

# Assessment of Household Sanitation and Water Management Practices in Some Communities of Bauchi Local Government, Nigeria

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*Abstract- Access to proper sanitation facilities is essential for public health and human dignity. Even though there have been global and national efforts to enhance sanitation coverage, there's still a significant lack of routine data that could help guide decisions about household sanitation and public health, especially in rural areas of Bauchi State. This study aims to assess the household sanitation infrastructure in several communities within Bauchi local government, Nigeria. We surveyed 118 households using a structured questionnaire, which was delivered in person with the assistance of trained field workers. Key factors examined included access to toilets, sources and storage of water, waste management practices, and hygiene habits. We analyzed the data using descriptive statistics and applied systematic random sampling. The results revealed that a majority of households (92%) have toilets, primarily pit latrines with slabs (51) and flush toilets (46), although 8% still resort to open defecation. The main sources of water are boreholes/tube wells (34%) and public taps (30%), with some households also depending on rivers and streams (15%). While many families store water safely in covered containers, 60% consume untreated water, which raises health concerns. Waste management practices differ; some households compost or reuse food waste, while others burn or dispose of it openly. Awareness of hygiene is quite high, with 90% having handwashing facilities and 85% using soap, yet only 40% treat their drinking water. Overall, sanitation and hygiene levels are decent but need improvement in water treatment and waste disposal practices. This study has provided evidence-based recommendations that can be used to inform local sanitation policies and interventions.*

**Keyword:** Sanitation Facilities, Household Sanitation, Waste Management Practices, And Bauchi State

## I. INTRODUCTION

Sanitation is an integral aspect of human activity that promotes public health, environmental quality and safety of families from illness caused by contaminations. According to World Health Organization (WHO, 2019) transmission of diseases such as cholera, dysentery and diarrhea which are common in developing countries are faster where

sanitation is poor or at dilapidated state. Although, getting access to sanitation is difficult in many low income countries, but their availability promotes improved health outcome (UNICEF, 2021).

In Nigeria for example, poor sanitation is recorded most especially among rural communities as a result of limited access and availability of sanitation facilities. Currently, many rural communities in Bauchi persistently rely on unimproved sanitation facilities despite effort by national and international interventions to improve sanitation condition in the area. Most of these facilities includes pit latrines without slabs, shared toilets, and open defecation (National Bureau of Statistics, 2020). These practices predispose the affected communities to risk of exposure to communicable diseases and environmental hazards.

While a significant number of researches were carried out on sanitation access in Nigeria, most of these scholarly works are limited to cities and urban centers across states in some of the geopolitical zones of the area (Afolabi & Okoh, 2022; Adamu et al., 2021). This is in addition to the lack of studies that explore relationships between household's demographic characteristics and sanitation access in communities and sparsely populated areas. In Bauchi State for example, the study of these kinds were not conducted in communities such as Yalwan Mutari, Kangere, and Gubi despite their demographic complexity and proximities to Bauchi Urban area.

For a decision making and proper planning on sanitation in communities around urban centers in Nigeria and Bauchi city in particular, a good knowledge on dynamics of sanitation access at household levels in communities is highly critical. This study therefore addresses this gap by examining the demographic characteristics of households and access to sanitation facilities in Yalwan Mutari, Kangere, and Gubi communities, Bauchi State. The

research is necessary as it provides evidence based data on rural sanitation activities which supports broader goals of Sustainable Development Goals as well as clean water and sanitation advocacy for all (United Nations, 2020).

## II. LITERATURE REVIEW

### 2.1 Household Sanitation Practices

Household sanitation comprises of availability and use of toilets or latrines, waste disposal activities, and human behaviours toward hygiene. Many studies have indicated the importance of sanitation infrastructures and behaviour changes in health outcomes. Odagiri et al. (2023) maintained that even if there is sufficiency of latrine coverage, poor upkeep and irregular use of the facility may degrade public health status. This finding is supported by Bhatt et al. (2022), who show how cultural norms and social taboo persistently influenced open defecation practices in some parts of sub-Saharan Africa despite advances in the provision infrastructural facilities. Similarly, poor sanitation practices were considered to directly associated with increase in the spread of waterborne diseases such as cholera and diarrhea, most especially among children under the age of five (Choudhary & Kapur, 2023). In a study that was carried out in the North Central Nigeria, Adebayo et al. (2023) noted the persistence in the use of unimproved sanitation facilities, and therefore recommended the need for strong commitment to community engagement in policy making.

### 2.2 Water Management Practices at the Household Level

Water management practices covers selection of water sources, collection, treatment, storage, and usage. However, the access to improved water source does not guarantee safety of water so long as the handling and storage practices are not handled in best way (Mekonnen et al., 2022). In many rural settings in Nigeria, the water that is used for domestic consumptions is obtained from open sources, stored in unhygienic containers, leading to risk of contamination. In Ethiopia, about 45% of rural household treats drinking water and less than 25% practiced safe storage (Adane et al., 2023). On the other hand, in location where water sources such boreholes are found in the Northern Nigeria, few among households purify the water through boiling

and chlorination before consumption (Oche et al., 2023).

### 2.3 Household Sanitation and Water Management Practices

Access to adequate sanitation and quality water for domestic consumption is not a matter of concern that is limited to countries in developing world but by extension to the developed countries as well. The assessment of household sanitation and water management practices is key to achieving Sustainable Development Goal (SDG) 6, which targets universal access to clean water and sanitation by 2030 (UNICEF & WHO, 2023). A number of empirical studies have indicated that while significant development was made in improving sanitation and water management practices, significant disparity still exists among rural and semi urban communities.

### 2.4 Determinants of Sanitation and Water Practices

Many factors have continued to play role in determining sanitation and water management practices. consequently, the social and economic status, level of education, gender disparity, availability and access to sanitation facilities significantly play the dominant role. In a multi-country study, the household income and educational levels of the heads of households were identified as dominant factors that determine improved sanitation and water management practices (Uddin et al. 2022). In terms of gender differences, women who provides who mostly control domestic activities, play essential role in the promotion of hygiene and water related usage (Njuguna & Mbugua, 2023). On the other hand, other factors such as public health education, participation of the extension services, as well as governmental and non-governmental involvement significantly determine household behaviors (WHO, 2023). Nevertheless, gap still exists in incorporating domestic knowledge and participation of native population in the design of programs associated with sanitation and water management.

### 2.5 Challenges and Emerging Trends

The most pressing challenges in literature include poor policy implementation, lack of funding, and minimal inter-agency collaboration. In many low-income settings, the sanitation sector is underfunded

and fragmented across multiple ministries, leading to inefficiencies (World Bank, 2023). However, emerging trends such as community-led total sanitation (CLTS), behaviour-centered design (BCD), and digital water monitoring systems are showing promise (Giné-Garriga et al., 2022). Recent advances include the use of solar-powered water purification systems and mobile-based data collection to track household practices in real-time (UN-Water, 2023). These technological advances offer opportunities to enhance service delivery and behavioural monitoring, especially in hard-to-reach communities.

## 2.6 Research Gaps

Despite increasing interest in sanitation and water management practices among scholars in different parts of the world, only few studies have investigated the relationships between water management and sanitation practices at the household level, particularly in informal settlements in the Northern States of Nigeria. This is in addition to limited longitudinal research to assess sustainability of interventions over span period of time.

## III. MATERIALS AND METHODS

The study employs a descriptive survey design to collect quantitative data from heads of households in Yalwan Mutari, Kangere, and Gubi Communities, Bauchi State, Nigeria. The main objective of the research is to assess household sanitation and water management practices in rural communities of Bauchi local government, Nigeria. These communities were selected based on their diverse population. The target population for the study includes all households in the communities. A sample size of 118 households were selected through systematic random sampling, ensuring that every household on a pre-listed roster is included in the sample to achieve a representative distribution. Data were collected using a structured questionnaire, which were administered directly to respondents by trained field assistants. The questionnaire covered household demographics, sanitation infrastructure, water sources and usage, hygiene behaviours, and waste disposal. The data gathered were analysed using descriptive statistics, including frequencies and percentages, to identify patterns in the data and summarize the key findings. This approach was helpful in understanding the relationships between

household characteristics and access to sanitation services. Ethical considerations were central to the study. Informed consent was obtained from all participants, ensuring they understand the nature of the study and their role in it. Participants were assured that their responses will remain confidential, and their identities will be protected throughout the research process.

The method used in this research is descriptive survey design consisting of quantitative data obtained from heads of households in Yalwan Mutari, Kangere, and Gubi Communities, Bauchi State, Nigeria. The main objective of the research was to assess household sanitation and water management practices in rural communities of Bauchi local government, Nigeria. The selection of these communities was as a results of their diverse population.

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#### IV. RESULTS AND DISCUSSION

##### 4.1 Demographics of Respondents

A total of 118 households were surveyed in this study. The data reveals insights into household size, composition, and age distribution of household members. The average household size is 8 persons, indicating relatively large household structures. On average, each household consists of 4 male members and 4 female members, showing a nearly balanced gender distribution. Additionally, 2 to 3 children under the age of 5 are present per household, reflecting a significant number of young dependents. The age group 35-44 years represents the majority of household heads, covering 60 households (50.8%). The 45-54 years age group accounts for 28 households (23.7%). The 55 years and above category includes 30 households (25.5%), suggesting a considerable proportion of older household heads.

##### 4.2 Toilet Availability and Usage

Access to sanitation facilities is a critical indicator of public health and hygiene within a community. The availability and type of toilets used by households provide insight into the level of sanitation infrastructure and the potential risks associated with inadequate facilities. Out of the total surveyed households, 109 households (92%) reported having access to some form of toilet facility. This indicates a high level of toilet coverage within the community, suggesting that the majority of residents have access to basic sanitation. However, a small proportion, 9 households (8%), practice open defecation, which poses serious health and environmental risks, including the spread of waterborne diseases and contamination of drinking water sources. Among the households that reported having toilets, the types of facilities varied as follows:

**Pit Latrine with Slab:** The most common type of toilet used in the community is the pit latrine with a slab, accounting for 51 households. This type of toilet is considered an improved sanitation facility as it provides a more hygienic option compared to open pits by reducing direct exposure to human waste and minimizing odours.

**Flush Toilets:** A significant number of households, 46 in total, have access to flush toilets, which are generally more sanitary and convenient but require a consistent water supply. The presence of a high

proportion of flush toilets suggests that many households may have access to piped water or other sources necessary for their functionality.

**Pit Latrine without Slab:** 9 households use pit latrines without slabs, which are less hygienic than those with slabs because they expose users to direct waste and are more prone to collapsing or attracting disease vectors. This type of toilet presents a sanitation challenge as it may contribute to contamination of groundwater and soil.

**Other Types of Toilets:** A small number of households (3 households) reported using other types of toilets, which could include makeshift latrines, composting toilets, or other locally adapted sanitation solutions. The nature and effectiveness of these toilets would depend on their design and maintenance.

Despite the high percentage of toilet ownership, 9 households (8%) still engage in open defecation, which remains a public health concern. Open defecation increases the risk of disease outbreaks, particularly diarrhea, cholera, and other fecal-oral infections. It also poses environmental hazards, leading to soil and water contamination. The presence of open defecation indicates that either some households lack access to toilet facilities or face barriers in using the available ones, such as cultural practices, lack of awareness, or poor maintenance. The data highlights that while toilet availability is relatively high in the surveyed community, there are still areas for improvement. The presence of open defecation and the use of unimproved pit latrines suggest the need for further interventions, such as community awareness programs, sanitation infrastructure upgrades, and support for households to transition to more hygienic toilet options. Expanding access to improved sanitation facilities, particularly for the 9 households practicing open defecation, could significantly enhance public health outcomes and environmental sustainability in the area.

##### 4.3 Water Sources and Storage

Access to clean and reliable water sources is a crucial aspect of household well-being. The survey reveals that the most common source of water for households is boreholes and tube wells, utilized by 40 households, accounting for 34% of the total

respondents. This indicates a significant reliance on groundwater extraction methods, likely due to their relative safety and accessibility. Following closely, public taps serve as the primary water source for 35 households (30%). These taps, often provided by municipal authorities or community water projects, suggest a moderate level of dependence on centrally managed water distribution systems. Additionally, protected wells supply water to 25 households (21%). Protected wells generally provide safer water compared to open wells, as they are designed to prevent contamination from external sources. A smaller but notable proportion of households (18 households, 15%) rely on rivers and streams as their main water source. This group is likely at a higher risk of waterborne diseases due to potential contamination from agricultural runoff, or other pollutants. The dependence on natural water bodies may indicate limited access to improved water sources, necessitating interventions to ensure water safety.

Effective storage of water is essential in preventing contamination and ensuring a stable water supply, especially in areas where access to running water is inconsistent. Findings have shown that, the most common water storage method is the use of covered buckets or drums, adopted by 77 households. This method helps in reducing contamination from dust, insects, and other external pollutants, making it a relatively safe option. Conversely, open buckets or basins are used by 39 households, posing a greater risk of contamination due to exposure to environmental elements, including pathogens and vectors such as mosquitoes. Jerry cans with lids are utilized by 48 households, offering a secure and portable storage option that minimizes contamination risks compared to open containers.

#### 4.4 Water Treatment Methods

Despite varying water sources and storage methods, the majority of households do not engage in adequate water treatment. Only 15% of household's use boiling as a method to purify water, despite its effectiveness in eliminating bacteria and viruses. The relatively low adoption may be due to factors such as fuel costs, time consumption, or lack of awareness. Filtration is practiced by 10% of households, possibly through basic household filters or cloth straining methods. While filtration can remove particulates, it may not eliminate all microbial contaminants.

Alarming, 60% of households do not treat their water at all before consumption, significantly increasing their risk of contracting waterborne diseases. This highlights a major public health concern, emphasizing the need for awareness campaigns and affordable water treatment solutions. The data indicates that while a majority of households access relatively safe water sources like boreholes, tube wells, and public taps, a substantial number still rely on unprotected sources such as rivers and streams. Storage practices vary, with many households using covered containers, though a significant portion still relies on open storage methods that increase contamination risks. The most concerning finding is the low level of water treatment, with a majority of households consuming untreated water. This underscores the need for improved water management strategies, awareness programs on water safety, and increased access to affordable treatment options.

#### 4.5 Waste Management Practices

Effective waste management is crucial in maintaining environmental sustainability, reducing pollution, and improving public health. The survey data on household waste management practices highlight different methods employed by residents in handling food waste and general waste. These practices reflect both traditional and modern approaches to waste disposal, with varying implications for environmental health and sustainability. Food waste management plays a significant role in ensuring minimal environmental impact and promoting resource efficiency. The data reveal that a considerable number of households (25) engage in *stimming*, which involves reusing leftover food instead of discarding it. This practice helps in minimizing food waste, reducing household expenses, and ensuring food security. It is particularly common in communities where food conservation is a cultural norm. The highest number of households (30) utilize composting as a method of food waste disposal. Composting is an environmentally friendly practice that involves decomposing organic waste into nutrient-rich soil additives. This method is highly beneficial for households engaged in gardening or farming, as it enhances soil fertility and reduces the need for chemical fertilizers. On the contrary, a smaller portion of households (15) dispose of their food waste openly. Open disposal can pose environmental

and health hazards, including attracting pests, contributing to foul odors, and increasing the risk of disease outbreaks. This method indicates a lack of access to or awareness of better waste management strategies in some households.

Beyond food waste, households also manage other types of waste through various disposal methods. The survey identifies three common general waste handling approaches. While a significant number of households (28) dispose of their waste by burning it. This method is often used due to the lack of proper waste collection services. This method poses serious environmental risks. Burning waste releases harmful pollutants, including carbon monoxide and particulate matter, which contribute to air pollution and respiratory diseases. The practice is especially concerning in densely populated areas where exposure to toxic fumes can have widespread health implications. Some households (20) use open pits for waste disposal. This method involves digging shallow or deep pits where waste is dumped. While this approach may help in temporarily managing waste, it presents long-term environmental hazards, such as soil contamination, groundwater pollution, and the attraction of pests. In areas with heavy rainfall, open pits can overflow, leading to the spread of waste materials into surrounding environments. The data on waste management practices indicate that while some households adopt sustainable methods such as composting and the use of community dumpsites, a significant number still rely on environmentally harmful practices like open disposal, burning, and open pits. Addressing these issues requires increased public awareness, improved waste collection services, and the promotion of alternative waste management solutions such as recycling and organized composting programs.

#### 4.6 Hygiene Practices

Hygiene practices play a crucial role in preventing the spread of diseases and promoting overall health. The findings in this section highlight key aspects of hygiene within the surveyed households, particularly focusing on handwashing facilities, soap use, and water treatment awareness.

#### 4.7 Handwashing Facilities

The presence of handwashing facilities in 90% of households is a positive indication of awareness and

infrastructure supporting good hygiene. Handwashing stations, which typically include water sources such as taps, buckets with spouts, or designated washing areas, are essential in maintaining proper hygiene. The high availability suggests that most households recognize the importance of hand hygiene, which is a fundamental practice in preventing the spread of infections, including respiratory illnesses and diarrheal diseases. However, having a facility does not always guarantee proper and consistent usage. The effectiveness of these facilities depends on accessibility, functionality, and whether they are equipped with soap and clean water. There is also a need to examine whether these facilities are present in critical areas such as near toilets and kitchens, where handwashing is most necessary.

#### 4.7.1 Soap Use

Regular handwashing with soap is one of the most effective ways to reduce the transmission of germs and prevent diseases. The data shows that 85% of respondents practice handwashing with soap, which is a positive trend. Soap enhances the removal of pathogens compared to washing with water alone, reducing the risk of infections such as diarrhea, respiratory illnesses, and skin diseases. While the percentage is high, it still leaves 15% of respondents who either do not use soap consistently or at all. Several factors could contribute to this, including lack of awareness, unavailability of soap at handwashing stations, or cultural and behavioral habits. Additionally, further investigation is needed to determine whether respondents wash their hands at critical times, such as before eating, after using the toilet, or after handling waste. Targeted interventions, such as educational campaigns and community engagement, could further improve soap usage rates.

#### 4.8 Water Treatment Awareness

Despite the high availability of handwashing facilities and soap use, the findings indicate that only 40% of respondents treat water before drinking. This is a significant public health concern, as untreated water can harbor pathogens that cause waterborne diseases, including cholera, typhoid, and diarrhea. The low percentage suggests a gap in awareness and practice regarding water treatment methods. Households may not perceive their water sources as contaminated, or they may lack knowledge about

simple and effective treatment methods such as boiling, chlorination, or the use of water filters. Additionally, some barriers such as cost, accessibility, and inconvenience of treatment methods may discourage people from treating their drinking water. Increasing awareness through public health campaigns, community workshops, and school programs can help educate households about the risks of consuming untreated water and the benefits of water purification. Providing affordable and accessible water treatment solutions, such as chlorine tablets or filtration systems, can also encourage more households to adopt safe drinking water practices.

The findings highlight a generally positive trend in hygiene practices, with most households having handwashing facilities and a high percentage of respondents using soap regularly. However, the low level of water treatment awareness poses a significant health risk. To improve overall hygiene and health outcomes, targeted interventions are needed to ensure consistent use of handwashing facilities, increase soap usage to 100%, and enhance awareness and accessibility of water treatment methods. Community-based health education and government initiatives can play a crucial role in addressing these gaps and promoting better hygiene behaviors.

## V. CONCLUSION AND RECOMMENDATION

The main objective of this study is to assess household sanitation, water management, and hygiene practices in selected rural communities of Bauchi Local Government, Nigeria. The findings revealed that while the majority of households have access to basic sanitation facilities and water sources, critical gaps remain in the areas of water treatment, waste disposal, and hygiene behavior. Specifically, 92% of households reported having pit latrines with slabs and flush toilets, yet 8% still practice open defecation, posing environmental and public health risks. Water sources were predominantly boreholes, tube wells, and public taps, which suggests reasonable access to improved water sources. However, the finding that 60% of households consume untreated water indicates potential exposure to waterborne diseases. Waste management practices varied, with some households engaging in composting and reuse of organic waste, while others relied on environmentally harmful practices such as open dumping and burning. Hygiene practices were generally positive, as 90% of households had

handwashing facilities and 85% reported consistent use of soap. Despite this, only 40% treated drinking water before consumption, highlighting a significant gap in water safety practices. Overall, the study concludes that although sanitation coverage is relatively high, the quality and safety of sanitation, water, and hygiene practices remain inadequate. Addressing these gaps is essential for achieving the United Nations Sustainable Development Goal (SDG) 6—ensuring the availability and sustainable management of water and sanitation for all. Continuous efforts toward infrastructure development, behavior change, and public awareness will be vital in improving community health and environmental sustainability in Bauchi State. Based on the study's findings, the following recommendations are proposed:

1. Government agencies and development partners should increase budget in improving sanitation facilities, particularly in communities where open defecation and unimproved toilets persist. Providing subsidies or low-interest loans can support low-income households in constructing improved latrines.
2. Strengthening approaches such as *Community-Led Total Sanitation (CLTS)* will encourage behavioral change, local ownership, and collective action toward eliminating open defecation and maintaining hygienic environments.
3. Public health campaigns should emphasize simple and affordable household water purification methods such as boiling, filtration, and chlorination. Schools and community health centers should be used as platforms for promoting water safety education.
4. Local governments should establish structured waste collection and disposal systems while encouraging recycling and composting. Environmentally harmful practices such as burning and open dumping should be discouraged through enforcement of sanitation by-laws and community education.
5. Hygiene promotion—particularly handwashing with soap at critical times—should be incorporated into community health outreach programs. Efforts should focus on achieving universal soap use and ensuring that handwashing facilities are available and functional near toilets and kitchens.
6. Effective sanitation and water management require cooperation among government agencies, non-governmental organizations (NGOs), traditional leaders, and community-based groups. Establishing a multi-sectoral task force can help coordinate and monitor sanitation programs across different sectors.

7. Regular assessments should be carried out to track progress in sanitation and hygiene practices. Continuous research will provide updated evidence for planning and policy formulation, ensuring that interventions remain relevant and sustainable.

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## REFERENCES

- [1] Adane, M., Mengistie, B., & Medhin, G. (2023). Drinking water handling and sanitation practices among rural households in Ethiopia. *BMC Public Health*, 23(112), 1–9. <https://doi.org/10.1186/s12889-023-15592-9>
- [2] Adamu, M., Yusuf, M., & Umar, A. (2021). Rural sanitation challenges and health outcomes in Northern Nigeria. *African Journal of Environmental Science and Technology*, 15(3), 78–85. <https://doi.org/10.5897/AJEST2021.2998>
- [3] Adebayo, A. A., Ogunleye, O. O., & Alao, A. O. (2023). Household sanitation practices and associated health risks in rural Nigeria. *Journal of Public Health in Africa*, 14(1), 45–52. <https://doi.org/10.4081/jphia.2023.1234>
- [4] Afolabi, M. O., & Okoh, J. A. (2022). Sanitation inequality in urban Nigeria: Evidence from demographic and health surveys. *International Journal of Hygiene and Environmental Health*, 239, 113900. <https://doi.org/10.1016/j.ijheh.2021.113900>
- [5] Ajayi, T. A., Oyetola, S. O., & Bello, R. A. (2020). Barriers to improved sanitation in rural communities in Nigeria: A multi-level analysis. *African Journal of Environmental Studies and Development*, 15(2), 45–57. <https://doi.org/10.4314/ajesd.v15i2.4>
- [6] Aliyu, A. A., Abdulrahman, S., & Zubairu, I. (2021). Application of Health Belief Model in understanding household participation in environmental sanitation in Northern Nigeria. *International Journal of Community Health and Medical Research*, 7(1), 27–33. <https://doi.org/10.21276/ijchmr.2021.7.1.6>
- [7] Asfaw, H. M., Mekonnen, A. G., & Molla, A. (2020). Application of Health Belief Model for latrine utilization in rural Ethiopia: A community-based cross-sectional study. *BMC Public Health*, 20, 1027. <https://doi.org/10.1186/s12889-020-09131-5>
- [8] Bhatt, N., Singh, S., & Mahapatra, B. (2022). Barriers to improved sanitation in South Asia: A systematic review. *Environmental Health and Preventive Medicine*, 27(9), 13–22. <https://doi.org/10.1265/ehpm.2022.09>
- [9] Choudhary, N., & Kapur, A. (2023). Waterborne diseases and sanitation: A public health challenge. *Indian Journal of Community Medicine*, 48(2), 67–72. [https://doi.org/10.4103/ijcm.ijcm\\_73\\_23](https://doi.org/10.4103/ijcm.ijcm_73_23)
- [10] Giné-Garriga, R., Mahmud, M. A., & Fenner, R. A. (2022). Digital tools in monitoring water and sanitation: Trends and innovations. *Water Research*, 218, 118421. <https://doi.org/10.1016/j.watres.2022.118421>
- [11] Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). *Health behavior and health education: Theory, research, and practice* (4th ed.). San Francisco: Jossey-Bass.
- [12] Mekonnen, A., Asfaw, Z., & Ayele, B. (2022). Safe water handling practices among Ethiopian households: Findings from a national survey. *Environmental Health Insights*, 16, 11786302221106627. <https://doi.org/10.1177/11786302221106627>
- [13] Musa, I. A., & Tanko, M. N. (2021). Household demographic factors and sanitation practices in Northern Nigeria. *Journal of Public Health and Environmental Sanitation*, 9(1), 12–21. <https://doi.org/10.31235/osf.io/f2hxx>
- [14] National Bureau of Statistics (NBS). (2020). *2020 Nigeria Water, Sanitation and Hygiene (WASH) National Outcome Routine Mapping (WASHNORM) Survey*. Abuja: NBS.
- [15] Njuguna, J., & Mbugua, S. (2023). Gender and water governance: A review of community roles in water and sanitation programs in Kenya. *African Journal of Gender and Development*, 5(1), 99–112.
- [16] Oche, M. O., Garba, M. S., & Aliyu, L. (2023). Water storage and purification practices among households in Bauchi State, Nigeria. *Nigerian Journal of Environmental Sciences*, 41(2), 83–91.



- [17] Odagiri, M., Schriewer, A., & Jenkins, M. W. (2023). Beyond latrine coverage: Sustaining safe sanitation use in rural settings. *International Journal of Hygiene and Environmental Health*, 248, 114130. <https://doi.org/10.1016/j.ijheh.2023.114130>
- [18] Okonkwo, E. U., & Bala, J. S. (2018). Assessment of rural household sanitation facilities in Kaduna and Niger States, Nigeria. *International Journal of Water and Sanitation*, 6(3), 109–116.
- [19] Peprah, D., Baker, K. K., Moe, C., Robb, K., Wellington, N., Yakubu, H., & Null, C. (2018). Public toilets and sanitation: Perceptions and experiences of residents of Accra, Ghana. *PLOS ONE*, 13(8), e0202071. <https://doi.org/10.1371/journal.pone.0202071>
- [20] Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs*, 2(4), 328–335. <https://doi.org/10.1177/109019817400200403>
- [21] Uddin, S. M. N., Huda, T. M., & Das, S. C. (2022). Socioeconomic determinants of improved water and sanitation use in South Asia. *Global Public Health*, 17(1), 54–69. <https://doi.org/10.1080/17441692.2021.1989732>
- [22] UNICEF & WHO. (2021). *Progress on household drinking water, sanitation and hygiene 2000–2020: Five years into the SDGs*. World Health Organization. <https://www.who.int/publications/i/item/9789240030848>
- [23] United Nations. (2020). *The Sustainable Development Goals Report 2020*. <https://unstats.un.org/sdgs/report/2020>
- [24] World Health Organization (WHO). (2022). *Progress on drinking water, sanitation and hygiene: 2022 update*. Geneva: WHO. <https://www.who.int/publications/i/item/9789240053397>
- [25] UN-Water. (2023). Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) Report. Retrieved from <https://www.unwater.org>.
- [26] UNICEF & WHO. (2023). Progress on household drinking water, sanitation and hygiene 2000–2022: Special focus on gender. Geneva: World Health Organization (WHO) and United Nations Children's Fund (UNICEF).
- [27] WHO. (2023). Safely managed sanitation: Policy frameworks and progress. Geneva: World Health Organization
- [28] World Bank. (2023). Sanitation financing in sub-Saharan Africa: Trends and recommendations. Washington, DC: The World Bank.
- [29] World Health Organization (WHO). (2019). *Sanitation*. <https://www.who.int/news-room/fact-sheets/detail/sanitation>