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Socio-Economic Determinants of Access to Improved Drinking Water in North East Nigeria

[1]**Abubakar Sadiq Salisu & [2]Bappah Ayuba**
[1&2]*Department of General Studies, Gombe State Polytechnic*

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Abstract

Access to improved drinking water remains a major development challenge in Nigeria, particularly in the conflict-affected North-Eastern region. The study examines the effect of socio-economic determinants of access to improved drinking water. Primary data were collected from 384 households through a structured questionnaire using a multistage sampling technique. Access to improved drinking water was defined using the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) classification and modeled as a binary outcome and binary logistic regression was employed for analysis. The findings reveal that household income, educational attainment of household head, urban households, the age of the household head, significantly increases the likelihood of accessing improved drinking water. Conversely, households that experienced economic or livelihood shocks are significantly less likely to access improved drinking water, underscoring the vulnerability of water access to shocks. Gender disparities are also evident, with male-headed households more likely to have access than female-headed households. The study concludes that access to improved drinking water in North-Eastern Nigeria is shaped by intersecting socio-economic, demographic, and spatial factors. Targeted policies focusing on rural infrastructure development, economic empowerment, education, gender-sensitive interventions, and shock-responsive water systems are essential for achieving equitable access and advancing progress toward Sustainable Development Goal 6.

Keywords:
Improved Drinking water, North East, Logistic regression, Joint Monitoring Programme

Corresponding Author:
Abubakar Sadiq Salisu

Background to the Study

Access to improved drinking water is a fundamental prerequisite for human health, socio-economic development and environmental sustainability (Aragaw et al., 2023). Despite its centrality to human welfare, an estimated 2.2 billion people globally remain without safely managed drinking water services, with the burden disproportionately concentrated in low- and middle-income countries (WHO & UNICEF, 2022). Improved water sources such as piped systems, boreholes, and protected wells significantly reduce exposure to waterborne diseases and enhance hygiene, thereby improving household well-being and productivity (Oyekale, 2021).

In Sub-Saharan Africa, progress toward universal and equitable access to safe drinking water remains slow and uneven. Persistent structural challenges, including poverty, limited infrastructure and spatial disparities, continue to shape the distribution of improved water services (Aboagye et al., 2022). Nigeria mirrors these continental patterns. Although national access levels have improved over time, substantial geographical inequalities persist (Amankwaa et al., 2021). Recent national surveys show that while the southern zones enjoy high coverage, the North-East lags behind with only about 60.6% of households able to access improved drinking water sources (MICS, 2021).

The North-East's chronic deficit in water access is closely tied to prolonged armed conflict, infrastructural destruction, large-scale population displacement, pervasive poverty and weak governmental presence (Idowu et al., 2023). These conditions have heightened reliance on unimproved water sources such as unprotected wells, streams, and water vendors thereby elevating health risks and undermining human development outcomes (Azeez et al., 2023; Abubakar, 2019). Even in relatively stable areas, rural communities face longer distances to water points, inconsistent supply and greater vulnerability to droughts, factors that significantly constrain access to safe drinking water (Awodoyin & Adeoti, 2022).

Socio-economic factors such as income and education consistently emerge as strong predictors of improved water access (Oloruntoba et al., 2021; Adepoju & Olanrewaju, 2022). Demographic characteristics including age and gender of the household head have also been linked to water access disparities, with female-headed households often facing greater barriers due to lower income and reduced access to resources (Adelekan et al., 2023). Spatial determinants, particularly rural-urban residence and distance to water infrastructure, further shape access outcomes, with rural households being substantially less likely to obtain improved water sources than their urban counterparts (Amankwaa et al., 2021; Umeh et al., 2020).

However, significant empirical gaps remain. Much of the existing literature adopts a national or urban focus, with limited attention given to conflict-affected regions such as the North-East, where the interplay between socio-economic disadvantage, demographic pressures and spatial marginalization is particularly acute. Furthermore, few studies integrate variables related to household shocks such as sudden income loss, displacement

or food insecurity which can substantially reduce a household's ability to secure improved water sources (Oluwasola et al., 2023; Sadiq et al., 2022). This study addresses these gaps by providing a comprehensive analysis of the socio-economic, demographic and spatial determinants of access to improved drinking water in North-Eastern Nigeria. The paper is structured as follows, following this introduction; remainder of the paper is organized as follows: Section Two reviews the relevant literature, Section Three outlines the methodology, Section Four presents and discusses the results, and Section Five concludes with key findings, policy implications, and suggestions for future research.

Literature Review

Theoretical Literature Review

Capabilities and Entitlement Approach

Sen's capability and entitlement framework provides a robust theoretical foundation for understanding household access to improved drinking water. This perspective emphasizes that access to essential services is not merely a matter of physical availability but is mediated by the household's capability set, which includes financial resources, education and knowledge, social capital, and institutional entitlements (Aragaw et al., 2023). Improved water access depends on whether households can effectively convert available resources into valuable functionings, such as safe and reliable water consumption (Adepoju & Olanrewaju, 2022). For instance, households with higher income or greater educational attainment are more likely to navigate institutional arrangements, pay for improved water services and adopt hygiene-promoting behaviors, thereby enhancing their effective access. Moreover, social networks and community-based support systems can amplify entitlements, enabling households to overcome structural barriers to water services. This approach underscores the multidimensional nature of water access, highlighting the interplay between socioeconomic assets, individual capabilities and institutional environments.

Household Production Theory

Household production theory conceptualizes water as an economic commodity that households "produce" through a combination of time, labor, financial resources and technology (Amankwaa et al., 2021). The theory frames water-access decisions as a trade-off between the utility derived from consuming improved water and the costs incurred in obtaining it, which may include travel time, effort, and financial expenditures. Households evaluate the opportunity costs associated with collecting water from distant or unreliable sources versus using closer, but potentially unimproved, alternatives. The theory also considers the influence of household-level factors such as labor availability, time allocation, and access to water collection technologies, which collectively shape decisions on water-source choice (Awodoyin & Adeoti, 2022). Consequently, policies aimed at improving water access must address not only the supply of water infrastructure but also the economic and temporal constraints households face, ensuring that improved sources are both physically and economically accessible.

Vulnerability and Resilience Framework

The vulnerability and resilience framework provides critical insight into how exposure to shocks economic, environmental, or socio-political affects household water security (Oluwasola et al., 2023). Households experiencing recurrent shocks, such as inflation, droughts, or conflict, often face weakened capacities to secure and maintain improved water services (Idowu et al., 2023). This perspective highlights the dynamic and context-dependent nature of water access, emphasizing that vulnerability is not solely determined by a lack of resources but also by the household's ability to anticipate, absorb, and recover from disruptions. In regions like North-Eastern Nigeria, where armed conflict, displacement, and climate-related stressors are prevalent, this framework is particularly relevant.

Socio-Economic Determinants

Household Income and Wealth

Empirical evidence consistently indicates that household income and overall wealth status are key determinants of access to improved water sources (Oloruntoba et al., 2021; Aboagye et al., 2022). Households with higher income levels are better positioned to pay for piped water connections, invest in private boreholes or wells and purchase packaged or bottled water, thereby reducing reliance on unsafe and unimproved sources. Wealthier households also tend to have greater capacity to cope with intermittent service or sudden price shocks in water markets, ensuring continuity of access. In contrast, low-income households often face trade-offs between water expenditure and other basic needs, which can perpetuate reliance on contaminated or distant sources.

Education of Household Head

The educational attainment of the household head is a critical socio-economic determinant of water access. Education enhances awareness of waterborne diseases, hygiene practices, and the health risks of using unimproved sources (Oyekale, 2021). It also strengthens households' procedural capacity to engage with water authorities, negotiate services, and adopt improved water technologies (Adepoju & Olanrewaju, 2022). Studies in Nigeria demonstrate a robust positive correlation between education and the likelihood of accessing piped water, boreholes, or other improved sources, indicating that informed households are more proactive in securing safe water.

Access to Credit

Access to financial credit, though less extensively studied in the water-access literature, has emerged as an enabling factor for household water security. Credit facilities allow households to invest in private water infrastructure, such as storage tanks, boreholes, or home-based filtration systems, particularly in areas where public utilities are underdeveloped or unreliable (Aboagye et al., 2022). Financial inclusion thus indirectly strengthens water security by enhancing households' capacity to mobilize resources for water access and manage associated costs.

Demographic Determinants

Gender of Household Head

Gender plays a significant role in shaping water access outcomes. Female-headed households frequently encounter structural constraints, including lower income levels, limited decision-making autonomy, and reduced access to productive assets, which collectively restrict their ability to secure improved water services (Adelekan et al., 2023). In patriarchal settings, these disparities are exacerbated, highlighting the intersection of gender and socio-economic inequality in influencing water access.

Age of Household Head

The age of the household head can influence access to improved water through accumulated social capital, experience in resource management, and capacity to mobilize assets (Oloruntoba et al., 2021). Older household heads often benefit from established networks, long-term income stability, and familiarity with local water-service institutions, increasing the likelihood of consistent access to improved water sources.

Household Size

Household size directly affects water demand and the patterns of water collection and use. Larger households face higher water needs, which may intensify the time and financial burden of accessing improved sources. Empirical studies suggest that household size is often negatively associated with access to safe water, as the increased costs and time requirements may prompt households to rely on proximate but unimproved alternatives (Amankwaa et al., 2021).

Spatial and Infrastructural Determinants

Rural–Urban Differentials

Geographical location is a crucial determinant of water access. Urban households generally benefit from denser infrastructure networks, regulated utility services, and multiple water-market options, resulting in higher access to improved sources (Umeh et al., 2020). Conversely, rural communities often experience infrastructural neglect, long travel distances, and limited availability of piped or treated water, which constrains household water security (Awodoyin & Adeoti, 2022).

Distance and Time to Water Source

The physical distance to water sources and the time required for collection substantially influence household water-source decisions. Longer travel times increase the opportunity cost of obtaining improved water, often prompting households to substitute with closer, unimproved alternatives (Amankwaa et al., 2021). This highlights the importance of integrating spatial planning with water-supply interventions.

Service Reliability

Even when water infrastructure is present, service reliability significantly affects household water access. Intermittent supply, frequent breakdowns, and irregular maintenance disrupt household routines, compelling reliance on alternative or unsafe

sources (Awodoyin & Adeoti, 2022). This underscores that access is not solely a matter of infrastructure presence but also of consistent functionality and service quality.

Shocks, Conflict and Household Vulnerability

i. Conflict and Displacement: Armed conflict in North-Eastern Nigeria has severely disrupted water infrastructure, governance systems, and household entitlements to reliable water services (Idowu et al., 2023). Displacement further increases vulnerability, as households lose access to previously secure sources and are often forced to rely on unsafe, temporary alternatives.
ii. Economic and Livelihood Shocks: Households facing sudden economic shocks such as income loss, rising food prices, or unemployment experience reduced capacity to pay for improved water services (Sadiq et al., 2022). Such shocks exacerbate reliance on low-cost but unsafe water sources, demonstrating the close link between economic resilience and water security.
iii. Environmental Variability: Seasonal and climatic variability, particularly in semi-arid and drought-prone areas, affects the availability of groundwater and surface water sources, increasing pressure on limited resources (Oluwasola et al., 2023). Households in such environments face fluctuating water reliability, necessitating adaptive strategies such as storage, rationing, or alternative source utilization.

Empirical Literature review

Recent studies on water and sanitation access emphasize the significant role of socio-economic, demographic, and spatial factors across different countries. In Ghana, Boateng et al. (2025) identified regional and gender disparities in sanitation access among older adults. Ogun bode et al. (2024) found housing characteristics and gender distribution as key predictors of water demand in Iwo, Nigeria. Similarly, Adedotun et al. (2024) revealed significant disparities in water consumption across residential densities in Osogbo, linking water scarcity to health risks.

Terefe et al. (2024) showed that wealth, education, and urban residence significantly influenced safe water access in East Africa, while Aragaw et al. (2023) found spatial clustering of unimproved water use in Ethiopia driven by poverty and rural residence. Azeez et al. (2023) confirmed that education and wealth strongly predict access to improved WASH services in Nigeria. Kassie & Mengistu (2022) tracked progress in Ethiopia but highlighted persistent geographic and socio-economic disparities.

Further, Kong et al. (2020) in Malaysia, and Gomez et al. (2019) in a global rural panel study, linked water access to education, income, governance, and community type. In Nigeria, Abubakar (2019) revealed sharp rural-urban and regional inequalities in water access, especially in the conflict-affected North-East. Collectively, these studies underline the need for context-specific, data-driven, and inclusive interventions to improve water equity and advance SDG 6.

Okeniyi & Ajayi (2024) analyzed factors affecting household access to drinking water in Nigeria using 2018 DHS data. Findings show that 68.9% lacked water sources within their premises, and 23.2% had poor access predominantly in Northern Nigeria, indicating regional disparities. Significant determinants included geopolitical zone, residence type, toilet type, electricity access, ethnicity, household size, sex of household head, and wealth index. Religion, age, and education were not significant. The study recommends a regional approach to improve water access, especially in the North, and suggests borehole provision as a feasible solution to address the ongoing challenge of clean water accessibility in Nigeria. In another study Solagbade et al., (2024) examined access to improved water, sanitation, and handwashing facilities among under-18 orphans in Nigeria using 2018 survey data. It found that orphans in rural areas had significantly lower access to these basic services compared to those in urban areas. Education level also influenced access to sanitation. The findings highlight the need for targeted interventions to enhance WASH access for orphans, especially in disadvantaged rural communities.

In another related study, Roy, (2023) used NFHS-5 data to explore regional disparities in access to drinking water and sanitation in India. Using spatial and logistic regression analyses, it found that limited access is clustered in central and western states, with education, wealth, and residence significantly influencing outcomes. The authors recommend spatially targeted policies and improvements in water distribution and sanitation infrastructure to address inequalities in underserved regions and promote equitable access to basic services. Similarly, in another related study, Roy, (2023) used NFHS-5 data to explore regional disparities in access to drinking water and sanitation in India. Using spatial and logistic regression analyses, it found that limited access is clustered in central and western states, with education, wealth, and residence significantly influencing outcomes. The authors recommend spatially targeted policies and improvements in water distribution and sanitation infrastructure to address inequalities in underserved regions and promote equitable access to basic services.

Adil et al., (2021) examined key factors influencing access to safe drinking water and improved sanitation in Punjab using 2017–2018 survey data. Logistic regression results identified household media exposure, education level, wealth status, and ethnicity as major determinants of water access. For sanitation, social norms and residence location also played significant roles, especially social norms. The study recommends improving media access, education, living standards, and promoting positive sanitation-related social norms

Methodology

Study Area

The study is situated in the North-East geopolitical zone of Nigeria, one of the six major geopolitical regions in the country. The zone comprises six states: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe. Geographically, the region lies between latitudes 9°N and 14°N and longitudes 9°E and 14°E. It shares international borders with Cameroon to the east and the Republic of Chad to the northeast, and domestic boundaries with the North-West, North-Central, and South-East zones.

The North-East is predominantly characterized by savannah vegetation, ranging from Sudan savannah in the northern areas to Guinea savannah in the southern parts. The climate is tropical, marked by distinct wet and dry seasons. Based on projections from the 2006 national census, the region hosts an estimated population of about 26 million people, distributed across both rural and urban settlements. Socioeconomic conditions in the region are typified by high poverty rates, relatively low literacy levels, and widespread unemployment. The economy is primarily agrarian, with households engaged in subsistence farming, livestock production, and small-scale trading.

Method of Data Collection

The study utilizes primary data collected through a structured questionnaire designed to obtain information on household socioeconomic, demographic, spatial, and shock-related characteristics. Key variables include household income, savings, access to credit, education level of the household head, household size, age and gender of household head, rural–urban residence, distance to water sources, and exposure to economic shocks.

Study Population and Sample Size Determination

The study population comprises households across the six states within the North-East region. The required sample size was determined using Cochran's (1977) sample size formula for large populations, particularly when the population proportion possessing a specific attribute is unknown.

The formula is expressed as:

$$n = \frac{Z^2 . p . (1-p)}{e^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (1)$$

Where:
n = Required Sample Size
Z = Z-value (1.96 for 95% confidence level)
P = estimated proportion of an attribute present in the population (0.5 used for maximum variability)
e = Margin of error (0.05)

Substituting Values: $n = \frac{1.96^2 . 0.5 . (1-0.5)}{0{,}05^2} = 384.16$

Therefore, a sample size of 384 households is deemed sufficient and statistically reflective of the broader population.

Sampling Procedure

A multistage sampling technique was adopted. First, three states were randomly selected from the six states in the region. Second, two Local Government Areas (LGAs) were randomly chosen from each selected state, yielding six LGAs. Third, two communities were randomly selected from each LGA, giving a total of 12 communities. Finally, 32

households were randomly selected from each community to arrive at the required sample size of 384. This multistage approach ensures adequate representation of the region's socioeconomic and spatial diversity.

Method of Data Analysis

Data analysis for this study began with descriptive statistics to summarize the demographic, socioeconomic, and environmental characteristics of households in the North East region of Nigeria. Frequencies, percentages, means, and standard deviations will be calculated to provide an overview of household access to improved drinking water. To determine the core factors influencing household access to improved drinking water, a binary logistic regression model was employed. The dependent variable, access to improved drinking water, is coded as a binary outcome (1 = access, 0 = no access) based on the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) classification. In line with the JMP methodology, water sources such as piped water, boreholes, protected wells, protected springs, rainwater, and packaged water are categorized as improved, while unprotected wells, unprotected springs, surface water, tanker trucks, and water from vendors are classified as unimproved. Determinants/independent variables include household income, household size, and education level of household head, age of household head, gender of household head, rural/urban residence, and economic shock. Adjusted odds ratios (AOR) and 95% confidence intervals are reported to evaluate the strength and significance of associations. Model diagnostics will include multicollinearity checks using the correlation matrix. A significance level of $p < 0.05$ is adopted for all statistical tests. All statistical analyses were performed using R, STATA 13 to ensure accuracy, flexibility in data manipulation, and robust model validation.

Model Specification

The binary logistic regression model employed in the study is expressed as:

$$logit(P) = \ln \frac{P}{(1-P)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \mu \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

P = is the probability that a household has access to improved drinking water

β_0 = The intercept

$\beta_1, \beta_2 \ldots, \beta_k$ = are coefficients for the explanatory variables, $X_1, X_2 \ldots, X_k$

μ = The error term

Result and Discussion

The logistic regression below presents the result of the determinants of access to improved drinking water in North East Nigeria.

Table 1: Logistic Regression Result: Dependent variable (Access to Improved Drinking Water)

Variable	Coeff	Std. Err.	z	p-value	OR	[95% CI]
Household Income	0.145***	0.023	6.16	0.000	1.16	0.099 – 0.191
Age (HH Head)	0.005**	0.002	2.07	0.039	1.01	0.000 – 0.010
Education of Household Head (Ref = non-formal)						
Primary	0.298***	0.096	3.12	0.002	1.35	0.111 – 0.485
Secondary	0.371***	0.096	3.88	0.000	1.45	0.184 – 0.558
Tertiary	0.721***	0.106	6.81	0.000	2.06	0.513 – 0.928
Household Shock (Ref = No shock)						
Experienced shock	-0.262***	0.069	-3.82	0.000	0.77	-0.397 – -0.128
Residence (Ref = Rural)						
Urban	0.789***	0.081	9.71	0.000	2.20	0.630 – 0.948
Gender of Household Head (Ref = Female)						
Male	0.702***	0.152	4.61	0.000	2.02	0.404 – 1.001
Constant	-1.552***	0.267	-5.82	0.000	0.21	-2.074 – -1.029
Model statistics:						
Number of observations = 384						
LR χ^2 (8) = 282.42						
Prob > χ^2 = 0.0000						
Log likelihood = −3220.43						
Pseudo R^2 = 0.0420						

Source: Author's computation using Stata 13.

The logistic regression model predicting household access to improved drinking water was statistically significant (LR χ^2 (8) = 282.42, $p < 0.001$), indicating that the set of predictors included in the model collectively provide meaningful explanation for access to improved water sources. This suggests that socio-economic, demographic, and contextual factors play a significant role in determining whether a household can obtain safe drinking water.

Household income was a strong positive predictor. A one-unit increase in the natural log of income was associated with 1.15 times higher odds of accessing improved drinking water (OR = 1.16, 95% CI: 1.09–1.20, $p < 0.001$). This implies that households with greater financial resources are better able to afford piped water connections, construct or maintain boreholes, or otherwise secure safe water.

The age of the household head also had a small but significant effect. Each additional year in the age of the household head increased the odds of accessing improved drinking water by 1.01 times (OR = 1.01, 95% CI: 1.00–1.01, $p = 0.039$). This suggests that older heads may

possess more experience, social capital, or knowledge to navigate access to improved water services.

Education of the household head showed a strong and graded association with water access. Compared to heads with non-formal education, households led by heads with primary education had 1.32 times higher odds of improved water access (OR = 1.32, 95% CI: 1.10–1.59, p = 0.002), those with secondary education had 1.42 times higher odds (OR = 1.42, 95% CI: 1.18–1.72, p < 0.001), and those with tertiary education had 2.02 times higher odds (OR = 2.02, 95% CI: 1.64–2.48, p < 0.001). This gradient indicates that education enhances awareness of health risks, improves decision-making regarding water sources, and strengthens the ability to mobilize resources for improved water access.

Households that experienced shocks, such as economic hardship or environmental disruptions, were less likely to have access to improved drinking water, with 23% lower odds compared to households without shocks (OR = 0.77, 95% CI: 0.67–0.88, p < 0.001). This finding underscores the vulnerability of households to shocks, which may limit their capacity to invest in or maintain safe water sources.

The place of residence was also a strong determinant. Urban households were 2.26 times more likely to access improved water than rural households (OR = 2.26, 95% CI: 1.93–2.65, p < 0.001), highlighting persistent disparities in water infrastructure and service delivery between urban and rural areas. Urban areas typically benefit from piped water systems and municipal utilities, whereas rural communities rely on less reliable sources such as unprotected wells and springs.

Finally, gender of the household head significantly influenced water access. Male-headed households were 2.02 times more likely to access improved drinking water than female-headed households (OR = 2.02, 95% CI: 1.50–2.72, p < 0.001). This likely reflects gender inequalities in income, decision-making power, and access to resources, which can limit the ability of female-headed households to secure safe water.

In summary, access to improved drinking water is determined by a combination of economic status, education, age, gender, household vulnerability, and residence location. Households with higher income, older heads, better-educated heads, male heads, and those living in urban areas are more likely to have improved water, whereas households exposed to shocks are less likely to do so. These findings highlight the need for policies that address socio-economic and structural inequalities, strengthen education, and improve rural water infrastructure to ensure equitable access to safe drinking water for all households.

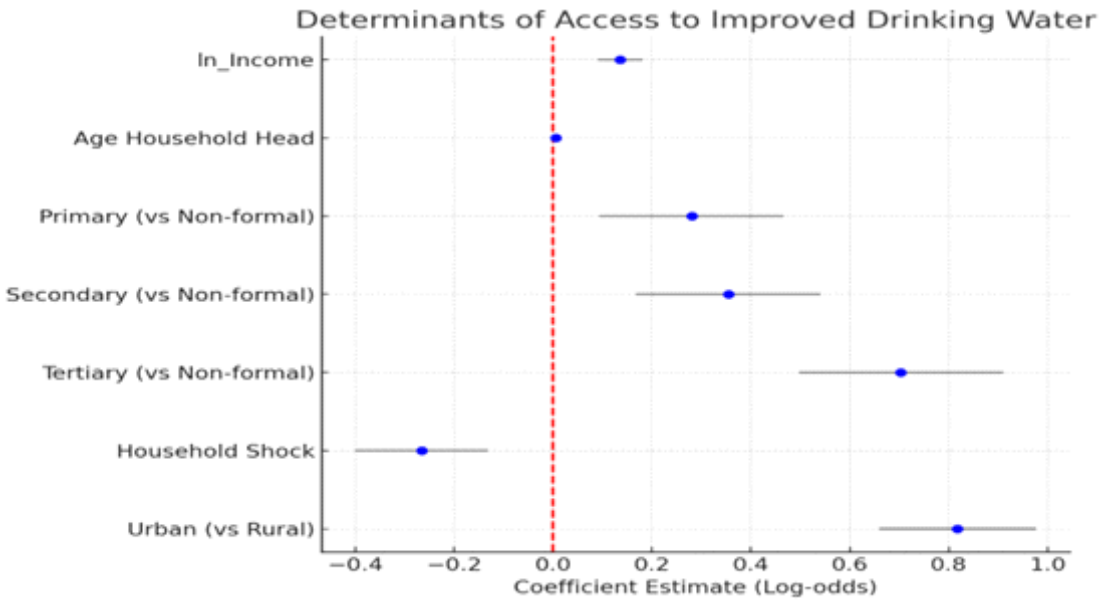

Figure 1: Determinants of Access to improved Drinking Water

The plot shows that income, age, education, and urban residence are drivers of access, while household shocks are barriers. Education and urban location have the largest positive effects, while shocks exert a substantial negative effect.

Summary, Conclusion and Recommendation

Summary of Findings

The study identified key socioeconomic, demographic, spatial, and vulnerability-related factors that significantly influence household access to improved drinking water in North-Eastern Nigeria. Household income strongly increased the likelihood of accessing improved water, indicating that economic capability is a primary enabler of safe water acquisition. Education of the household head exhibited a strong positive gradient, showing that higher educational attainment enhances awareness, institutional navigation, and adoption of improved water sources. Age of the household head had a modest positive effect, reflecting accumulated experience and social capital.

Households that experienced economic or livelihood shocks were significantly less likely to access improved water, illustrating how vulnerability diminishes the ability to maintain or invest in safe water services. Residence location showed one of the largest effects: urban households were more than twice as likely as rural households to obtain improved water, highlighting persistent infrastructural and service disparities. Gender also played a role, with male-headed households more likely to access improved water, underscoring structural gender inequalities in resource access and decision-making

Conclusion

Access to improved drinking water in the North-East is strongly influenced by household economic capacity, demographic characteristics, and location. Income, education, age, and urban residence increase access, while shocks and female headship reduce it. These findings reveal entrenched socioeconomic and spatial inequalities that hinder progress toward SDG 6. Addressing these disparities requires integrated strategies that combine infrastructure expansion with socioeconomic empowerment and resilience support.

Recommendations

On the basis of findings, the study made the following recommendations

i. Government and development partners should prioritize the expansion and rehabilitation of rural water infrastructure, particularly boreholes, protected wells, and small-scale piped systems. Targeted investments in underserved rural communities will help reduce the pronounced rural–urban disparities in access to improved drinking water.
ii. Policies aimed at improving household income and livelihood opportunities should be integrated into water access interventions. Microcredit schemes, conditional grants, and flexible financing options can enable households, especially low-income and vulnerable ones, to invest in improved water sources and water storage facilities.
iii. Given the strong positive effect of education on access to improved drinking water, efforts should be made to enhance educational attainment and water, sanitation, and hygiene (WASH) awareness. Community-based education programs and adult literacy initiatives can improve knowledge of water-related health risks and encourage the adoption of safe water practices.
iv. Households experiencing economic, environmental, or conflict-related shocks are significantly less likely to access improved water. Social protection measures, emergency water supply systems, and shock-responsive safety nets should be strengthened to support households affected by displacement, income loss, or climatic stress.
v. Water supply planning should be integrated into broader regional development and spatial planning frameworks. This will ensure that water infrastructure development aligns with population distribution, settlement patterns, and long-term climate and environmental considerations.

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