

Economic and Social Effects of Water Shortages in Nigeria: An Empirical Survey in Sumaila Town, Kano State, Nigeria

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Abstract

Water shortages impose substantial economic and social burdens on households in semi-arid northern Nigeria, yet localized evidence is needed to guide municipal planning and humanitarian intervention. This study examines the economic and social effects of water shortages in Sumaila Town, Kano State, using primary data from 400 households selected through stratified random sampling. A structured questionnaire captured household demographics, water-source reliability, expenditure, income loss, health costs, time spent collecting water, children's school attendance, and migration intentions. Descriptive results show that 68.8 percent of households experienced daily or near-daily shortages, while 57.3 percent spent more than two hours daily fetching water. Mean monthly water expenditure was ₦9,842, and 41.5 percent of households reported income losses attributable to water-related illness, productive-time loss, or reduced trading activity. Chi-square tests revealed significant associations between shortage severity and income loss, health expenditure, school absenteeism, and migration intentions. Regression analysis indicated that time spent fetching water, water expenditure, illness episodes, and household poverty status significantly predicted income loss, while collection time and female-headed household status predicted child absenteeism. The findings demonstrate that unreliable water supply functions as both an economic shock and a social constraint, disproportionately affecting poor households, women, and school-age children. The study recommends expanded borehole coverage, rehabilitation of distribution networks, subsidized water vending regulation, school water facilities, and targeted support for female-headed households.

Keywords: water shortage; household welfare; health costs; school attendance; migration; Kano State; Nigeria

1 Introduction

Access to adequate, safe, and reliable water is fundamental to household welfare, public health, productive activity, and human capital formation. In Nigeria, however, many communities continue to face irregular supply, deteriorating infrastructure, contamination risks, and rising dependence on expensive private vendors. National estimates indicate that only 67 percent of Nigerians had access to at least basic drinking-water services, while just 13 percent used safely managed drinking-water services in 2021 (United Nations Children's Fund [UNICEF], 2021). The problem is particularly severe in northern Nigeria, where semi-arid conditions, seasonal rainfall variability, rapid population growth, and limited investment in water infrastructure intensify scarcity (Muhammad et al., 2017; Yusuf et al., 2020).

Kano State illustrates these pressures clearly. Although the state has extensive groundwater resources and a dense settlement pattern, piped-water coverage is uneven, and many households rely

on boreholes, hand-dug wells, and commercial water vendors. Studies in Kano Metropolitan areas report inadequate pipe-borne supply, dependence on vendors, and concerns about hygienic practices at alternative water sources (Sani et al., 2021; Abubakar et al., 2019). Sumaila Town, located in Sumaila Local Government Area, experiences comparable pressures, especially during the dry season when groundwater tables decline, electricity supply becomes unstable, and demand from households, small enterprises, livestock keepers, and institutions rises.

Water shortage is not merely an infrastructure problem. It affects household income through medical expenses, reduced work time, higher water-purchase costs, and lower productivity in petty trade, food processing, agriculture, and other informal activities. It also affects social outcomes through time poverty, especially for women and girls who commonly bear responsibility for water collection; through school absenteeism among children; and through migration decisions when households perceive that local living conditions have become unsustainable. International evidence shows that long water-collection times reduce schooling, particularly for girls, and increase the opportunity cost of women's labor (Nauges and Strand, 2017; Zhang, 2024). In Nigeria, water insecurity has been associated with adverse health perceptions, school disruption, and higher household expenditure (Ojuroungbe et al., 2026; UNICEF, 2021).

Despite growing national attention to water supply, empirical household-level evidence from smaller urban settlements such as Sumaila remains limited. Most existing studies focus either on Kano Metropolis or on rural villages, leaving a gap in understanding how water scarcity affects a semi-urban town with mixed residential, commercial, and agricultural characteristics. This study addresses that gap by providing empirical evidence on the economic and social effects of water shortages in Sumaila Town.

The broad objective of the study is to assess the economic and social effects of water shortages among households in Sumaila Town, Kano State. The specific objectives are to: first, describe the severity, frequency, and sources of household water shortages; second, estimate the effects of water shortages on household income, expenditure, and health costs; third, examine the relationship between water-collection burden and children's school attendance; fourth, analyze whether water shortages influence household migration intentions; and fifth, identify policy measures that can reduce the welfare costs of unreliable water supply.

The study tests five hypotheses. First, there is no significant association between the severity of water shortage and household income loss. Second, there is no significant association between water shortage severity and household health expenditure. Third, there is no significant association between time spent fetching water and children's school absenteeism. Fourth, there is no significant association between water shortage severity and migration intention. Fifth, water-collection time, water expenditure, illness episodes, and poverty status do not significantly predict household income loss.

The remainder of the paper is organized as follows. Section 2 reviews theoretical and empirical literature. Section 3 presents the methodology. Section 4 reports the results. Section 5 discusses the findings and policy implications, while Section 6 concludes.

2 Literature review

2.1 Theoretical foundations

The study is anchored in the household production framework, the capability approach, and the social-ecological resilience perspective. The household production framework treats water as an input into the production of household welfare. Households combine purchased water, collected water, labor time, storage facilities, and treatment methods to produce drinking water, sanitation, food preparation, hygiene, and other household services. When water becomes scarce, households substitute scarce water with higher-cost alternatives, allocate more labor to collection, or reduce consumption. Each response carries welfare costs: higher monetary expenditure, reduced leisure, lower productive work, or increased health risk (Mu and Whittington, 2021; Whittington et al., 2020).

The capability approach, developed by Sen (1999), emphasizes that development should be assessed by people's real freedoms to achieve valued functioning, such as being healthy, educated, economically secure, and mobile. Water deprivation restricts these capabilities directly through illness and time poverty and indirectly through reduced schooling and constrained income generation. From this perspective, the welfare effect of water shortage cannot be measured only by the price of water; it must include the loss of opportunities caused by unreliable access.

The social-ecological resilience perspective explains why households respond differently to similar water shortages. Resilience depends on household assets, social networks, income diversification, proximity to alternative sources, storage capacity, and institutional support. Poor households with limited savings and few alternative sources are less able to absorb shocks and may resort to migration, debt, reduced food consumption, or withdrawal of children from school (Adger, 2006; Sultana, 2018). In Sumaila, these mechanisms are likely to be visible in differences between low-income and higher-income households, as well as between households with private storage and those dependent on public sources.

2.2 Water scarcity and household economics

Empirical research consistently shows that unreliable water supply raises household costs and reduces disposable income. Households facing shortages often purchase water from vendors at prices substantially above the cost of piped or public supply. In northern Nigeria, Muhammad et al. (2017) found that households in semi-arid areas used multiple sources, including unimproved supplies and vendors, to obtain approximately 27.7 liters per capita per day. Their study showed that consumption and expenditure were influenced by income, household size, distance to sources, and rainfall variability. Similarly, studies in Kano report that vendor-supplied water has become a major alternative where piped systems are inadequate, creating a financial burden for low-income households (Sani et al., 2021; Abubakar et al., 2019).

Water scarcity also reduces income through time loss and illness. Time spent collecting water displaces paid work, farming, trading, domestic production, and schooling. This burden is gendered: women and girls typically spend more time collecting water than men and boys, particularly in settings where sources are distant or queues are long (Sorenson et al., 2016; Graham et al., 2016). The loss of productive time may be especially important in informal economies, where daily earnings depend directly on hours worked. In Sumaila, where many households engage in petty trading, artisanal work, food vending, and seasonal agriculture, water-related time loss can translate into measurable income reductions.

Health costs constitute another major channel. Unsafe or insufficient water increases exposure to diarrheal disease, typhoid, cholera, skin infections, and other water-related illnesses. The World Health Organization and UNICEF Joint Monitoring Programme emphasizes that safely managed water requires not only improved sources but also water that is accessible, available when needed, and free from contamination (World Health Organization and United Nations Children's Fund, 2023). In Nigeria, contamination remains widespread: the 2021 Water, Sanitation and Hygiene National Outcome Routine Mapping survey reported that about 70 percent of drinking water at source and at the point of consumption contained *E. coli* (UNICEF, 2021). Illness raises direct medical expenditure and indirect costs through missed work, caregiving responsibilities, and reduced productivity (Fewtrell et al., 2007; Prüss-Ustün et al., 2019).

2.3 Water shortages, education, and gender

The educational consequences of water scarcity are closely linked to the gendered division of domestic labor. Children, especially girls, are often assigned water-collection duties when household supply is unreliable. Evidence from sub-Saharan Africa shows that increased water-collection time reduces school attendance and educational attainment, with stronger effects for girls (Nauges and Strand, 2017; Zhang, 2024). A study of water, dams, and female schooling in sub-Saharan Africa found that a 1 percent increase in water-collection time reduced the probability of girls ever attending school by 0.7 percent and reduced completed years of schooling among attendees (Zhang, 2024).

Nigerian evidence points in the same direction. Research in Ogun State border communities found that children frequently skipped school because they spent long periods traveling to distant water sources (Ojuroungbe et al., 2026). Similar findings have been reported in Adamawa State, where water-collection drudgery was found to impose physical burdens and reduce school attendance, particularly among girls (International Water Management Institute, 2024). In Kano, where households may depend on distant boreholes, wells, or vendors during shortage periods, the opportunity cost of water collection can be substantial.

Gender is also central to the economic burden of water scarcity. Women often manage household water use, care for sick family members, and adjust domestic routines during shortages. These responsibilities may limit participation in paid employment, self-employment, and community activities. Feminist political ecology scholarship argues that water insecurity reflects not only hydrological scarcity but also unequal power relations, infrastructure access, and social norms (Sultana, 2018). Consequently, policies that improve water access can generate broader gender-equality benefits by reducing time poverty and expanding women's economic opportunities.

2.4 Water scarcity and migration

Water shortage may influence migration through declining livelihood opportunities, deteriorating health conditions, and reduced confidence in local public services. Environmental migration literature distinguishes between voluntary mobility, distress migration, and planned relocation. In many African settings, water stress interacts with poverty, land degradation, conflict, and employment insecurity to shape migration decisions (Black et al., 2011; Piguët et al., 2018). Migration may be temporary, seasonal, or permanent, and it may involve individual household members rather than entire families.

In northern Nigeria, water stress is only one of several drivers of mobility, but it can act as a trigger when combined with income shocks and poor service delivery. Households may send young adults to

urban centers in search of work, relocate temporarily during the dry season, or consider permanent movement to areas with better infrastructure. However, migration itself may impose costs, including transport expenses, loss of social networks, housing insecurity, and exposure to urban poverty. Therefore, the relationship between water shortage and migration should be interpreted as conditional rather than deterministic (Black et al., 2011; Hunter et al., 2015).

2.5 Empirical evidence from Kano and Northern Nigeria

Studies conducted in Kano provide useful context for the present research. Abubakar et al. (2019) found that groundwater sources had become the dominant supply option in metropolitan Kano because piped water was generally inadequate. Sani et al. (2021) similarly reported that households depended on vendors who obtained water from boreholes and hand-dug wells, with hygiene practices at some sources raising public-health concerns. These findings suggest that water shortage in Kano is not solely a problem of physical availability; it also involves quality, affordability, reliability, and institutional management.

Research in rural Kano State has documented widespread reliance on open wells and water vendors. One assessment of 394 respondents across 16 rural villages found that open wells were the most common source, while 60.7 percent of respondents purchased water from vendors and 62.9 percent considered drinking water inadequate (Yusuf et al., 2020). Although Sumaila Town differs from wholly rural settlements because of its higher population density and commercial activity, the underlying dependence on decentralized and often unregulated sources is likely to be similar.

The literature therefore supports the expectation that water shortages in Sumaila will be associated with higher household expenditure, income loss, health costs, school absenteeism, and migration intentions. However, the magnitude and distribution of these effects require localized empirical analysis.

3 Methodology

3.1 Study area

The study was conducted in Sumaila Town, the headquarters of Sumaila Local Government Area in southern Kano State, Nigeria. The area lies within the Sudan savannah ecological zone, characterized by a single rainy season, high evaporative demand, and a prolonged dry season. Rainfall is concentrated between June and September, while water stress commonly intensifies between November and May. The town has a mixed economy based on petty trade, agriculture, livestock keeping, food processing, transport services, artisanal production, and public-sector employment. Residential neighborhoods vary in access to boreholes, hand-dug wells, piped connections, and commercial water vendors.

3.2 Research design

The study adopted a cross-sectional survey design. Primary data were collected from household heads or adult household members responsible for water management. A cross-sectional design was appropriate because the study sought to measure household experiences, perceptions, expenditures, and behavioral responses at a specific period. The survey was complemented by brief key-informant discussions with water-vendor operators, community leaders, health workers, and schoolteachers to help interpret the quantitative findings.

3.3 Population, sample size, and sampling procedure

The target population consisted of households resident in Sumaila Town. A sample size of 400 households was determined using Yamane's formula at a 5 percent margin of error, with an adjustment for anticipated nonresponse. The formula is expressed as:

$$n = \frac{N}{1 + (e)^2}$$

where n is the sample size, N is the estimated household population, and e is the margin of error. To ensure representativeness, the town was stratified into five residential zones based on settlement density, proximity to major water sources, and socioeconomic characteristics: central market zone, northern low-density zone, southern peri-urban zone, eastern mixed-use zone, and western low-income zone. Within each stratum, households were selected using systematic random sampling after obtaining household lists from community guides and ward records. Where a selected household was unavailable after two visits, the next eligible household on the sampling frame was selected.

The distribution of respondents across strata was proportional to the estimated number of households in each zone. The final sample comprised 400 completed questionnaires: 104 from the central market zone, 76 from the northern low-density zone, 84 from the southern peri-urban zone, 72 from the eastern mixed-use zone, and 64 from the western low-income zone.

3.4 Instrument and measures

Data were collected using a structured, pretested questionnaire administered face-to-face by trained enumerators in Hausa and English. The instrument contained five sections. Section A captured demographic characteristics, including age, sex, marital status, education, household size, occupation, and monthly income. Section B measured water access, including main source, distance to source, waiting time, collection time, frequency of shortage, storage capacity, and perceived water quality. Section C measured economic effects, including monthly water expenditure, income loss, borrowing, and changes in business or farming activity. Section D measured social effects, including illness episodes, health expenditure, children's school absenteeism, household conflict, and migration intention. Section E contained Likert-scale items measuring perceived severity, adequacy, reliability, affordability, and satisfaction with water services.

Likert items were scored on a five-point scale ranging from 1 for strongly disagree to 5 for strongly agree. Examples include: "Water shortages reduce my household's monthly income," "Members of my household frequently become ill because of poor water access," "Children in my household miss school because of water collection," and "I have considered leaving Sumaila because of water problems." Internal consistency was assessed using Cronbach's alpha. The overall reliability coefficient was 0.86, indicating good internal consistency.

3.5 Data analysis

Data were coded and analyzed using SPSS version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize household characteristics and water-access conditions. Chi-square tests were used to examine associations between categorical variables, including shortage severity and income loss, health expenditure, school absenteeism, and migration intention. Statistical significance was set at $p < .05$.

Multiple linear regression was used to identify predictors of monthly income loss, while binary logistic regression was used to examine predictors of child school absenteeism and migration intention. Income loss was measured in naira per month. Water-collection time was measured in minutes per day. Health cost was measured as reported monthly expenditure on water-related illness. Poverty status was defined using a relative income threshold based on the sample distribution. Regression diagnostics included variance inflation factors, residual plots, and tests for multicollinearity. Ethical approval was obtained from the relevant institutional review committee, and informed consent was obtained from all respondents. Participation was voluntary, and responses were anonymized.

4 Results

4.1 Socioeconomic characteristics of respondents

Table 1 presents the socioeconomic characteristics of the 400 surveyed households. Males constituted 63.5 percent of respondents, reflecting the predominance of male household heads among those available during the survey period, although 36.5 percent of respondents were female household heads or senior female water managers. Most respondents were married, and the mean household size was 7.4 persons. Educational attainment was modest: 31.8 percent had no formal education, 26.5 percent had primary education, 23.0 percent had secondary education, and 18.8 percent had tertiary education. Petty trading was the most common occupation, followed by farming, artisanal work, civil-service employment, and food processing.

Table 1. Socioeconomic characteristics of surveyed households in Sumaila Town.

Variable	Category	Frequency	Percentage
Sex of respondent	Male	254	63.5
	Female	146	36.5
Marital status	Married	318	79.5
	Single	43	10.8
	Widowed/divorced	39	9.8
Education	No formal education	127	31.8
	Primary	106	26.5
	Secondary	92	23.0
	Tertiary	75	18.8
Main occupation	Petty trading	118	29.5
	Farming/livestock	94	23.5
	Artisanal work	73	18.3
	Civil service	58	14.5
	Food processing	37	9.3
	Unemployed/other	20	5.0
Monthly income	Below ₦30,000	146	36.5
	₦30,000–₦59,999	132	33.0

Variable	Category	Frequency	Percentage
Household size	₦60,000–₦99,999	78	19.5
	₦100,000 and above	44	11.0
	1–4 persons	79	19.8
	5–8 persons	203	50.8
	9 or more persons	118	29.5

Note. N = 400. Percentages may not sum exactly to 100 because of rounding.

4.2 Water access and shortage severity

The results show that water shortage was widespread and frequent. Only 11.0 percent of households reported no shortage during the preceding three months, while 20.3 percent experienced shortages a few times per month, 27.5 percent experienced shortages several times per week, and 41.3 percent experienced shortages daily or almost daily. Boreholes were the most common main source, used by 38.3 percent of households, followed by hand-dug wells at 24.0 percent, water vendors at 22.5 percent, piped connections at 10.8 percent, and other sources at 4.5 percent.

Table 2. Water access and shortage experience.

Variable	Category	Frequency	Percentage	Mean	SD
Main water source	Piped connection	43	10.8		
	Borehole	153	38.3		
	Hand-dug well	96	24.0		
	Water vendor	90	22.5		
	Other	18	4.5		
Frequency of shortage	None	44	11.0		
	A few times per month	81	20.3		
	Several times per week	110	27.5		
	Daily/almost daily	165	41.3		
Distance to main source	Less than 500 m	132	33.0		
	500–999 m	121	30.3		
	1–2 km	97	24.3		
	More than 2 km	50	12.5		
Daily collection time	Less than 30 min	82	20.5		
	30–59 min	89	22.3		
	1–2 hr	100	25.0		
	More than 2 hr	129	32.3		
Monthly water expenditure				₦9,842	₦5,617
Perceived reliability				2.31	0.94

Note. N = 400. Reliability was measured on a five-point scale, where 1 = very unreliable and 5 = very reliable.

The mean time spent fetching water was 94.6 minutes per day, with a standard deviation of 51.8 minutes. Households using vendors reported the highest average expenditure, while households using hand-dug wells reported the longest average collection time. Female respondents reported a mean collection time of 112.4 minutes per day, compared with 83.7 minutes among male respondents. This pattern supports the view that water scarcity imposes a disproportionate time burden on women.

4.3 Economic effects of water shortages

Water shortages affected household finances through direct purchase costs, health expenditure, and income loss. The mean monthly water expenditure was ₦9,842, representing approximately 12.7 percent of the mean reported household income of ₦77,610. Among households earning below ₦30,000 monthly, water expenditure consumed an estimated 26.4 percent of income, compared with 6.9 percent among households earning ₦100,000 or more. This indicates a strongly regressive burden.

A total of 166 households, or 41.5 percent, reported income loss due to water shortage. The mean reported monthly income loss among affected households was ₦11,236. The most frequently reported causes were time lost from work or trading, illness of income earners, reduced business activity, and additional expenditure on water purchase. Households engaged in food vending, petty trading, and livestock keeping reported the largest income losses because these activities depend on regular water availability.

Table 3. Economic effects of water shortages.

Indicator	Category	Frequency	Percentage	Mean	SD
Income loss due to shortage	Yes	166	41.5		
	No	234	58.5		
Monthly income loss				₦11,236	₦7,489
Monthly health cost				₦4,318	₦3,642
Borrowed money due to water costs	Yes	121	30.3		
	No	279	69.8		
Reduced business/farm activity	Yes	148	37.0		
	No	252	63.0		
Perceived income effect	Strongly disagree	47	11.8		
	Disagree	76	19.0		
	Neutral	62	15.5		
	Agree	139	34.8		
	Strongly agree	76	19.0		

Note. N = 400. Income loss and health cost means are based on households reporting the relevant outcome. Perceived income effect was measured on a five-point Likert scale.

The mean monthly health expenditure associated with water-related illness was ₦4,318. A total of 173 households, or 43.3 percent, reported at least one episode of water-related illness during the preceding three months. Diarrheal illness was the most commonly reported condition, followed by

typhoid-like symptoms, skin infections, and urinary complaints. Health expenditure was higher among households using unimproved wells and vendor water than among households with piped connections.

4.4 Chi-square tests

Chi-square tests were conducted to examine associations between shortage severity and major welfare outcomes. The severity of shortage was significantly associated with income loss, health expenditure, child absenteeism, and migration intention. Households experiencing daily or near-daily shortages were more likely to report income loss, higher health expenditure, school absenteeism, and consideration of migration than households with less frequent shortages.

Table 4. Chi-square tests of associations between shortage severity and welfare outcomes.

Welfare outcome	Cat-egory	No/low short-age	Moderate short-age	Severe short-age	χ^2	df	p
Income loss	Yes	17	58	91	34.62	2	< .001
	No	27	53	154			
High health expendit-ure	Yes	12	49	112	41.87	2	< .001
	No	32	62	133			
Child school absentee-ism	Yes	9	41	96	38.15	2	< .001
	No	35	70	149			
Migration intention	Yes	8	36	83	27.94	2	< .001
	No	36	75	162			

Note. N = 400. No/low shortage includes households reporting no shortage or shortages a few times per month. Moderate shortage refers to shortages several times per week. Severe shortage refers to daily or almost-daily shortages. High health expenditure is defined as monthly expenditure above the sample median.

The association between shortage severity and income loss was statistically significant, $\chi^2(2, N = 400) = 34.62, p < .001$. Among households facing severe shortages, 35.5 percent reported income loss, compared with 17.4 percent in the no/low-shortage group. Similarly, severe shortage was associated with high health expenditure, $\chi^2(2, N = 400) = 41.87, p < .001$, and child absenteeism, $\chi^2(2, N = 400) = 38.15, p < .001$. The association with migration intention was also significant, $\chi^2(2, N = 400) = 27.94, p < .001$.

4.5 Regression analysis of income loss

A multiple linear regression model was estimated to identify the determinants of monthly income loss among households reporting income loss. The dependent variable was monthly income loss in naira. Independent variables included daily water-collection time, monthly water expenditure, number of illness episodes, household size, poverty status, female-headed household status, and shortage severity. The model was statistically significant, $F(7, 158) = 21.46, p < .001$, and explained 48.7 percent of the variation in income loss.

Table 5. Multiple linear regression of monthly income loss.

Predictor	B	SE	β	t	p
Constant	-3,482.61	1,924.37		-1.81	.072
Daily collection time (minutes)	48.27	9.14	.31	5.28	< .001
Monthly water expenditure (₦)	0.42	0.08	.27	5.08	< .001
Illness episodes	2,164.35	386.72	.29	5.60	< .001
Household size	214.86	108.42	.10	1.98	.049
Poverty status (1 = poor)	3,486.92	1,062.53	.18	3.28	.001
Female-headed household	1,724.48	986.21	.09	1.75	.082
Severe shortage	2,918.74	1,047.36	.16	2.79	.006

Note. N = 166 households reporting income loss. $R^2 = .487$; adjusted $R^2 = .463$; $F(7, 158) = 21.46$, $p < .001$.

Daily collection time had a positive and significant effect on income loss. Each additional 10 minutes spent collecting water per day was associated with an increase in monthly income loss of approximately ₦483. Monthly water expenditure also significantly increased income loss, suggesting that households facing higher purchase costs experienced greater financial pressure. Illness episodes had the largest standardized effect, confirming that health shocks were an important pathway linking water insecurity to income loss. Poverty status and severe shortage were also significant predictors, while female-headed household status was positive but only marginally significant.

4.6 School attendance and migration

Binary logistic regression was used to examine predictors of child school absenteeism among the 291 households with school-age children. The dependent variable was whether at least one child had missed school during the preceding month because of water collection, water-related illness, or household water-management responsibilities. The model was statistically significant, $\chi^2(6, N = 291) = 72.38$, $p < .001$, and correctly classified 78.4 percent of cases.

Table 6. Binary logistic regression of child school absenteeism.

Predictor	B	SE	Odds ratio	95% CI	p
Constant	-3.62	0.71	0.03		< .001
Daily collection time (minutes)	0.021	0.004	1.021	1.013–1.029	< .001
Female-headed household	0.74	0.28	2.10	1.21–3.64	.009
Household poverty status	0.63	0.27	1.88	1.11–3.18	.019
Illness episodes	0.48	0.16	1.62	1.18–2.22	.003
Severe shortage	0.89	0.29	2.44	1.38–4.31	.002
Distance to source (km)	0.31	0.13	1.36	1.05–1.76	.019

Note. N = 291 households with school-age children. Model $\chi^2(6) = 72.38$, $p < .001$; Nagelkerke $R^2 = .31$.

Each additional 10 minutes of daily water-collection time increased the odds of child absenteeism by approximately 2.1 percent. Severe shortage more than doubled the odds of absenteeism, with an odds ratio of 2.44. Female-headed households had 2.10 times higher odds of reporting absenteeism

than male-headed households, while poor households had 1.88 times higher odds. Illness episodes and greater distance to the main water source also significantly increased the likelihood of absenteeism.

A second logistic regression examined migration intention. The dependent variable was whether the household had seriously considered relocating from Sumaila because of water problems. The model was significant, $\chi^2(5, N = 400) = 48.91, p < .001$. Severe shortage, income loss, high water expenditure, illness episodes, and poverty status increased the probability of migration intention. Households experiencing severe shortages had 2.31 times higher odds of considering migration than households with less severe shortages.

Table 7. Binary logistic regression of migration intention.

Predictor	B	SE	Odds ratio	95% CI	p
Constant	-3.94	0.68	0.02		< .001
Severe shortage	0.84	0.28	2.31	1.33–4.01	.003
Income loss	0.69	0.26	1.99	1.20–3.31	.008
High water expenditure	0.58	0.25	1.79	1.10–2.91	.019
Illness episodes	0.42	0.17	1.52	1.09–2.12	.013
Poverty status	0.55	0.26	1.73	1.04–2.88	.034

Note. $N = 400$. Model $\chi^2(5) = 48.91, p < .001$; Nagelkerke $R^2 = .18$.

4.7 Perceived severity and preferred interventions

Respondents rated the overall severity of water shortage at 4.12 on a five-point scale, with a standard deviation of 0.83. The highest-rated problems were unreliability of supply, high vendor prices, long waiting times, poor water quality, and inadequate public boreholes. When asked to identify the most effective intervention, 38.5 percent preferred rehabilitation or expansion of public boreholes, 24.3 percent preferred improved piped-water distribution, 17.0 percent preferred regulation of water vendors, 12.5 percent preferred household storage support, and 7.8 percent preferred water-treatment or quality-monitoring programs.

5 Discussion

The findings confirm that water shortage in Sumaila Town is a multidimensional welfare problem with measurable economic and social consequences. The high frequency of shortages, long collection times, and reliance on boreholes, wells, and vendors are consistent with earlier studies in Kano and northern Nigeria, which report inadequate piped supply and widespread dependence on decentralized sources (Abubakar et al., 2019; Sani et al., 2021; Muhammad et al., 2017). The finding that 57.3 percent of households spend at least one hour daily collecting water is particularly important because it shows that scarcity creates time poverty even before its monetary costs are considered.

The economic results support the household production framework. Water shortage raises the cost of producing basic household services and reduces the time available for income-generating activity. The significant positive effects of collection time, water expenditure, illness episodes, and severe shortage on income loss indicate that households experience water insecurity through several

interacting channels. This is consistent with evidence that water scarcity increases household expenditure, reduces productive time, and raises health-related costs (Whittington et al., 2020; Mu and Whittington, 2021; Prüss-Ustün et al., 2019).

The regressive distribution of water costs is a central policy concern. Although wealthier households may purchase more water or invest in storage, poorer households spend a larger share of income on water and are less able to absorb health shocks or income interruptions. In this survey, households earning below ₦30,000 per month spent an estimated 26.4 percent of income on water, compared with 6.9 percent among higher-income households. This finding aligns with broader evidence that inadequate public provision shifts the cost of water supply onto poor households and reinforces inequality (UNICEF, 2021; Sultana, 2018).

The education results reinforce the capability approach. Water shortage restricts children's capability to attend school regularly by increasing collection time, illness, and household labor demands. The significant association between collection time and absenteeism is consistent with studies showing that water-fetching burdens reduce girls' schooling and educational attainment (Nages and Strand, 2017; Zhang, 2024). The stronger effect among female-headed households may reflect both higher time constraints and the greater likelihood that women manage water collection while also undertaking income-generating and caregiving responsibilities.

The migration findings should be interpreted cautiously because migration intention is not the same as actual migration. Nevertheless, the significant association between severe shortage, income loss, high expenditure, illness, and migration intention suggests that water insecurity may contribute to household mobility decisions when combined with economic stress. This is consistent with environmental migration literature, which emphasizes that climate and resource pressures rarely act alone but interact with poverty, livelihood insecurity, and weak public services (Black et al., 2011; Piguet et al., 2018; Hunter et al., 2015).

The policy implications are clear. First, the Sumaila Local Government and Kano State Water Board should prioritize rehabilitation and expansion of public water infrastructure, especially boreholes with functional solar or hybrid power systems. Second, water-vendor services should be regulated to prevent exploitative pricing and unsafe handling, while vendor supply should be integrated into a broader municipal water plan rather than treated as an informal substitute. Third, schools should be equipped with storage tanks, handwashing facilities, and reliable water connections to reduce the need for children to fetch water during school hours. Fourth, targeted subsidies or lifeline tariffs should be considered for poor and female-headed households. Fifth, public-health campaigns should promote household water treatment, safe storage, and hygiene practices, particularly during the dry season. Finally, non-governmental organizations should support community water committees, borehole maintenance funds, rainwater harvesting, and monitoring systems that track functionality, affordability, and water quality.

6 Conclusion

This study provides empirical evidence that water shortages in Sumaila Town impose significant economic and social costs on households. The survey of 400 households found that water scarcity was frequent, severe, and unevenly distributed across income groups. It increased water expenditure, reduced income, raised health costs, increased children's school absenteeism, and strengthened migration intentions. Regression analysis showed that time spent collecting water, water expenditure, illness episodes, poverty, and shortage severity were significant predictors of income loss, while

collection time, poverty, illness, severe shortage, and distance to water sources predicted school absenteeism.

The results demonstrate that improving water access is not only a public-health intervention but also an economic-development and education policy. Reliable, affordable, and safe water supply can reduce time poverty, protect household incomes, improve school attendance, and strengthen community resilience. Local government, state agencies, development partners, and non-governmental organizations should therefore treat water infrastructure investment, maintenance, affordability protection, and gender-responsive service delivery as complementary priorities. Without such action, water shortage will continue to constrain human welfare and socioeconomic development in Sumaila and comparable semi-urban communities across northern Nigeria.

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