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Research article

COMPARATIVE ASSESSMENT OF CHOLERA OUTBREAKS AND ENVIRONMENTAL HYGIENE PRACTICES AMONG RESIDENTS OF SELECTED WARDS IN YAKURR LOCAL GOVERNMENT AREA, CROSS RIVER STATE, NIGERIA

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ABSTRACT

Cholera remains a major public health challenge in Nigeria, yet localized, comparative evidence on how cholera occurrence relates to environmental hygiene practices across neighbouring wards remains limited, leaving it unclear whether variations in access to safe drinking water and sanitation facilities influence the distribution of cholera outbreaks at the ward level. This study assessed cholera outbreaks and environmental hygiene practices among residents of selected wards in Yakurr Local Government Area, Cross River State, Nigeria. A cross-sectional research design combining questionnaire survey and direct observation was adopted. Seven wards, Nko, Mkpani/Agoi, Ekori, Idomi, Inyima, Assiga, and Ugep, were purposively selected based on the presence of a healthcare facility. Secondary data on cholera cases for the period 2021 to 2025 were obtained from healthcare centres within the selected wards, while primary data were collected from 400 respondents, proportionately allocated across the wards using the Taro Yamane formula, to assess residents' access to sanitation facilities and environmental hygiene practices. Data were analysed using descriptive statistics and the Chi-square (X^2) test. The findings revealed a statistically significant difference in the distribution of cholera cases across the wards and years of study ($X^2 = 272.257$, $df = 28$, $p < .001$). Mkpani/Agoi recorded the highest proportion of cholera cases (24.49%), while 2023 recorded the highest overall annual incidence (26.33%). The study further revealed inadequate access to improved sanitation facilities, with traditional pit latrines with open slabs the most common facility, and the persistence of unhygienic practices, including open dumping of refuse (21.5%), drinking of untreated water (23.5%), and open defecation (15.25%), among residents. The study concludes that inadequate access to safe water and sanitation facilities, together with unhygienic environmental practices, may contribute to the recurrence and uneven spatial distribution of cholera outbreaks in Yakurr Local Government Area, and recommends the provision of adequate sanitation facilities and sustained community health education to improve hygiene practices and reduce cholera incidence in the study area.

KEYWORDS

Cholera outbreaks; Environmental hygiene practices; Sanitation facilities; Environmental health; Yakurr Local Government Area; Cross River State

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INTRODUCTION

Cholera, a waterborne disease, remains a major public health challenge and a significant cause of morbidity and mortality globally, particularly in developing countries where access to safe drinking water, adequate sanitation facilities, and proper hygiene practices are limited. Cholera is an acute infectious disease caused by the bacterium *Vibrio cholerae* and is transmitted through the faecal-oral route, primarily through the ingestion of food or water contaminated with the pathogen; the portal of entry of the pathogen into the human body is the mouth, while the portal of exit is through faeces, which can contaminate water and food sources when improperly disposed of (Eyo, Oboma, Omubo, Ekpe, Agbor & Oyo-Ita, 2026). The disease is characterised by profuse watery diarrhoea, dehydration, and death within a short period if prompt treatment is not provided. The presence of *Vibrio Cholerae* in food served in hotels within the study area is a potential source of biological contamination and poses a risk to public health (Eyo, Fingite & Joshua, 2025). In addition to household transmission, poor safety practices among food handlers such as inadequate hand hygiene and handling food without appropriate Personal Protective Equipment (PPE), including gloves may facilitate the transmission of *Vibrio Cholerae* from infected food handlers to hotel guests in the study area (Eyo, Omubo, Joshua, Ekpe, Oboma, Bassey & Ndiyo, 2025).

Over the past 150 years, cholera outbreaks have remained a significant global health challenge, with the greatest burden occurring in Africa, Asia, and Central and South America (Eneh, Onukansi, Anokwuru, Ikhuoria, Edeh, Obiekwe, Dauda, Praise-God & Okpara, 2024). Large cholera outbreaks have been reported in the twenty-first century in countries including Haiti, Yemen, Nigeria, the Democratic Republic of Congo, the Dominican Republic, Egypt, Somalia, Bangladesh, Pakistan, the Philippines, China, Ghana, and Cameroon, while the disease remains endemic in several of these countries (Ilic & Ilic, 2023; Eneyo, 2026a). It is estimated that approximately 2.9 million cholera cases occur globally each year, resulting in 95,000 deaths, with the majority of cases and fatalities occurring in low- and middle-income countries (Sow, Haruna, Amos, Olajide, Amene & Odususi, 2022; Eneyo, 2026b). In 2021, cholera outbreaks were reported in the World Health Organization's African and Eastern Mediterranean Regions, and the global resurgence continued into 2022, with outbreaks in 30 countries across five of the six WHO regions (WHO, 2024). Nigeria is among the countries with the highest burden of cholera in sub-Saharan Africa and the disease is considered endemic in the country; since the first major outbreak in 1970, Nigeria has experienced several significant epidemics, including those of 1991 (59,478 cases, 7,654 deaths, case fatality rate of 12.9%), 2010 (41,787 cases, 1,716 deaths across 18 states, case fatality rate of 4.1%), 2018 (43,916 cases, 836 deaths across 20 states, case fatality rate of 2%), and mid-2024 (1,579 suspected cases, 54 deaths across 32 states, case fatality rate of 3.4%) (Eneh et al., 2024; Eneyo, 2026c).

The consistent recurrence of cholera outbreaks in Nigeria indicates that the country is highly vulnerable to the disease due to several interrelated factors, including inadequate access to safe drinking water, flooding, poverty, illiteracy, poor sanitation infrastructure, limited access to quality healthcare, population displacement resulting from conflict, and weak disease surveillance systems (Smith, 2024), conditions that together create a favourable environment for the transmission and persistence of *Vibrio cholerae*. Cross River State has similarly experienced recurrent cholera outbreaks over the years despite efforts by government agencies and development partners to improve knowledge of cholera transmission pathways and to implement preventive and control measures, suggesting that existing interventions may not have adequately addressed the underlying environmental and sanitation-related determinants of the disease. Yakurr Local Government Area comprises communities with varying levels of environmental hygiene practice and sanitation infrastructure, and differences in access to toilet facilities, safe potable water, waste management services, drainage systems, and household hygiene behaviour may influence the occurrence and spread of cholera across its wards. Environmental hygiene practices such as proper waste disposal, regular cleaning of surroundings, safe storage and treatment of drinking water, use of improved sanitation facilities, and good personal hygiene have been recognised as critical measures for the prevention and control of cholera (WHO & UNICEF, 2023).

However, studies comparing cholera outbreaks with environmental hygiene practices among residents across selected wards in Yakurr Local Government Area of Cross River State are limited, so that it remains unclear whether variations in access to safe drinking water and sanitation facilities influence the occurrence and distribution of cholera outbreaks across these wards. This lack of localised comparative evidence constitutes a significant knowledge gap, and addressing it will provide valuable information for identifying communities at greater risk and for designing targeted environmental health interventions aimed at preventing and controlling future outbreaks.

It is against this background that the present study was designed, with the broad aim of undertaking a comparative assessment of cholera outbreaks and environmental hygiene practices among residents of selected wards in Yakurr Local Government Area, Cross River State, Nigeria. Specifically, the study sought to assess the distribution of cholera cases across the selected wards and within the study period (2021-2025), to assess residents' access to sanitation facilities in the selected wards, and to examine environmental hygiene practices among residents in the study area, on the hypothesis that there is no significant difference in the distribution of cholera cases across the wards and years of study in Yakurr Local Government Area.

LITERATURE REVIEW

Global Evidence on Sanitation, Hygiene, and Cholera

Environmental sanitation and good hygiene practices are important considerations for the control of cholera. Environmental sanitation is the maintenance of hygienic conditions through services such as garbage collection

and wastewater disposal, and can also be understood as the control of all factors in the physical environment capable of causing harmful effects on human health and survival (Alabi, 2010). Between 2000 and 2022, 2.1 billion people globally gained access to safe drinking water, and the number of people lacking at least basic drinking water services decreased from 1.2 billion to 703 million; two thirds, 1.4 billion, of those with access to safe drinking water services lived in urban areas, compared with 704 million in rural areas. In 2022, 57% of the global population, 4.5 billion people, used safe sanitation services, while 75% of the global population, 6 billion people, had a basic handwashing facility with soap and water available at home, 17%, 1.4 billion people, had handwashing facilities lacking water or soap, and 8%, 640 million people, had no handwashing facility at all (WHO & UNICEF, 2023). This global evidence establishes water, sanitation, and hygiene access as a foundational determinant of cholera risk, one that this study examines at the more localised ward level within Yakurr Local Government Area.

Regional and African Evidence

In sub-Saharan Africa and other developing regions, 1.7 billion people still obtain their water from faeces-polluted sources, contributing to a significant number of cholera deaths (Ebob, 2020). In Nigeria specifically, 30% of the population lacks access to basic water services, only 10% have access to safely managed water services, and 44% have access to basic sanitation services; it is estimated that 46 million Nigerians, 23% of the population, lack access to proper sanitation (USAID, 2021), while the World Bank has reported that Nigeria loses 455 billion naira, 1.3% of GDP, annually as a result of poor sanitation (Egbooboh, 2019). Cholera cases in Nigeria have increased significantly since the 1970s, primarily linked to limited access to safe water for drinking and to sanitation facilities, especially in rural areas where most of the population resides (NCDC, 2019), though cholera can still spread where personal and home hygiene practices are inadequate, underscoring the importance of public health education in minimising pathogen transmission (Anbarci, Escaleras & Register, 2012).

Studies have identified inadequate water, sanitation, and hygiene (WASH) services as an important factor in cholera outbreaks in Nigeria (Tarek, Bartel, de W., Jamie & Eline, 2023). Research on the genetic relatedness of *Vibrio cholerae* found that in Kano and Plateau States, contaminated wastewater used for irrigating vegetables contributed to cholera outbreaks (Abakpa & Umoh, 2023), while Chamley, Yennan, Ochu, Kelman, Gaythorpe and Murray (2023) established an association between conflict, climate, and increased cholera risk. Similarly, a study in Funtua Local Government Area, Katsina State, found that high temperatures and rainfall were significantly associated with cholera outbreaks between 1985 and 2014, with a peak particularly in August (Abaje, Abdullahi & Jeje, 2016). The number of cholera cases in Nigeria has varied from year to year, but the case fatality rate has shown a downward trend from a peak of 12.9% in the early 1990s to 4.1% in 2010, with the 1991 outbreak remaining the deadliest and the 2010 epidemic the most geographically widespread (Eneh et al., 2024), a decline that suggests a positive response to public health intervention and case management (Asaolu & Abiona, 2024). Nigeria has implemented various strategies, including public policy, surveillance, water purification, and hygiene promotion (Ayenigbara, Ayenigbara & Adeleke, 2019), established a National Cholera Multi-Sectoral Technical Working Group to monitor cholera incidence and support affected states, and deployed Integrated Disease Surveillance and Response and Event-Based Surveillance systems to continuously track cholera cases (NCDC, 2024), while the Nigeria Centre for Disease Control has partnered with Gavi and the World Health Organization to provide free cholera vaccines to affected areas (Ebob, 2020).

Local Research Gap

Notwithstanding this body of national and international evidence linking WASH access to cholera risk, studies comparing cholera outbreaks with environmental hygiene practices among residents across selected wards in Yakurr Local Government Area of Cross River State remain limited, so that it is not empirically established whether the ward-level variations in WASH access that characterise the Local Government Area translate into correspondingly uneven ward-level distributions of cholera cases. The present study therefore addresses this gap by comparing cholera case distribution against environmental hygiene practices and sanitation access across seven purposively selected wards in Yakurr Local Government Area over a five-year period, providing localised, comparative evidence to guide targeted environmental health interventions in the study area.

THEORETICAL FRAMEWORK

The study adopted the Disease Causation Theory, specifically the Epidemiologic Triad, as its guiding theoretical framework. The Epidemiologic Triad was first developed in the early twentieth century and is associated with the work of the American epidemiologist Wade Hampton Frost, who contributed to the development of the epidemiological concepts underlying the model. The model holds that disease results from the interaction of three components, agent, host, and environment. In this study, the agent is *Vibrio cholerae*, the bacterium responsible for cholera; the host refers to residents of the selected wards who may be exposed to contaminated water or food; and the environment refers to the external conditions that facilitate interaction between the agent and the host, such that inadequate sanitation facilities can encourage unhygienic practices, including open defecation and open dumping of waste, thereby promoting disease transmission.

Understanding the Epidemiologic Triad is useful for disease prevention and control because disease transmission can be disrupted by intervening in one or more of its components: providing safe water and adequate sanitation can reduce environmental exposure, while health education can promote safer behavioural practices among the host population. The model nonetheless has limitations; it is relatively simple and may not adequately capture the complex social, economic, behavioural, and institutional factors that influence cholera occurrence, and it is less effective in explaining the temporal variations in cholera outbreaks observed across wards. Despite these limitations, the Epidemiologic Triad remains a foundational model widely used in modern public health and provides a useful lens for interpreting the interaction between agent, host, and environment, and for identifying points for disease prevention and control, in the present study.

METHODOLOGY

Study Area

Yakurr Local Government Area is located in the Central Geographical Region of Cross River State, Nigeria. It lies between latitudes 5°45'N and 5°55'N of the equator and longitudes 8°11'E and 8°20'E of the Greenwich Meridian. The Local Government Area has a landmass of 48 square kilometres and a projected population of 326,557 persons in 2026 (Ebin, Efiang & Odunsi, 2019). Yakurr falls within the tropical rainforest zone, characterised by high temperature, rainfall, and humidity (Ibiang, Ozah & Inah, 2019). It comprises 13 council wards drawn from 9 communities and is predominantly inhabited by farming communities whose people exhibit a high degree of social cohesion, with strong cultural, political, religious, and linguistic affinities (Uyouyo, 2002). Settlement patterns are predominantly clustered, with residents living in close proximity to one another, a pattern that may pose challenges to effective solid waste management and environmental sanitation, particularly where waste collection and disposal facilities are inadequate (Bassey & Ubi, 2023).

Research Design

The study adopted a cross-sectional research design, combining a questionnaire survey with direct observation, so that residents' self-reported access to sanitation facilities and hygiene practices could be triangulated against field-observed conditions and compared against ward-level secondary data on reported cholera cases.

Sampling and Sample Size

The study adopted a stratified sampling technique followed by convenience sampling. Yakurr Local Government Area was stratified into seven wards, Nko, Mkpani/Agoi, Ekor, Idomi, Inyima, Assiga, and Ugep, purposively selected based on the location and availability of healthcare centres from which information on cholera cases could be obtained, a stratification that facilitated the collection and comparison of data on the occurrence and distribution of cholera outbreaks across the study area. The study population comprised the 326,557 residents of Yakurr Local Government Area, and using the Taro Yamane formula at a 5% level of precision, an overall sample size of 400 was determined and proportionately allocated across the seven wards based on their respective 2026 projected population sizes, as presented in Table 1. Respondents were selected from each ward based on their availability, residency in the area for at least five years, and willingness to participate in the study.

Table 1. Population of the selected wards and proportionate sample size

Ward	2014 est. population	2026 proj. population	Sample size
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Ward	2014 est. population	2026 proj. population	Sample size
Nko	35,482	49,334	60
Mkpani/Agoi	22,418	31,161	38
Ekori	54,501	75,756	93
Idomi	20,225	38,113	47
Inyima	15,224	21,161	26
Assiga	18,012	25,037	31
Ugep	61,867	85,995	105
Total	227,739	326,557	400

Each ward comprises 8 to 12 constituent communities. Adapted from Ebin, Efiang and Odunsi (2019).

Data Collection

Data were collected through the administration of a structured questionnaire to residents of the selected wards, designed to obtain data on residents' accessibility to safe potable water, toilet facilities, and waste management facilities, and on residents' hygiene practices. In addition to the questionnaire survey, direct observation was employed, using a checklist, to assess the availability of potable water, toilet facilities, waste management facilities, and residents' hygiene practices within the study area. Secondary data on cases of cholera outbreaks for a five-year period, 2021 to 2025, were obtained from healthcare centres within the selected wards.

Data Analysis

Data were analysed using descriptive statistics, including frequencies and percentages, to summarise residents' access to sanitation facilities and environmental hygiene practices. The Chi-square (X^2) test was used to test the hypothesis that there is no significant difference in the distribution of cholera cases across the wards and years of study, computed as $X^2 = \sum[(O - E)^2 / E]$, where O represents the observed frequency and E the expected frequency in each ward-year category, at the 5% level of significance.

RESULTS

Distribution of Cholera Cases Across Wards and Years

Table 2 presents the number of reported cholera cases across the seven sampled wards for each year of the study period, 2021 to 2025. A total of 1,090 cholera cases were reported across the study area over the five-year period. The proportion of cases increased from 18.35% (200 cases) in 2021 to a peak of 26.33% (287 cases) in 2023, after which it declined to 20.18% (220 cases) in 2024 and 13.21% (144 cases) in 2025. Across the wards, Mkpani/Agoi recorded the highest proportion of cases, 24.49% (267 cases), followed by Inyima, 17.98% (196 cases), and Assiga, 15.87% (173 cases), while Ugep recorded the lowest proportion, 7.61% (83 cases).

Table 2. Cholera cases across the wards within the years of study

Year	Nko	Mkpani/Agoi	Ekori	Idomi	Inyima	Assiga	Ugep	Total
2021	23	48	19	26	35	33	16	200
2022	29	57	22	32	41	38	20	239
2023	30	69	27	36	54	46	25	287
2024	25	61	21	28	39	32	14	220
2025	18	32	15	20	27	24	8	144
Total	125	267	104	142	196	173	83	1090

Figures are case counts (F); Total row/column percentages are reported in the text. Source: Fieldwork, 2026.

Access to Water, Sanitation, and Waste Management Facilities

Respondents reported access to different sources of drinking water, including streams, rainwater, boreholes, wells, and treated pipe-borne water. Across the wards, 45% of respondents reported streams as a source of drinking water, while less than 35% reported access to borehole water; except in Ugep, access to treated pipe-borne water was reported by none of the respondents across the wards. Regarding toilet facilities, more than

50% of respondents across the wards reported traditional pit latrines with open slabs as the most common facility, while less than 10% reported access to water closets in most wards, except in Ugep, where more than 30% reported access to water closets. Regarding waste management practices, 43.25% of respondents reported open dumping of refuse, 35% practised open defecation, 18% disposed of waste in streams, and only 3.5% reported burning their waste.

Environmental Hygiene Practices

Table 3 presents the positive environmental hygiene practices reported among residents of the sampled wards. Of the 400 respondents, 79.75% reported participating in community environmental sanitation activities around households and markets, while smaller proportions reported regular handwashing with water and soap especially after defecation and before handling food (7%), proper disposal of household waste (6.5%), treatment of water before drinking (3.75%), and proper use of toilet facilities (3%).

Table 3. Positive environmental hygiene practices among residents of Yakurr LGA

Practice	F	Per cent (%)
Regular handwashing with water and soap, especially after defecation and before handling food	28	7.00
Participation in community sanitation around households and markets	319	79.75
Proper use of toilet facilities	12	3.00
Treatment of water before drinking	15	3.75
Proper disposal of household waste	26	6.50
Total	400	100.00

Source: Fieldwork, 2026.

Table 4 presents the negative environmental hygiene practices reported among the same residents. Drinking of untreated water was the most commonly reported negative practice (23.5%), followed by open dumping of refuse (21.5%), poor hand hygiene or irregular handwashing (20.75%), poor food hygiene, that is, preparing or selling food in unhygienic conditions (19%), and open defecation (15.25%).

Table 4. Negative environmental hygiene practices among residents of Yakurr LGA

Practice	F	Per cent (%)
Open defecation	61	15.25
Open dumping of refuse	86	21.50
Poor hand hygiene / irregular handwashing	83	20.75
Drinking of untreated water	94	23.50
Poor food hygiene (preparing or selling food in unhygienic conditions)	76	19.00
Total	400	100.00

Source: Fieldwork, 2026.

The study also found that 56.52% of respondents were aware of the causes and preventive measures of cholera, while 18.25% were uncertain. Despite this level of awareness, residents reported experiencing challenges in adopting and maintaining appropriate hygiene behaviour, the major challenges reported across the wards being increased population and overcrowding (30.75%) and inadequate funding for sanitation in the study area.

Test of the Hypothesis

Table 5 presents the crosstabulation of cholera cases by ward and year of report, disaggregated into the eight community-level reporting categories from which the seven-ward totals in Table 2 were aggregated. Table 6 presents the corresponding Chi-square test result. The Pearson Chi-square value of 272.257, at 28 degrees of freedom, was statistically significant ($p < .001$), indicating a statistically significant difference in the distribution of cholera cases across the wards and years of study. The null hypothesis, that there is no significant difference in the distribution of cholera cases across the wards and years of study in Yakurr Local Government Area, was therefore rejected, confirming that cholera cases were not evenly distributed across the wards and study years.

Table 5. Wards by year of report crosstabulation (count)

Ward	2021	2022	2023	2024	2025	Total
Nko	23	29	30	25	18	125
Mkpani	48	0	0	61	32	141
Agoi	0	57	69	0	0	126
Ekorì	19	22	27	21	15	104
Idomi	26	32	36	28	20	142
Inyima	35	41	54	39	27	196
Assiga	33	38	46	32	24	173
Ugep	16	20	25	14	8	83
Total	200	239	287	220	144	1090

Mkpani and Agoi are the two constituent communities reported separately by their respective health facilities and combined as the Mkpani/Agoi ward in Table 2 (Mkpani + Agoi = 267), consistent with the 28 degrees of freedom (8 reporting categories x 5 years) in Table 6. Source: Fieldwork, 2026.

Table 6. Chi-square tests

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	272.257	28	.000
Likelihood Ratio	374.055	28	.000
N of valid cases	1090	-	-

Source: Fieldwork, 2026.

DISCUSSION OF FINDINGS

The findings revealed that residents across the sampled wards relied predominantly on streams, followed by boreholes, as sources of drinking water. These sources may be susceptible to contamination, particularly where water treatment and the protection of water sources are inadequate. Notably, Mkpani/Agoi, which recorded the highest proportion of cholera cases, showed substantial reliance on these water sources, whereas Ugep, which recorded the lowest proportion of cases, had access to treated pipe-borne water. Although this pattern does not establish a direct causal relationship between water source and cholera occurrence, it suggests that limited access to safe and treated drinking water may contribute to increased exposure to waterborne pathogens, an observation consistent with WHO (2004) evidence linking unsafe drinking water, inadequate sanitation, and poor hygiene with substantial burdens of disease, including diarrhoeal disease and cholera.

The findings further revealed that traditional pit latrines with open slabs were the most accessible toilet facilities across the sampled wards. Wards where residents relied heavily on such facilities, particularly Mkpani/Agoi, recorded relatively higher proportions of cholera cases than Ugep, where some residents had access to improved sanitation facilities such as pour-flush toilets and water closets. These findings are consistent with WHO/UNICEF (2015) evidence on inadequate sanitation, which has identified unimproved sanitation, shared sanitation, and open defecation as continuing challenges under Sustainable Development Goal 6, Target 6.2, which calls for universal access to adequate sanitation and hygiene and an end to open defecation by 2030.

The findings on waste management practices further showed that open dumping of refuse, open defecation, and disposal of waste into streams were common practices across the sampled wards. These practices carry important environmental health implications, since indiscriminate waste disposal can contaminate surface water sources and the surrounding environment, a finding corroborated by Ibiang et al. (2019), who reported unsafe excreta disposal practices, including disposal in open fields, bushes, gutters, and streams, among residents of Yakurr Local Government Area, practices that may create pathways for faecal contamination of water and food.

Cholera cases increased during the earlier part of the study period and subsequently declined between 2024 and 2025, a decline that may be associated with increased awareness, improved sanitation practices, interventions by health authorities, or other factors, though the present study did not directly establish which of these factors accounted for the reduction. The significant difference in the distribution of cholera cases across

the wards and study years, particularly the relatively higher burden observed in Mkpani/Agoi, Inyima, and Assiga, points to spatial and temporal variation in cholera occurrence that reinforces the need for targeted Water, Sanitation and Hygiene (WASH) interventions and sustained disease surveillance in wards with greater environmental health vulnerabilities. Within the Epidemiologic Triad framework adopted for this study, these findings indicate that the environmental component of the triad, specifically the sanitation and water-access conditions that vary across the wards, offers the most tractable point of intervention for disrupting cholera transmission in Yakurr Local Government Area, since neither the agent nor the host population can be as readily modified as the environmental conditions that mediate their interaction.

Despite the generally high level of awareness of cholera causes and preventive measures reported among residents, 56.52%, the persistence of risky practices such as the drinking of untreated water, 23.5%, and open defecation, 15.25%, indicates that awareness alone has not been sufficient to change behaviour in the study area, most plausibly because the structural barriers residents identified, increased population and overcrowding, 30.75%, and inadequate funding for sanitation, constrain the practical options available to residents regardless of their knowledge of cholera prevention. This gap between awareness and practice is consistent with the broader Nigerian evidence that public health education, while necessary, functions best when paired with the physical provision of sanitation infrastructure rather than as a stand-alone intervention (Anbarci, Escaleras & Register, 2012).

CONCLUSION

The study concludes that cholera cases in Yakurr Local Government Area were not evenly distributed across the sampled wards and study period, with Mkpani/Agoi bearing the highest proportion of cases and 2023 recording the highest annual incidence. Cholera occurrence in the study area was associated with WASH-related challenges across the sampled wards: residents relied predominantly on potentially unsafe water sources and unimproved sanitation facilities, and open defecation and open dumping of waste into streams were common practices. These conditions may create pathways for faecal contamination of water and the surrounding environment and consequently increase the risk of cholera transmission. The findings demonstrate the need for sustained and targeted WASH interventions, particularly in wards with limited access to safe drinking water and improved sanitation facilities.

RECOMMENDATION

Given that Mkpani/Agoi recorded the highest proportion of cholera cases among the study wards, it is recommended that urgent and targeted WASH interventions be prioritised in that ward, alongside sustained interventions across the other wards in Yakurr Local Government Area, including the provision of safe potable water, improved sanitation facilities, and proper waste management.

It is further recommended that hygiene education be sustained across all sampled wards, and that such education be paired with the physical provision of sanitation infrastructure rather than delivered as a stand-alone intervention, given the evidence in this study that a high level of awareness of cholera causes and prevention did not, on its own, translate into safer practices among residents constrained by overcrowding and inadequate sanitation funding.

Finally, it is recommended that continuous cholera surveillance be maintained across the wards of Yakurr Local Government Area, so that the ward-level and year-on-year variation in cholera incidence identified in this study can be tracked over time and used to guide the timing and targeting of future environmental health interventions and outbreak responses.

DECLARATIONS

Ethical approval: The study used questionnaires, direct observation, and field assistants; secondary data on reported cholera cases were obtained from relevant healthcare centres with the necessary administrative permission, and confidentiality and anonymity of participants and health records were maintained throughout the study.

Informed consent: Informed consent was obtained from all respondents who participated in the questionnaire survey.

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Conflict of interest: The authors declare that they have no conflict of interest in relation to the authorship or publication of this manuscript.

Authors' contribution: All authors contributed to the conception and design of the study, participated in data collection, including questionnaire administration, direct observation, and the acquisition of secondary cholera case data from healthcare centres, and contributed to data analysis and interpretation of the findings.

Data availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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