

# Exploring Pharmacists' Knowledge, Perception, and Practice regarding the Recent Cholera Outbreak in Nigeria

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## ABSTRACT

**Background:** Cholera outbreak is a significant public health concern in Nigeria, and pharmacists play critical roles in preventing and managing outbreaks. However, there is limited research on their knowledge, perception, and practices about cholera. This study explored pharmacists' knowledge, perception, and practices about cholera during the recent cholera outbreak in Nigeria.

**Methods:** This cross-sectional study was conducted between August 1 and August 31, 2024. A sample size of 374 pharmacists was calculated using Epi-Info software based on an estimated population of 13,924 licensed pharmacists. The survey tool was distributed across Nigeria's six geopolitical zones, via online and physical platforms. Specific data were collected using a four-structured self-administered questionnaire with focus on pharmacists' knowledge of cholera transmission, prevention, and treatment; their perceptions of the disease; and their involvement in cholera outbreak management. Reliability was evaluated using Cronbach's alpha and Guttman's Lambda. Descriptive and inferential statistics were computed using R (version 4.4.2).

**Results:** Three hundred and ninety-nine (399) pharmacists participated in the study, with a mean age of  $40.3 \pm 12.6$  years. The majority were males (54.2%) and practiced in community (39.3%) or hospital pharmacy (35.1%) settings. The overall mean knowledge score was  $20.9 \pm 3.0$  out of 30, with 58.1% of pharmacists demonstrating good knowledge of cholera. Most respondents (84.5%) had a positive perception of cholera management. Approximately 41.1% reported having managed cholera cases, but only 14.8% had reported cases to the Nigeria Centre for Disease Control (NCDC). Despite good knowledge, barriers such as limited access to formal training and a lack of involvement in disaster preparedness were identified.

**Conclusion:** Pharmacists in Nigeria exhibited good knowledge and a positive perception of cholera disease and are well-positioned to support cholera outbreak responses. Despite their involvement in the management of cholera disease, challenges such as limited access to training and a lack of formal inclusion in disaster preparedness plans must be addressed. Targeted interventions to enhance pharmacists' roles through continuous professional development and structured inclusion in national health emergency plans will be critical in mitigating future outbreaks.

## Introduction

Cholera, an acute diarrheal infection caused by ingesting food or water contaminated with *Vibrio cholerae*, remains a significant global health concern, particularly in regions with poor sanitation and limited access to clean water<sup>1</sup>. According to Ali et al. (2015)<sup>2</sup>, cholera outbreaks continue to pose a threat to public health, with an estimated 1.3 to 4

million cases and 21,000 to 143,000 deaths worldwide each year, predominantly in low- and middle-income countries<sup>2</sup>. Despite substantial efforts to prevent and control cholera, countries like Nigeria have continued to witness recurrent outbreaks, exacerbated by poor hygiene, inadequate water supply, and weak health systems<sup>1,3</sup>. Nigeria, with a population exceeding 200 million, has been

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one of the hardest-hit African nations in recent years, facing regular cholera outbreaks that claim thousands of lives. As of September 1, 2024, the Nigeria Centre for Disease Control and Prevention (NCDC) reported a total of 7,056 cases, including 204 deaths since the beginning of the year, with children below five years and young adults aged between 25-34 years being the most affected<sup>3</sup>. This translates to a 2.9% case fatality ratio (CFR). The peak in the reported cases occurred in June through to September and coincided with the peak of the country's rainy season. The recurrence of cholera in Nigeria indicates the need for sustainable public health interventions.

In cholera-endemic regions like Nigeria, pharmacists are integral members of the healthcare system, playing vital roles in both the prevention and management of infectious diseases, including cholera<sup>4</sup>. Their responsibilities include educating the public on safe water practices, dispensing oral rehydration salts (ORS) and antibiotics, and providing guidance on the proper use of vaccines. Community pharmacists are often known as one of the most accessible healthcare professionals, particularly in underserved and rural areas, where their involvement can significantly influence the outcome of public health interventions. However, despite their critical role, more research is needed to examine pharmacists' knowledge, perception, and practice regarding cholera outbreaks in Nigeria. Previous studies have focused primarily on the general preparedness of healthcare workers<sup>5</sup> and healthcare sector<sup>6</sup> with limited attention given to the specific contributions and challenges pharmacists face during such outbreaks. Moreover, barriers such as inadequate training, lack of access to updated clinical guidelines, and insufficient government support have been highlighted as significant challenges in the effective management of cholera by healthcare professionals in resource-limited countries like Nigeria<sup>6-8</sup>. This study aimed to address this gap by exploring the knowledge, perception, and practices of pharmacists in Nigeria regarding cholera outbreaks. The findings will provide valuable insights into the barriers and challenges pharmacists encounter and offer recommendations for enhancing their role in managing future outbreaks.

## Materials and Methods

### Study Design

This study utilized a cross-sectional survey designed to explore the knowledge, perception, and practices of pharmacists regarding the prevention, diagnosis, and

management of cholera outbreaks in Nigeria. The survey was conducted between August 1 and August 31, 2024 via online and in-person administration channels to ensure broad participation.

### Study Population and Sampling

The study population consisted of pharmacists practicing in various fields and settings, across Nigeria's six geopolitical zones. According to the Register of the Pharmacy Council of Nigeria (PCN, 2023), there were 13,924 licensed pharmacists in the country as of 31st December 2023. A purposive sampling technique was used to ensure representation from clinical and non-clinical settings, spanning the six geopolitical zones and including urban and rural areas.

### Sample Size

A sample size of 374 pharmacists was calculated using Epi-Info software, based on an estimated population of 13,924 licensed pharmacists in Nigeria (as of 31st December 2023), with an expected prevalence of 50% and a 5% margin of error at a 95% confidence level. Proportional sample sizes for the respective geopolitical zones of the country were calculated as North Central (86), North East (19), North West (31), South East (41), South South (66), and South West (131).

### Questionnaire Development and Data Collection

Data was collected using a structured questionnaire, designed based on a comprehensive review of literature on cholera outbreaks and pharmacists' roles in healthcare. The draft questionnaire was subjected to review by six subject matter experts and was thereafter piloted. The pilot test was conducted with 10% of the sample size to ensure the clarity and reliability of the questionnaire, and revisions were made before commencement of data collection.

The questionnaire was divided into four sections:

1. Demographics: Age, gender, years of practice, and workplace setting (public/private, urban/rural).
2. Knowledge: Questions (16) assessing pharmacists' knowledge of cholera transmission, prevention, and treatment options.
3. Perception: Questions (9) examining pharmacists' perception of their roles in cholera management and prevention efforts.
4. Practice: Questions (4) addressing the pharmacists' practice behaviors, including involvement in cholera diagnosis, treatment, and community education.

## Data Analysis

Data were entered and analyzed using R (version 4.4.1). Scale reliability was evaluated using both Cronbach's alpha and Guttman's Lambda 6 (G6) where higher values indicated a higher level of reliability. Descriptive statistics (means, frequencies, percentages) were calculated to summarize the demographic information and the responses for knowledge, perception, and practice. The data were further analyzed using inferential statistics (bivariate and multivariate analyses, and chi-square tests) to examine the relationships between demographic factors and pharmacists' knowledge, perception, and practice regarding cholera outbreak in the country.

The first outcome variable of interest is pharmacists' knowledge of cholera prevention and management which was calculated as a continuous measure. The knowledge questions comprised twelve multiple-choice questions and four multiple-response questions. For the multiple-choice questions, one point was assigned to each "correct" response and zero point was assigned to each "incorrect" or "not sure" response. For multiple-response questions, one point was assigned to each correct option selected. Notably, failure to select an incorrect option from among the multiple-response options was regarded as a correct response, as such, one point was also awarded. These amounted to a total of 30 points. Furthermore, individual scores were dichotomized into "poor" and "good" knowledge using a cutoff point of 70% (equivalent to 21/30 correct responses). This 70% cutoff point was chosen to be more lenient and reflective.

The second outcome variable of interest measures pharmacists' perception of the prevention and management of cholera and was measured as a 5-point Likert scale consisting of 7 items in total. The variable was dichotomized into "positive" (Agree/Strongly Agree) and "negative" (Disagree/Strongly Disagree/Neutral) categories. A p-value of <0.05 was considered statistically

significant. Following binomial logistic regression, a stepwise model was generated based on the Akaike Information Criterion (AIC) for the knowledge score.

## Ethical Considerations

Ethical approval for this study was obtained from the Oyo State Ministry of Health Research Ethics Committee (NHREC/OYOSHRIEC/10/11/22). All participants were informed of the study's purpose and provided written or electronic consent before participation. The anonymity and confidentiality of participants were maintained throughout the study.

## Results

### Sociodemographic Distribution of Respondents

A sample size of 374 pharmacists were targeted, and 399 responses were received, and analysed. The mean age of participants was  $40.3 \pm 12.6$  years. The majority were males (54.2%), and were in the 18–29 years (28.1%) or  $\geq 50$  years (27.8%) age groups. Most pharmacists (46.6%) were from the South West geopolitical zone, followed by the South East zone (21.6%). Participants from North Central, South South, North East and North West zones did not meet their targeted proportion of responses, while those from South East and South West exceeded their targeted responses. The majority (74.9%) of respondents practiced in urban areas, with significantly fewer pharmacists working in semi-urban (17.5%) or rural (7.5%) settings. Over half of the pharmacists (50.9%) held a Bachelor of Pharmacy degree (BPharm), while others had Masters (15.8%) and PhDs (14.0%). Most participants practiced in community (39.3%) and hospital (35.1%) pharmacies. Additionally, 50.1% of the respondents had more than ten years of professional experience, while 32.8% had less than five years. The differences in geographical zone, region, education level, practice area, and experience were statistically significant, with  $p < 0.001$ .

**Table 1: Sociodemographic distribution of respondents**

Characteristics	N	%	P-value*
40.3 ± 12.6 years	399		
<b>Sex</b>			p>0.05
Female	182	45.8	
Male	215	54.2	
<b>Age group</b>			p>0.05
18-29 years	111	28.1	
30-39 years	92	23.3	
40-49 years	82	20.8	
50 years and older	110	27.8	

<b>Geographic zone</b>			p<0.001
North Central	55	13.8	
North East	10	2.5	
North West	11	2.8	
South East	86	21.6	
South South	51	12.8	
South West	186	46.6	
<b>Geographic area</b>			p<0.001
Rural	30	7.5	
Semi-urban	70	17.5	
Urban	299	74.9	
<b>Education</b>			p<0.001
BPharm	203	50.9	
PharmD	28	7.0	
FPCPharm	49	12.3	
Masters	63	15.8	
PhD	56	14.0	
<b>Area of practice</b>			p<0.001
Academic	44	11.0	
Community	157	39.3	
Hospital	140	35.1	
Industry	21	5.3	
Public health	14	3.5	
Regulatory/Administration	23	5.8	
<b>Years of Practice</b>			p<0.001
< 5 years	131	32.8	
5-10 years	68	17.0	
≥ 10 years	200	50.1	

\* All p-values from Chi-square statistics

FPCPharm => Fellow of the West African Post-graduate College of Pharmacists

## Pharmacists' Knowledge of Cholera

### Bivariate analysis of factors associated with knowledge of Cholera

In the bivariate analysis of factors associated with pharmacists' knowledge of cholera (Table 2), the overall mean knowledge score was  $20.9 \pm 3.0$  (min=12, max=27) out of a total score of 30 points. Furthermore, 58.1% of respondents are categorized to have a good knowledge of the disease while 41.9% are categorized to have a poor knowledge of the disease. There was a significant association between sex and knowledge level ( $p = 0.02$ ), where males demonstrated a higher proportion of good knowledge (63.7%) compared to females (52.2%).

Although not statistically significant, a trend was observed with age. Pharmacists aged 50 years and older had the highest percentage of good knowledge (66.4%, mean= 21.6), while those aged 18-29 years showed relatively lower levels of good knowledge (49.5%, mean=20.2) ( $p = 0.089$ ). Similarly, respondents from the North East (70.0%) and those from the South South zones exhibited the highest proportion of good knowledge (66.7%), although these differences were not statistically significant ( $p = 0.118$ ).

When considering educational qualifications, pharmacists with a Master's degree (68.3%) and those who have attained FPCPharm (Fellow of the West African Post-graduate College of Pharmacists) title (67.3%) showed a higher percentage of good knowledge compared to those with a BPharm (53.7%) or PhD (53.6%). However, this association did not reach statistical significance ( $p = 0.161$ ). Similarly, no significant associations were observed in practice area ( $p = 0.367$ ) or experience level ( $p = 0.209$ ), although pharmacists with less than five years of experience had slightly higher levels of good knowledge (61.8%) compared to those with ten or more years of experience (51.9%).

**Table 2: Bivariate analysis of the factors associated with pharmacists' knowledge of cholera outbreak**

Characteristics	Mean ± SD	Poor N (%)	Good N (%)	p-value*
<b>Overall</b>	20.9 ± 3.0	167 (41.9%)	232 (58.1%)	
<b>Sex</b>				0.02
Female	20.6 ± 2.9	87 (47.8%)	95 (52.2%)	
Male	21.1 ± 3.0	78 (36.3%)	137 (63.7%)	
<b>Age group</b>				0.089
18-29 years	20.2 ± 3.1	56 (50.5%)	55 (49.5%)	
30-39 years	20.9 ± 3.0	37 (40.2%)	55 (59.8%)	
40-49 years	20.8 ± 2.8	34 (41.5%)	48 (58.5%)	
50 years and older	21.6 ± 2.8	37 (33.6%)	73 (66.4%)	
<b>Geographic zone</b>				0.118
North-central	21.2 ± 2.8	20 (36.4%)	35 (63.6%)	
North-east	21.3 ± 3.1	3 (30.0%)	7 (70.0%)	
North-west	20.7 ± 2.0	4 (36.4%)	7 (63.6%)	
South-east	20.0 ± 3.3	47 (54.7%)	39 (45.3%)	
South-south	21.0 ± 2.9	17 (33.3%)	34 (66.7%)	
South-west	21.1 ± 2.9	76 (40.9%)	110 (59.1%)	
<b>Geographic area</b>				0.118
Rural	20.2 ± 3.3	15 (50.0%)	15 (50.0%)	
Semi-urban	21.1 ± 2.8	22 (31.4%)	48 (68.6%)	
Urban	20.9 ± 3.0	130 (43.5%)	169 (56.5%)	
<b>Education</b>				0.161
BPharm	20.6 ± 3.1	94 (46.3%)	109 (53.7%)	
PharmD	20.7 ± 3.4	11 (39.3%)	17 (60.7%)	
FPCPharm	21.4 ± 3.0	16 (32.7%)	33 (67.3%)	
Masters	21.4 ± 2.5	20 (31.7%)	43 (68.3%)	
PhD	20.9 ± 2.8	26 (46.4%)	30 (53.6%)	
<b>Area of Practice</b>				0.367
Academic	20.3 ± 2.7	24 (54.5%)	20 (45.5%)	
Community	21.1 ± 3.0	60 (38.2%)	97 (61.8%)	
Hospital	20.7 ± 3.0	59 (42.1%)	81 (57.9%)	
Industry	20.8 ± 3.0	11 (52.4%)	10 (47.6%)	
Public health	21.4 ± 2.6	5 (35.7%)	9 (64.3%)	
Regulatory/Administration	21.2 ± 3.6	8 (34.8%)	15 (65.2%)	
<b>Years of Practice</b>				0.209
< 5 years	21.1 ± 3.3	26 (38.2%)	42 (61.8%)	
5-10 years	21.1 ± 2.9	78 (39.0%)	122 (61.0%)	
≥ 10 years	20.4 ± 2.9	63 (48.1%)	68 (51.9%)	

\* All p-values from Chi-square statistics

FPCPharm => Fellow of the West African Post-graduate College of Pharmacists

### Multivariate analysis of factors associated with knowledge of Cholera

In the multivariate analysis of factors associated with pharmacists' knowledge of cholera (Table 3), several variables showed significant associations in both the initial and final models. Age remained a significant factor, with an adjusted odds ratio (aOR) of 1.01 ( $p = 0.003$ ), suggesting that older pharmacists were slightly more likely to have better knowledge of cholera.

Sex was also significantly associated with knowledge in the final model, with males being more likely to have good knowledge compared to females (aOR = 1.12,  $p = 0.017$ ).

Respondents' geographical zones, areas of practice, educational qualifications, and regions were not significantly associated with knowledge in the final model.

Table 3: Multivariate analysis of the factors associated with pharmacists' knowledge of cholera outbreak

Characteristics	Crude OR (95% CI)	p-value	aOR (95% CI)	p-value
<b>Intercept</b>	-		1.34 (1.13, 1.59)	<0.0001
	1.02 (1.01, 1.04)	<b>0.004</b>	1.01 (1.00, 1.01)	<b>0.003</b>
<b>Sex</b>				
Female	Reference		Reference	
Male	1.61 (1.08, 2.41)	<b>0.021</b>	1.12 (1.02, 1.24)	<b>0.017</b>
<b>Geographic zone</b>				
North-central	Reference			
North-east	1.33 (0.33, 6.72)			
North-west	1.00 (0.27, 4.21)			
South-east	0.47 (0.23, 0.94)	<b>0.035</b>		
South-south	1.14 (0.51, 2.56)			
South-west	0.83 (0.44, 1.53)			
<b>Geographic area</b>				
Rural	Reference			
Semi-urban	2.18 (0.91, 5.29)			
Urban	1.30 (0.61, 2.77)			
<b>Education</b>				
B.Pharm	Reference			
PharmD	1.33 (0.60, 3.07)			
FPCPharm	1.78 (0.93, 3.51)			
Masters	1.85 (1.03, 3.42)	<b>0.043</b>		
PhD	1.00 (0.55, 1.81)			
<b>Area of Practice</b>				
Community	Reference			
Academic	0.52 (0.26, 1.01)	0.054*		
Hospital	0.85 (0.53, 1.35)			
Industry	0.56 (0.22, 1.41)			
Public health	1.11 (0.37, 3.77)			
Regulatory/Administrat	1.16 (0.47, 3.03)			
<b>Experience</b>				
< 5 years	Reference			
5-10 years	1.50 (0.83, 2.74)			
≥ 10 years	1.45 (0.92, 2.26)			

All p-values above 0.10 significance level were excluded

\* p-value significant at 0.10 alpha level

## Perception of Pharmacists on Cholera Management

### Reliability analysis

The scale demonstrated excellent internal consistency, with a Cronbach's alpha of 0.91 (95% CI: 0.85–0.94). Similarly, Guttman's Lambda 6 indicated a high level of reliability ( $G6 = 0.94$ ), reinforcing the robustness of the scale. The average inter-item correlation was 0.62, suggesting strong relationships among the items. Additionally, all individual items exhibited high corrected item-total correlations ( $r \geq 0.55$ ), indicating that each item contributed meaningfully to the overall scale. No items significantly increased or decreased the scale's reliability when considered for removal, further supporting the scale's consistency. The distribution of responses across all items showed no missing data, ensuring the completeness of the dataset for analysis.

### Perception of pharmacists

The study assessed pharmacists' perceptions of their role and confidence in managing cholera outbreaks (Table 4). Most pharmacists (81.2%) expressed confidence in their

ability to guide cholera prevention and treatment, while only a small proportion (13.8%) disagreed or strongly disagreed. Training on cholera management was reported by 73.2% of respondents, though a notable 14.3% disagreed or strongly disagreed that they had received any training.

Most pharmacists (84.7%) strongly agreed or agreed that they have a role to play in addressing the cholera outbreak. A significant proportion (77.5%) also believed it is their responsibility to ensure the continuous supply of cholera vaccines during an outbreak and to maintain vaccine quality. Furthermore, 79.4% of respondents felt that pharmacists trained in vaccination could administer cholera vaccines during an outbreak.

There was also strong support for pharmacist involvement in emergency planning and disaster preparedness, with 82.7% agreeing or strongly agreeing that pharmacists should be included in such efforts. Additionally, 83.8% of respondents agreed or strongly agreed that enhanced training on disaster management and emergency preparedness is necessary to effectively address cholera outbreaks.

**Table 4: Respondents' perception on cholera management**

Scale Item	Strongly disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly agree N (%)
Pharmacists are confident in their ability to provide guidance on cholera prevention and treatment.	42 (10.5)	13 (3.3)	20 (5.0)	156 (39.1)	168 (42.1)
Pharmacists receive some form of training on cholera management.	39 (9.8)	18 (4.5)	50 (12.5)	156 (39.1)	136 (34.1)
Pharmacists have a role to play in the fight against the cholera outbreak.	43 (10.8)	4 (1.0)	14 (3.5)	89 (22.3)	249 (62.4)
It is the responsibility of the pharmacist to ensure continuous supply of cholera vaccine during an outbreak and to ensure that the vaccines supplied are in optimal condition.	45 (11.3)	13 (3.3)	32 (8.0)	106 (26.6)	203 (50.9)
Pharmacists trained in the art of vaccination can also administer cholera vaccines during an outbreak	46 (11.5)	10 (2.5)	26 (6.5)	99 (24.8)	218 (54.6)
Pharmacists should be involved in emergency planning and disaster preparedness during cholera outbreak.	42 (10.5)	6 (1.5)	21 (5.3)	99 (24.8)	231 (57.9)
Pharmacists need enhanced training on disaster management and emergency preparedness to be able to properly address cholera outbreaks effectively.	44 (11.0)	6 (1.5)	15 (3.8)	90 (22.6)	244 (61.2)

### Factors associated with perception

A bivariate analysis was conducted to examine factors associated with pharmacists' perceptions of cholera (Table 5). Most respondents (84.5%) had a positive perception of cholera management. Pharmacists with good knowledge of cholera were significantly more likely to have a positive perception (88.8%,  $p = 0.005$ ) compared to those with poor knowledge (78.4%). No significant associations were observed between perception and sex ( $p = 0.408$ ), age category ( $p = 0.855$ ), or geo-zone ( $p = 0.143$ ). While there were variations across regions, with 86.3% of urban pharmacists having a positive perception compared to 73.3% of rural pharmacists, the difference was not statistically significant ( $p = 0.13$ ).

Education level and practice area also did not show a significant association with perception, with  $p$ -values of 0.389 and 0.386, respectively. Similarly, work experience was not significantly associated with perception ( $p = 0.674$ ), although pharmacists with more than 10 years of experience had slightly higher positive perceptions (86.0%) compared to those with less experience.

**Table 5: Bivariate analysis of factors associated with perception of cholera**

Characteristics	Negative N (%)	Positive N (%)	p-value
<b>Overall</b>	62 (15.5)	337 (84.5)	
<b>Knowledge</b>			<b>0.005</b>
Good	26 (11.2)	206 (88.8)	
Poor	36 (21.6)	131 (78.4)	
<b>Sex</b>			0.408
Female	25 (13.7)	157 (86.3)	
Male	36 (16.7)	179 (83.3)	
<b>Age group</b>			0.855
18-29 years	17 (15.3)	94 (84.7)	
30-39 years	15 (16.3)	77 (83.7)	
40-49 years	10 (12.2)	72 (87.8)	
50 years and older	18 (16.4)	92 (83.6)	
<b>Geographic Zone</b>			0.143
NC	10 (18.2)	45 (81.8)	
NE	4 (40.0)	6 (60.0)	
NW	-	11 (100.0)	
SE	16 (18.6)	70 (81.4)	
SS	7 (13.7)	44 (86.3)	
SW	25 (13.4)	161 (86.6)	
<b>Region</b>			0.13
Rural	8 (26.7)	22 (73.3)	
Semi-urban	13 (18.6)	57 (81.4)	
Urban	41 (13.7)	258 (86.3)	
<b>Education</b>			0.389
BPharm	33 (16.3)	170 (83.7)	
FPCPharm	5 (10.2)	44 (89.8)	
Masters	10 (15.9)	53 (84.1)	
PhD	12 (21.4)	44 (78.6)	
PharmD	2 (7.1)	26 (92.9)	
<b>Area of Practice</b>			0.386
Academic	8 (18.2)	36 (81.8)	
Community	30 (19.1)	127 (80.9)	
Hospital	15 (10.7)	125 (89.3)	
Industry	4 (19.0)	17 (81.0)	
Public health	1 (7.1)	13 (92.9)	
Regulatory/Administration	4 (17.4)	19 (82.6)	
<b>Years of Practice</b>			0.674
< 5 years	23 (17.6)	108 (82.4)	
5-10 years	11 (16.2)	57 (83.8)	
≥ 10 years	28 (14)	172 (86.0)	



### Pharmacists' Practice Regarding Cholera Management

In terms of practice, a significant portion of pharmacists (41.1%) reported having managed cholera cases either at home or in their place of work (Table 6). However, 53.6% indicated they had never managed such cases, while 5.3% were unsure. When it came to reporting suspected cholera outbreaks, only 14.8% of pharmacists had ever reported a case to the Nigeria Centre for Disease Control (NCDC) or the nearest hospital, with the majority (83%) indicating they had not reported a case.

A high percentage of pharmacists (90.5%) expressed their readiness to contribute to the development of new treatments and vaccines through research and development. Regarding preventive measures, nearly all respondents (98%) practiced handwashing, and 91.7% engaged in proper disposal of feces and drinking treated water. Health education was also a prominent practice, with 91.5% of pharmacists incorporating it into their cholera prevention strategies. Other common measures included reducing the number of people in a room (37.1%) and the use of antibiotics (27.3%).

Several barriers were identified that hinder pharmacists' roles during cholera outbreaks. The most frequently cited barrier was the lack of resources, including vaccines and equipment (89%), followed by staff shortages and workload constraints (70.2%). Additionally, more than half of the respondents mentioned personal protective equipment shortages (62.7%), lack of requisite training (54.9%), and funding and resource allocation shortages (79.2%). Cultural and language barriers were reported by 49.4% of pharmacists.

**Table 6: Respondents' practice regarding cholera management**

Characteristics	N	%
<b>Have you ever managed cholera cases at home or place of work?</b>		
Yes	164	41.1
No	214	53.6
Not sure	21	5.3
<b>Have you ever reported a suspected case of a cholera outbreak to the NCDC or the nearest hospital?</b>		
Yes	59	14.8
No	331	83.0
Not sure	9	2.3
<b>Are you ready to contribute to the development of new treatments and vaccines via research and development?</b>		
Yes	361	90.5
No	20	5
Not sure	18	4.5
<b>What measures do you take to prevent the spread of cholera at home or place of practice</b>		
Hand washing	391	98
Reduce the number of people in a room	148	37.1
Health education	365	91.5
Unclean environment	0	0
Proper disposal of faeces	366	91.7
Drinking treated water	366	91.7
Use of antibiotics	109	27.3
<b>Which of the following do you perceive as barriers to the Pharmacist's role during the cholera outbreak?</b>		
Lack of resources including vaccines and equipment	355	89
Staff shortage and workload constraints	280	70.2
Cultural and language barriers	197	49.4
Lack of requisite training on cholera management	219	54.9
Personal protective equipment shortages	250	62.7
Funding and resource allocation shortages	318	79.2

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## Discussion

This study provides valuable insights into the knowledge, perceptions, and practices of pharmacists in Nigeria regarding the recent cholera outbreak, focusing on sociodemographic variations and the factors influencing their understanding and engagement in cholera management. The findings indicate that a significant proportion of pharmacists exhibited good knowledge of cholera, with factors such as age and sex showing statistically significant associations. However, the relationship between level of education, area of practice, and cholera knowledge was not statistically significant, a result that contrasts with previous studies<sup>9-11</sup>, highlighting the importance of advanced education in improving health-related knowledge.

The higher levels of knowledge observed among older pharmacists and males suggest that experience and potential exposure to cholera outbreaks could be critical factors. Older pharmacists may have encountered previous outbreaks or engaged in more professional development activities. Male pharmacists also had a significantly higher proportion of good knowledge compared to their female counterparts, which could reflect gender disparities in access to training opportunities or differential engagement in outbreak responses. This finding is consistent with other studies that have noted gender-based differences in health education outcomes<sup>10</sup>.

Although geographic region did not show a statistically significant association with knowledge, pharmacists from regions that are historically more affected by cholera, such as the North-East and South-South, demonstrated higher knowledge levels. This could be attributed to their first-hand experience and heightened awareness of cholera-related challenges, as observed in past outbreaks<sup>11</sup>.

Perceptions of pharmacists about their role in cholera management were generally positive, with over 80% expressing confidence in their ability to provide guidance on cholera prevention and treatment. However, a notable gap was observed in the proportion of pharmacists who reported receiving formal training on cholera management. This gap emphasizes the need for more structured and widespread training programs to enhance the capacity of pharmacists, particularly in rural and underserved areas where cholera outbreaks are more frequent but health resources are often limited<sup>1</sup>.

The findings from this study align with the growing body of literature advocating for the expanded role of pharmacists in outbreak management. Pharmacists are increasingly recognized as key players in public health interventions,

particularly in ensuring vaccine supply chains and providing patient education during outbreaks<sup>4</sup>. However, their involvement in emergency planning and disaster preparedness, as well as in vaccination efforts during cholera outbreaks, remains limited. The high level of support expressed by respondents for these roles highlights an opportunity for policymakers to formally integrate pharmacists into emergency response frameworks, thereby leveraging their expertise in pharmaceutical care and disease prevention.

The pharmacists' practice of infection control and prevention measures varied significantly. While many adhered to general hygiene practices, the consistent use of personal protective equipment (PPE) and more specialized infection control strategies was less frequent. This variation may be due to the limited availability of PPE and the inconsistent training on infection control protocols during outbreaks. Addressing these practical gaps is crucial for enhancing the pharmacist workforce's preparedness for future cholera outbreaks.

## Study Strengths and Limitations

The study is very timely, considering the current mortalities and morbidities arising from the cholera outbreak and the severe impacts on the communities in many parts of Nigeria. Despite their potential role in disease prevention and management, pharmacists are often overlooked in public health responses. Also, the study has provided a more in-depth understanding of pharmacists' capabilities and limitations for future interventions and policies that can encourage pharmacists' integration into health response teams and promote interdisciplinary approaches in healthcare. Overall, the study can significantly impact academic knowledge and practical applications in public health, particularly in managing infectious diseases.

However, the cross-sectional design limits causal inferences regarding the associations between sociodemographic factors and cholera knowledge or perception. The use of a purposive sampling technique and the reliance on self-reported data may introduce recall bias or social desirability bias. Future studies should consider longitudinal designs and incorporate objective measures of cholera knowledge, such as standardized assessments, to validate self-reported outcomes.

## Conclusion

This study demonstrates that pharmacists in Nigeria have a good understanding of cholera prevention and management, with most respondents exhibiting positive perceptions of their role in cholera outbreak control.

However, barriers such as insufficient training, lack of formal inclusion in national disaster preparedness plans, and resource constraints limit their full potential in public health responses. The results suggest that professional experience plays a significant role in outbreak preparedness.

By addressing the barriers identified, and integrating pharmacists into national health emergency frameworks, pharmacists can be more effectively mobilized as key players in managing future cholera outbreaks. Future public health policies should focus on improving pharmacists' training and preparedness, enhancing communication and reporting systems, and ensuring that pharmacists are included in emergency preparedness and outbreak response plans at both local and national levels. These actions will strengthen Nigeria's ability to respond to cholera outbreaks and other public health emergencies.

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