

Knowledge, Perceptions and Preventive Practices Against Waterborne Diseases among Residents of Obubra Local Government Area, Cross River State, Nigeria

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Abstract

Background

Waterborne diseases remain a significant public health challenge in developing regions. In sub-Saharan Africa, Nigeria records some of the highest rates of these infections. This high burden is mainly linked to widespread open defecation in rural communities, where human waste is often deposited in rivers and lakes that also serve as sources of drinking water, leading to the contamination of these water bodies.

Objectives

This study assessed the knowledge, perceptions, and preventive practices regarding waterborne diseases among residents of Obubra Local Government Area, Cross River State, Nigeria.

Methods

An analytical cross-sectional study design was adopted, with a sample size of 310, selected using a multistage sampling technique. Data were collected using a pre-tested semi-structured questionnaire administered via Open Data Kit. Descriptive statistics (frequencies, percentages, means) and inferential statistics (chi-square test and multivariate logistic regression) were used for data analysis. Reliability of the instrument was confirmed using Cronbach's alpha ($\alpha = 0.71$). Ethical approval was obtained, and informed consent was secured from all participants. Statistical significance was set at $p < 0.05$, and data were analysed using Statistical Product and Service Solutions (SPSS) version 23.

Results

The majority of respondents were females 181(58.4%) and aged 34–49 years 184(59.4%). Most respondents 226(72.9%) had poor knowledge of waterborne diseases, while 187(60.3%) demonstrated negative perceptions. Despite this, 224(72.3%) reported good preventive practices. There was no significant association between socio-demographic characteristics and knowledge or preventive practices ($p > 0.05$). However, marital status showed a significant association with perceptions ($\chi^2 = 14.374$, $p = 0.013$). Multivariate logistic regression revealed that respondents with secondary education were significantly less likely to engage in preventive practices compared to those with no formal education (AOR = 0.38; 95% CI: 0.19–0.74; $p = 0.004$), while other socio-demographic variables showed no significant associations.

Conclusions

The study revealed poor knowledge and negative perceptions of waterborne diseases despite generally good preventive practices among respondents. Education emerged as a key determinant of preventive behaviour. The findings emphasized the need for strengthened community-based health education, improved water and sanitation hygiene interventions, and targeted awareness campaigns to bridge knowledge gaps and sustain effective preventive practices against waterborne diseases in the study area.

1 Introduction

The World Health Organization has emphasized that access to safe drinking water is one of the most important determinants of health [1]. However, approximately 2.1 billion people globally, including about 66 million individuals in Nigeria, still lack access to clean and safe drinking water [2, 3]. Neglecting to guarantee the safety of water can potentially subject communities to the threat of water-borne disease (WBDs) outbreaks [4]. WBDs are illnesses typically caused by the contamination of water with pathogenic viruses, bacteria, protozoa, or helminths found in human or animal faeces and/or urine. These diseases are directly transmitted when individuals consume unsafe water [5]. Common bacterial agents associated with waterborne diseases include *Salmonella spp.*, *Escherichia coli*, *Klebsiella spp.*, *Proteus mirabilis*, and *Enterobacter spp.* [6]. WBDs include diarrheal diseases and typhoid fever (transmitted via the faecal-oral route), malaria (spread by mosquitoes as disease vectors), and schistosomiasis (transmitted by snails acting as disease vectors for trematodes) [7].

WBDs persist as a major public health concern in developing countries, and are particularly prevalent in sub-Saharan Africa, Asia, and Latin America primarily due to insufficient access to clean water and inadequate sanitation facilities [8, 9]. Globally, WBDs contribute to over 2–3 million deaths annually [2]. Nigeria records some of the highest incidence rates of WBDs in sub-Saharan Africa [10]. This is largely attributed to practices in many rural communities where open defecation is prevalent, and individuals often defecate in rivers and lakes that also serve as sources of drinking water, thereby contaminating these water bodies [11]. Climate change and rapid urbanisation present further challenges in controlling WBDs. Increasing temperatures and heavy rainfall events contribute to flooding, which often contaminates water sources with harmful pathogens [9]. Communities in Cross River State, Nigeria are especially vulnerable because of their riverine geography, heavy rainfall, and dependence on untreated surface water for domestic use. These conditions, combined with poverty, limited healthcare access, and low levels of hygiene awareness, heighten the risk of infection.

Recent outbreaks of diarrhoea, cholera, and other WBDs have been reported in the study area, resulting in significant loss of lives [12]. In response to these outbreaks this study was designed to knowledge, perceptions and preventive practices against waterborne infections among residents of Obubra Local Government Area, Cross River State, Nigeria. Specifically, the study seeks to determine the level of knowledge and perceptions of community members regarding waterborne diseases, evaluate their preventive practices, and examine the influence of socio-demographic characteristics on these factors. By addressing these objectives, the study aims to generate context-specific evidence that can inform

targeted interventions, promote WASH practices, and strengthen efforts aimed at preventing WBDs within community settings in Nigeria.

2 Methods

2.1 Study location

The research was conducted in Obubra, a region in Cross River State, Nigeria. Obubra LGA is one of the eighteen (18) Local Government Areas (LGAs) in Cross River State, Nigeria. It is one of the oldest Local Government Areas in Nigeria. It is located between latitude 6.0820°N and longitude 8.3278° E. Obubra is bordered by Yala and Ikom Local Government Areas to the North, Yakurr Local Government Area to the South, and Ebonyi State to the West. The present-day Obubra covers an area of 1,086 km² with a population of 262,800 people [13]. The main occupation of the residents in these communities is subsistence farming and fishing. Some are civil servants and part-time worker, businessmen, while some engage in tourism activities in their area. Obubra LGA is known for its agricultural activities, with crops such as cocoa, oil palm, yams, cassava, and various vegetables being cultivated by the local populace. The area also has a significant number of rivers and streams, which contribute to its agricultural productivity and support fishing activities [14].

2.2 Research design

This study adopted an analytical cross-sectional descriptive design with to assess the knowledge, perceptions and preventive practices against waterborne infections among residents of Obubra LGA, Cross River State, Nigeria regarding waterborne infections. This design was selected because it enables the assessment of several variables at one point in time, making it appropriate for evaluating knowledge, perceptions, and preventive practices within a defined population.

2.3 Study population

The study population included residents of Obubra LGA, Cross River State.

2.4 Sample size determination

The sample size was determined using Fisher's formula.

$$n = \frac{z^2 pq}{d^2}$$

Where;

n = Desired sample size

Z = Confidence level

p = Prevalence rate

q = Proportion of non-occurrence (1-p)

d = margin of error

Therefore:

Z = 95% (1.96)

p = 23.9% = 0.239 [15]

q = 1 - 0.239 = 0.761

d² = 5% = (0.05)² = 0.0025

$$n = \frac{1.96^2 \times 0.239 \times 0.761}{0.0025}$$

$$n = \frac{3.841 \times 0.239 \times 0.761}{0.0025}$$

n = 279.4 = 279

$$\frac{n}{1 - NRR}$$

Assuming a nonresponsive rate of 10% (0.1)

$$n = \frac{279}{1 - 0.10}$$

$$n = \frac{279}{0.90}$$

= 310

The total sample size is 310

2.5 Sampling procedure

A probability sampling method was employed to select residents of Obubra. Data collection was conducted at the respondents' residences. A multi-stage sampling technique was utilized in the selection of wards, villages, households and respondents.

Stage 1: Selection of wards: Obubra LGA comprises of eleven wards, and a simple random sampling technique was employed, involving balloting method, to select six of these wards.

Stage 2: Selection of villages: Five villages were selected from each of the six selected wards using simple random sampling making 30 villages in total.

Stage 3: Selection of households: In each of the villages selected, systematic random sampling was used to select eleven (10) households ($310/30 = 10.3$). This was done using the fixed interval and the random starting point. The number of households in each village was identified. At the end of identification of households, the interval was determined by dividing the total number of households in each village by the desired households (10) to be sampled per village.

Stage 4: Selection of respondents: One eligible respondent was selected from each of ten households on every street using simple random sampling. The remaining ten respondents required to complete the sample size were randomly selected from any of the previously chosen households.

2.6 Instrument for data collection

The instrument used for data collection was a semi-structured questionnaire developed based on the research objectives. Data were collected using Open Data Kit (ODK) Collect, an Android-based application that can be linked to KoboToolbox, a web-based platform that facilitates easy data collection and transmission [16]. The questionnaire was programmed into the ODK form and administered in person by trained research assistants rather than being distributed online. This method was adopted to ensure accurate responses and enable real-time data capture during household visits. The questionnaire consisted of the following sections:

Section A consisted of a semi-structured questionnaire to collect relevant socio-demographic characteristics of the respondents. Section B consisted of questions to assess the knowledge of water borne infections among respondents. Section C consisted of questions to assess the perceptions about water borne infections among respondents. Section D consisted of questions to assess Preventive practice against water-borne infection.

2.7 Instrument validation and reliability of data collection instruments

Face and content validity of the instrument were ensured through expert review by specialists in the Department of Public Health, University of Calabar, Nigeria. The questionnaire was pre-tested among 31 residents of Ikom LGA in Cross River State. Ikom was selected for the pre-test because it shares a boundary with Obubra LGA and possesses similar socio-demographic characteristics to the study area. The pre-test was conducted to evaluate the effectiveness of the instrument in collecting data relevant to the study objectives and to assess respondents' understanding of the questions. It also helped to confirm the relevance of the variables being measured, identify and eliminate ambiguities, and improve the clarity of the questionnaire. Feedback obtained from the pre-testing exercise was used to refine and adjust the instrument accordingly.

The reliability of the questionnaire was determined using the Cronbach's alpha correlation coefficient based on the pre-test data, which yielded a value of 0.71, indicating high internal consistency and reliability.

2.8 Method of data collection

Three research assistants aided in the collection of data by using an interviewer administered questionnaire. Written in English and comprising semi-structured questions, the questionnaire was delivered in digital format via the Open Data Kit (ODK) on mobile devices. The research assistants were trained on the correct use of the ODK tool to guarantee uniformity and accuracy in collecting the data.

2.9 Method of data analysis

Upon completion, questionnaires were manually reviewed to verify their completeness. All relevant data were meticulously recorded, cleaned, and analysed using Microsoft Excel. Following this, the data were transferred to Statistical Product and Service Solutions (SPSS) Version 23 for further analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the data and presented in tables and charts, with Microsoft Excel employed to compute scores for respondents' knowledge, attitude, and preventive practices. Chi-square tests were conducted to examine the associations between socio-demographic characteristics and respondents' knowledge, attitude, and preventive practices, while logistic regression was performed to identify their determinants. Statistical significance was set at a p-value of < 0.05 with a 95% confidence interval.

2.10 Outcome variables

The knowledge section included 15 items, with each correct response scored 1 point and incorrect responses scored 0, giving a maximum possible score of 15. Knowledge levels were categorised using Bloom's cutoff: 0–8 = poor, 9–11 = fair, and 12–15 = good. The perception section comprised 9 items measured on a Likert scale (Strongly Disagree = 0, Disagree = 1, Agree = 2, Strongly Agree = 3), yielding a maximum score of 27; scores were classified as negative (0–13) or positive (14–27). The preventive practice section consisted of 8 items, including water hygiene and safety behaviours such as source of water, treatment before consumption, handwashing, use of sanitizer, surface cleaning, washing fruits and vegetables, safe cooking water, and proper water disposal. Practices were scored to a maximum of 15 points, with 0–7 indicating poor and 8–15 indicating good preventive practices.

3. Results

3.1 Socio-demographic characteristics of respondents

Table 1 below presents the socio-demographic characteristics of the respondents. The majority, 181(58.4%), were female. Most respondents, 184(59.4%), were between the ages of 34 and 49 years, with a mean age of 39.33 years and a standard deviation of 12.176. In terms of education, a significant proportion, 125(40.3%), reported having no formal education. More than half of the respondents, 210(68%), identified as Christians. Additionally, over a quarter of the respondents, 85(27.4%), were co-habiting with partners.

Table 1
Socio-demographic characteristics of respondents

Variables	Frequency (n = 310)	Percentage (%)
Gender	Mean = 39.33, SD = 12.176	
Male	129	41.6
Female	181	58.4
Age range		
18–33	85	27.4
34–49	184	59.4
50 and above	41	13.2
Highest educational level		
No formal education	125	40.3
Primary education	87	28.1
Secondary education	70	22.6
Tertiary education	28	9.0
Religion		
Christianity	210	68
Islam	15	5
Traditional belief	85	27
Marital status		
Single	39	12.6
Married	81	26.1
Co-habiting partners	85	27.4
Divorced	44	14.2
Separated	37	11.9
Widow/widower	24	7.7

3.2 Knowledge of waterborne infections among residents

Table 2 presents the knowledge of waterborne infections among residents. The majority of respondents, 157(50.6%), reported that contaminated drinking water can transmit waterborne infections. However, most respondents, 178(57.4%), did not know that drinking untreated water increases the risk of

waterborne infections. More than half of the respondents, 178(57.4%), were aware that poor sanitation practices can contaminate water sources and lead to waterborne infections. Conversely, 161(51.9%) lacked knowledge that waterborne infections can spread through contaminated food and water. Knowledge of the common symptoms of waterborne infections, including diarrhoea, vomiting, and abdominal pain, was reported by 140(45.2%) of respondents. Fewer respondents, 123(39.7%), recognised that boiling water before drinking can help prevent waterborne infections, while 152(49.0%) were aware that filtering or purifying water can reduce the risk of waterborne infections. Proper handwashing with soap to prevent waterborne infections was known by only 121(39.0%) of respondents. Regarding environmental hygiene, 142(45.8%) reported knowledge that improper disposal of waste can contaminate water sources, and 143(46.1%) knew that storing drinking water in clean and covered containers helps prevent contamination. A majority of respondents, 171(55.2%), were aware that children are more vulnerable to waterborne infections, and 169(54.5%) knew that untreated sewage can contaminate rivers, wells, and other water sources. Knowledge that regular treatment of drinking water helps reduce the risk of waterborne infections was reported by 134(43.2%) of respondents, while 129(41.6%) were aware that maintaining proper sanitation and hygiene helps prevent waterborne infections. Finally, 172(55.5%) of respondents knew that using safe and clean water for cooking and drinking can prevent waterborne infections.

Table 2
Knowledge of waterborne infections among residents

Variables	Yes	No
Contaminated drinking water can transmit waterborne infections.	157(50.6%)	153(49.4%)
Drinking untreated water increases the risk of waterborne infections.	132(42.6%)	178(57.4%)
Poor sanitation practices can contaminate water sources and lead to waterborne infections.	178(57.4%)	132(42.6%)
Waterborne infections can spread through contaminated food and water.	149(48.1%)	161(51.9%)
Common symptoms of waterborne infections include diarrhoea, vomiting, and abdominal pain.	140(45.2%)	170(54.8%)
Boiling water before drinking can help prevent waterborne infections.	123(39.7%)	187(60.3%)
Filtering or purifying water can reduce the risk of waterborne infections.	152(49.0%)	158(51.0%)
Proper handwashing with soap can help prevent waterborne infections.	121(39.0%)	189(61.0%)
Improper disposal of waste can contaminate water sources.	142(45.8%)	168(54.2%)
Storing drinking water in clean and covered containers helps prevent contamination.	143(46.1%)	167(53.9%)
Children are more vulnerable to waterborne infections.	171(55.2%)	139(44.8%)
Untreated sewage can contaminate rivers, wells, and other water sources.	169(54.5%)	141(45.5%)
Regular treatment of drinking water helps reduce the risk of waterborne infections.	134(43.2%)	176(56.8%)
Maintaining proper sanitation and hygiene helps prevent waterborne infections.	129(41.6%)	181(58.4%)
Using safe and clean water for cooking and drinking can prevent waterborne infections.	172(55.5%)	138(44.5%)

Knowledge level of waterborne infections among residents

Figure 1 below, shows the knowledge level of waterborne infections among residents. Using Blooms cutoff for knowledge level, majority of the respondents 226(72.9%) had poor knowledge of waterborne infections while 76(24.5%) had fair knowledge of waterborne infections and finally, 8(2.6%) had good knowledge of waterborne infections.

Score range, 0–8 = poor knowledge; 9–11 = Fair knowledge; 12–15 = Good knowledge

3.3 Perceptions towards waterborne infections

Table 3 presents the perceptions of residents regarding waterborne infections. Most respondents, 123(39.7%), disagreed that waterborne infections pose a significant health risk in their community. Similarly, the majority, 110(35.5%), disagreed that most residents are aware of common waterborne infections in the area. A larger proportion, 126(40.6%), agreed that proper sanitation and hygiene practices can prevent waterborne infections. Regarding access to clean and safe drinking water, 125(40.3%) agreed that it is a challenge in their community. Respondents were evenly split on government efforts to provide clean water and sanitation facilities, with 111(35.8%) agreeing. The majority, 123(39.7%), agreed that they are satisfied with the quality of water provided by public sources. On personal knowledge of preventive measures, 129(41.6%) disagreed that they are adequately informed. Most respondents, 121(39.0%), disagreed that there is a need for more public awareness campaigns on waterborne infections. Lastly, 123(39.7%) agreed that community education campaigns effectively reduce the risk of waterborne infections.

Level of perceptions towards waterborne infections

Figure 2 below, is a graphical representation of the level of perceptions towards waterborne infections among respondents. Majority of the respondents 187(60.3%) had negative perception towards waterborne infections while 123(39.7%) of the respondents had positive perception.

Table 3
Perceptions towards waterborne infections

Variable	SA	A	D	SD
I believe waterborne infections pose a significant health risk in my community.	19(6.1%)	89(28.7%)	123(39.7%)	79(25.5%)
I think most residents are aware of common waterborne infections in our area.	31(10.0%)	102(32.9%)	110(35.5%)	67(21.6%)
I feel that proper sanitation and hygiene practices can prevent waterborne infections.	31(10.0%)	126(40.6%)	110(35.5%)	43(13.6%)
I perceive access to clean and safe drinking water as a challenge in my community.	34(11.0%)	125(40.3%)	107(34.5%)	44(14.2%)
I believe the government is doing enough to provide clean water and sanitation facilities.	37(11.9%)	111(35.8%)	111(35.8%)	51(16.5%)
I am satisfied with the quality of water provided by public sources in my area (e.g., taps, wells).	27(8.7%)	123(39.7%)	117(37.7%)	43(13.9%)
I feel adequately informed about the measures I can take to prevent waterborne infections.	24(7.7%)	103(33.2%)	129(41.6%)	54(17.4%)
I think there is a need for more public awareness campaigns on waterborne infections and prevention.	34(11.0%)	94(36.3%)	121(39.0%)	61(19.7%)
I believe community education campaigns effectively reduce the risk of waterborne infections.	39(12.6%)	123(39.7%)	114(36.8%)	34(11.0%)
Strongly Disagree = SD, Disagree = D, Agree = A, Strongly Agree = SA				

Score range: 0–13 Negative perception; 14–27 Positive perception

3.4 Practices against water-borne infections

Table 4 below, illustrates respondents' practices against water borne infections. The majority of the respondents, 115(37.1%), indicated that their primary source of water was well water, while about 90(29.0%) reported that their major source of water was from other sources. Furthermore, 79(25.5%) of the respondents indicated that they treated their drinking water before consumption. Almost half of the respondents, 152(49.0%), reported that they did not treat their drinking water before drinking. More than one third of the respondents, 116(37.4%), stated that they occasionally washed their hands with soap and water. More than half of the respondents, 203(65.5%), reported that they did not use hand sanitizer when soap and water were not available. About 129(41.6%) of the respondents sanitized or cleaned surfaces that came in contact with water (e.g., water containers). Also, about 111(35.8%) indicated that they occasionally washed fruits and vegetables before consuming them. The majority of the

respondents, 125(40.3%), ensured the safety of water used for cooking or preparing food through filtration. Finally, about 139(44.8%) of the respondents disposed of wastewater in their households through a piped drainage system.

Practice level against water-borne infections

Figure 3 below is a graphical representation of the practices against water borne infections. The results revealed that 224(72.3%) had good practice against water borne infections while 86(27.7%) had poor practice.

Table 4
Practices against water-borne infections

Variables	Frequency (n = 310)	Percentage (%)
Primary source of water		
Tap water	98	31.6
Bottled water	7	2.3
Well water	115	37.1
Streams and rivers	90	29.0
Treat your drinking water before consumption		
Yes	79	25.5
Sometimes	79	25.5
No	152	49.0
Wash your hands with soap and water		
Several times a day	39	12.6
Once a day	109	35.2
Occasionally	116	37.4
Rarely	46	14.8
Use hand sanitizer if soap and water are not available		
Yes	107	34.5
No	203	65.5
Sanitize or clean surfaces that come in contact with water (e.g. water containers)		
Daily	59	19.0
Weekly	129	41.6
Occasionally	96	31.0
Never	26	8.4
Wash fruits and vegetables before consuming them		
Several times a day	58	18.7
Once a day	110	35.5

Variables	Frequency (n = 310)	Percentage (%)
Primary source of water		
Occasionally	111	35.8
Rarely	31	10.0
Ensure the safety of water used for cooking or preparing food		
Boiling	98	31.6
Filtration	125	40.3
Chlorination	84	27.1
Others	3	1.0
Dispose of water in your household		
Piped drainage system	139	44.8
Septic tank	110	35.5
Open drainage	61	19.7

Score range: 0–7 = Poor; 8–15 = Good

Figure 3: Practice level against water-borne infections

3.5 Test of hypotheses

3.5.1 Hypothesis 1: association between socio-demographic characteristics and knowledge of water-borne infections

In Table 5 below, chi square analysis showed no significant association between socio-demographic characteristics (age, gender, highest level of education, and marital status) and respondents' knowledge of water-borne infections ($p > 0.05$). These findings suggest that respondents' background characteristics did not significantly influence whether they had poor, fair, or good knowledge of water-borne infections.

Table 5

Association between socio-demographic characteristics and knowledge of water-borne infections

Variables	Knowledge level			χ^2 /FFH	P-Value
	Poor	Fair	Good		
Age range (years)					
18–33	62(72.9%)	20(23.5%)	3(3.5%)	1.132	0.828
34–49	134(72.8%)	45(24.5%)	5(2.7%)		
50 and above	30(73.2%)	11(26.8%)	0(0.0%)		
Gender					
Male	90(69.8%)	35(27.1%)	4(3.1%)	1.245	0.564
Female	136(75.1%)	41(22.7%)	4(2.2%)		
Highest educational level					
No formal education	86(68.8%)	34(27.2%)	5(4.0%)	3.517	0.649
Primary education	66(75.9%)	20(23.0%)	1(1.1%)		
Secondary education	54(77.1%)	14(20.0%)	2(2.9%)		
Tertiary education	20(71.4%)	8(28.6%)	0(0.0%)		
Marital status					
Single	24(61.5%)	12(30.8%)	3(7.7%)	16.440	0.088
Married	55(67.9%)	25(30.9%)	1(1.2%)		
Co-habiting partners	63(74.1%)	21(24.7%)	1(1.2%)		
Divorced	38(86.4%)	5(11.4%)	1(2.3%)		
Separated	25(67.6%)	10(27.0%)	2(5.4%)		
Widow/Widower	21(87.5%)	3(12.5%)	0 (0.0%)		
χ^2 = Chi-square statistic, p-value= Probability value; *Statistical significance based on p-Value < 0.05; FFH = Fisher–Freeman–Halton exact					

3.5.2 Hypothesis 2: association between socio-demographic characteristics and perceptions towards waterborne infections

Results from Table 6 below, revealed a significant association between marital status with respondents' perceptions towards waterborne infections. Respondents who were widows/widowers had a higher percentage of positive perception compared to their counterparts ($\chi^2 = 14.374$, $p = 0.013$). The Cramer's V coefficient of 0.215 indicates a weak to moderate association between marital status and perception of waterborne infections. However, no statistically significant association was found between perception and respondents' age, gender, and highest level of education.

Table 6

Association between socio-demographic characteristics and perceptions towards waterborne infections

Variables	Perceptions			
	Negative	Positive	χ ²	P-Value
Age range (years)				
18–33	47(55.3%)	38(44.7%)	2.023	0.364
34–49	117(63.6%)	67(36.4%)		
50 and above	23(56.1%)	18(43.9%)		
Gender				
Male	78(60.5%)	51(39.5%)	0.002	0.965
Female	109(60.2%)	72(39.8%)		
Highest educational level				
No formal education	80(64.0%)	45(36.0%)	1.434	0.697
Primary education	51(58.6%)	36(41.4%)		
Secondary education	39(55.7%)	31(44.3%)		
Tertiary education	17(60.7%)	11(39.3%)		
Marital status				
Single	25(64.1%)	14(35.9%)	14.374	0.013*
Married	53(65.4%)	28(34.6%)		
Co-habiting partners	54(63.5%)	31(36.5%)		
Divorced	18(40.9%)	26(59.1%)		
Separated	27(73.0%)	10(27.0%)		
Widow/Widower	10(41.7%)	14(58.3%)		
χ ² = Chi-square statistic, p-value= Probability value; *Statistical significance based on p-Value < 0.05				

3.5.3 Hypothesis 3: association between socio-demographic characteristics and preventive practices

In Table 7, chi square analysis reveals no significant association between socio-demographic characteristics (age, gender, highest level of education, and marital status) and respondents' preventive practices of water-borne infections ($p > 0.05$). These findings suggest that respondents' background

characteristics did not significantly influence whether they had poor or good preventive practices of water-borne infections.

Table 7
Association between socio-demographic characteristics and preventive practices

Variables	Preventive practice			
	Poor	Good	χ ²	P-Value
Age range (years)				
18–33	46 (54.1%)	39 (45.9%)	1.428	0.490
34–49	110 (59.8%)	74 (40.2%)		
50 and above	21 (51.2%)	20 (48.8%)		
Gender				
Male	73 (56.6%)	56 (43.4%)	0.023	0.879
Female	104 (57.5%)	77 (42.5%)		
Highest educational level				
No formal education	73 (58.4%)	52 (41.6%)	1.600	0.659
Primary education	50 (57.5%)	37 (42.5%)		
Secondary education	36 (51.4%)	34 (48.6%)		
Tertiary education	18 (64.3%)	10 (35.7%)		
Marital status				
Single	24 (61.5%)	15 (38.5%)	11.020	0.051
Married	49 (60.5%)	32 (39.5%)		
Co-habiting partners	53 (62.4%)	32 (37.6%)		
Divorced	17 (38.6%)	27 (61.4%)		
Separated	24 (64.9%)	13 (35.1%)		
Widow/Widower	10 (41.7%)	14 (58.3%)		
χ ² = Chi-square statistic, p-value= Probability value; *Statistical significance based on p-Value < 0.05				

3.5.4 Multivariate logistics regression analysis of the sociodemographic characteristics and preventive practices

Table 8 shows the multivariate logistic regression analysis of the sociodemographic characteristics and preventive practices. In the table, females had lower odds of practising preventive measures compared to males (AOR = 0.75; 95% CI: 0.44–1.29); however, this association was not statistically significant ($p = 0.297$), indicating no conclusive evidence of a gender effect while controlling for age, educational level, and marital status. Regarding age, respondents aged 34–49 years (AOR = 1.31; 95% CI: 0.72–2.38; $p = 0.376$) and those aged 50 years and above (AOR = 1.53; 95% CI: 0.63–3.73; $p = 0.347$) had higher odds of practising preventive measures compared to those aged 18–33 years; however, these associations were not statistically significant, suggesting no strong age effect while controlling for gender, education, and marital status. Educational level emerged as a significant predictor of preventive practices. Respondents with secondary education were significantly less likely to practise preventive measures compared to those with no formal education (AOR = 0.38; 95% CI: 0.19–0.74; $p = 0.004$), suggesting a 62% reduction in odds. Respondents with primary education (AOR = 0.59; 95% CI: 0.31–1.14; $p = 0.114$) and tertiary education (AOR = 0.60; 95% CI: 0.24–1.52; $p = 0.279$) did not show statistically significant associations, indicating no clear effect of these educational levels on preventive practices. Marital status did not significantly influence preventive practices. Compared to single respondents, being married (AOR = 1.93; 95% CI: 0.75–5.01; $p = 0.175$), co-habiting (AOR = 0.99; 95% CI: 0.41–2.42; $p = 0.987$), divorced (AOR = 0.62; 95% CI: 0.23–1.66; $p = 0.336$), separated (AOR = 1.00; 95% CI: 0.35–2.91; $p = 0.995$), or widowed (AOR = 0.65; 95% CI: 0.21–2.04; $p = 0.462$) showed no statistically significant associations, indicating that marital status had no strong effect on preventive practices while controlling for gender, age, and education.

Table 8
Multivariate logistics regression analysis of the sociodemographic characteristics and preventive practices

Variables	AOR [95% Confidence Interval (CI)]	p-value
Age range (years)		
18–33 (a)		
34–49	1.31 [0.72–2.38]	0.376
50 and above	1.53 [0.63–3.73]	0.347
Gender		
Male (a)		
Female	0.75 [0.44–1.29]	0.297
Highest educational level		
No formal education (a)		
Primary	0.59 [0.31–1.14]	0.114
Secondary	0.38 [0.19–0.74]	0.004*
Tertiary	0.60 [0.24–1.52]	0.279
Marital status		
Single (a)		
Married	1.93 [0.75–5.01]	0.175
Co-habiting partners	0.99 [0.41–2.42]	0.987
Divorced	0.62 [0.23–1.66]	0.336
Separated	1.00 [0.35–2.91]	0.995
Widow/Widower	0.65 [0.21–2.04]	0.462
(a) indicates the reference category for each predictor variable; AOR = Adjusted Odds Ratio; CI = Confidence Interval; p-value= Probability value; *Statistical significance based on p-Value < 0.05		

4 Discussion

Findings from our study showed that the overall knowledge of WBDs among respondents was generally low. Although about half of the respondents were aware that contaminated drinking water can transmit WBDs and that poor sanitation practices can contaminate water sources, many lacked knowledge of important transmission routes and preventive measures. For instance, the majority did not know that drinking untreated water increases the risk of infection, and more than half were unaware that WBDs can

also spread through contaminated food and water. Knowledge of preventive practices such as boiling water, filtering or purifying water, and proper handwashing with soap was also relatively low. In addition, less than half of the respondents recognised common symptoms of WBDs such as diarrhoea, vomiting, and abdominal pain. These findings suggest that significant knowledge gaps exist within Obubra LGA, which may increase vulnerability to WBD transmission.

The findings are consistent with studies by Berhe, Aregay [17] in Ethiopia and Barrow, Badjie [18] in the Gambia, which also reported a high proportion of respondents with poor knowledge of WBDs. However, this contrasts with the study by Mbereko, Chimbari [19], which reported relatively high awareness of schistosomiasis in rural communities in South Africa and Zimbabwe, and the study by Gbolagunte, Olanrewaju [15] in Nigeria, where respondents demonstrated moderate to high knowledge of WBDs. The higher knowledge levels observed in these studies may be attributed to differences in exposure to health information and public health interventions.

Results of respondents' perception towards WBDs revealed that the majority of respondents demonstrated a negative perception towards WBDs. A large proportion of respondents did not consider WBDs to be a significant health risk in their community and also believed that most residents were not adequately aware of common WBDs in the area. These findings suggest that the perceived susceptibility and severity of WBDs among community members may be relatively low, which can influence their level of concern and willingness to adopt preventive behaviours. Low risk perception may therefore contribute to limited community engagement in preventive measures and health-seeking practices.

Despite this generally negative perception, some respondents acknowledged key preventive strategies. A number of respondents agreed that proper sanitation and hygiene practices can prevent WBDs, while many also recognised that access to clean and safe drinking water remains a challenge within their community. However, respondents expressed mixed opinions regarding government efforts to provide clean water and sanitation facilities. In addition, many respondents reported that they were not adequately informed about preventive measures, and a considerable proportion did not perceive the need for additional public awareness campaigns. These perceptions may partly explain the persistence of unsafe practices and inadequate preventive behaviours within the community.

The findings of this study are comparable with those of Anthonj, Diekkrüger [20], who reported varying levels of risk perception towards water-related infectious diseases among wetland communities in Kenya. Their study showed that although a majority of respondents perceived people living in wetlands to be at higher health risk, a notable proportion either disagreed or were uncertain about the level of risk. Similarly, Adeleye, Orifah [21] reported that most artisans in Dutse mechanic village in north-western Nigeria believed that microbial pollutants in water could cause WBDs, although a minority held contrary views. In contrast, Wagaja, Hassan [22] reported a higher level of perceived risk among residents in Maiduguri, Nigeria, where the majority of respondents believed that diseases such as cholera and typhoid could be contracted through the consumption of contaminated water.

Also, results from our study revealed that respondents generally demonstrated good preventive practices against WBDs. Regarding the sources of water, a considerable proportion of respondents relied on well water for their daily needs, while others depended on alternative sources. However, despite the availability of these water sources, almost half of the respondents reported that they did not treat their drinking water before consumption. This suggests that although water is accessible, appropriate household water treatment practices are not consistently adopted among community members. Concerning hygiene practices, a proportion of respondents reported occasionally washing their hands with soap and water, while the majority indicated that they did not use hand sanitizers when soap and water were unavailable. Some of the respondents also reported cleaning surfaces that come into contact with water, such as storage containers, and occasionally washing fruits and vegetables before consumption. In addition, many respondents ensured the safety of water used for cooking through filtration and disposed of household wastewater through piped drainage systems.

The findings from this study are similar to those reported by Ibrahim, ElSayed [8], who assessed water handling practices and the prevalence of WBDs in East Nile locality, Khartoum State, Sudan. Their study revealed that artesian wells were the most common source of drinking water among respondents, and the majority did not treat their drinking water at the household level. Similarly, only a small proportion of respondents practised adequate hygiene behaviours such as washing hands before collecting water or regularly cleaning water containers. Another study conducted by Baydakova, Unguryanu [23] among high school teachers in Rawalpindi, Pakistan, also reported varying levels of practices related to safe drinking water. The study revealed that although many participants were aware of water safety measures such as boiling and chlorination, gaps still existed in some areas of knowledge and practices related to WBDs. These findings highlight the need for continuous public health education and the promotion of safe water handling practices in order to strengthen preventive behaviours within communities.

Strengths and limitations of the study

A key strength of this study is that it provides context-specific evidence on the knowledge, perceptions, and preventive practices related to WBDs among residents of Obubra LGA, an area that has recently experienced outbreaks of diarrhoea, cholera, and other WBDs. The use of a multi-stage probability sampling technique enhanced the representativeness of the sample across several wards and villages. In addition, data were collected using a pre-tested and validated questionnaire with acceptable reliability (Cronbach's alpha = 0.71), and the use of digital data collection tools such as ODK improved the accuracy, efficiency, and completeness of the data captured. The study also employed both descriptive and inferential statistical analyses, including chi-square tests and logistic regression, which strengthened the analytical depth of the findings and allowed the identification of factors associated with preventive practices.

However, the study had some limitations. The cross-sectional design limits the ability to establish causal relationships between socio-demographic characteristics and knowledge, perceptions, or preventive practices regarding WBDs. Data were obtained through self-reported responses, which may have

introduced recall bias or social desirability bias, particularly in relation to preventive practices such as handwashing and water treatment. Additionally, a considerable proportion of respondents had no formal education, which may have affected their interpretation of some questionnaire items despite the assistance provided during interviews. The study was also limited to residents of Obubra LGA; therefore, the findings may not be fully generalisable to other regions with different socio-economic, environmental, or cultural contexts. Consequently, the results should be interpreted with caution when applying them to other populations.

5 Conclusion

This study assessed the knowledge, perceptions, and preventive practices regarding waterborne diseases among residents of Obubra LGA, Cross River State, Nigeria. The findings revealed that the majority of respondents had poor knowledge and negative perceptions of WBD, despite demonstrating generally good preventive practices. While some respondents were aware of key transmission routes and preventive measures, notable gaps existed in areas such as water treatment, hygiene practices, and recognition of symptoms. The study found no significant association between socio-demographic characteristics and knowledge or preventive practices. However, marital status showed a significant association with perception towards WBDs. Multivariate analysis further identified educational level as a significant predictor of preventive practices, with respondents who had secondary education being less likely to engage in appropriate preventive behaviours compared to those with no formal education. Other socio-demographic factors, including age, gender, and marital status, did not show significant influence on preventive practices. Overall, the findings highlight a disconnect between knowledge, perception, and practice, suggesting that preventive behaviours may not always be driven by adequate understanding or risk awareness. This emphasises the need for targeted health education programmes aimed at improving knowledge and reshaping community perceptions of WBDs. Strengthening WASH interventions, promoting safe water handling practices, and enhancing access to clean water and sanitation facilities are essential to reducing the burden of waterborne diseases in the study area. Future research should focus on evaluating the effectiveness of community-based interventions and extending similar studies to other rural and urban settings to provide comparative insights for policy and programme development.

Declarations

Data availability

The data sets that were utilized and examined in this study can be obtained from the corresponding author upon a reasonable request.

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Contributions

The authors' contributions to the article are as follows: SAI., JEE, CPU and PAK. played key roles in the study conception, data acquisition, analysis, and interpretation. SAI, and PAK. were involved in manuscript preparation. JEE, BEE and NCO, critically reviewed the research content. All authors read and approved the final manuscript draft.

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Ethics declarations

Ethics approval and consent to participate

A letter of introduction was secured from the Head of Department, and ethical approval was obtained from the Department of Public Health Ethical Clearance Committee, University of Calabar, under reference number UC/CM/PUH/ETH/2449. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Participants were fully informed about the purpose of the study, and written informed consent was obtained prior to their involvement. Confidentiality was guaranteed, and respondents were informed of their right to withdraw from the study at any time.

Clinical trial number

Not applicable

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests

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Figures

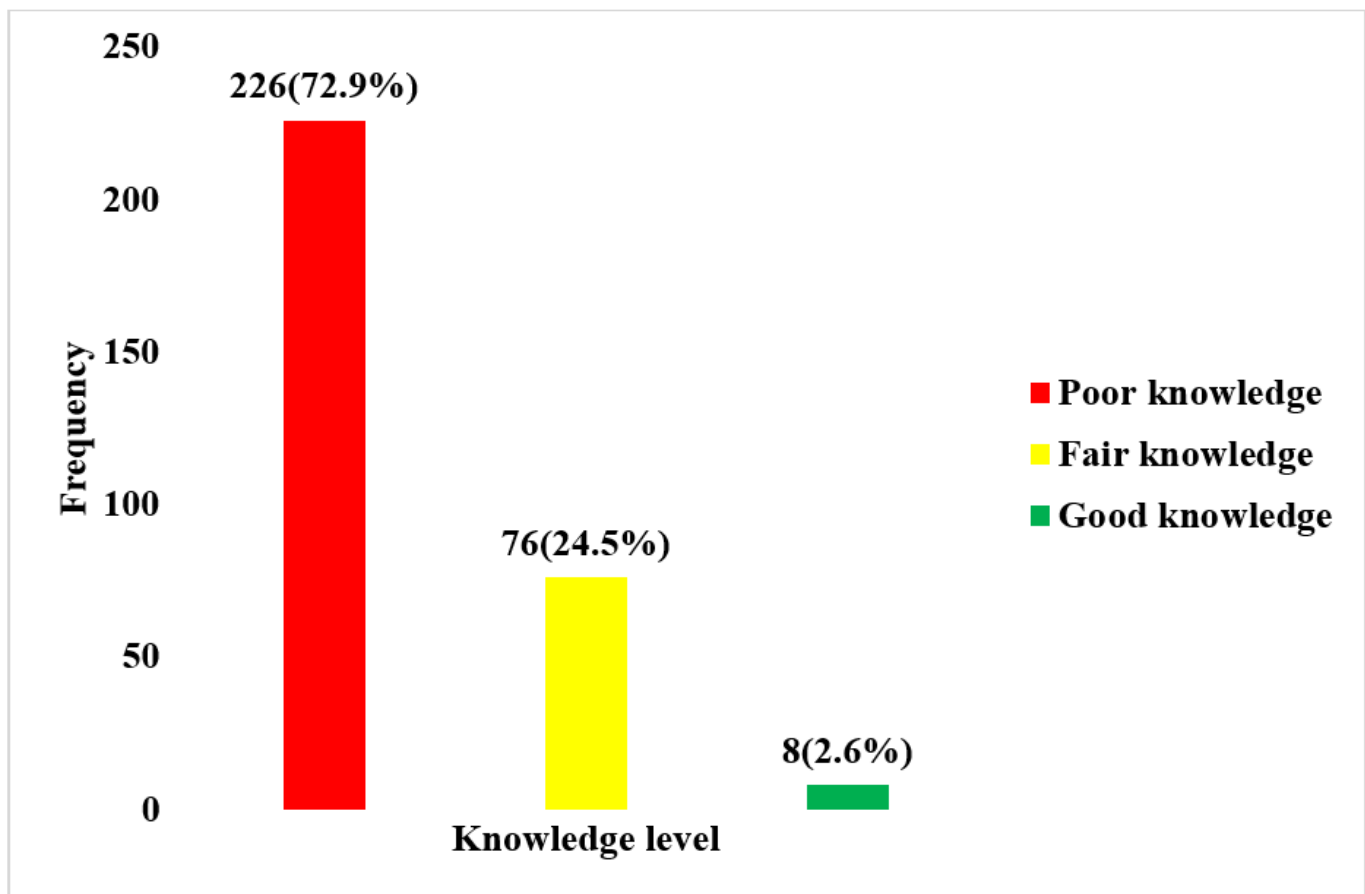


Figure 1

Knowledge level of waterborne infections among residents

Score range, 0-8 = poor knowledge; 9-11 = Fair knowledge; 12-15 = Good knowledge

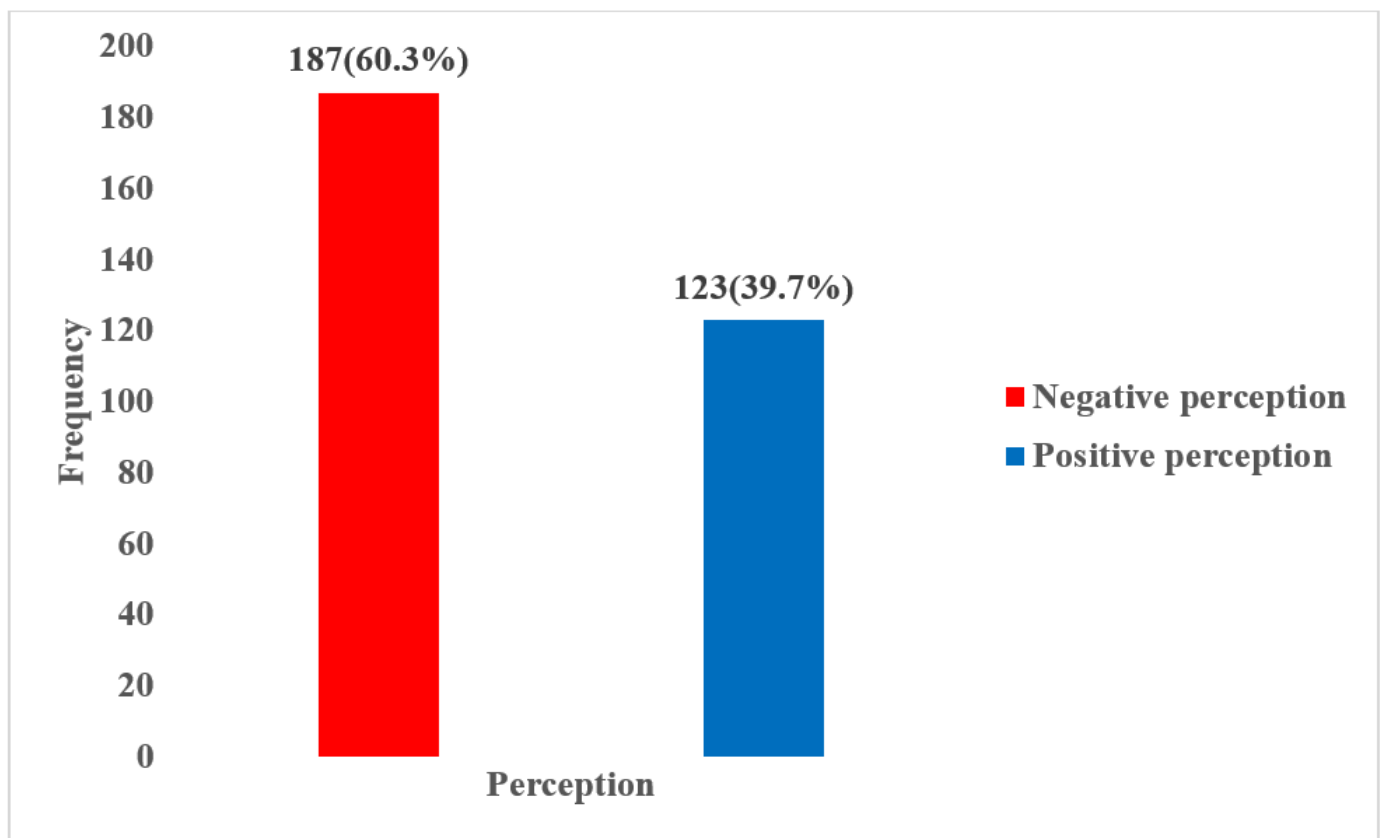


Figure 2

Perceptions towards waterborne infections

Score range: 0-13 Negative perception; 14-27 Positive perception

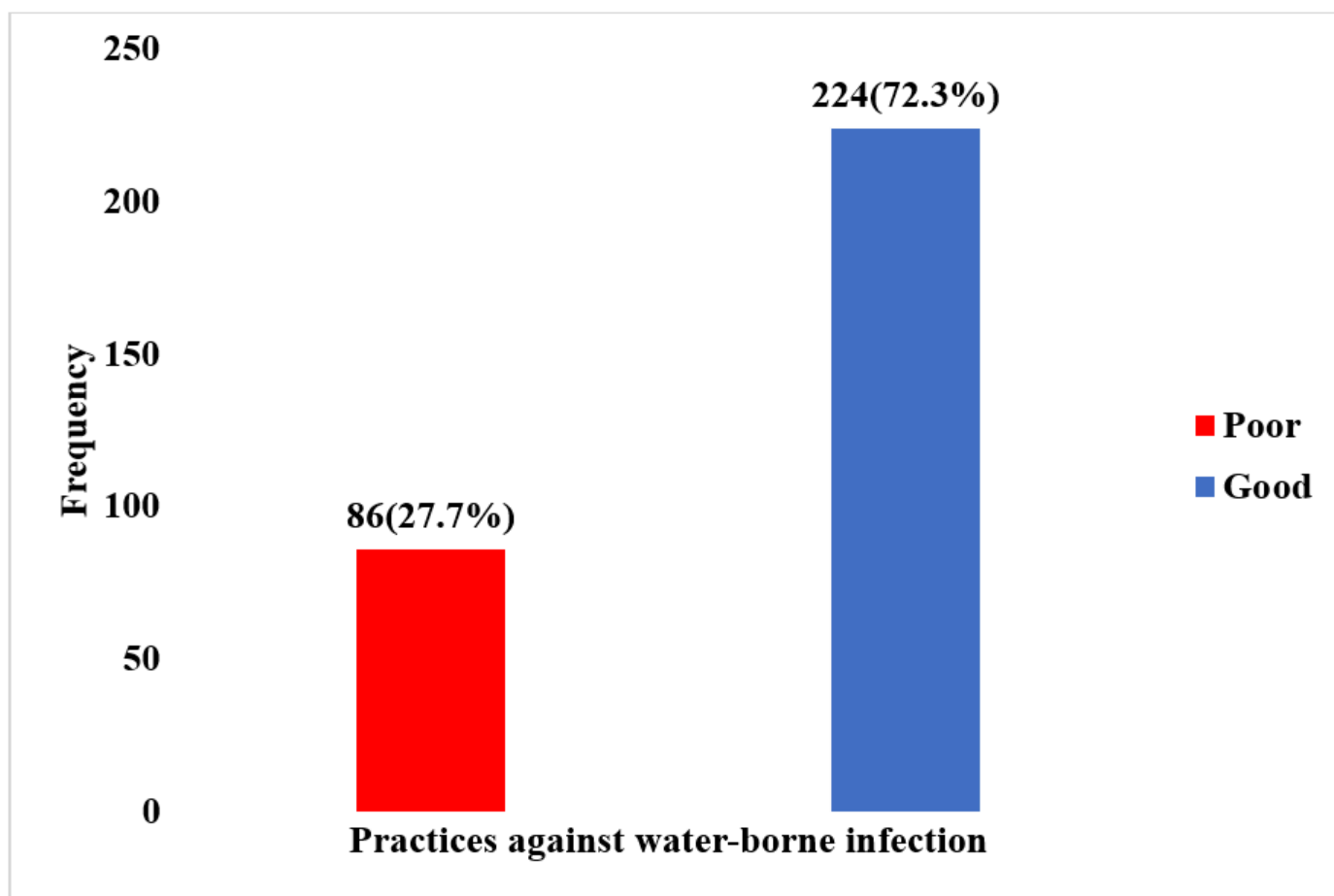


Figure 3

Practice level against water-borne infections

Score range: 0-7 = Poor; 8-15= Good