Disparities in Municipal Services and Incidences of Diarrheal Diseases in Jimeta, Nigeria

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Abstract

This study investigates the impact of access to municipal services on the prevalence of diarrheal diseases in urban areas. The research focuses on Karewa GRA Extension and Rumde residential districts in Jimeta Yola. The study employed field investigations, interviews with community heads and officials, and a household questionnaire survey. A total of 495 questionnaires were administered, with 193 for Karewa GRA Extension and 302 for Rumde. The findings show that Karewa has a 1.9% prevalence rate of diarrheal diseases, while Rumde has a significantly higher rate of 13.1%. Binary logistic regression analysis identifies predictors of the high prevalence in Rumde. The study recommends various urban management and community engagement strategies to improve the provision of municipal services. These include enhanced collaboration between municipal agencies, the establishment of community development departments, and improved access to land and housing for the urban poor. This research contributes to understanding the relationship between access to municipal services and diarrheal diseases prevalence in urban areas. By identifying key factors and proposing recommendations, it aims to guide interventions that can effectively reduce the prevalence of diarrheal diseases in urban communities.

Keywords*:* Municipal services, Diarrheal Diseases, Health equity, Neighbourhoods.

INTRODUCTION

Majority of research on healthy urban planning has focused on the determinants of chronic diseases, such as diabetes, cancer, and cardiovascular diseases (McNamara *et al*., 2017; Juma *et al*., 2019; Bono and Matranga, 2019). However, infectious diseases, including diarrheal diseases, remain a significant cause of morbidity and mortality (Maher and Sekajugo, 2010) and account for 63 percent of all deaths (Excler *et al*., 2021). Diarrheal diseases are widespread worldwide, particularly in developing regions like Africa, Southeast Asia, and the Eastern Mediterranean, where rapid population growth, increased urbanization, and limited access to safe water, infrastructure, and health systems are prevalent (W.H.O., 2005). Factors such as improper human fecal waste disposal, crowded rudimentary housing, and poor overall hygiene standards contribute to the high prevalence of diarrheal diseases (Yaya *et al*., 2018). It has been shown that poor and unhealthy housing environments increase the risk of diarrheal diseases, and eradicating these diseases aligns with the United Nations Sustainable Development Goals (Yahaya, 2018).

Studies examining disparities in diarrheal disease prevalence in urban areas have identified various socio-demographic, biological, behavioral, and environmental factors at the individual, household, community, and district levels (Akinyemi, 2018). For example, differences in children caregivers' hygiene education across residential districts in Burundi were associated with geographical disparities in diarrheal disease prevalence (Diouf *et al*., 2014). Other research has implicated differences in personal hygiene habits across urban residential districts

(George *et al*., 2014; Oloruntoba *et al*., 2014; Ekpo, 2016; Anteneh *et al*., 2017), while studies have linked disparities to inequality in access to healthcare facilities in urban areas (Adewoyin *et al*., 2018; Chavehpour *et al*., 2019; Dong *et al*., 2020). However, little is known about the relationship between access to municipal services and the prevalence of diarrheal diseases in residential districts of urban areas. This paper argues that disparities in diarrheal disease prevalence in urban areas are largely influenced by inequities in access to municipal water supply, solid waste management services, land, and housing in Jimeta Yola. The study focuses on Karewa GRA Extension and Rumde Residential neighborhoods in Jimeta, Adamawa State, as a case study.

METHODOLOGY

The Study Area

Jimeta is located on Latitude 9°15' North and Longitude 12° 28' East of the equator (Figure 1). It is located on an altitude of about 190 meters above mean sea level. It is bordered to the north by Ngurore town to the east by the River Benue, to the south by Yola Town, and to the west by the Mayine hills (Liman & Ngah, 2015). It has an estimated annual population growth rate of 3.6% (National Population Commission, 1991). Based on the 2006 population records of 191,732 the estimated projected population for the year 2020 is 286,648.

Jimeta consists of 11 administrative wards in the Yola -north local government area, amongst which are Karewa (including Karewa GRA extension) and Rumde. However, about 17 residential neighbourhoods were identified and classified into the two based on their varying socio economic and physical characteristics (Table 1). From these, Karewa GRA Extension an urbanised residential neighbourhood and Rumde a slum residential neighbourhood were selected for this study.

Karewa GRA Extension in Jimeta was established in 1977 to provide housing for civil servants, resulting in the displacement of the original inhabitants and the development of Karewa GRA Extension. The area now has an estimated population of 10,604 people and covers a land area of 204.64 hectares. It features a gridiron road network with drainage lines, and the houses are designed as modern bungalows or duplexes.

Rumde residential neighborhood has a projected population of Rumde in 2020 is 21,113, occupying a land area of 88.8 hectares. The ward has experienced organic growth and is subdivided into Rumde Sarkin Wuta, Rumde Madagalire, Rumde Va'atita, and Rumde Makera. Blacksmiths, GSM sales shops, and POS shops have proliferated in the area. However, most houses lack road access and drainage provision, resulting in irregular block arrangements.

Data Collection

The data for this study was collected through questionnaires and field investigations. Socio-economic characteristics, access to municipal services, and self-reported health data were gathered. Socio-economic data included household head's educational attainment, maternal education, and monthly household income. Data on access to municipal services comprised distance to water supply, adequacy of water supply, source of water supply, and per capita household water consumption. Field surveys collected data on floor area ratio, availability of solid waste disposal facilities, and wastewater disposal facilities. Self-reported prevalence of diarrheal diseases in households was obtained from household heads.

Deliberations were conducted with staff members of the Adamawa State Urban Planning and Development Authority. A cross-sectional survey questionnaire was then distributed

proportionally to 10% of households in both Karewa GRA Extension and Rumde using a systematic random sampling procedure. This resulted in a total of 193 households in Karewa GRA Extension and 302 households in Rumde, making a combined total of 495 sampled households.

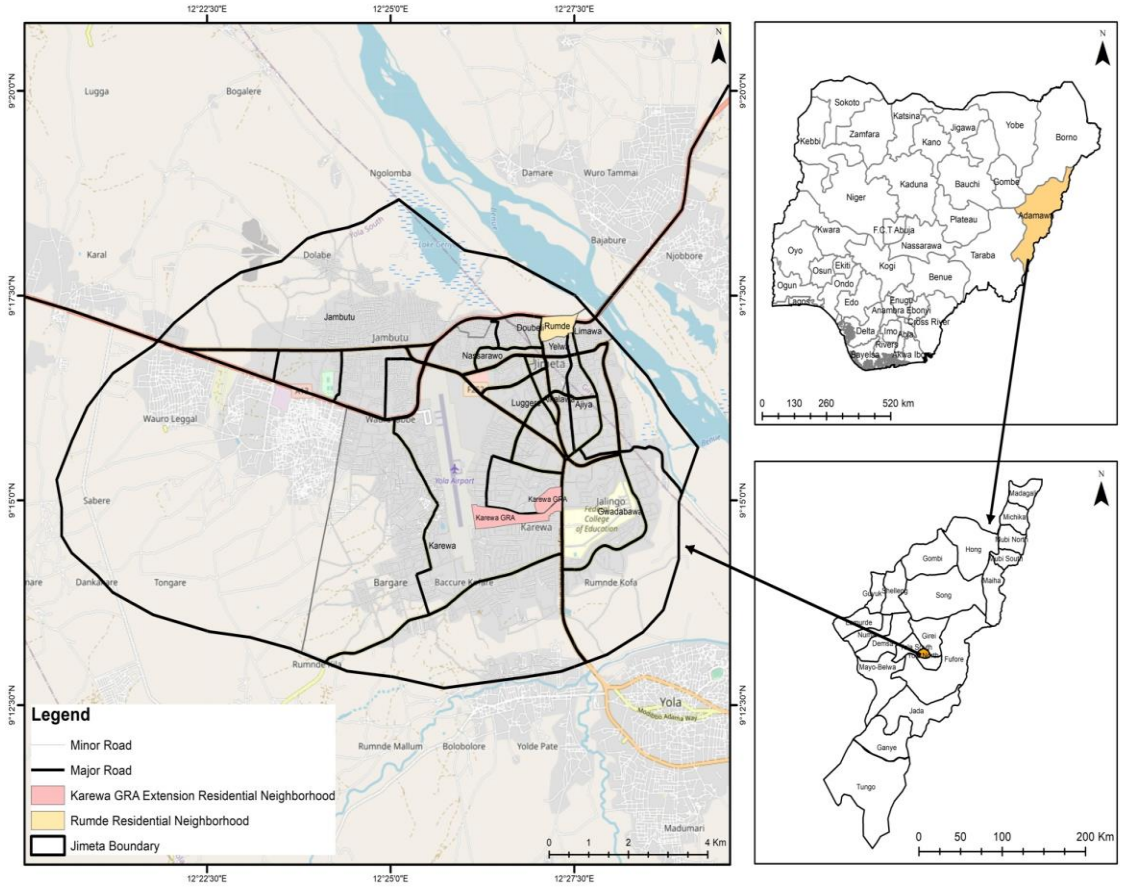

Figure 1: Location map of the study area.

Table 1: Sampled households

Sub Areas	2021 Population	Number of Households	Sampled Households
Rumde	21,113	3,016	302
Karewa GRA	10,605	1,928	193
Total	***34,398***	***5,673***	***495***

Population Census Projected to 2021

Statistical Analysis

Both descriptive and inferential statistics were used for the analysis in this study. Descriptive statistics involved the use of a Mann-Whitney test to examine the disparity in the prevalence of diarrheal diseases between Karewa GRA Extension and Rumde. Additionally, the Chi-square tests of homogeneity and Cramer's V (φc) were employed to assess the differentials and strength of differentials in socio-economic characteristics and access to municipal services between the two residential neighborhoods.

Inferential statistics were applied using a Binary logistic regression model to analyze the relationship between access to municipal services and the prevalence of diarrheal diseases in the two neighborhoods. The regression coefficients were presented as odds ratios (OR), and

statistical significance was evaluated at p<.05. The analysis was performed using SPSS statistics software version 23.

Prevalence of Diarrheal Diseases

According to the findings presented in Table 2, the prevalence of diarrheal diseases was higher in Rumde (13.1%) compared to Karewa GRA Extension (1.9%). The Mann-Whitney test was conducted to assess the difference in diarrheal disease prevalence between the two areas. The test revealed a statistically significant difference ($Z = -4.296$, $p < 0.001$), indicating that the prevalence of diarrheal diseases differs significantly between Karewa GRA Extension and Rumde. Therefore, the null hypothesis, which suggests no statistically significant difference in diarrheal disease prevalence between the two areas, is rejected in favor of the alternative hypothesis, which supports a statistically significant difference in diarrheal disease prevalence between the two residential neighborhoods.

Table 2: Mann Whitney test of differences in Diarrheal Diseases Prevalence between Karewa GRA Extension and Rumde

	Karewa GRA Extension		Rumde		Overall		Z- score	P-value
Diseases	N=702	%	N=3001	%	N=3703	%		
Diarrhoea	13	1.9	392	13.1	405	10.9	-4.296	.000

Differentials in Socio Economic Characteristics and Access to Municipal Services

Table 3 presents the results of the Chi-square test of homogeneity, examining socio-economic characteristics and access to municipal services in Karewa GRA Extension and Rumde residential neighborhoods. The analysis revealed significant differences in maternal education ($\chi2 = 327.371$, $p \leq .000$, $V = .813$) and household income ($\chi2 = 367.253$, $p \leq .000$, $V = .861$) between the two areas. Rumde had a higher percentage of mothers with no formal education (72.8%) compared to Karewa GRA Extension (34.7%), and a larger proportion of households with a monthly income below N 50,000.00 (71.5%) compared to Karewa GRA Extension (2.1%). These socio-economic disparities contribute to the higher prevalence of diarrheal diseases in Rumde. Poor maternal education leads to inadequate awareness of environmental hygiene practices. Additionally, the discrepancy in household income affects the affordability and access to municipal services, further exacerbating the health risks in Rumde.

Regarding access to municipal services, significant differences were found in distance to water supply ($X2(1) = 61.508$, $p \leq 0.001$, $V = .382$), frequency of water supply ($X2(1) = 74.234$, $p \leq 0.001$, $V = .473$), source of water supply ($X2(2) = 96.162$, $p \leq 0.001$, $V = .483$), floor area ratio ($X2(2) = 7.751$, $p \leq .005$, $V = .415$), and occupancy rate ($X2(2) = 71.121$, $p \leq .005$, $V = .415$) between Karewa GRA Extension and Rumde. Rumde heavily relies on water vendors for water supply (71.9%), and most residents (74.2%) have to travel more than 200 meters to access public standpipes. In contrast, Karewa GRA Extension has regular pipe-borne water supply (86.0%) and better access to solid waste disposal facilities (83.9%).

Furthermore, wastewater disposal practices in Rumde pose health risks, with a majority of residents (85.0%) indiscriminately throwing wastewater in the compound or streets. The unequal provision of municipal services is also evident in terms of sullage disposal, with residents in Karewa GRA Extension utilizing septic tanks (74.6%) while Rumde residents' resort to improper methods such as throwing wastewater into storm drains (12.5%).

There were no significant differences between the two areas in terms of availability of household solid waste storage bins and access to healthcare facilities. The majority of households in both Karewa GRA Extension and Rumde have waste storage bins (91% and 87%, respectively), and most households are within accessible distance to healthcare facilities (93.8% in Karewa GRA Extension and 83.5% in Rumde).

Table 3: Socio Economic Characteristics and Indicators of Access to Municipal Services

Socio-economic Characteristics and Access to Municipal Services	**Residential Areas** Karewa Frequency % 193 (100)	Rumde Frequency % 302 (100)	Total Frequency % 495 (100)	Statistical Significance X^2 P(≤0.05); V(φ)
Household head Education				
No Formal Education	3 (1.6)	55 (18.2)	58 (11.7)	X^2 (1)= 0.013
Formal Education	190 (98.4)	247 (81.7)	437 (88.3)	p < .913;V=001
Maternal education				
No Formal Education	67 (34.7)	220 (72..8)	287 (58.0)	X^2 (1)=327.371
Formal Education	126 (65.3)	82 (27.2)	208 (42.0)	p≤ .000;V =.813
Monthly household income (₦)				
< 50,000.00	4 (2.1)	216 (71.5)	220 (44.4)	X^2 (2)= 67.253
50,000,00 -100,000.00	123 (63.7)	29 (9.6)	152 (30.7)	p ≤ .000;V=.861
> 100,000.00	66 (34.2)	57 (18.9)	123 (24.8)	
Distance to public standpipe				
> 200 meters	6 (3.1)	224 (74.2)	230 (46.5)	X^2(1) = 61.508
< 200 meters	187 (96.9)	78 (25.8)	265 (53.5)	p≤ 0.001;V =.382
Frequency of municipal water supply				
Not regular	31 (16.1)	228 (75.5)	259 (52.3)	X^2(1) = 74.234
Regular	162 (83.9)	74 (24.5)	236 (47.7	p≤ 0.001;V =.473
Source of water supply				
Water Vendors	22 (11.4)	217 (71.9)	239 (48.3)	X^2(2) = 96.162
Public standpipes	5 (2.6)	69 (22.8)	74 (14.9)	p< 0.001;V =.483
Private boreholes/Piped into house	166 (86.0)	16 (5.3)	182 (36.8)	
Quantity of municipal supply				
< 60 liters per capita	16 (8.3)	233 (77.2)	249 (50.3)	X^2(1) = 35.639
> 60 liters per capita	177 (91.7)	69 (22.8)	246 (49.7)	p≤ 0.001 V=.422
Frequency of Refuse Collection				
Not Regular	31(16.1)	231(76.5)	262 (52.9)	X^2(1) = 24.995
Regular	162 (83.9)	71 (23.5)	233 (47.1)	p≤ .001;V =.239
Sullage Disposal method				
Thrown in compound/streets	12 (6.2)	224 (85.0)	236 (47.7)	X^2(2) = 52.307
In to neghborhood drainages	37 (19.2)	71 (12.5)	108 (21.8)	p< .001; V =.346
Septic tank	144 (74.6)	7 (2.5)	151 (30.5)	
Floor Area Ratio				
> 0.5	29 (15.0)	260 (86.1)	289 (58.4)	X^2(2) = 7.751
< .05	164 (85.0)	42 (13.9)	206 (41.6)	p≤ .005;V =. 141
Crowding				
> 3 persons per room	10 (5.1)	270 (89.4)	280 (56.6)	X^2(2) = 71.121
< 3 persons per room	183 (94.9)	32 (10.6)	215 (43.4)	p≤ .005;V =. 415
Use of Solid waste storage bins				
No	17 (9.0)	39 (13)	36 (7.3)	X^2(1) = 3.639
Yes	176 (91.0)	263 (87)	439 (88.7)	p≤ .160;V =.083
Access to health facility				
No	12 (6.2)	50 (16.5)	62 (12.5)	X^2(1) = 3.668
Yes	181 (93.8)	252 (83.5)	433 (87.5)	p≤ .160 ;V =.092

Relationship between Access to Municipal Services and of Diarrheal diseases prevalence

Table 4 provides an overall model evaluation of the relationship between access to municipal services and the prevalence of diarrheal diseases in Karewa GRA Extension and Rumde. The 2 log-likelihood ratio statistic for both areas predicts the decisions correctly without exceeding the maximum limit. The Cox and Snell R square and the Nagelkerke R squared statistics also do not exceed the maximum limit. The goodness-of-fit test, conducted using the Hosmer and Lemeshow test, indicates that the model fits the data well for analysis in both Karewa GRA Extension and Rumde residential neighborhoods.

In table 4, the binary logistic regression analysis reveals significant relationships between access to municipal services and diarrheal disease prevalence. Maternal education is significantly related to diarrheal disease prevalence in both Karewa GRA Extension and Rumde, with a higher prevalence in Rumde. Frequency of refuse collection also predicts diarrheal disease prevalence in both areas. However, other determinants of diarrheal disease prevalence show inequities between the two neighborhoods, except for per capita water consumption and occupancy rate.

In Rumde, household monthly income below ₦50,000.00 and between ₦50,000.00 and ₦100,000.00 have significant relationships with diarrheal disease prevalence. Distance to water supply, frequency of water supply, and source of water supply are significant predictors of diarrheal disease prevalence in Rumde. Wastewater disposal practices, such as disposal in the compound or through municipal drainages, also significantly relate to the prevalence of diarrheal diseases. A higher floor area ratio is associated with a significant relationship with diarrheal disease prevalence. However, occupancy rate does not significantly predict diarrheal disease prevalence in Rumde.

DISCUSSION

This study investigates the impact of access to municipal services on the prevalence of diarrheal diseases in two residential districts in Jimeta, Nigeria. The findings reveal that the lack of maternal education is a significant risk factor for diarrheal disease in both areas, highlighting the influence of poor income and educational background on health maintenance. In Rumde, where financial insecurity is prevalent in 71.5% of households and 72.8% of mothers lack formal education, the prevalence of diarrheal diseases is particularly high.

The study also identifies a higher prevalence of diarrheal diseases among households in Rumde that must travel more than 200 meters to access municipal water sources. This aligns with research conducted in Islamabad, Pakistan, which links increased distance to water sources with negative health outcomes, including diarrheal diseases in children. Variations in water supply frequency and sources are observed between different residential zones in Jimeta, and the consumption of water from vendors significantly impacts the prevalence of diarrheal diseases in Rumde compared to Karewa.

The majority of Rumde residents (76.0%) relying on water vendors explains the higher prevalence of diarrheal diseases (13.1%) in comparison to Karewa (1.9%). This finding contrasts with a study in Senegal that did not find a significant relationship between drinking water sources and diarrheal disease prevalence, suggesting the presence of other contributing factors in urban areas.

Table 4: Binary Logistic Regression Results of Relationship between Access to Municipal Services and Diarrheal Diseases Prevalence in Karewa GRA Extension and Rumde

Predictor	**Karewa GRA Extension**					**Rumde**				
	β	S.E β	wald	p-value	OR	β	S.E β	wald	p-value	OR
Maternal Education										
No formal education	2.570	1.0053	2.556	0.012	13.065	2.860	0.7573	3.393	0.001	17.461
Formal education					1					1
Household income										
< 50,000	-1.608	1.5767	1.019	0.308	4.994	-2.463	1.1105	2.208	0.027	11.738
51,000-100,000	-0.327	0.8125	0.402	0.668	0.721	-1.966	0.8431	2.311	0.02	7.14
> 101,000					1					1
Distance to Water Supply										
> 200 meters	1.184	0.5641	2.098	0.135	3.267	2.144	1.4346	.494	0.036	8.534
< 200 meters					1					1
Frequency of water supply										
Regular	- 0.751	0.7842	0.957	0.391	2.119	-5.228	2.0783	2.515	.012	186.418
Not regular					1					1
Source of water supply										
Water vendors	1.408	1.5021	0.0937	0.349	4.087	2.246	0.9942	2.259	0.024	9.453
Public stand pipes	1.306	1.1438	1.141	0.508	2.134	2.243	1.091	2.053	0.044	9.395
Piped into the house					1					1
Quantity of water supply										
< 60 liters per capita	-0.001	0.0013	0.171	0.679	1	0	0.001	0	0.685	1
> 60 liters per capita					1					1
Freq of Refuse Collection										
Not Available	1.738	.6564	2.547	0.023	5.684	1.965	.8669	2.266	0.008	7.163
Available					1					1
Wastewater Disposal										

Thrown in compound/ streets	2.074	1.2952	2.564	.109	7.955	3.366	1.3878	2.425	0.015	28.966
Neghborhood drians	1.296	.6943	3.487	.062	3.656	4.055	1.5651	2.590	0.010	57.665
Floor area Ratio					1					1
> 50	1.142	2.2064	0.519	.603	3.145	2.092	.7076	2.957	0.003	8.109
< 50					1					1
Occcupancy Rate										
> 3 per room	.328	.3462	.947	.344	.721	.188	.1410	1.333	.181	1.252
< 3 per room					1					1
Constant	-2.571	1.9851	1.677	0.195	13.078	-6.15	2.8884	4.533	0.033	468.717
Overall model evaluation										
Lkelihood rato test			59.312					16.682		
Cox and snell R sqaure			.038					.018		
Nagelkerke R square			.134					.034		
Goodness of fit test										
Hosmer and Lemeshow			1.913	.928				5.853	.119	

Furthermore, the study highlights the significant contribution of irregular solid waste collection and disposal, as well as the lack of proper wastewater disposal systems, to the prevalence of diarrheal diseases in Rumde. These findings differ from previous studies that attributed variations in diarrheal disease prevalence to indiscriminate solid waste and wastewater disposal, emphasizing the importance of comprehensive waste management systems.

Residential density plays a role in disease transmission, with a floor area ratio above 50% significantly predicting the prevalence of diarrheal diseases compared to a lower ratio. High population density has been associated with the transmission of diseases with epidemic potential, such as acute respiratory infections, meningitis, typhus, cholera, and scabies. Disease outbreaks tend to be more frequent and severe in densely populated areas.

CONCLUSION

The study confirms that the distribution of diarrheal disease risks is unequal in urban areas, emphasizing the need to prioritize low-income neighborhoods in urban community management. Urban development and public health policies should incorporate urban governance and citizen engagement to improve environmental quality, ensuring access to solid waste management, piped water, and housing for all residents regardless of socioeconomic status or location.

To address these disparities, educational programs targeting women in urban areas and poverty alleviation initiatives should be implemented. These measures will empower residents of disadvantaged neighborhoods to engage in income-generating activities and acquire resources that reduce the prevalence of diarrheal diseases in urban communities. By addressing social determinants of health and promoting equitable access to essential services, urban areas can alleviate the burden of diarrheal diseases and enhance overall community well-being.

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