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Effect Of Water Handling Practices on The Health Outcomes of Rural Households in Bauchi State, Nigeria

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Abstract- ***The purpose of this study is to assess household's water handling in relations to their consequences on health indicators of rural dwellers in some communities of Bauchi state Nigeria. This study is motivated by the increasing report of diseases that are caused by water contamination in rural areas across the region. And the need to improve in the provision of hygienic water. This study adopts cross sectional survey design. The data was collected from 118 heads of households in the area by using a structured questionnaire. The method used for data collection includes percentages, and cross- tabulation analysis. Findings from the analyzed data indicated that 59.3% used open containers, and 61.9% used one container such as a cup for drinking water in the entire household. Also, about 62.7% of the households had reported a case of sickness that is related to waterborne in the last 12 months. The study therefore concludes that the current water handling practices in the areas has negative health implication on the people in rural communities across Bauchi State Nigeria. Therefore, in order to improve living condition in rural areas, health education with emphasis on handling practices should be advocated. In addition, separate water drinking containers should be maintained in the households.***

Keywords: Health Outcomes, Water Handling, Rural, Household, Bauchi State

I. INTRODUCTION

Provision of clean and safe drinking water is one of the constitutional rights of the citizens upon the government. However, despite advances made in meeting up with these fundamental rights in some parts of the world, in the middle- and low-income nations unsafe drinking water remain one of the significant contributors of diseases.

Evidences have shown that in low-income countries such as Africa, waterborne related diseases such diarrhea, and cholera are caused largely by water contamination at both sources and household's levels and have contributed significantly to the current morbidity and mortality cases in the area (Saxena et al., 2024).

Globally, there is a close relationship between public health outcome and water, sanitation and hygiene (WASH) practices. In many countries of Africa such Nigeria, poor health outcomes in both rural and urban dwellings are closely associated to poor water and sanitation practices the scenario which frustrates targeted progress toward attainment of sustainable development goals. For example, the study have revealed an increased exposure of infectious diseases and environmental health risk to poor sanitation, unsafe water handling and poor hygiene practices (Okesanya et al., 2024). This underscores the need to assess water access and management at household level.

Household water handling practices are critical pathways through which contamination occurs. Even when water is collected from relatively safe sources, it can become contaminated during transportation, storage, and usage. Common risk factors include the use of uncovered containers, infrequent cleaning of storage facilities, lack of water treatment, and poor hand hygiene during water collection and handling. A recent study by Mohamed et al. (2025) found that while a majority of households perceived their water as safe, a significant proportion did not treat their water, and unsafe practices such as uncovered storage and inadequate sanitation persisted, contributing to increased health risks.

Furthermore, household water treatment and safe storage practices often referred to as point-of-use interventions have been identified as effective strategies for reducing waterborne diseases. However, evidence suggests that adoption of these

practices remains inconsistent across sub-Saharan Africa due to factors such as lack of awareness, socio-economic constraints, and cultural practices (Atalay et al., 2024). This indicates that improving water quality alone is insufficient without addressing behavioral and household-level practices.

In addition, rapid population growth, urbanization, and inadequate infrastructure in many developing regions exacerbate challenges related to water safety. These factors increase reliance on household-level water, thereby heightening the risk of contamination if proper practices are not followed. As such, understanding the dynamics of water handling at the household level is essential for designing effective public health interventions.

Given these concerns, there is a growing need for empirical studies that assess how specific water handling practices influence health outcomes within local contexts. While global and regional studies provide valuable insights, localized data is crucial for identifying context-specific risk factors and informing targeted interventions.

Therefore, this study seeks to examine household water handling practices and their implications for health outcomes in Some rural communities of Bauchi State Nigeria. By doing so, it aims to contribute to the existing body of knowledge and provide evidence-based recommendations for improving household water safety and reducing the burden of waterborne diseases.

Despite global efforts to improve access to safe drinking water, a large proportion of households still experience water contamination due to poor handling practices. Evidence shows that inadequate WASH conditions contribute to approximately 1.4 million preventable deaths annually.

In many communities, households store water in unsafe conditions, fail to regularly clean storage containers, and lack proper separation of drinking water. These practices increase exposure to pathogens and heighten the risk of diseases such as cholera and gastroenteritis. However, there is limited empirical evidence linking specific household water handling practices to health outcomes at the local level in [Some rural communities of Bauchi State Nigeria]. This gap necessitates a focused study to examine these relationships and provide context-specific solutions.

This study is justified by its significant contribution to public health, policy development, and academic scholarship, particularly in the context of water, sanitation, and hygiene (WASH). Unsafe water handling practices remain a major pathway for household-level water contamination, thereby increasing the risk of waterborne diseases such as diarrhea, cholera, and gastroenteritis.

Despite ongoing global and national efforts to improve access to safe water, evidence indicates that health risks persist due to improper handling practices at the point of use World Health Organization [WHO], 2024). This underscores the need to move beyond access-focused interventions and critically examine behavioral and household-level determinants of water safety.

From a policy perspective, this study provides context-specific evidence that can inform the design and implementation of effective WASH interventions. Governments, non-governmental organizations, and development partners require empirical data to develop targeted strategies that address the root causes of water contamination within households. By identifying key risk factors associated with unsafe water practices, this study can support the formulation of policies and programs aimed at improving water quality, enhancing public awareness, and ultimately reducing disease burden.

Furthermore, the findings will contribute to ongoing efforts to achieve Sustainable Development Goal 6, which emphasizes universal access to safe and affordable drinking water (United Nations, 2023).

Academically, this study adds to the growing body of literature on the relationship between household water management practices and health outcomes. While previous studies have established general links between WASH conditions and disease prevalence, there remains a gap in localized empirical evidence that captures the specific dynamics of water handling practices in different contexts (Saxena et al., 2024;

Atalay et al., 2024). By addressing this gap, the study enhances understanding of how micro-level practices influence health outcomes and provides a foundation for future research. Overall, the study is both timely and relevant, as it integrates public health concerns with practical, evidence-based solutions for improving household water safety.

Objectives of the Study

The main objective of this study is to assess household water handling practices their implications on the health outcomes of some rural households in Bauchi State Nigeria. The specific objectives of the study are:

1. To assess household water handling practices in some rural communities of Bauchi State Nigeria, including methods of covering of containers, cleaning frequency, and water separation practices.
2. To examine the relationship between household water handling practices and health outcomes, particularly the occurrence of waterborne diseases such as diarrhea, cholera, and gastroenteritis.

II. LITERATURE REVIEW

Household Water Treatment Practices and Health Outcomes Another important theme identified in the reviewed literature is household water treatment practices. Water treatment methods such as boiling, chlorination, filtration, and sedimentation are recognized as effective measures for improving drinking water quality and preventing waterborne diseases. Aluko et al. (2022) found that households that treated their drinking water were less exposed to health risks associated with contaminated water. The study revealed that although some households practiced boiling and chlorination, the overall level of water treatment remained relatively low.

Consequently, many households continued to consume untreated water despite potential contamination risks. The findings indicate that water treatment serves as an important protective mechanism against pathogens that may enter water during collection, transportation, storage, or distribution. The study therefore underscores the importance of promoting affordable and accessible household water treatment technologies as a means of improving health outcomes in rural communities.

Access to Improved Water Sources and Water Handling Practices

Access to improved water sources constitutes another recurring theme in the literature. Several studies have demonstrated that the availability and accessibility of potable water influence household water handling behaviours and health conditions. Aikowe and Mazancová (2021) observed that distance to water sources, reliability of supply, and socioeconomic conditions significantly influenced households' choice of water sources. Households lacking access to improved water facilities often depended on rivers, streams, ponds, and other unimproved sources, thereby increasing their exposure to contaminated water.

Similarly, Sule et al. (2022) found that the provision of solar-powered boreholes in rural communities of Northern Bauchi State improved access to potable water and reduced reliance on unsafe water sources. However, both studies emphasized that access to improved water sources alone does not guarantee safe drinking water. Water can still become contaminated during transportation, and consumption if appropriate handling practices are not followed. These findings suggest that water infrastructure development should be complemented by public education on safe water handling practices to maximize health benefits.

Water Handling Practices and Household Health Outcomes

The reviewed studies consistently highlight the relationship between water handling practices and household health outcomes. Evidence from the literature shows that unsafe water handling behaviours contribute to the prevalence of diarrhoeal diseases, gastrointestinal infections, and other waterborne illnesses. Aliyu et al.

(2019) reported that poor water handling, sanitation, and hygiene practices were associated with increased risks of disease outbreaks in rural communities. Likewise, Wada et al. (2021) found that inadequate water management and hygiene practices exposed households to numerous health hazards. The studies suggest that household health outcomes depend not

only on the quality of water at the source but also on how water is managed after collection. Unsafe practices such as using contaminated containers, storing water for extended periods, and handling water with unwashed hands create opportunities for microbial contamination and disease transmission. Consequently, improving water handling practices at the household level can significantly reduce the burden of preventable diseases and enhance overall community health.

Socioeconomic Factors Influencing Water Handling Practices

The influence of socioeconomic factors on water handling practices also emerged as a prominent theme from the reviewed studies. Aluko et al. (2022) found that variables such as household income, educational attainment, and gender significantly affected the adoption of water treatment practices.

Households with higher socioeconomic status were more likely to treat drinking water and adopt safer water management behaviours than poorer households. Similarly, Aikowe and Mazancová (2021) reported that economic conditions influenced households' ability to access improved water sources.

These findings suggest that water handling practices are not determined solely by individual choices but are also shaped by broader socioeconomic circumstances. Consequently, interventions aimed at improving household water safety should incorporate strategies that address financial constraints, educational barriers, and awareness deficits among rural populations.

Research Gap in Bauchi State

Despite the substantial body of evidence on household water handling practices and health outcomes, a significant knowledge gap remains regarding rural communities in Bauchi State. Most of the reviewed studies were conducted in states such as Osun, Plateau, Kogi, and Kano, while only Sule et al. (2022) focused on Bauchi State. However, the study concentrated primarily on access to improved water sources and did not specifically examine the effects of water handling practices on household health outcomes. Furthermore, many of the studies investigated water, sanitation, and hygiene conditions broadly without directly assessing how water collection, transportation, storage, treatment, and withdrawal practices influence health outcomes.

Therefore, there is a need for empirical studies that specifically examine the effect of water handling practices on household health outcomes in rural communities of Bauchi State. Such studies would provide context-specific evidence that could guide policies and interventions aimed at improving water safety and public health in the state.

III. METHODOLOGY

This study adopted a cross-sectional research design, which was appropriate for examining the relationship between household water handling practices and health outcomes at a single point in time. The study was conducted in selected rural communities of Bauchi State, Nigeria, targeting households as the primary unit of analysis.

The study population comprised all heads of household in Kwanan Labi, Kafin Kawu, Kafin Liman, and Huturu communities. Stratified random sampling was adopted in selecting households for the survey. In each household, a senior female wife was interviewed where the male head is not available.

Data for the study were collected using a structured questionnaire, which was administered to respondents face to face, and formed the basis of the dataset used in the research. The questionnaire captured key variables, including types of water storage containers, covering practices, cleaning frequency, water separation methods, and reported health outcomes such as the occurrence of diarrhea, cholera, or gastroenteritis within a period of last 12 months. In addition, data on socio-demographic characteristics such as age, education level, and household size were collected.

For data analysis, descriptive statistical techniques were employed. Descriptive statistics, including frequencies, and percentages were used to summarize household water practices and health outcomes. Cross tabulation was also used to determine the extent to which water handling practices predicted health outcomes. The cross tabulation was

appropriate given the binary nature of the dependent variable such as presence or absence of disease. All analyses were conducted using statistical software such as SPSS.

Ethical considerations were strictly adhered to throughout the study. Participation was voluntary, and informed consent was obtained from all respondents. Confidentiality and anonymity of participants were ensured by excluding personal identifiers from the dataset.

IV. RESULTS AND DISCUSSION

Household size

Data on household size is presented in table 1. The findings revealed that households with 10 persons and above constituted the largest proportion of the respondents (31.4%), followed by households with 4–6 persons (28.0%) and 7–9 persons (25.4%), while households with 1–3 persons accounted for the smallest proportion (15.3%). This finding indicates that large household size is one of the common characteristics of rural communities in the study area.

Already it is established by the National Population Commission and the National Bureau of Statistics, which reported that rural households in Northern Nigeria constitutes of larger family sizes due to extended family structures and high fertility rates. Similarly, Afolabi and Ilesanmi (2012) found that large household sizes are prevalent in rural Nigerian communities and significantly influence household demand for basic resources, including water, grazing land, and farmlands.

Table 1: Household Size

Category	Frequency (n)	Percentage (%)
1–3 persons	18	15.3
4–6 persons	33	28.0
7–9 persons	30	25.4
10 and above	37	31.4
Total	118	100.0

Source: field survey, 2025

The predominance of large households has important implications for water storage and handling practices because larger households require greater quantities of water for domestic use such as cooking, washing, and drinking. According to Howard and Bartram (2003), increasing household size often increases water demand and the frequency of water collection, storage, and handling activities. Impliedly, larger households may experience greater challenges in maintaining safe water storage conditions and preventing contamination. The finding therefore suggests that household size constitutes an important contextual factor influencing water management practices and household health outcomes in rural Bauchi State.

Gender of respondents

Table 2 show gender distribution. The study found that male respondents accounted for 55.1% of the sample, while females represented 44.9%. In Northern Nigeria, most of the households are led by men. It is only when the male head is not available during survey that female are contacted.

It is important to state that both men and women play important roles in household water management, although their responsibilities often differ. In many rural African settings, women are primarily responsible for water collection, storage, and utilization, while men often influence decisions relating to household resources and infrastructure.

Table 2: Gender

Variable	Category	Frequency (n)	Percentage (%)
Gender of Respondent	Male	65	55.1
	Female	53	44.9

Source: field survey, 2025

The substantial representation of female respondents in this study is particularly important because women frequently possess practical knowledge regarding water storage and handling practices. Therefore, the participation of both genders enhances the reliability of the findings and provides a more comprehensive understanding of the factors affecting water-related health outcomes within rural households

Water handling practices

The data on water handling practices is presented in table 2. The findings revealed that only 22.9% of respondents cleaned their storage containers daily,

thus even if the containers did not show any physical dirt. In same vein, about 66.9% of the households cleaned the containers only when they appeared dirty.

This clearly show that the practice of preventive hygiene is scarcely practiced among the households in the study areas and this may contribute to water contamination. This finding agrees with Jensen et al. (2002) who emphasized irregular cleaning of water storage facility to dangers associated with household contamination of drinking water. Similarly, Mintz et al. (1995) observed that improper maintenance of storage containers is capable of increasing risk of microbial growth and disease transmission.

The result of this study also supports the conclusions of Gundry et al. (2004), who argued that household water quality depends many factors ranging from the quality of the water source to post-collection handling practices.

Therefore, the attitude of cleaning containers to only when visibly dirty suggests limited awareness of microbial contamination, which may occur even when containers appear clean. Consequently, the result reinforces the importance of promoting routine cleaning practices as a means of improving household health outcomes.

Table 3: Water handling practices: Cleaning Frequency of Storage Containers

Category	Frequency (n)	Percentage (%)
Daily	27	22.9
Weekly	7	5.9
Only when dirty	79	66.9
Total	118	100.0

Source: field survey, 2025

Use of separate container for drinking water
Data on use of container for drinking water is presented in table 5. The findings showed that about 61.9% of the household in the area uses same container for drinking water while 33.9% shows some level of separating containers used for water consumption.

This finding suggests that majority of the population in the area share same container for water drinking, the attitude which may facilitate rapid widespread of communicable disease. Further, this attitude signifies low awareness of the people in the area to means of dissemination of communicable diseases. Several existing study on use of dedicated container for drinking water and its effect on human health condition suggests that, households that uses separate drinking water containers experiences lower levels of bacterial infection (World Health Organization, 2017; Roberts et al., 2001)

Table 4: Use of Separate Container for Drinking Water

Category	Frequency (n)	Percentage (%)
Yes	40	33.9
No	73	61.9
Missing	5	4.2
Total	118	100.0

Source: field survey, 2025

This finding also corroborates the work of Clasen et al. (2006), who reported that water contamination frequently occurs during household's handling processes. This therefore mean that, the failure to maintain separate containers for drinking water may increase the likelihood of contamination through repeated handling and contact with potentially contaminated objects. Therefore, the result highlights an important behavioural factor that may contribute to the high prevalence of waterborne diseases observed among households in the study area.

Household health outcomes (waterborne diseases)
Concerning findings on household health outcome (table 6), the study found that 62.7% of households reported experiencing at least one water-related illness in the last 12 months, while only 37.3% reported no illness. This finding demonstrates that waterborne diseases remain a major public health challenge within the community in the study area.

This finding clearly shows the link between water handling practices and prevalence of waterborne diseases in the areas. The result of this study is consistent with the findings of Prüss-Ustün et al. (2014), who reported that unsafe water, sanitation, and hygiene conditions may be responsible factor accounting for a substantial proportion of disease burdens in low-income countries. Similarly, the World Health Organization (2023) identified contaminated drinking water as a major contributor to diarrhea diseases and other health problems globally, and in Africa in particular.

Table 5: Household Health Outcomes (Waterborne Diseases)

Category	Frequency (n)	Percentage (%)
No illness reported	44	37.3
At least one illness reported	74	62.7
Total	118	100.0

Source: field survey, 2025

The finding further supports studies conducted within Nigeria. For example, Oloruntoba et al. (2014) who found that poor household water management practices significantly increased the risk of diarrhoeal diseases among rural households. The high prevalence of illness observed in the present study therefore provides empirical evidence that inadequate water handling practices can negatively affect household health outcomes of the people in the rural areas of Bauchi State.

Relationship between water handling practices and health outcomes

Finding from cross-tabulation analysis (table 7) revealed that disease occurrence was highest among households that cleaned storage containers only when visibly dirty, with 58 reported cases of illness compared to 21 cases where no illness was reported.

In contrast, households that cleaned containers daily recorded relatively fewer cases of disease. This finding is consistent with the work of Fewtrell et al. (2005), who found that improved water, sanitation, and hygiene practices significantly reduced the incidence of diarrheal diseases in developing countries.

Table 6: Relationship between water handling practices and health outcomes (cross-tabulation)

Cleaning Frequency	Disease Present (n)	Disease Absent (n)	Total
Daily	4	3	7
Weekly	12	15	27
Only when dirty	58	21	79
Total	74	44	118

Source: field survey, 2025

The finding also supports Esrey et al. (1991), who found a strong relationship between household hygiene practices and health outcomes. The observed pattern (table 7) suggests that inadequate cleaning practices may facilitate microbial contamination of stored water, thereby increasing prevalence of disease occurrence. Consequently, the finding provides strong descriptive evidence that water handling practices are closely associated to household health outcomes in rural areas across Bauchi State.

CONCLUSION

The study examined water handling practices and their implications for household health outcomes in rural communities of Bauchi State, Nigeria. The findings revealed that large household sizes were common among the population studied, implying increased demand for water and more frequent water handling activities.

Although most households possessed water storage facilities, a significant proportion utilized unsafe storage methods, including the use of uncovered containers and the failure to maintain separate containers for drinking water. Furthermore, most households cleaned their storage containers only when visibly dirty, reflecting inadequate water hygiene practices. These conditions were accompanied by a high prevalence of water-related

illnesses, suggesting that unsafe water management practices continue to pose serious public health challenges within the study area.

The cross-tabulation analysis further indicated that households practicing poor water handling behaviors experienced higher disease occurrence than those adopting better hygiene practices. Overall, the findings demonstrate that household health outcomes are influenced not only by access to water but also by how water is handled, and maintained after collection.

The study therefore concludes that improving household water management practices is essential for reducing waterborne diseases and enhancing public health in rural communities. Future research should extend the scope of investigation by examining additional socio-economic, environmental, and behavioral factors that may influence household water handling practices.

There is also a need for longitudinal studies to assess the effectiveness of hygiene education programmes and safe technologies in reducing disease prevalence. Furthermore, future researchers should incorporate microbiological testing of stored household water to provide objective evidence of contamination levels and strengthen causal explanations regarding the relationship between water management practices and health outcomes. This would contribute to a more comprehensive understanding of household water safety and public health challenges in Nigeria and other developing countries.

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