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Research Article

Burden of Childhood Diarrhea and Knowledge of Management Strategies Among Caregivers in Rural and Urban Areas of Rivers State, Nigeria

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Abstract

Diarrhea remains a major cause of morbidity and mortality, especially among children in low-resource settings such as Nigeria. This study assessed the prevalence of childhood diarrhea and caregivers' knowledge of its management in urban and rural communities of Rivers State, Nigeria. A cross-sectional study was conducted using structured questionnaires administered to caregivers. Diarrhea prevalence and knowledge levels were estimated in rural and urban settings. Statistical analyses, such as percentages for prevalence, Chi-square tests for association, and binary logistic regression to identify the predictors of poor knowledge management strategies. All statistical significance was set at $P<0.05$. Diarrhea prevalence was significantly higher in rural areas (60.7%; 95% CI: 53.1%-67.9%) compared to urban areas (38.8%; 95% CI: 33.0%-45.0%). Knowledge levels also differed markedly: rural caregivers (n = 163) had a mean knowledge score of 10.15 ± 4.402, with 64.4% classified as having poor knowledge, while urban caregivers (n = 250) achieved a higher mean score of 14.92 ± 4.669, with 76.0% demonstrating good knowledge. The difference was statistically significant ($t = -7.43$, $p < 0.001$). Urban caregivers had better access to healthcare services, improved water sources, and higher education levels, which contributed to more effective diarrhea management practices, including greater uptake of exclusive breastfeeding (54.8% vs. 28.2% in rural areas). Key predictors of poor knowledge included young age, low income, limited education, lack of exclusive breastfeeding, and use of unimproved water sources. Surprisingly, urban caregivers using improved water sources were more likely to have poor knowledge, possibly due to false perceptions of safety. Significant disparities in diarrhea prevalence and caregiver knowledge exist between urban and rural areas. Targeted health education and improved rural infrastructure are critical to reducing this burden.

Keywords

Diarrhea Prevalence, Caregiver Knowledge, Rural-Urban Disparities, Child Health, Rivers State, Nigeria

1. Introduction

Childhood diarrhea continues to be a significant public health concern, particularly in low- and middle-income countries (LMICs) such as Nigeria. It is a leading cause of morbidity and mortality among children under five years of age globally, accounting for an estimated 446,000 deaths in 2022 [1]. In Nigeria alone, diarrhea diseases are responsible

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for approximately 10-15% of under-five deaths annually [2]. These statistics highlight the urgency of addressing the persistent burden of diarrheal illnesses through improved prevention, early recognition, and effective management strategies [3].

The risk of childhood diarrhea is particularly high in communities with limited access to safe drinking water, poor sanitation, inadequate hygiene practices, and suboptimal health-seeking behaviours [4]. Rural areas are especially vulnerable due to infrastructural and healthcare access limitations. However, densely populated urban slums with poor waste management also experience high rates of diarrheal disease. In Rivers State, located in Nigeria's Niger Delta region, these environmental and systemic challenges are compounded by pollution, overcrowding, and economic disparities, making both rural and urban children susceptible to recurrent diarrheal episodes [5].

Despite the availability of simple, effective, and affordable management strategies such as Oral Rehydration Therapy (ORT), zinc supplementation, continued breastfeeding, and appropriate fluid intake, diarrhea-related mortality remains high [6]. The World Health Organization recommends the combined use of ORT and zinc for the effective management of acute diarrhea, yet studies have shown that these interventions remain underutilized, particularly in rural communities where caregiver knowledge and access to health education may be limited [7, 8].

Caregivers play a critical role in the prompt recognition and home-based management of diarrheal diseases. Their knowledge, attitudes, and practices are key determinants of how early and effectively a child receives treatment [9]. Numerous studies have shown a significant association between caregiver education levels, knowledge of diarrhea management, and outcomes in children [10-12]. However, these knowledge levels often differ significantly between rural and urban populations, influenced by factors such as literacy, media exposure, access to healthcare, cultural beliefs, and economic status [3].

While some urban caregivers may benefit from higher health literacy and better access to pediatric care, those in rural areas may depend heavily on traditional remedies or delay seeking professional help due to distance, cost, or lack of awareness [13]. This rural-urban disparity in knowledge and management practices has critical implications for childhood health outcomes and health policy planning in Rivers State and Nigeria as a whole. This study, therefore, aims to assess the burden of childhood diarrhea and evaluate the knowledge and management strategies employed by caregivers in both rural and urban areas of Rivers State. The findings will contribute to identifying gaps in awareness and service delivery and guide interventions aimed at reducing the morbidity and mortality associated with childhood diarrhea in the region.

Research Questions

1) What is the prevalence of childhood diarrhea in urban and rural areas in Rivers State?
2) How is the level of knowledge of caregivers on diarrhea and its management in urban and rural areas in Rivers State?

2. Methodology

2.1. Study Area

This study was conducted across four Local Government Areas (LGAs) in Rivers State, Nigeria. Port Harcourt and Obio/Akpor represent urban areas, and Etche and Asari-Toru represent rural areas. A total of eight communities were purposively selected to capture the demographic, cultural, and infrastructural diversity between urban and rural settings. These included Ogbunabali and Rumukalagbor (Port Harcourt), Rumueme and Rukpoku (Obio/Akpor), Okehi and Ndashi (Etche), and Abalama and Tema (Asari-Toru).

Port Harcourt and Obio/Akpor are highly urbanized with better access to healthcare, education, and public infrastructure, yet they still exhibit disparities in sanitation and healthcare utilization. In contrast, Etche and Asari-Toru LGAs represent rural and riverine communities with limited access to modern health facilities, greater reliance on traditional health practices, and environmental challenges such as poor water supply and flooding [14]. These differences are essential to understanding how contextual factors influence caregivers' knowledge and practices regarding childhood diarrhea management. This urban-rural comparative framework offers critical insights for tailoring public health interventions across diverse community settings in Rivers State.

2.2. Study Design

This study employed a comparative cross-sectional design to assess differences in diarrhea management practices among caregivers of children in urban and rural areas of Rivers State, Nigeria.

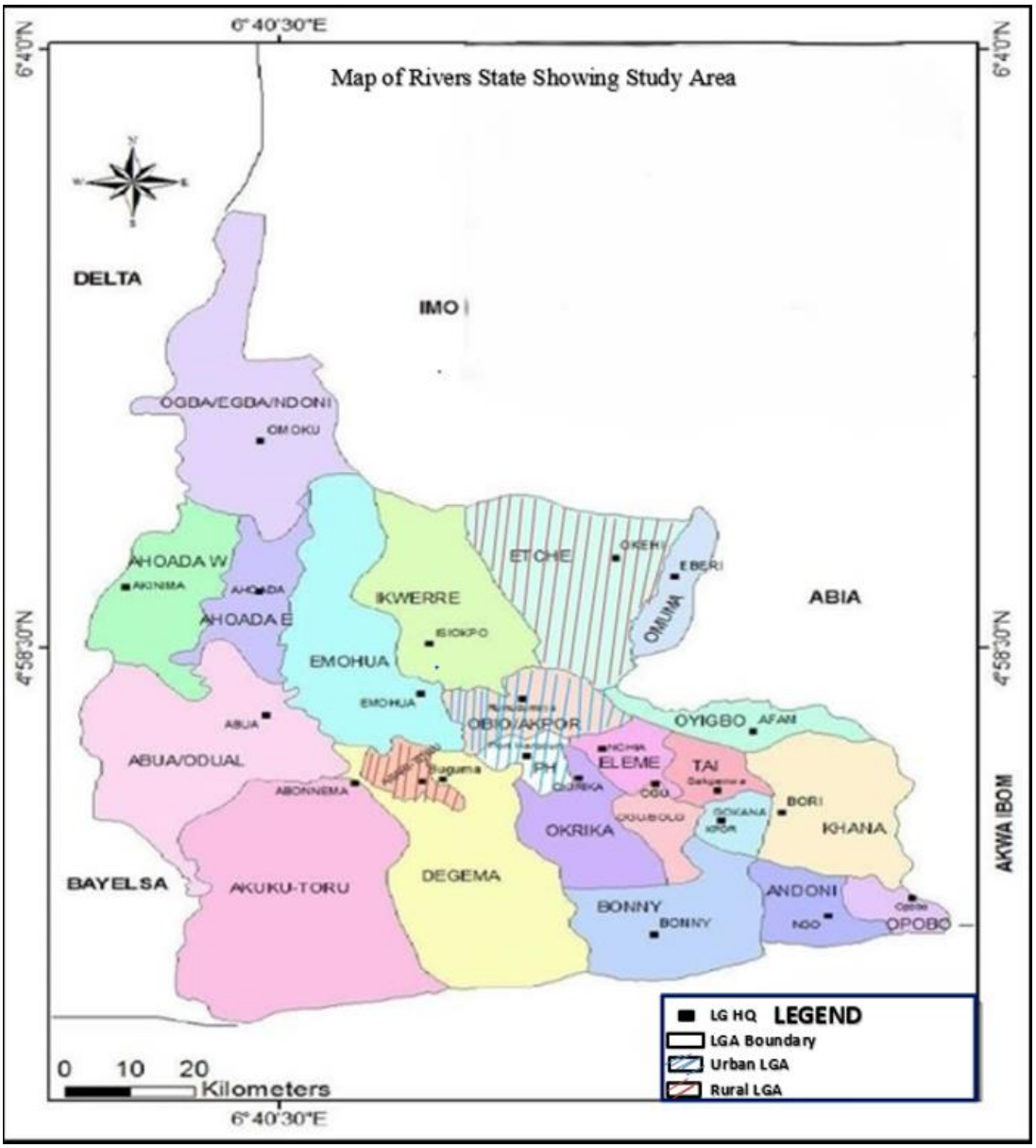

Figure 1. *Map of Rivers State Showing the Study Locations.*

2.3. Study Population

The study population included caregivers of children under five years old living in selected urban (Port Harcourt and Obio/Akpor) and rural (Etche and Asari-Toru) communities across four Local Government Areas (LGAs) in Rivers State. Participants were mothers, fathers, or guardians who held primary responsibility for childcare.

Caregivers were considered eligible for participation if they had primary responsibility for a child under five, had lived in the selected urban or rural communities for at least six months, were able to communicate in English or a local language, and provided informed consent. Conversely, caregivers were excluded if they were not the primary caregiver, such as domestic helpers, if they cared for children with chronic illnesses or disabilities, had lived in the community for less than six months, had communication impairments, or declined to give consent or participated in a similar study within the past six months.

2.4. Sample Size Determination and Sampling Technique

The sample size for this comparative study was determined using the standard formula for comparing two independent proportions [15, 16].

$$n = \frac{(Z\alpha/2\sqrt{2P(1-P)} + Z\beta\sqrt{P1(1-P1)+P2(1-P2)})^2}{(P1-P2)^2}$$

The sample size was estimated as 413 based on P1 = 0.40 and P2 = 0.27, for urban and rural settings [17, 18]. Where P is the average of P1 and P2.

The 23 Local Government Areas (LGAs) of Rivers State were clustered into rural and urban settings, and two LGAs were randomly selected from each setting. Obio/Akpor and Port Harcourt for urban, and Etche and Asari-Toru for rural. The participants were proportionally allocated based on household estimates, with 250 respondents selected from urban areas and 163 from rural areas. One ward was randomly selected from each LGA using the lottery method: Rumueme (Obio/Akpor), Ogbunabali (Port Harcourt), Okehi (Etche), and Abalama (Asari-Toru). Two communities were randomly chosen from each selected ward, yielding a total of eight communities. The urban communities included Rumueme and Mgbuoshimiri for Obio/Akpor, and Ogbunabali and Rumukalagbor for Port Harcourt. Similarly, the rural communities were Okehi and Ndashi for Etche, and Abalama and Tema for Asari-Toru. The household was selected using systematic sampling.

2.5. Data Collection Procedure and Instrument

Data for the study were collected from the households of the wards of the selected LGAs from 16th September to 20th October 2024 using a semi-structured, interviewer-administered questionnaire after obtaining informed consent from the participants. The questionnaire, developed from insights obtained through a review of relevant literature, was divided into three sections. Section A captured respondents' socio-demographic characteristics, Section B assessed their knowledge of diarrhea and its management, while Section C focused on management practices. To minimize misinterpretation of questions and enhance the accuracy of responses, the instrument was administered by trained interviewers. Content and construct validity were ensured through expert review by three public health specialists, and Cronbach's Alpha (CA) test of reliability was calculated as 0.80.

2.6. Data Analysis

The prevalence of diarrhea in urban and rural areas of Rivers State was estimated using proportions and its 95% confidence intervals. To ascertain the knowledge of caregivers regarding diarrhea and its management, a composite knowledge score was generated from correct responses to structured questions and for multiple response questions, dichotomous variables were created with each option coded as 1 for a correct answer and 0 for a non-correct answer. A total of 27 knowledge items were assessed, with the maximum obtainable score being 27 (100%). Knowledge levels were categorized based on percentage scores using a 50% benchmark, in line with previous studies [19-21]. Respondents who scored below 50% (0-13 points) were classified as having poor knowledge, while those who scored ≥50% (14-27 points) were categorized as having good knowledge. Descriptive statistics such as mean scores, standard deviations, and frequency distributions were employed to summarize the knowledge levels of caregivers in both settings. A binary logistic regression was used to identify the factors associated with poor knowledge. Odds ratios (ORs) with their 95% confidence intervals (CIs) were reported to quantify the strength of association. The level of statistical significance for all inferential analyses was set at $p < 0.05$. Results were presented in tables and charts for clarity and easy interpretation in line with the study objectives.

3. Results

3.1. Prevalence of Diarrhea in Urban and Rural Areas of Rivers State

Results of the prevalence of diarrhea in urban and rural areas are shown in Tables 1 and 2, respectively.

The overall prevalence of diarrhea was significantly higher in the rural area (60.7%; 95% CI: 53.1%-67.9%) compared with the urban area (38.8%; 95% CI: 33.0%-45.0%).

Prevalence varied across age groups in both settings. Among caregivers aged 15-25 years, diarrhea prevalence was 77.8% (95% CI: 61.9%-88.3%) in rural compared with 36.4% (95% CI: 22.2%-53.4%) in urban areas. For the 26-35 years' age group, prevalence was 60.0% (95% CI: 48.3%-70.7%) in rural versus 39.0% (95% CI: 30.9%-47.9%) in urban. Similarly, caregivers above 35 years recorded a higher prevalence in rural (50.9%; 95% CI: 38.3%-63.4%) compared with urban (39.4%; 95% CI: 30.1%-49.5%).

Diarrhea prevalence was consistently higher among those not married, with rural respondents recording 71.8% (95% CI: 58.7%-82.1%) compared to 18.3% (95% CI: 10.4%-30.0%) in urban areas. Among the married, prevalence was also higher in rural (52.2%; 95% CI: 42.1%-62.1%) than in urban (45.0%; 95% CI: 38.1%-52.1%).

Caregivers with below secondary education had a higher prevalence in rural (62.5%; 95% CI: 47.0%-76.0%) compared to urban (34.8%; 95% CI: 17.8%-56.0%). Similarly, among those with secondary and above, rural prevalence (60.2%; 95% CI: 50.9%-69.0%) exceeded urban (39.2%; 95% CI: 32.9%-45.9%).

Unemployed caregivers reported the highest burden of diarrhea in both settings, with rural prevalence of 82.4% (95% CI: 56.6%-94.9%) versus 18.2% (95% CI: 5.2%-47.7%) in urban. Among the self-employed, rural prevalence was 57.8% (95% CI: 47.3%-67.6%), higher than the 40.4% (95% CI: 31.3%-50.2%) observed in urban. Civil/public servants followed the same pattern, with 59.5% (95% CI: 41.5%-75.5%) in rural compared with 39.2% (95% CI: 30.9%-48.1%) in urban areas.

Across all income levels, diarrhea prevalence was higher in rural than in urban areas. Among households earning less than ₦30,000, prevalence was 62.0% (95% CI: 48.7%-73.7%) in rural compared to 35.8% (95% CI: 23.5%-50.4%) in urban. For the ₦30,000-100,000 group, rural prevalence was 50.7%

(95% CI: 37.5%-63.8%) versus 35.9% (95% CI: 27.6%-45.2%) in urban. The highest prevalence was observed among caregivers earning above ₦100,000, with 84.0% (95% CI: 63.9%-94.3%) in rural areas compared to 45.0% (95% CI: 34.1%-56.4%) in urban areas.

Households with 1-2 children recorded a prevalence of 58.5% (95% CI: 49.6% - 66.9%) in rural compared to 39.4% (95% CI: 33.0% - 46.1%) in urban areas. For households with 3 or more children**,** prevalence rose to 71.4% (95% CI: 51.3% - 85.8%) in rural areas, compared with 22.2% (95% CI: 6.3% - 54.7%) in urban.

Diarrhea prevalence was higher among caregivers using improved water sources in rural **(**65.4%; 95% CI: 54.6%-74.7%**)** compared to urban **(**37.9%; 95% CI: 32.0%-44.2%**).** Interestingly, those relying on unimproved water sources had a prevalence of 51.8% (95% CI: 37.9%-65.5%) in rural and 60.0% (95% CI: 26.2%-85.5%) in urban areas.

Exclusive breastfeeding was associated with a lower prevalence in both settings, but rural figures were still higher. Among those who exclusively breastfed, diarrhea prevalence was 51.1% (95% CI: 35.0%-67.0%) in rural compared with 33.3% (95% CI: 24.8%-43.1%) in urban. Conversely, for those who did not practice exclusive breastfeeding, prevalence was 64.4% (95% CI: 54.5%-73.2%) in rural compared to 43.5% (95% CI: 35.3%-52.1%) in urban.

Table 1. *Comparative Prevalence of Diarrhea in Urban and Rural Areas of Rivers State.*

Variable	**Urban Prevalence (n=250)**			**Rural Prevalence (n= 163)**		
	Diarrhea			**Diarrhea**		
	No n (%)	**Yes n (%)**	**95% CI for prevalence**	**No n (%)**	**Yes n (%)**	**95% CI for Prevalence**
Overall	153 (61.2)	97 (38.8)	38.8 (33.0-45.0)	64 (39.3)	99 (60.7)	60.7 (53.1-67.9)
Respondent's Age						
15-25 yrs	21 (63.6)	12 (36.4)	36.4 (22.2-53.4)	8 (22.2)	28 (77.8)	77.8 (61.9-88.3)
26-35 yrs	75 (61.0)	48 (39.0)	39.0 (30.9-47.9)	28 (40.0)	42 (60.0)	60.0 (48.3-70.7)
>35 yrs	57 (60.6)	37 (39.4)	39.4 (30.1-49.5)	28 (49.1)	29 (50.9)	50.9 (38.3-63.4)
Marital Status						
Married	104 (55.0)	85 (45.0)	45.0 (38.1-52.1)	44 (47.8)	48 (52.2)	52.2 (42.1-62.1)
Not Married	49 (81.7)	11 (18.3)	18.3 (10.4-30.0)	20 (28.2)	51 (71.8)	71.8 (58.7-82.1)
Highest Education						
Below Secondary	15 (65.2)	8 (34.8)	34.8 (17.8-56.0)	15 (37.5)	25 (62.5)	62.5 (47.0-76.0)
Secondary & Above	138 (60.8)	89 (39.2)	39.2 (32.9-45.9)	49 (39.8)	74 (60.2)	60.2 (50.9-69.0)
Occupation						
Civil/Public Servant	79 (60.8)	51 (39.2)	39.2 (30.9-48.1)	15 (40.5)	22 (59.5)	59.5 (41.5-75.5)
Self-employed	65 (59.6)	44 (40.4)	40.4 (31.3-50.2)	46 (42.2)	63 (57.8)	57.8 (47.3-67.6)
Unemployed	9 (81.8)	2 (18.2)	18.2 (5.2-47.7)	3 (17.6)	14 (82.4)	82.4 (56.6-94.9)
Monthly Income (₦)						
<30,000	34 (64.2)	19 (35.8)	35.8 (23.5-50.4)	27 (38.0)	44 (62.0)	62.0 (48.7-73.7)
30,000-100,000	75 (64.1)	42 (35.9)	35.9 (27.6-45.2)	33 (49.3)	34 (50.7)	50.7 (37.5-63.8)
>100,000	44 (55.0)	36 (45.0)	45.0 (34.1-56.4)	4 (16.0)	21 (84.0)	84.0 (63.9-94.3)
Under-5 Children						
1-2	146 (60.6)	95 (39.4)	39.4 (33.0-46.1)	56 (41.5)	79 (58.5)	58.5 (49.6-66.9)
3+	7 (77.8)	2 (22.2)	22.2 (6.3-54.7)	8 (28.6)	20 (71.4)	71.4 (51.3-85.8)
Source of Drinking						

Variable	Urban Prevalence (n=250)			Rural Prevalence (n= 163)		
	Diarrhea			Diarrhea		
	No n (%)	Yes n (%)	95% CI for prevalence	No n (%)	Yes n (%)	95% CI for Prevalence
Water						
Improved	149 (62.1)	91 (37.9)	37.9 (32.0-44.2)	37 (34.6)	70 (65.4)	65.4 (54.6-74.7)
Unimproved	4 (40.0)	6 (60.0)	60.0 (26.2-85.5)	27 (48.2)	29 (51.8)	51.8 (37.9-65.5)
Exclusive Breast-feeding						
Yes	74 (66.7)	37 (33.3)	33.3 (24.8-43.1)	22 (48.9)	23 (51.1)	51.1 (35.0-67.0)
No	78 (56.5)	60 (43.5)	43.5 (35.3-52.1)	42 (35.6)	76 (64.4)	64.4 (54.5-73.2)

3.2. Knowledge Level of Caregivers on Diarrhea and Its Management in Urban and Rural Areas of Rivers State

Table 2 shows the distribution of caregivers' knowledge of diarrhea and its management across urban (n = 250) and rural (n = 163) areas of Rivers State. The findings reveal clear disparities between the two groups.

Overall, 180 (72.0%) of urban caregivers had heard about diarrhea compared to 89 (54.6%) of rural caregivers, while 70 (28.0%) urban and 74 (45.4%) rural caregivers reported never having heard of it.

When asked to define diarrhea, 160 (64.0%) urban caregivers and 90 (55.2%) rural caregivers correctly identified it as the passage of three or more loose stools per day. Incorrect definitions such as passage of one loose stool per day were reported by 20 (8.0%) urban and 15 (9.2%) rural caregivers, while 20 (8.0%) urban and 10 (6.1%) rural caregivers described it as inability to stool. A notable proportion of respondents had no idea: 50 (20.0%) urban and 48 (29.4%) rural caregivers.

With regard to symptoms of diarrhea, the most commonly cited was "three or more loose stools with blood," reported by 130 (52.0%) urban and 85 (52.1%) rural caregivers. Other symptoms mentioned included fever and weakness (90; 36.0% urban vs. 70; 42.9% rural) and repeated vomiting (60; 24.0% urban vs. 45; 27.6% rural). However, 50 (20.0%) urban and 48 (29.4%) rural caregivers could not identify any symptom.

On the age when diarrhea is most dangerous, 120 (48.0%) urban and 95 (58.3%) rural caregivers correctly identified infants (0-1 year), while 100 (40.0%) urban and 60 (36.8%) rural caregivers mentioned under-fives (0-4 years). Misconceptions were also observed, with 20 (8.0%) urban and 5 (3.1%) rural caregivers incorrectly identifying adolescents (10-19 years) as the most vulnerable.

Knowledge of ORS (Oral Rehydration Solution) and salt-sugar solution was higher among urban caregivers (168; 67.2%) compared to rural caregivers (92; 56.4%). Among those familiar with ORS, 140 (56.0%) urban and 85 (52.1%) rural caregivers correctly identified its use in the treatment of diarrhea. Misconceptions were more frequent in rural areas, where 15 (9.2%) thought it was for cough and 5 (3.1%) for diabetes, compared to 20 (8.0%) and 10 (4.0%) in urban areas, respectively. Notably, 80 (32.0%) urban and 58 (35.6%) rural caregivers still did not know the use of ORS.

Regarding preventive and management strategies, correct practices were more commonly cited in urban areas. These included exclusive breastfeeding for at least six months (70; 28.0% urban vs. 33; 20.2% rural), handwashing with soap (162; 64.8% urban vs. 94; 57.7% rural), vitamin A supplementation (80; 32.0% urban vs. 45; 27.6% rural), improved water supply and sanitation (95; 38.0% urban vs. 52; 31.9% rural), and use of ORS and salt-sugar solution (168; 67.2% urban vs. 92; 56.4% rural). However, 40 (16.0%) urban and 35 (21.5%) rural caregivers reported not knowing any preventive measures.

On whether prompt and effective management of diarrhea is beneficial, 200 (80.0%) urban and 120 (73.6%) rural caregivers agreed. However, more rural respondents disagreed (28; 17.2%) compared to urban (25; 10.0%). About 25 (10.0%) urban and 15 (9.2%) rural caregivers stated they did not know.

Table 2. Knowledge Levels of Diarrhea and its Management among Caregivers in Urban and Rural Areas of Rivers State (N = 413).

Variables	Urban (N = 250) n (%)	Rural (N = 163) n (%)
Heard about diarrhea		
Yes	180 (72.0)	89 (54.6)
No	70 (28.0)	74 (45.4)
Definition of diarrhea		
Passage of three or more loose stools per day	160 (64.0)	90 (55.2)
Passage of one loose stool per day	20 (8.0)	15 (9.2)
Inability to stool	20 (8.0)	10 (6.1)
I don't know	50 (20.0)	48 (29.4)
Symptoms of diarrhea		
Three or more loose stools with blood	130 (52.0)	85 (52.1)
Fever and weakness	90 (36.0)	70 (42.9)
Repeated vomiting	60 (24.0)	45 (27.6)
I don't know	50 (20.0)	48 (29.4)
Age when diarrhea is most dangerous		
Infant (0 - 1 year)	120 (48.0)	95 (58.3)
Under-5 (0 - 4 years)	100 (40.0)	60 (36.8)
Adolescent (10 - 19 years)	20 (8.0)	5 (3.1)
I don't know	10 (4.0)	3 (1.8)
Do you know the Meaning of ORS and salt-sugar solution		
Yes	168 (67.2)	92 (56.4)
No	82 (32.8)	71 (43.6)
If yes, what are they used for?		
Management/treatment of diarrhea	140 (56.0)	85 (52.1)
Management/treatment of cough	20 (8.0)	15 (9.2)
Management/treatment of diabetes	10 (4.0)	5 (3.1)
I don't know	80 (32.0)	58 (35.6)
Methods to prevent and manage Diarrhea		
Exclusive breastfeeding (≥6 months)	70 (28.0)	33 (20.2)
Hand-washing with soap	162 (64.8)	94 (57.7)
Vitamin A supplementation	80 (32.0)	45 (27.6)
Improved water supply and sanitation	95 (38.0)	52 (31.9)
Use of ORS and salt-sugar solution	168 (67.2)	92 (56.4)
I don't know	40 (16.0)	35 (21.5)
Prompt and effective management is Beneficial		
Yes	200 (80.0)	120 (73.6)
No	25 (10.0)	28 (17.2)

Variables	Urban (N = 250) n (%)	Rural (N = 163) n (%)
I don't know	25 (10.0)	15 (9.2)
Knowledge level		
Poor knowledge	24.0%	64.4%
Good knowledge	76.0%	35.6%

3.3. Knowledge Level on Diarrhea and Its Management in Urban and Rural Areas in Rivers State

The comparative analysis presents a comparative analysis of the number of knowledge questions, score ranges, mean scores, and categorized knowledge levels on diarrhea and its management between rural and urban caregivers in Rivers State. Knowledge was assessed with 27 questions, yielding possible scores between 0 and 27. The results show that rural caregivers (n = 163) had a mean knowledge score of 10.15 ± 4.402, while urban caregivers (n = 250) recorded a higher mean score of 14.92 ± 4.669. This difference indicates that caregivers in urban settings generally demonstrated a stronger understanding of diarrhea and its management than those in rural areas. When knowledge levels were categorized into good and poor, clear disparities emerged. Among rural respondents, 105 caregivers (64.4%) had poor knowledge, while only 58 (35.6%) demonstrated good knowledge. Conversely, in urban areas, 190 caregivers (76.0%) had good knowledge, compared to 60 (24.0%) with poor knowledge.

Statistical analysis using an independent samples T-test yielded a value of -7.43, with a corresponding p-value of 3.12e-12 (<0.001). This confirms that the observed difference in mean knowledge scores between rural and urban caregivers is highly significant and not due to chance.

Table 3. *Number of questions, Scores, and Knowledge level on diarrhea and its management in Urban and Rural Areas in Rivers State.*

Knowledge		Rural (n=163)			Urban (n=250)			T-test	P-value
Number of Questions	Range of Scores	Total Scores Mean ± SD	Poor Level (%)	Good level (%)	Total Score Mean ± SD	Poor Level (%)	Good Level (%)	-7.43	3.12e-12
27	0-27	10.15±4.402	105 (64.4%)	58 (35.6%)	14.92±4.669	60 (24.0%)	190 (76.0%)		

3.4. Caregivers' Sources of Information on Diarrhea and Its Management in Urban and Rural Areas of Rivers State

The comparison of Caregivers' Sources of Information on diarrhea and Its Management in Rural and Urban Areas of Rivers State is shown in Figure 2 below.

Health facilities are the most common source in urban areas (48.0%) compared to rural areas (36.2%). Family and friends are the dominant source in rural areas (49.7%) compared to urban areas (35.6%). Media contributes slightly more to the urban populations (10.4%) than rural populations (8.6%). Reading Instruction is minimally used in both settings, with slightly higher use in urban areas (3.6%) than rural areas (2.5%). Other sources contribute marginally, with rural areas (3.1%) slightly exceeding urban areas (2.4%).

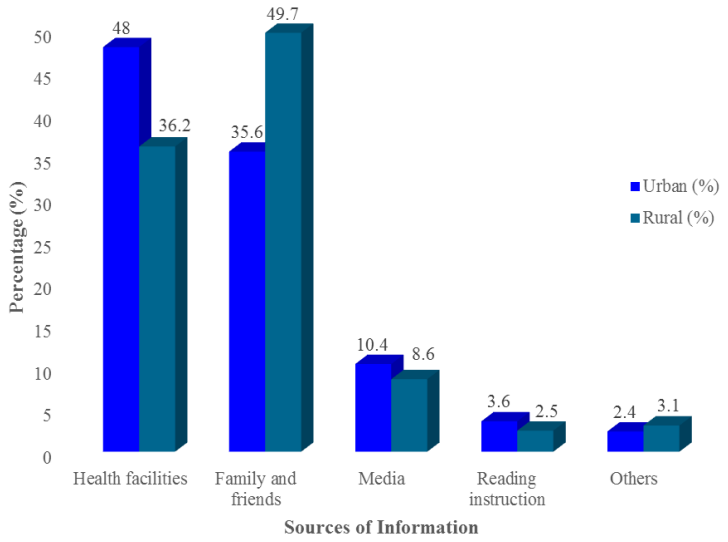

Figure 2. *Caregivers Sources of Information on Diarrhea and its Management.*

3.5. Perceived Causes of Diarrhea in Rural and Urban Areas in Rivers State

The comparison of the perceived causes of diarrhea between urban and rural populations in Rivers State is shown in Figure 3. It categorizes the causes into five groups: Drinking unclean water, eating unclean and infested food, Poor hygiene practice by caregiver, Teething of the child, and I don't know. Drinking unclean water is the most cited cause in urban areas (63.2%) but significantly lower in rural areas (8.0%). Eating unclean and infested food is more recognized in rural areas (29.4%) than urban areas (19.2%). Poor hygiene practice by caregivers is also a notable concern in rural areas (20.2%) compared to urban areas (11.6%). Teething of the child is a major perceived cause in rural areas (34.4%) but much lower in urban areas (4.0%), reflecting traditional beliefs. I don't know responses are slightly higher in rural areas (8.0%) than in urban areas (2.0%).

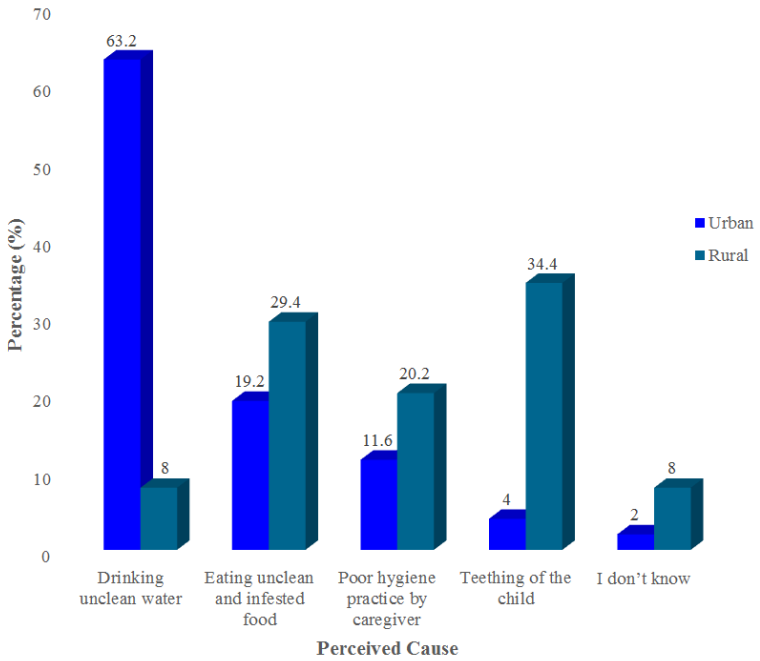

Figure 3. *Caregivers Perceived Causes of diarrhea in Rural and Urban area in Rivers State.*

3.6. Factors Associated with Poor Knowledge of Caregivers on Diarrhea and Its Management

The tables present the logistic regression analyses examining the sociodemographic and behavioral factors associated with poor caregiver knowledge of diarrhea and its management in rural and urban areas of Rivers State. While some predictors were consistent across both settings, notable contextual differences were observed.

In rural areas, younger caregivers (15-25 years) initially appeared less likely to exhibit poor knowledge in the bivariate analysis (COR = 0.091, p < 0.001), but this association was not significant after adjustment (AOR = 0.457, p = 0.307). Similarly, marital status showed a significant crude association (COR = 3.750, p < 0.001), which disappeared in the multivariable model (AOR = 1.962, p = 0.122), suggesting it is not an independent predictor of knowledge. Educational attainment, however, demonstrated a stronger influence in rural settings. Caregivers with below-secondary education had significantly higher odds of poor knowledge at the bivariate level (COR = 0.188, p < 0.001), though the association weakened after adjustment (AOR = 0.363, p = 0.076).

In urban areas, education level did not significantly predict knowledge at either the crude or adjusted level (AOR = 0.670, p = 0.506). Occupational status was also not independently associated with caregiver knowledge in either setting. Although rural self-employed caregivers showed lower odds of poor knowledge in the crude model (COR = 0.385, p < 0.001), the relationship lost significance after adjustment (AOR = 0.902, p = 0.859). Similar patterns were observed among civil/public servants in both rural and urban areas.

Monthly income emerged as a consistent and significant determinant of knowledge across both settings. In rural areas, caregivers earning less than ₦30,000 per month had significantly higher odds of poor knowledge at both crude (COR = 0.164, p < 0.001) and adjusted levels (AOR = 0.194, p = 0.009). Likewise, in urban areas, low income was also an independent predictor of poor knowledge (AOR = 0.159, p = 0.002), underscoring the impact of economic barriers on health awareness.

Household size, defined by the number of children, was significantly associated with knowledge in rural areas. Caregivers in households with 1-2 children had better knowledge outcomes (AOR = 0.283, p = 0.019). However, no significant association was found in urban settings (AOR = 0.650, p = 0.642).

Water source quality did not significantly influence knowledge in rural areas. However, in urban settings, caregivers relying on improved water sources were paradoxically more likely to have poor knowledge (AOR = 7.948, p = 0.009). This unexpected finding may reflect a false sense of security and reduced engagement with health education messages.

Exclusive breastfeeding showed contrasting effects across settings. In urban areas, caregivers who practiced exclusive breastfeeding had significantly lower odds of poor knowledge in both crude (COR = 11.545, p < 0.001) and adjusted models (AOR = 7.484, p < 0.001). Although a similar protective trend was observed in rural areas, the association was not statistically significant after adjustment (AOR = 2.161, p = 0.090). See Tables 4 and 5 below.

Table 4. *Factors Associated with Poor Knowledge of Caregivers on Diarrhea and Its Management in Rural Areas.*

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Respondent's Age				
15-25 years	0.091 (0.028 - 0.296)	0.000	0.457 (0.102 - 2.055)	0.307
25- 35 years	0.865 (0.539 - 1.388)	0.548	2.427 (0.980 - 6.006)	0.055
>35 years	Reference	-	Reference	-
Marital Status				
Currently married	3.750 (2.646 - 5.315)	0.000	1.962 (0.835 - 4.611)	0.122
Not Married				
Education Level				
Below secondary	0.188 (0.078 - 0.448)	0.000	0.363 (0.118 - 1.110)	0.076
Secondary and above	Reference	-	Reference	-
Occupation				

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Civil/Public Servant	1.923 (0.984 - 3.759)	0.056	1.684 (0.451 - 6.293)	0.439
Self-employed	0.385 (0.252 - 0.586)	0.000	0.902 (0.290 - 2.806	0.859
Unemployed	Reference	-	Reference	-
Monthly Income				
<30,000	0.164 (0.084 - 0.320)	0.000	0.194 (0.057 - 0.668)	0.009
30,000-100,000	0.943 (0.586 - 1.517)	0.808	0.508 (0.178 - 1.450	0.206
>100,000	Reference	-	Reference	-
Number of Under-5 Children in Household				
1-2	0.452 (0.314 - 0.650)	0.000	0.283 (0.099 - 0.811)	0.019
3+	Reference	-	Reference	-
Source of Drinking Water				
Improved	0.877 (0.600 - 1.282)	0.499	2.052 (0.834 - 5.051)	0.118
Unimproved				
Exclusive Breastfeeding				
Yes	1.500 (0.826 - 2.723)	0.183	2.161 (0.888 - 5.262)	0.090
No	Reference	-	Reference	-

Table 5. *Factors Associated with Poor Knowledge of Caregivers on diarrhea and its Management in Urban Areas.*

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Respondent's Age				
15-25 years	1.750 (0.861 - 3.557)	0.122	0.610 (0.202 - 1.841)	0.381
25- 35 years	2.875 (1.923 - 4.299)	0.000	0.684 (0.295 - 1.585)	0.375
>35 years	Reference	-	Reference	-
Marital Status				
Currently married	3.750 (2.646 - 5.315)	0.000	0.853 (0.379 - 1.923)	0.702
Not Married		0.835		
Education Level				
Below secondary	0.917 (0.404 - 2.077)		0.670 (0.206 - 2.181)	0.506
Secondary and above	Reference	-	Reference	-
Occupation				
Civil/Public Servant	8.214 (4.717 - 14.306)	0.000	1.989 (0.453 - 8.737)	0.362
Self-employed	1.750 (1.187 - 2.581)	0.005	0.936 (0.237 - 3.698)	0.924
Unemployed				
Monthly Income				

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
<30,000	1.208 (0.704 - 2.075)	0.493	0.159 (0.049 - 0.522)	0.002
30,000-100,000	2.742 (1.817 - 4.137)	0.000	0.365 (0.123 - 1.084)	0.070
>100,000	Reference	-	Reference	-
Number of Under-5 Children in Household				
1-2	3.155 (2.348 - 4.239)	0.000	0.650 (0.106 - 4.004)	0.642
3+	Reference	-	Reference	-
Source of Drinking Water				
Improved	3.615 (2.659 - 4.915)	0.000	7.948 (1.673 - 37.755)	0.009
Unimproved	Reference	-	Reference	-
Exclusive Breastfeeding				
Yes	11.545 (6.236 - 21.371)	0.000	7.484 (3.278 - 17.087)	0.000
No	Reference	-	Reference	-

4. Discussion

This study reveals a significantly higher prevalence of diarrhea in rural areas compared to urban areas of Rivers State, Nigeria. This finding aligns with evidence from sub-Saharan Africa, where rural populations are more vulnerable due to poor sanitation, limited access to clean water, and suboptimal health-seeking behaviour [22, 23].

An unexpected trend was the elevated prevalence of diarrhea among individuals aged >35 years in rural settings. While diarrhea research traditionally focuses on children under five years [1], these results highlight a potential burden among older adults, likely attributable to compromised immunity, poor hygiene practices, and caregiving responsibilities. This finding supports Ezeh et al. [24], who emphasized adult vulnerability to waterborne diseases in underserved populations. Marital status did not significantly influence diarrhea prevalence between urban and rural respondents. However, the generally higher rates in rural communities suggest that structural disadvantages outweigh personal characteristics, consistent with the findings of Ajayi and Adebayo [25].

Education, typically considered protective against illness, did not show this effect in rural areas. Caregivers with secondary education or higher recorded even higher diarrhea prevalence compared to their less-educated counterparts. By contrast, in urban areas, the expected inverse relationship between education and prevalence was observed. This discrepancy suggests that formal education in rural contexts may not consistently translate into health-promoting behaviours, possibly due to poor infrastructure, limited health services, or ineffective health messaging [26, 27].

Occupational status also revealed rural disparities. Civil/public servants and self-employed caregivers in rural areas exhibited high diarrhea prevalence, contradicting assumptions that employment confers health advantages. This observation supports Afolabi et al. [28], who noted that job type does not necessarily translate into improved living conditions or health outcomes in rural Nigeria. Similarly, income levels were positively associated with diarrhea prevalence in both urban and rural areas. This contradicts existing literature [29] and may reflect misreporting, poor spending priorities, or a lack of investment in health-related needs [30].

Household size also influenced prevalence. In urban areas, households with three or more under-five children reported higher diarrhea rates, consistent with evidence linking overcrowding to increased faecal-oral disease transmission [31]. By contrast, rural household data appeared inconsistent, likely due to recall errors or reporting bias.

Water source quality was a clear determinant in rural areas: unimproved sources were strongly associated with diarrhea. In contrast, urban areas showed little variation by water source, possibly indicating other risk factors like food contamination or poor hygiene practices [32]. Exclusive breastfeeding appeared protective in rural areas, consistent with the WHO [4] guidelines. However, urban data revealed a reverse trend, potentially due to misreporting or cultural bias, as discussed by Adepoju et al. [33].

Regarding caregiver knowledge, urban respondents displayed stronger awareness, more accurate symptom identification, and better management practices than their rural

counterparts. While the majority of urban caregivers had heard of diarrhea, only about half of rural respondents were aware, a pattern echoed by Oloruntoba et al. [34]. Similarly, rural caregivers struggled more with recognizing symptoms or identifying appropriate treatments such as oral rehydration solution (ORS). Preventive strategies were more commonly cited by urban caregivers, who frequently mentioned hand-washing, access to clean water, and timely treatment. These behaviours are likely reinforced by higher literacy levels, better access to media, and proximity to health facilities [35]. By contrast, one-third of rural caregivers could not name any preventive measures, revealing an urgent need for targeted rural health education.

A significant knowledge gap exists between rural and urban caregivers. The mean knowledge score was significantly higher in urban areas than in rural settings, as confirmed by t-test analysis. Moreover, while approximately two-thirds of urban caregivers demonstrated good knowledge, only a small proportion of rural respondents did so, highlighting systemic inequities in health communication and education [36, 37]. Sources of health information also differed between settings. Urban caregivers relied more on formal institutions, whereas rural respondents depended largely on informal sources, including family and friends. These findings underscore the need for structured rural outreach through culturally appropriate channels [34].

Knowledge of diarrhea also varies by location. More than half of urban caregivers correctly identified unclean water as a major cause, while less than a third of rural caregivers did so. Many rural respondents attributed diarrhea to teething or were uncertain, reflecting deep-rooted cultural beliefs [38, 39]. Regression analyses further showed that younger caregivers (15-25 years) in rural areas had significantly poorer knowledge, a pattern linked to inexperience and limited exposure to health information [40]. This age-related trend was not significant in urban settings, likely due to better access to education and healthcare services.

Educational attainment remained a strong predictor of good knowledge in both settings. Caregivers with secondary education or higher consistently had better awareness, reaffirming the critical role of education in health literacy [35]. Income and occupation were also associated with knowledge: civil/public servants and higher-income earners displayed better understanding, whereas unemployed and low-income caregivers were more likely to have poor knowledge, supporting conclusions by Musa et al. [37].

Access to improved water sources and the practice of exclusive breastfeeding were associated with better knowledge in both settings, suggesting that health-promoting behaviours are often interconnected with exposure to health information [4, 35]. However, in urban areas, a counterintuitive finding showed that caregivers with access to improved water sources had higher odds of poor knowledge. This may reflect a false sense of security that discourages active learning, as suggested by Ogbo et al. [36].

5. Conclusion

This study reveals a significant urban-rural disparity in both the prevalence of diarrhea and caregiver knowledge in Rivers State, Nigeria. Rural communities reported higher diarrhea prevalence, driven by persistent challenges such as inadequate access to clean water, poor sanitation, and limited healthcare infrastructure. In contrast, lower prevalence in urban areas reflects better access to health services, hygiene practices, and public health information.

Caregivers in rural areas also demonstrated markedly lower knowledge of diarrhea symptoms, causes, and management, with misconceptions like attributing diarrhea to teething remaining common. Urban caregivers showed better awareness, supported by greater access to media, formal education, and health facilities.

Sociodemographic and behavioural factors—particularly education, income, occupation, age, exclusive breastfeeding, and water source—were significantly associated with knowledge levels. Higher education, formal employment, and improved income correlated with better knowledge, while young and unemployed caregivers in rural settings were more likely to have a poor understanding.

These findings underscore the urgent need for tailored, culturally appropriate health education programs in rural communities. Strengthening rural health infrastructure and ensuring equitable access to health information are critical steps toward reducing the diarrhea burden and closing the urban-rural health gap in Nigeria.

Abbreviations

WHO	World Health Organization
UNICEF	United Nations Children's Fund
NPC	National Population Commission
ORT	Oral Rehydration Therapy
LMICs	Low- and Middle-Income Countries
LGAs	Local Government Areas
OR	Odds Ratio
CL	Confidence Interval
COR	Crude Odds Ratio
AOR	Adjusted Odds Ratio

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Author Contributions

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Ethical Consideration and Informed Consent

The Ethical Review Committee, Faculty of Basic Medical Sciences, and Rivers State University granted ethical approval (Approval No: RSU/FBMS/REC/24/088). Written informed consent was obtained. Participation was voluntary, and all data were kept confidential and used strictly for research purposes.

Conflicts of Interest

The authors have no conflicts of interest to declare for this study.

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