Evaluation of Water Purification Methods among Residents of Dutse Metropolis, Jigawa State, Nigeria.

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ABSTRACT

Background: Access to safe drinking water remains a public health challenge in sub-Saharan Africa. This study evaluated water purification methods and their determinants among residents of Dutse Metropolis, Jigawa State, Nigeria.

Methods: A descriptive cross-sectional study was conducted among 355 adult residents selected through multistage sampling. Data were collected using structured interviewer-administered questionnaires and analyzed using SPSS version 25, with chi-square tests and binary logistic regression at $p < 0.05$ significance level.

Results: Borehole (45.1%) and well water (30.4%) were the primary drinking water sources. Although 68.7% of households practiced water purification, 31.3% consumed untreated water. Boiling was the most common method (28.2%), followed by filtration (17.5%), alum use (12.4%), and chlorination (10.6%). Knowledge of waterborne diseases was high (72.4%), yet a knowledge-practice gap persisted. Educational level was significantly associated with purification practice ($p = 0.001$). Logistic regression revealed that respondents with tertiary education were six times more likely to practice water purification (AOR = 6.00, 95% CI: 2.48–14.53) compared to those with no formal education. Knowledge of waterborne diseases increased the likelihood of treatment fivefold (AOR = 5.36, 95% CI: 3.05–9.42), while cost was a significant barrier (AOR = 0.40, 95% CI: 0.24–0.67).

Conclusion: Despite moderate uptake of water purification, significant gaps exist, driven by educational and economic factors. Improving household water safety requires integrated strategies combining health education, subsidized treatment options, and long-term investment in water infrastructure.

Keywords: Water purification, household water treatment, drinking water, Dutse Metropolis, Nigeria

INTRODUCTION

Access to safe and potable water is a fundamental human right and an essential determinant of public health. Globally, an estimated 2.2 billion people lack safely managed drinking water services, with sub-Saharan Africa bearing a disproportionate share of this burden (World Health Organization & UNICEF, 2023). Contaminated drinking water is strongly associated with water-borne diseases such as diarrhea, cholera, typhoid fever, and hepatitis A, which remain leading causes of morbidity and mortality in low- and middle-income countries. In

Nigeria, rapid urbanization, inadequate infrastructure, and weak regulatory enforcement continue to limit universal access to safely managed water supplies, particularly in northern states. In many urban centers, including Dutse Metropolis in Jigawa State, households rely on multiple water sources such as boreholes, hand-dug wells, vendors, and sachet water. However, studies conducted in northern Nigeria have reported microbial and physicochemical contamination in several of these sources, including the detection of coliform bacteria and *Escherichia coli*, indicating faecal pollution and heightened public health risk (Uduma, Abubakar, & Muhammed, 2021; Abubakar et al., 2020). Such findings underscore the need for effective household-level water treatment strategies to mitigate contamination at the point of use.

Household water purification methods such as boiling, chlorination, filtration, solar disinfection, and sedimentation are widely recommended as cost-effective interventions to improve drinking water safety where centralized treatment systems are inadequate. Evidence suggests that properly implemented point of use treatment can significantly reduce microbial contamination and lower the incidence of diarrheal diseases (World Health Organization, 2023). Nevertheless, the adoption and sustained use of these methods are influenced by socioeconomic status, knowledge and risk perception, cultural practices, cost of treatment materials, and taste preferences (Journal of Global Health, 2024). Inconsistent or improper application may compromise effectiveness and limit public health benefits. Despite growing attention to water quality monitoring in Nigeria, there remains limited empirical evidence evaluating the types, utilization patterns, and effectiveness of water purification methods among residents of Dutse Metropolis. Given the increasing population pressure and reliance on household water treatment options, a systematic evaluation of purification practices is critical to inform targeted public health interventions, strengthen water safety planning, and guide policy at the state and municipal levels. Therefore, this study seeks to evaluate water purification methods among residents of Dutse Metropolis, Jigawa State, Nigeria, with the aim of assessing their prevalence, effectiveness, and determinants. The findings are expected to contribute to the body of knowledge on household water treatment practices in northern Nigeria and support evidence-based strategies for improving access to safe drinking water.

Related Literature

Access to safe drinking water remains a central concern in public and environmental health, particularly in low- and middle-income countries where limited infrastructure and uncontrolled contamination pose ongoing health risks. This review of related literature synthesizes global, regional, and local research on water purification methods, household water treatment practices, and factors influencing adoption to provide context for the evaluation of water purification methods among residents of Dutse Metropolis, Jigawa State, Nigeria. Household water treatment (HWT) methods are widely implemented as interim solutions where centralized water treatment and distribution systems are insufficient or absent. A systematic review by Clasen et al. (2015) demonstrated that point-of-use interventions such as chlorination, filtration, and solar disinfection can significantly reduce microbial contamination and lower diarrhoeal disease incidence. The World Health Organization (WHO) has consistently recommended these methods as effective barriers against waterborne pathogens when properly applied and maintained (WHO & UNICEF, 2023). Moreover, research in contexts with varied socioeconomic conditions, such as rural and urban communities in Kenya, Bangladesh, and Peru, has underscored that household-level treatment reduces exposure to pathogens, thereby improving child health outcomes (Jenkins et al., 2018; Luby et al., 2016).

However, effectiveness is contingent on correct and consistent use. Studies report that intermittent or improper application can substantially diminish expected health benefits (Jenkins et al., 2018). Chaplin et al. (2019) also noted that behavioural and educational interventions are critical to sustaining long-term adoption of water purification practices.

In Nigeria, water safety challenges are compounded by rapid population growth, inadequate water infrastructure, and decentralized regulation of water quality (Oloruntoba et al., 2020). National surveys indicate that a substantial proportion of households do not treat water at the point of use, even when source contamination is documented (Adewuyi et al., 2018). Where treatment does occur, boiling and chlorination are among the most commonly used methods, although affordability and fuel scarcity often limit boiling practices, while perceived taste alterations may reduce chlorination acceptance (Adewuyi et al., 2018; Onalenna et al., 2021). At the regional level, studies conducted in northern states including Kano, Bauchi, and Kaduna have also documented

significant water quality challenges. For instance, Garba et al. (2021) reported high total coliform counts in drinking water sources in Bauchi Metropolis, highlighting the potential public health risks faced by urban dwellers and the need for effective treatment practices. Similarly, research in Kano found that sachet and borehole water often perceived as "safe" by residents—frequently exceed recommended microbial limits, prompting calls for greater community engagement in water treatment education (Suleiman & Ahmed, 2022).

While broader studies illustrate national and regional trends, research specific to Dutse Metropolis remains limited. Existing work has focused primarily on the microbiological quality of raw water sources rather than on household-level purification practices. Uduma, Abubakar, and Muhammed (2021) reported the presence of *Escherichia coli* and other coliforms in untreated surface water sources around Dutse, indicating potential faecal contamination. This aligns with findings by Abubakar et al. (2020), which found elevated bacterial loads in boreholes and dug wells compared to regulatory standards. These microbiological assessments underscore the imperative for effective water treatment at the household level. However, literature on the actual uptake, preference, and effectiveness of purification methods among residents of Dutse is scant. In a broader study of household water treatment practices in semi-urban northern Nigerian communities, Onalenna et al. (2021) observed that only a minority of households employed proven purification techniques consistently, with barriers including limited access to treatment products, low risk perception, and cultural norms. Social, economic, and educational factors have been shown to significantly influence the adoption of water purification practices globally and in Nigeria. A systematic review by Bain et al. (2018) identified that higher income, greater awareness of waterborne diseases, and access to treatment materials are consistently associated with increased home water treatment. Conversely, households headed by individuals with lower education levels or constrained by financial hardship are less likely to treat drinking water effectively (Jenkins et al., 2018; Bain et al., 2018). Studies in Nigerian urban settings reinforce this finding. Adewuyi et al. (2018) noted that households with better education and awareness of contamination risks were more likely to boil or chlorinate water regularly. Similarly, Onalenna et al. (2021) found that awareness campaigns and community health interventions improved adoption rates of simple purification methods.

Gaps in the Literature

While existing research provides valuable insights into water quality issues and household treatment practices across Nigeria, major gaps remain in the literature:

1. Limited empirical data on household water purification practices in Dutse Metropolis, despite evidence of source contamination.
2. Insufficient assessment of factors influencing adoption of purification methods in urban northern Nigerian contexts.
3. A dearth of comparative analyses evaluating the relative effectiveness of different purification techniques in community settings.

MATERIALS AND METHODS

Study Area

The study was conducted in Dutse Metropolis, the capital city of Jigawa State, located in North-West Nigeria. Dutse lies within the Sudan savannah ecological zone and is characterized by a semi-arid climate with distinct dry and rainy seasons. The metropolis comprises several urban and peri-urban wards with mixed residential settlements. Major sources of water supply include boreholes, hand-dug wells, piped tap water, and water vendors. Rapid urbanization and population growth have increased reliance on alternative water sources, making household water purification practices an important public health issue.

Study Design

A descriptive cross-sectional study design was employed to evaluate water purification methods among residents of Dutse Metropolis. This design was appropriate for assessing household practices, knowledge, and associated factors at a single point in time.

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Study Population

The study population comprised adult residents (18 years and above) living in Dutse Metropolis. Only individuals who had resided in the area for at least six (6) months prior to the study were included to ensure familiarity with household water sources and purification practices. Visitors and individuals who declined consent were excluded.

Sample Size Determination

The sample size was determined using the single population proportion formula for cross-sectional studies:

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

Where:

- n = minimum sample size
- Z = standard normal deviation at 95% confidence level (1.96)
- p = estimated proportion of households practicing water purification (assumed at 50% due to limited prior local data)
- $q = 1 - p$
- d = margin of error (0.05)

The calculated minimum sample size was 384. After adjusting for feasibility and response rate considerations, a total of 355 respondents were included in the study.

Sampling Technique

A multistage sampling technique was adopted:

- **Stage 1:** Random selection of wards within Dutse Metropolis using simple random sampling.
- **Stage 2:** Systematic selection of households within selected wards using a sampling interval determined by the estimated number of households.
- **Stage 3:** In each selected household, one eligible adult respondent was chosen using simple random selection where more than one eligible person was present.

Study Variables

- Independent Variables: Socio-demographic characteristics (age, sex, education level, occupation), water source, knowledge of waterborne diseases, cost, and availability of purification materials.
- Dependent Variable: Practice of household water purification (type of method used or non-use).

Data Collection Instrument

Data were collected using a structured interviewer-administered questionnaire adapted from previous related studies on household water treatment practices. The questionnaire consisted of five sections:

1. Socio-demographic characteristics
2. Sources of drinking water

3. Household water purification methods
4. Knowledge of waterborne diseases
5. Factors influencing water purification practices

The instrument was developed in English and translated into Hausa for ease of administration, then back-translated to ensure consistency.

Validity and Reliability of Instrument

Content validity was ensured through expert review by specialists in public health and environmental health. Pre-testing of the questionnaire was conducted among 10% of the sample size in a neighboring community outside the study area. Necessary corrections were made based on feedback obtained. Reliability was assessed using Cronbach's alpha for knowledge-related items, with a coefficient ≥0.70 considered acceptable.

Data Collection Procedure

Data collection was conducted over a period of four weeks by trained research assistants. The purpose of the study was explained to respondents, and written informed consent was obtained prior to participation. Interviews were conducted privately within respondents' homes to ensure confidentiality and reduce response bias.

Data Management and Analysis

Completed questionnaires were checked for completeness and consistency daily. Data were coded and entered into Statistical Package for the Social Sciences (SPSS) version 25 for analysis.

Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize variables. Inferential statistics (Chi-square test) were used to assess associations between socio-demographic factors and water purification practices. Statistical significance was set at $p < 0.05$. Results were presented in tables and charts where appropriate.

RESULTS

A total of 355 questionnaires were administered and all were properly completed and analyzed, giving a response rate of 100%.

Table 1: Socio-Demographic Characteristics (n = 355)

Variable	Frequency	Percentage (%)
Age Group (years)		
18–29	112	31.5
30–39	98	27.6
40–49	78	22.0
≥50	67	18.9
Sex		
Male	198	55.8
Female	157	44.2
Educational Level		
No formal education	82	23.1
Primary	91	25.6
Secondary	116	32.7
Tertiary	66	18.6

Table 1 presents the socio-demographic characteristics of the respondents. The majority of respondents 112 (31.5%) were aged 18–29 years, followed by those aged 30–39 years 98 (27.6%). Respondents aged 40–49 years accounted for 78 (22.0%), while 67 (18.9%) were aged 50 years and above. In terms of sex distribution, 198 (55.8%) were male and 157 (44.2%) were female. Regarding educational level, 116 (32.7%) had secondary education, 91 (25.6%) had primary education, 82 (23.1%) had no formal education, and 66 (18.6%) had tertiary education.

Table 2: Primary Sources of Drinking Water

Water Source	Frequency	Percentage (%)
Borehole	160	45.1
Well	108	30.4
Tap water	54	15.2
Water vendors	33	9.3
Total	355	100.0

The major sources of drinking water among respondents are shown in Table 2. Borehole water was the predominant source, reported by 160 (45.1%) of respondents. This was followed by well water used by 108 (30.4%) respondents. Tap water accounted for 54 (15.2%), while 33 (9.3%) depended on water vendors. These findings indicate a high dependence on alternative water sources rather than piped public water supply.

Table 3: Household Water Purification Methods

Purification Method	Frequency	Percentage (%)
Boiling	100	28.2
Filtration	62	17.5
Use of alum	44	12.4
Chlorination	38	10.6
No treatment	111	31.3
Total	355	100.0

Table 3 shows the types of water purification methods used by respondents. Overall, 244 (68.7%) respondents reported practicing some form of water treatment, while 111 (31.3%) consumed water without any treatment. Among those who treated their water: Boiling was the most common method, used by 100 (28.2%) respondents, Filtration was practiced by 62 (17.5%), Use of alum (sedimentation) was reported by 44 (12.4%), Chlorination was used by 38 (10.6%). Boiling emerged as the predominant household water purification method in the study area.

Table 4: Knowledge of Waterborne Diseases

Knowledge Variable	Frequency	Percentage (%)
Aware that unsafe water causes disease	257	72.4
Not aware	98	27.6
Total	355	100.0

Assessment of respondents' knowledge revealed that 257 (72.4%) were aware that unsafe water can cause diseases, while 98 (27.6%) were not aware. The most commonly identified waterborne diseases included diarrhea, typhoid fever, and cholera. Although awareness was relatively high, the findings show a gap between knowledge and actual purification practice, as nearly one-third of respondents still consumed untreated water.

Table 5: Factors Influencing Choice of Purification Method

Factor	Frequency	Percentage (%)
Cost of materials	129	36.3

Availability	92	25.9
Taste/odor of water	74	20.8
Perceived cleanliness	60	16.9
Total	355	100.0

Table 5 presents factors influencing the choice of water purification methods. The major influencing factor was cost of purification materials, reported by 129 (36.3%) respondents. Availability of materials accounted for 92 (25.9%), taste or odor of water influenced 74 (20.8%), while perceived cleanliness of water influenced 60 (16.9%) respondents.

Table 6: Association between Socio-Demographic Characteristics and Practice of Household Water Purification (n = 355)

Variable	Practice of Water Purification Yes n (%)	Practice of Water Purification No n (%)	χ^2	df	p-value
Sex					
Male (N = 198)	130 (65.7)	68 (34.3)	1.84	1	0.175
Female (N = 157)	114 (72.6)	43 (27.4)			
Educational Level					
No Formal Education (N = 82)	40 (48.8)	42 (51.2)	18.62	3	0.001*
Primary (N = 91)	58 (63.7)	33 (36.3)			
Secondary (N = 116)	90 (77.6)	26 (22.4)			
Tertiary (N = 66)	56 (84.8)	10 (15.2)			

Table 6: Chi-square analysis showed a statistically significant association between educational level and practice of water purification ($p < 0.05$). Respondents with secondary and tertiary education were more likely to practice water treatment compared to those with no formal education. However, no statistically significant association was observed between sex and water purification practice ($p > 0.05$).

Table 7: Association between Knowledge of Waterborne Diseases and Practice of Household Water Purification (n = 355)

Knowledge of Unsafe Water Causes Disease	**Practice Yes n (%)**	**Practice No n (%)**	**Total**	**χ^2**	**df**	**p-value**
Aware (n = 257)	205 (79.8)	52 (20.2)	257	35.47	1	0.001*
Not Aware (n = 98)	39 (39.8)	59 (60.2)	98			
Total	**244 (68.7)**	**111 (31.3)**	**355**			

Table 7 shows the association between knowledge of waterborne diseases and household water purification practice among residents of Dutse Metropolis in Jigawa State. The results indicate a statistically significant association between knowledge and practice ($\chi^2 = 35.47$, df = 1, $p = 0.001$). Respondents who were aware that unsafe water causes disease were significantly more likely to practice household water purification compared to those who were not aware.

Table 8: Binary Logistic Regression Analysis of Predictors of Household Water Purification Practice (n = 355)

Dependent Variable: Practice of Household Water Purification (Yes = 1, No = 0)

Here is your regression output formatted into a clean, single table:

Variable	Category	B	S.E.	Wald	df	p-value	Adjusted OR (95% CI)
Sex (Male ref.)	Female	0.29	0.22	1.74	1	0.187	1.34 (0.86–2.10)
Educational Level (No formal ref.)	Primary	0.62	0.31	4.00	1	0.045*	1.86 (1.01–3.42)
	Secondary	1.25	0.33	14.34	1	0.001*	3.49 (1.83–6.65)
	Tertiary	1.79	0.45	15.82	1	0.001*	6.00 (2.48–14.53)
Knowledge of Waterborne Diseases (Not aware ref.)	Aware	1.68	0.29	33.54	1	0.001*	5.36 (3.05–9.42)
Cost as Barrier (No ref.)	Yes	-0.91	0.27	11.36	1	0.001*	0.40 (0.24–0.67)
Constant	—	-1.12	0.41	7.46	1	0.006	—

Table 8: The logistic regression model identified significant predictors of household water purification practice among residents of Dutse Metropolis in Jigawa State. Educational level was a strong predictor. Respondents with tertiary education were six times more likely to practice water purification compared to those with no formal education (AOR = 6.00, 95% CI: 2.48–14.53). Knowledge of waterborne diseases was also a significant predictor. Respondents who were aware that unsafe water causes disease were over five times more likely to purify their water (AOR = 5.36, 95% CI: 3.05–9.42). Cost was negatively associated with practice; respondents who identified cost as a barrier were 60% less likely to practice water purification (AOR = 0.40, 95% CI: 0.24–0.67). Sex was not a statistically significant predictor ($p > 0.05$).

DISCUSSION OF FINDINGS

This study assessed household water purification methods and their determinants among residents of Dutse Metropolis in Jigawa State, Nigeria. The findings reveal important patterns in water source utilization, treatment practices, knowledge of waterborne diseases, and socio-economic predictors of household water purification. Overall, the results align with existing literature on household water treatment (HWT) behaviors in Nigeria and other low- and middle-income countries (LMICs), while also highlighting contextual nuances relevant to semi-urban communities in northern Nigeria. The predominance of borehole and hand-dug well water among respondents reflects the broader Nigerian context, where access to safely managed drinking water remains suboptimal. According to the World Health Organization and UNICEF (2023), a substantial proportion of households in sub-Saharan Africa rely on basic or limited water services, many of which are vulnerable to microbial contamination. Similarly, national data from the National Bureau of Statistics (2022) indicate that safely managed piped water coverage in Nigeria remains limited, particularly in northern states.

Reliance on boreholes and wells although often perceived as "improved" sources does not necessarily guarantee microbiological safety, especially where maintenance and environmental sanitation are inadequate. This underscores the continuing relevance of point-of-use water treatment in protecting household health. The findings therefore reinforce global evidence that infrastructure expansion alone is insufficient; complementary household-level interventions remain essential (WHO & UNICEF, 2023). In this study, 68.7% of respondents reported treating their drinking water, with boiling being the most common method. This proportion is higher than some national estimates. For instance, secondary analysis of the National Population Commission Nigeria Demographic and Health Survey (NDHS) indicates relatively low uptake of recommended HWT methods nationally (NPC & ICF, 2019). Variations between Dutse and national estimates may reflect contextual differences in perceived water quality, education levels, or localized public health messaging. Boiling as the predominant method is consistent with findings from other Nigerian and sub-Saharan African studies, where it is often regarded as the most accessible and culturally acceptable method. However, boiling can be resource-intensive, requiring fuel and time, and may not be consistently practiced. The continued reliance on traditional methods such as alum sedimentation also suggests a blend of indigenous knowledge and modern health practices. Despite relatively high awareness (72.4%) and reported practice (68.7%), nearly one-third of respondents still consumed untreated water. This knowledge–practice gap is widely documented in LMIC settings. Systematic reviews of HWT interventions demonstrate that awareness of contamination risks does not always translate into sustained behavior change, particularly where economic, structural, or perceptual barriers persist (Clasen et al.,

2015). Thus, the findings highlight the need for interventions that move beyond information dissemination to address enabling and reinforcing factors.

The significant association between knowledge of waterborne diseases and purification practice observed in this study corroborates behavioral health theories and empirical findings suggesting that perceived susceptibility and severity influence preventive action. Respondents who understood the link between unsafe water and diseases such as diarrhea, cholera, and typhoid fever were more likely to treat their drinking water. This aligns with evidence from multi-country analyses showing that households with greater awareness of water-related health risks demonstrate higher adoption of HWT practices (Rosa & Clasen, 2010). However, as demonstrated in other contexts, knowledge alone may not be sufficient. Structural constraints—such as irregular income, limited availability of treatment supplies, and competing household priorities—may hinder consistent adoption even among informed individuals. Therefore, health education interventions must be complemented with practical support mechanisms.

Educational attainment emerged as a significant predictor of water purification practice. Respondents with tertiary education were significantly more likely to treat their drinking water, even after adjusting for other variables. This finding is consistent with broader public health literature demonstrating that education enhances health literacy, risk perception, and uptake of preventive behaviors (Cutler & Lleras-Muney, 2010). Education likely influences water purification behavior through multiple pathways, including improved understanding of disease causation, greater exposure to public health information, and increased capacity to evaluate treatment options. These findings reinforce the importance of integrating water, sanitation, and hygiene (WASH) education into formal and informal learning systems, particularly in underserved communities.

Cost was identified as a significant negative predictor of water purification practice. Households reporting financial constraints were less likely to adopt treatment methods, highlighting the economic dimension of safe water access. This is consistent with evidence from LMICs showing that affordability significantly influences uptake and sustained use of point-of-use technologies (Hunter et al., 2009). In contexts where households face multiple competing needs, expenditure on fuel for boiling or purchasing chlorine tablets and filters may be deprioritized. Consequently, interventions that reduce cost barriers such as subsidies, social marketing, or integration of HWT products into primary healthcare outreach may improve uptake. Policymakers should consider targeted support for low-income households to ensure equitable access to safe water.

Implications for Policy and Practice

The study suggests that improving household water safety in Dutse Metropolis requires a dual approach. Health education campaigns should promote consistent water treatment, correct misconceptions, and engage community leaders to build trust. Economic barriers should be addressed through subsidized chlorine, low-cost filtration, and community-based planning. While household-level treatment is important short-term, long-term solutions need investment in water infrastructure, quality monitoring, and regulation. Combining behavioral and structural strategies is essential to sustainably reduce waterborne disease and achieve safe water access in line with Sustainable Development Goal 6.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional research ethics committee. Permission was also sought from relevant local authorities in Dutse. Participation was voluntary, and respondents were informed of their right to withdraw at any stage without penalty. Confidentiality and anonymity were strictly maintained, and no identifying information was recorded on the questionnaires.

CONCLUSION

This study found that although most households in Dutse Metropolis practice some form of water purification mainly boiling a significant proportion still consume untreated water. Boreholes and wells are the primary water sources, reflecting limited access to safely managed piped water. Education and knowledge of waterborne diseases were strong predictors of purification practices, indicating that health literacy plays an important role

in promoting safe water behaviors. However, financial constraints and other structural barriers limit consistent adoption of treatment methods, creating a gap between awareness and practice. Overall, improving household water safety requires integrated strategies that combine health education, affordable treatment options, and long-term investment in reliable water infrastructure to ensure sustainable and equitable access to safe drinking water.

RECOMMENDATIONS

To improve household water safety in Dutse Metropolis, the study recommends a combined approach of education, community engagement, and infrastructural support. Key actions include implementing targeted health education campaigns, involving community leaders to address misconceptions, providing subsidized or low-cost water treatment options, and promoting community-based water safety planning. Long-term improvements require investment in water infrastructure and routine monitoring. Integrating behavioral interventions with structural and economic support will help ensure sustainable access to safe drinking water and reduce waterborne disease risk, in line with Sustainable Development Goal 6.

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