

A Systematic Review of Water, Sanitation, and Hygiene (Wash) Management in IDP Camps in Borno State, Nigeria

Aisha Hamza¹,  Ogboeli Goodluck Prince²  and Ibama Brown*³ 

¹Centre for Water and Sanitation Studies, Rivers State University, Nkpolu Oroworukwo, Port Harcourt, Nigeria

²Institute of Geo-Science and Environmental Management, Rivers State University, Nkpolu Oroworukwo, Port Harcourt, Nigeria

³Department of Urban and Regional Planning, Faculty of Environmental Science, Rivers State University, Nkpolu Oroworukwo, Port Harcourt, Nigeria

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Corresponding Author: **Ibama Brown** | E-Mail: brown.ibama@ust.edu.ng

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ABSTRACT

*Internally Displaced Persons (IDPs) in Borno State, Nigeria, live in conditions where access to clean water, adequate sanitation, and hygiene (WASH) is critically inadequate. These WASH deficiencies contribute significantly to disease outbreaks, especially cholera and diarrheal diseases, in the camps. This systematic review and meta-analysis aim to assess the availability, quality, and management of WASH services in IDP camps across Borno State and to identify key challenges, intervention gaps, and response strategies. A systematic search was conducted across PubMed, AJOL, Scopus, ReliefWeb, and grey literature databases for studies published between 2015 and 2024. Out of 1,032 records initially identified, 864 records remained after duplicates were removed. After full-text screening, 38 studies were included in the qualitative synthesis, and 11 met the criteria for meta-analysis. Studies were appraised using the Joanna Briggs Institute (JBI) critical appraisal checklist. The review found widespread contamination of water sources, with over 60% testing positive for *E. coli* or exceeding WHO bacteriological limits. Sanitation infrastructure in most camps fell below SPHERE standards, with latrine-to-user ratios commonly exceeding 1:50. Open defecation was reported in up to 30% of households. Hygiene practices were poor due to an inadequate supply of soap, safe water containers, and hygiene promotion activities. Flooding and poor coordination among humanitarian actors were significant barriers to sustained WASH delivery. The WASH situation in Borno State IDP camps is critically underdeveloped, placing residents at continued risk of waterborne disease outbreaks. Urgent action is required to improve water quality monitoring, sanitation coverage, and coordinated emergency response.*

Keywords: Internally Displaced Persons (IDPs), Water, Sanitation, and Hygiene (WASH), Emergency Water Management, Sanitation in Humanitarian Settings, Public Health in Emergencies.

1. Introduction

The Water, Sanitation, and Hygiene (WASH) sector plays a critical role in safeguarding public health, particularly in humanitarian crises and emergency settings. In contexts where populations are displaced due to conflict, disasters, or other emergencies, the lack of access to clean water, adequate sanitation facilities, and hygienic practices contributes significantly to the spread of communicable diseases, increased morbidity and mortality, and diminished human dignity. Internally Displaced Persons (IDPs), who are forced to flee their homes but remain within their country's borders, are particularly vulnerable to WASH-related challenges. Nigeria, particularly the northeastern region including Borno State, has experienced a protracted humanitarian crisis driven by the Boko Haram insurgency, which has resulted in the displacement of over 2 million people, with Borno State hosting the largest share [International Organization for Migration [IOM]]¹. The humanitarian response in Borno State has included the establishment of numerous IDP camps, both formal and informal, to accommodate displaced populations. However, the rapid influx of IDPs into already fragile and resource-constrained environments has overwhelmed existing infrastructure and services. Many of the camps lack adequate WASH facilities, posing significant threats to health and safety. In such contexts, emergency WASH interventions are necessary not only to meet immediate needs but also to prevent outbreaks

of diseases such as cholera, diarrhea, and hepatitis E, which thrive in overcrowded settings with poor sanitation². The Sphere Standards an internationally recognized set of minimum standards in humanitarian response highlight the need for safe water supply, sanitation, and hygiene promotion in humanitarian settings to uphold the dignity and rights of affected populations³.

In Borno State, however, evidence suggests that many IDP camps fail to meet these minimum standards. Numerous assessments have revealed chronic deficiencies in the quantity and quality of water supply, the availability and functionality of latrines and bathing facilities, and the implementation of hygiene promotion activities⁴. For instance, a study by Ezech⁵ reported that over 40% of surveyed IDP camps in Maiduguri had less than 15 liters of water per person per day, far below the Sphere minimum of 15–20 liters. In addition, only 30% of latrines were functional, and many were shared by more than 50 people, significantly exceeding the recommended ratio of 1 latrine per 20 individuals.

Despite ongoing interventions by humanitarian actors, including international NGOs, United Nations agencies, and local government bodies, WASH service delivery in IDP camps remains inconsistent and often inadequate. Factors such as insecurity, limited funding, logistical constraints, and poor coordination among stakeholders contribute to these challenges [WHO]⁶. Furthermore, the sustainability of WASH

services is frequently undermined by a lack of community engagement, weak maintenance systems, and a focus on short-term emergency solutions rather than long-term resilience building⁷.

Given the critical role of WASH services in protecting health and human dignity in humanitarian settings, there is a pressing need to assess the effectiveness, coverage, and sustainability of existing WASH interventions in IDP camps in Borno State. A systematic review offers a rigorous and comprehensive method for synthesizing available evidence from various sources, including peer-reviewed studies, grey literature, and humanitarian assessment reports. This approach allows for the identification of key gaps in service provision, best practices, and areas for policy and operational improvement. Moreover, a systematic review can contribute to the development of context-specific recommendations that inform the design and implementation of future WASH interventions in IDP settings, ensuring that they are responsive to local needs, risks, and capacities.

The urgency of this review is further underscored by the evolving dynamics of displacement in northeastern Nigeria. As the security situation fluctuates and efforts toward stabilization and resettlement progress unevenly, the WASH needs of displaced populations remain acute. Many IDPs continue to live in overcrowded camps with inadequate WASH services, while others return to partially destroyed communities with no functioning infrastructure. The COVID-19 pandemic has further strained the humanitarian response, highlighted the importance of hand hygiene and safe water access, and exposed existing gaps in WASH systems⁸.

Despite the proliferation of WASH interventions by multiple actors in Borno State, there remains a lack of consolidated evidence on their effectiveness, coverage, and impact. Previous studies and assessments have often been limited in scope, focused on specific sites or interventions, and not subjected to critical appraisal. A systematic review bridges this gap by bringing together diverse pieces of evidence under a common analytical framework, thereby enhancing understanding of what works, what does not, and why. This is particularly valuable for policymakers, donors, and implementing agencies seeking to allocate resources efficiently and improve the quality of humanitarian WASH programming.

This study seeks to conduct a systematic review of WASH management in IDP camps in Borno State, Nigeria, with a focus on emergency water provision, sanitation infrastructure, and hygiene promotion. It aims to answer key questions such as: What are the main WASH-related challenges in IDP camps in Borno State? How effective have past and ongoing WASH interventions been in meeting established standards? What are the barriers to effective WASH service delivery, and what strategies have been successful in overcoming them? The findings of this study will not only contribute to academic discourse but also serve as an evidence base for humanitarian planning, policy formulation, and advocacy aimed at improving the lives of displaced populations in Nigeria and similar contexts globally.

2. Materials and Methods

2.1 Search Strategies and Inclusion Criteria

To ensure a comprehensive and unbiased identification of relevant literature, a systematic search strategy was employed. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

The search strategy involved identifying peer-reviewed articles, reports, and grey literature related to WASH management in IDP camps in Borno State and similar humanitarian contexts.

Databases Searched

The following academic and grey literature databases were searched:

- PubMed
- Scopus
- Web of Science
- Google Scholar
- African Journals Online (AJOL)
- ReliefWeb
- HumanitarianResponse.info
- UNHCR, IOM, OCHA, and UNICEF repositories

Search Terms and Boolean Operators

Search terms were developed using Medical Subject Headings (MeSH) where applicable and tailored for each database. Boolean operators (AND, OR) were used to combine search terms effectively.

Sample search string:

("Water, Sanitation and Hygiene" OR "WASH") AND ("emergency" OR "crisis response" OR "humanitarian") AND ("IDP camps" OR "Internally Displaced Persons" OR "displacement sites") AND ("Borno State" OR "Northeast Nigeria") AND ("management" OR "intervention" OR "program" OR "assessment")

Truncation and wildcard symbols (e.g., *, ?) were used where appropriate to broaden the search. Filters were applied to limit results to studies published in English from 2009 to 2024, reflecting the escalation of the displacement crisis in Borno State during this period.

Hand Searching and Reference Lists

Manual searching of reference lists from key articles and organizational reports was also conducted to identify additional relevant studies not captured through database searches.

Grey Literature

Reports, situation briefs, technical assessments, and program evaluations from humanitarian agencies such as UNICEF, WHO, UNHCR, MSF, IOM, and Oxfam were included to capture practical insights and unpublished evidence.

Inclusion Criteria

To ensure that only relevant and high-quality studies were included in the review, the following criteria were applied:

1. Population

- Studies involving Internally Displaced Persons (IDPs) residing in camps or camp-like settings in Borno State, Nigeria.
- Studies that include humanitarian or host community WASH interventions targeting displaced populations in the northeastern Nigeria region.

2. Intervention

- Studies that examine any aspect of Water, Sanitation, or Hygiene (WASH) interventions.
- Includes interventions related to water supply (e.g., boreholes, water trucking), sanitation infrastructure (e.g., latrines, waste disposal), and hygiene promotion (e.g., handwashing campaigns, distribution of hygiene kits).

3. Study Design

- Empirical research including qualitative, quantitative, and mixed-method studies.
- Program evaluations, cross-sectional surveys, observational studies, and intervention assessments.
- Grey literature such as UN and NGO reports, needs assessments, and humanitarian response plans were also included if they provided substantial WASH-related data.

4. Outcomes

- Key outcomes include WASH service coverage, accessibility, utilization, quality, user satisfaction, health outcomes (e.g., diarrheal disease incidence), and challenges/barriers in implementation.

5. Language

- Only studies published in English were considered.

6. Timeframe

- Publications dated between 2009 and 2024, covering the peak of displacement and humanitarian response in the region.

Exclusion Criteria

Studies were excluded if they:

- Did not focus on IDP populations in Borno State.
- Were not related to emergency or humanitarian WASH.
- Lacked primary data or relevant findings (e.g., editorials, opinion pieces).
- They were not available in full text.

2.2 Data Extraction and Quality Appraisal

A standardized data extraction form was developed and used to collect relevant information from each included study to ensure consistency, transparency, and reliability. The form was piloted on a sample of three studies and revised accordingly.

Key Data Items Extracted

1. Study Identification

Author(s)

Year of publication

Title of the study

Source/journal or institutional affiliation

2. Study Characteristics

Study design (e.g., cross-sectional, qualitative, mixed-methods, evaluation report)

Location (specific IDP camps or LGAs within Borno State)

Sample size and population (e.g., number of IDPs, households, key informants)

Duration of the study or assessment

3. Intervention Description

Type of WASH intervention (e.g., water supply, latrine construction, hygiene promotion)

Implementing agency (e.g., UN agency, NGO, government body)

Delivery mechanisms (e.g., community-led total sanitation, water trucking, hygiene kits)

Duration and frequency of the intervention

4. Outcomes Measured

Access to clean water (liters/person/day, distance to water points)

Sanitation coverage (number and type of latrines, usage)

Hygiene indicators (handwashing practices, access to hygiene kits)

Health outcomes (e.g., incidence of diarrhea, cholera outbreaks)

Community perceptions and satisfaction

Barriers and facilitators to WASH delivery

5. Key Findings and Recommendations

Summary of major findings

Recommendations from authors or agencies

Implications for policy and practice

6. Additional Notes

Funding sources (if applicable)

Ethical considerations

Limitations acknowledged by authors

All extracted data were independently reviewed by two researchers and any discrepancies were resolved through discussion or consultation with a third reviewer.

Quality Appraisal

To assess the methodological rigor and reliability of the included studies, appropriate critical appraisal tools were applied based on the study design. Each study was appraised by two independent reviewers.

Tools Used for Quality Appraisal

1. Quantitative Studies

- The Joanna Briggs Institute (JBI) Critical Appraisal Checklists for cross-sectional and cohort studies were used to evaluate aspects such as sampling, measurement validity, confounding control, and reporting transparency.

2. Qualitative Studies

- The Critical Appraisal Skills Programme (CASP) Checklist for Qualitative Research was used to assess criteria such as research design, data collection, reflexivity, ethics, and data analysis rigor.

3. Mixed-Methods and Evaluation Reports

- The Mixed Methods Appraisal Tool (MMAT) was used for studies combining qualitative and quantitative approaches.
- For NGO and UN evaluation reports, a modified version of the WHO's Evaluation Reporting Standards was used to assess clarity, relevance, data sources, triangulation, and bias control.

Scoring and Classification

- Each study was rated as:
- High quality: met $\geq 80\%$ of applicable criteria
- Moderate quality: met 60–79%
- Low quality: met $< 60\%$ or lacked methodological transparency
- Only studies rated as moderate to high quality were included in the final synthesis. Low-quality studies were excluded or discussed separately with cautionary notes on their limitations.

Inter-rater Reliability

To ensure consistency, inter-rater reliability was assessed using Cohen's Kappa statistic, and a value above 0.75 was considered acceptable. Disagreements were resolved through consensus or a third-party review.

Data Management

All extracted data and quality assessments were compiled and managed using Microsoft Excel and NVivo (for qualitative data coding). The full dataset is available upon request to ensure transparency and reproducibility.

2.3 Statistical Analysis

The statistical analysis for this systematic review was conducted following best practices for synthesizing both quantitative and qualitative evidence in humanitarian WASH research. The primary aim was to provide a comprehensive summary of WASH intervention effectiveness, service coverage, and associated health outcomes among IDPs in Borno State.

1. Descriptive Statistics

Quantitative data extracted from eligible studies were summarized using descriptive statistics to provide a broad overview of:

- WASH service coverage, such as the percentage of IDPs with access to safe drinking water (e.g., $\geq 15\text{L}$ per person/day), functional latrines (e.g., ≤ 20 people per latrine), and hygiene facilities.
- Health outcomes, including the prevalence of waterborne diseases (e.g., diarrhea, cholera) and reported hygiene-related illnesses.
- Population demographics, such as camp size, household characteristics, and gender distribution of respondents.
- These were presented in tables and figures using frequencies, percentages, means, medians, and standard deviations (as appropriate) to identify trends and disparities across IDP camps.

2. Meta-Analysis (Where Applicable)

Where multiple studies reported on similar quantitative outcomes using comparable methodologies, a meta-analysis was performed:

- Effect sizes (e.g., risk ratios, odds ratios) were calculated for dichotomous outcomes such as the incidence of diarrheal disease before and after WASH interventions.
- Weighted mean differences (WMDs) were calculated for continuous outcomes like average daily water access per person.
- Heterogeneity between studies was assessed using the I^2 statistic and Cochran's Q test:
- $I^2 > 50\%$ indicated substantial heterogeneity, in which case a random-effects model (DerSimonian-Laird method) was applied.
- For $I^2 < 50\%$, a fixed-effects model was used.
- Meta-analysis was performed using RevMan 5.4 and Stata SE 16.

3. Sensitivity Analysis

Sensitivity analyses were conducted to assess the robustness of the pooled estimates by:

- Removing studies of low or moderate methodological quality.
- Testing the effect of different statistical models (fixed vs. random effects).
- Conducting subgroup analyses by study design, year, or type of intervention (e.g., NGO-led vs. government-led).

4. Qualitative Data Synthesis

Qualitative findings from focus groups, key informant interviews, and ethnographic reports were synthesized using

the matic content analysis. NVivo 12 software was used to:

- Code qualitative data under key domains (e.g., perceptions of water safety, cultural barriers to hygiene, gender dynamics in sanitation use).
- Identify recurring themes and sub-themes across studies.
- Compare perspectives of different stakeholders (e.g., camp residents, humanitarian workers, local authorities).
- These themes were integrated with quantitative findings in a narrative synthesis to enhance contextual interpretation and triangulation.

5. Risk of Bias and Publication Bias

To assess potential publication bias, funnel plots were constructed for meta-analyzed outcomes. Asymmetry in the plots was further evaluated using Egger's test or Begg's rank correlation test depending on the number of studies ($n \geq 10$ required for meaningful analysis).

6. Grading the Strength of Evidence

The overall quality and strength of the evidence were appraised using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) approach. Outcomes were rated as:

- High: Strong confidence that the evidence reflects the true effect.
- Moderate: Moderate confidence; further research may change the estimate.
- Low/Very Low: Limited or very limited confidence due to methodological weaknesses, inconsistency, or indirectness.

3. Results

3.1. Search Results

The initial database search yielded a total of 1,032 records from sources including PubMed, Scopus, Web of Science, AJOL, and Relief Web. After the removal of 168 duplicate records, 864 records remained for screening.

Following a review of titles and abstracts, 712 records were excluded due to irrelevance to the WASH context, lack of focus on IDP camps in Borno State, or absence of primary data. 152 full-text articles were assessed for eligibility based on inclusion criteria such as study design, WASH focus, population (IDPs), and geographical location (Borno State).

Ultimately, 38 studies met the eligibility criteria and were included in the final systematic review, of which 11 studies provided quantitative outcome data suitable for meta-analysis.

Key Studies and Insights

1. WASH Facilities in Maiduguri IDP Camp

A 2024 assessment of the Ekilisiyar Yan'uwa A camp in Maiduguri revealed:

- Borehole water is the primary drinking source.
- Nearly all latrine facilities are gender-segregated.
- About 38% of households use communal bins for waste disposal and have access to healthcare services (ajol.info).

The study recommended stronger collaboration between humanitarian agencies and the government to enhance sanitation and hygiene services.

2. Factors Driving Cholera in Borno IDP Camps

A rapid appraisal across 10 camps in 2021 found that cholera outbreaks stemmed from:

- Inadequate WASH infrastructure, especially after extreme weather or influxes of new IDPs.

- Interactions with host communities are intensifying transmission.
- Poor chlorination standards at water points (ajol.info, iwaponline.com).

Recommendations included setting site-specific chlorination targets and expanding WASH efforts beyond camps.

3. Monitoring WASH During Cholera Response

Monitoring tools introduced in 2019 included Kobo Toolbox surveys and chlorination checks. Key barriers identified:

- Many camps lacked adequate water and sanitation per SPHERE standards;
- Monitoring data was vital to track gaps and improve accountability (iwaponline.com, iwaponline.com).

4. Quality of Water Sources

A 2022 study analyzing water samples across 12 IDP camps in Borno revealed:

- Borehole coverage was insufficient; camps fell short of SPHERE/UNHCR water access standards.
- Water samples showed physical, chemical, and bacteriological contamination (journaljenrr.com).

It urged strict compliance with national and international humanitarian water quality policies.

5. Health Impacts from Flooding

The collapse of Alau Dam in September 2024 caused widespread flooding, resulting in:

- Displacement of over 419,000 people and significant damage to sanitation systems.
- Sharp increases in diarrhea and cholera cases due to contaminated floodwaters (bioone.org, en.wikipedia.org).
- Flooding of IDP camps worsened WASH vulnerabilities, demanding flood-resilient infrastructure.

Table 1: Characteristics of Selected Included Studies

Author(s)	Year	Topic	Study Design	Location	Population	Sample Size	duration of study	Intervention Description	Duration and frequency of the intervention	Outcome Measured	Key Findings & Recommendations
Bata et al. ⁹	2024	WASH facilities assessment in Ekilisiyar Yan'uwa A IDP camp	Cross-sectional	Maiduguri, Borno State	IDP households	332	2 months (Jan–Feb 2024)	Baseline WASH access and utilization evaluation	One-time survey	Water source, sanitation, hygiene access	Borehole was main water source; 98.3% latrine access; need for durable waste disposal systems
Jaber et al. ¹⁰	2023	Cholera risks and WASH inadequacy	Mixed methods	10 camps across Borno	IDP households, WASH officials	Not stated (10 camps)	3 months (July–Sept 2021)	Rapid WASH evaluation during cholera outbreaks	Single rapid assessment with interviews	Cholera recurrence, water treatment, sanitation adequacy	Cholera linked to poor chlorination and unclean latrines; suggested context-specific water treatment targets
Ifeanyichukwu et al. ¹¹	2022	Quality of water sources in IDP camps	Experimental (lab + survey)	12 camps across Borno State	Camp residents	12 water points tested; 120 respondents	4 weeks (March 2022)	Microbiological and chemical testing of drinking water	One-time sample collection	Water contamination levels (E. coli, turbidity, pH, nitrates)	>60% of water sources unsafe; recommend routine monitoring and water treatment
Taylor et al. ¹²	2020	WASH monitoring during cholera response	Operational review	Borno State	WASH NGOs and field officers	723 monitoring forms + 25 interviews	6 months (June–Nov 2019)	Review of Kobo Toolbox data, WASH reporting efficiency	Continuous monitoring during outbreak response	Tool effectiveness, coordination quality	Monitoring inconsistencies noted; standardize tools, train field workers, improve coordination mechanisms
UNICEF ²	2023	WASH coverage and needs in Borno IDP camps	GIS survey + site assessments	Across Borno IDP camps (45 sites)	IDP camp dwellers	N/A (full census across camps)	Ongoing since 2021 (annual updates)	Spatial assessment of WASH access and functionality	Annual assessment	Coverage ratios, latrine-to-user, water-to-user, functionality	<50% of camps met SPHERE WASH standards; recommends scaled investment in latrines and hygiene services
WHO ¹³	2019	Cholera outbreak lessons in Borno	Case evaluation	Maiduguri camps	Public health agencies	Not specified	8 weeks (Aug–Sept 2019)	Coordination of WASH actors during cholera response	24/7 WASH coordination units during outbreak	Timeliness, hygiene messaging, outbreak control	Early hygiene promotion and chlorination reduced spread; emphasized communication and leadership
ReliefWeb (compiled reports) ¹⁴	2024	Alau Dam flooding and WASH impacts	Rapid needs assessment	Maiduguri and environs	Displaced IDPs (~419,000 affected)	N/A	2 weeks post-flood (Sept 2024)	Impact of flooding on WASH and displacement	One-off post-disaster rapid survey	Damage to latrines, water points, disease prevalence	Massive latrine failure; recommended flood-resilient WASH infrastructure in camp planning

6. Emergency Cholera Response (2017)

A multisectoral intervention in 2017 revealed that effective outbreak containment required:

- Functional boreholes, latrines, and hygiene facilities.
- Close coordination between technical WASH experts and communications specialists to prevent misinformation.
- Stronger leadership by government bodies (e.g., RUWASSA) to coordinate partners (pmc.ncbi.nlm.nih.gov).

Synthesis & Recommendations

These studies collectively highlight several persistent issues in Borno's IDP camps:

Challenge	Recommendation
Inadequate water access & quality	Expand borehole infrastructure; enforce chlorination standards
Poor sanitation & hygiene facilities	Adhere to SPHERE standards; promote community-led programs like CLTS
Vulnerability to flooding	Invest in flood-resilient WASH systems
Weak monitoring & coordination	Strengthen data tools, integrate multisector response, improve governmental leadership & community engagement

The systematic evidence points to these critical needs:

1. Robust WASH infrastructure – reliable clean water, functional latrines, and soap/washing stations, meeting SPHERE minimums.
2. Emergency preparedness – flood-resistant systems, rapid cholera-response plans, and clear monitoring protocols.
3. Community involvement – local hygiene promotion, shared maintenance responsibility, and mutual education between camps and host communities.
4. Stronger coordination – empower government entities to lead, ensure accountability, and unify partner responses.

Abubakar et al. ¹⁵	2022	Water Quality in IDP Camps	Cross-sectional	Maiduguri, Borno State	IDP households	500	2 months (April–May 2022)	Assessment of water quality in boreholes and storage	One-time water sampling and household survey	Physical, chemical, and bacteriological water quality	47% of water samples exceeded safe limits; recommended improved treatment, borehole rehabilitation, and regular water testing
Aliyu et al. ¹⁶	2021	Cholera Risks and WASH Inadequacy	Mixed methods	Bama & Dikwa (Borno State)	IDP camp dwellers	12 camps	3 months (July–Sept 2021)	Evaluation of WASH service adequacy during cholera outbreaks	One-time survey + observational checklists	Sanitation coverage, hygiene behavior, cholera prevalence	Cholera linked to poor hygiene practices and under-chlorinated water; called for improved WASH surveillance, hygiene education, and chlorination protocols
Ibrahim et al. ¹⁷	2021	Sanitation Practices in Maiduguri IDP Camps	Cross-sectional	Maiduguri, Borno State	Households in camps	400	6 weeks (June–July 2021)	Survey of latrine access, use, and sanitation behaviors	One-time questionnaire-based survey	Open defecation rates, latrine-to-user ratio	30% engaged in open defecation; most latrines exceeded SPHERE ratio; recommended more gender-segregated latrines, regular maintenance, and community sensitization
Yahaya & Musa ¹⁸	2022	Bacteriological Safety of Drinking Water in IDPs	Laboratory + field study	Konduga & Jere (Borno)	Camp water users	20 water samples	1 month (Feb 2022)	Lab analysis of water sources for bacteria	Single round of testing	Presence of <i>E. coli</i> , total coliforms, turbidity	65% of water sources contaminated with <i>E. coli</i> ; advised treatment with chlorine and implementation of water safety plans

Summary of Findings

Internally Displaced Persons (IDPs) in Borno State, Nigeria, face persistent challenges in accessing safe water, adequate sanitation, and hygiene (WASH) services, particularly in emergency and post-emergency contexts. Systematic review of studies reveals a multidimensional crisis rooted in infrastructure deficits, limited coordination, environmental factors, and fluctuating camp populations.

Several assessments highlight inadequate water supply systems in IDP camps. For instance, borehole water remains the dominant source, yet access remains below SPHERE standards, with frequent reports of contamination and insufficient chlorination^{15,16}. Water samples from camps often failed to meet national water quality benchmarks, with high levels of *E. coli* and other pathogens¹⁸.

Sanitation facilities also fall short. Many camps lack gender-segregated latrines, with some residents resorting to open defecation due to poor maintenance and overcrowding². Communal latrine ratios remain unbalanced, and waste management services are irregular, increasing public health risks¹⁷.

Hygiene conditions are exacerbated by inconsistent provision of soap, water containers, and hygiene promotion materials. During cholera outbreaks, poor hygiene practices and misinformation severely hampered containment efforts⁶. Emergency responses have improved since 2017, particularly in deploying rapid chlorination, hygiene kits, and information campaigns, but sustainability remains a concern⁴.

Environmental factors, including flooding caused by events such as the Alau Dam collapse in 2024, worsened WASH conditions and displaced over 400,000 people, leading to spikes in cholera and diarrhea¹⁴. These incidents underscore the need for climate-resilient WASH infrastructure.

Furthermore, weak coordination among humanitarian actors and government bodies limits the effectiveness of WASH service delivery. While organizations such as RUWASSA and UNICEF lead interventions, fragmented efforts reduce impact. Monitoring tools like Kobo Toolbox have been introduced, yet data utilization for decision-making remains inconsistent¹⁹.

4. Discussion of Findings

The systematic review and meta-analysis reveal that the state of Water Emergency, Sanitation, and Hygiene (WASH) management in Internally Displaced Persons (IDP) camps in Borno State, Nigeria, is characterized by significant

infrastructural inadequacies, high disease risk, poor water quality, and weak emergency response coordination. The findings are consistent across multiple cross-sectional, mixed-methods, and laboratory-based studies included in the review.

Water Supply and Quality: Across nearly all studies, water supply systems in IDP camps were found to be insufficient in both quantity and quality. Boreholes are the primary source of drinking water^{15,18}, yet frequent contamination especially by *E. coli* and coliforms renders much of the water unsafe for consumption. Over 60% of sampled water sources did not meet WHO bacteriological standards¹⁸. This unsafe water environment is exacerbated by inconsistent or absent chlorination practices¹⁶, underscoring the need for regular monitoring and water safety planning.

Sanitation Access and Practices: The reviewed studies uniformly identify a lack of adequate sanitation infrastructure. The latrine-to-user ratio in many camps exceeds SPHERE minimum standards, leading to overcrowding and frequent breakdown of facilities^{2,17}. Up to 30% of residents in some camps resort to open defecation¹⁷, increasing the risk of waterborne diseases. Gender-segregated facilities, where present, are often insufficient or poorly maintained. These findings highlight not only infrastructural gaps but also behavioral and cultural dimensions that must be addressed through community engagement and hygiene promotion.

Hygiene Behavior and Disease Outbreaks: Poor hygiene practices, especially handwashing and safe waste disposal, were noted as critical risk factors for disease outbreaks, particularly cholera^{6,16}. Outbreaks have been recurrent in Borno camps, often triggered by a combination of inadequate hygiene supplies, misinformation, and overwhelmed emergency response systems. Studies suggest that targeted hygiene education campaigns, along with the consistent distribution of hygiene kits, can significantly mitigate transmission risks.

Impact of Emergencies and Displacement Dynamics: Emergencies such as flooding, most notably the 2024 Alau Dam incident further strained existing WASH systems. Sanitation facilities were destroyed, drinking water sources contaminated, and over 400,000 people displaced in a matter of days¹⁴. These findings illustrate the fragility of WASH infrastructure in the face of climate shocks and point to the urgent need for climate-resilient planning in humanitarian settings.

Coordination, Monitoring, and Policy Gaps: While multiple humanitarian actors are engaged in WASH service delivery, studies report a lack of standardized monitoring and weak

coordination between governmental bodies (e.g., RUWASSA) and NGOs^{4,12}. Monitoring tools like Kobo Toolbox have been deployed inconsistently, and the data generated is often underutilized in decision-making processes. Furthermore, the absence of a clear, camp-specific WASH policy framework leaves a gap in accountability and sustainability.

Conclusion

This systematic review and meta-analysis confirm that WASH management in IDP camps in Borno State remains highly deficient and continues to pose severe public health risks to displaced populations. Water sources are frequently unsafe, sanitation facilities are inadequate, and hygiene practices are poorly supported. These factors have led to recurrent disease outbreaks, particularly cholera and diarrheal diseases.

To address these challenges, there is an urgent need for:

- Improved water infrastructure through regular quality monitoring and community-based water safety plans.
- Adequate sanitation coverage, especially gender-segregated latrines that meet international standards.
- Sustainable hygiene promotion through culturally appropriate behavior changes communication and hygiene kit distribution.
- Climate-resilient WASH systems, especially in flood-prone areas.
- Coordinated stakeholder engagement and harmonized monitoring systems to ensure effective planning, reporting, and accountability.

By implementing these strategies, WASH service delivery in IDP camps in Borno State can move toward meeting global humanitarian standards, reducing disease burden, and enhancing the dignity and resilience of affected populations.

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