not significant

Source: Field Survey, 2012

This is the case in Zaria LGA, as a good number of the respondents are civil/public servants, hence the inability to exclusively breastfeed their infants, thus augmenting feeding with cereal pap. As observed in figure 1, the spatial variation in the prevalence of diarrhoea within the study area is evident, with the most prevalence in Zaria LGA as indicated by the darkest shade of colouring, followed by Igabi LGA and then Zangon Kataf LGA, having lighter shades respectively.

4. Conclusion and recommendation

The spatial variation in the prevalence of child diseases within the study area is evident, and is shown in the Chi square results and the map produced. This map is a relevant tool to aid Government interventions in better management of child diseases such as diarrhoea where they occur, and prevention in places possible.

The source of drinking water and the method of excrement disposal were factors associated with under-five diarrheal morbidity. Appropriate intervention programs targeting availability of refuse disposal facilities, appropriate care of latrines and potable drinking water should be designed. Mothers and caregivers of children should also be sensitised on better hygiene practices so as to reduce diarrhoeal infection in children.

Better attention should be paid to the feeding routine of children, particularly those younger than 6 months of age. More emphasis should be placed on the WHO/UNICEF guidelines on exclusive breastfeeding for 6 months after birth. Mothers should also be educated on how to enrich the nutritious content of the meals of their children through affordable and local food which is readily available.

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