Factors Influencing Households' Access to Portable Water in Rural Nigeria

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Abstract: Inability to access safe drinking water is one of the strongest indicators of underdevelopment because it is basic need of man. In Nigeria, compared to pre-independence era, access to safe water has drastically declined, despite the country's assent to the Millennium Development Goals (MDGs). This study analysed the factors that influence access of rural people to safe water using the Demographic and Health Survey (DHS) data of 2008. The data were analysed with descriptive and Probit regression methods. Results show that ignoring distance, about 57.30 percent of the households obtained their drinking water from sources that are unimproved, while 57.40 percent obtained non-drinking water from unimproved sources. About 27.7 percent and 27.8 percent obtained drinking and non-drinking water respectively from flowing or stagnant water sources such as rivers, dams, lakes, streams. About 20.50 percent had the water in premises of their houses while 39.26 percent would have to trek less than 20 minutes to the water sources. Also, only 13.9 percent were treating water before use. Probit model results show that North East zone (-ve). North West (+ve) South East (-ve), South South (-ve), distance from main source (-ve), sex (-ve) among other were statistical significantly ($p<0.10$) influencing access to safe water. It was recommended that efforts to resuscitate water supply in the rural areas should be put in place while creation of awareness on the need for water treatment is important.
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Introduction

Water is life. This phrase aptly describes the important role that water plays in human development and survival. After air, the next important and essential need of human is water. The relevance of water to humans and their environment is definitely unlimited, and the environment is central to the survival of any human society. Gbadegesin *et al* (2007) made reference to water as a precious natural resource that is vital for life, development and the environment. It can be a matter of life and death, depending on how it occurs and how it is managed. When it is too much or too little, it can bring destruction, misery or death. Irrespective of how it occurs, if properly managed, it can really be an instrument for economic survival and growth.

Therefore, the usefulness of water cannot be over-emphasized. It can be an instrument for poverty alleviation, lifting people out of the degradation of having to live without access to safe water and sanitation, while at the same time bringing prosperity to all. However, when it is inadequate in either quantity or quality, it can be a limiting factor in poverty alleviation and economic recovery, resulting in poor health and low productivity, food insecurity and constrained economic development. Progress towards reducing inequality in access to safe water has gone far globally, considering the fact that this has been a major target of the Millennium Development Goals (MDG) which seeks to half the proportion of those without access to safe water and basic sanitation by the year 2015.

Water is not distributed evenly over the globe. Fewer than 10 countries possess 60 percent of the world's available fresh water supply. Less than 3 percent of the world's water is fresh; the rest is seawater and not fit for drinking. Of the 3 percent that is fresh water, 2.5 percent is frozen, locked up in Antarctica, the Arctic and glaciers, and not available to man. Thus humanity must rely on the remaining 0.5 percent for all of man's water needs. It has become a cause for concern that many rural areas lack access to clean, safe water and basic sanitation services. Many times over, the rural areas have fallen outside the jurisdiction of development programs relating to water and sanitation. An important factor responsible for this is that such people without access to clean, safe water and sanitation are difficult to reach due to remoteness of their living conditions (Anand, 2006; UNDP, 2006).

It was reported that more than 1.2 billion of people living in river basins live in conditions of water scarcity and another 1.6 billion people live in areas of economic water scarcity, where human, institutional and financial capital limits access to water (WHO/UNICEF 2006). These are conditions that are prevalent in Southern Asia and sub-Saharan Africa.

Symptoms include lack of or underdeveloped water infrastructure, high vulnerability to short- and long–term drought, and difficult access to reliable water supplies especially for rural people.

Olorunsogo (2006) reports that Nigeria ranks amongst the countries with the lowest level of portable water supply in the world despite being signatory to the International Water Decade (1981-1990). It is to this end that there is a general agreement that the utility services in Nigeria of which water supply is an example, is failing to provide and develop the services, and the infrastructure required for social and political development. Water supply systems have therefore become unreliable and underdeveloped.

In response to the limitations of water supply, 44 percent of households in Nigeria have their own private boreholes and many rely on water vendors whose high prices amount to more than 30 percent of households' income for the poorest (Hall, 2006). As a result, a large proportion of poor households resort to drawing water from unhygienic sources. Rural status of supply is characterized by low level coverage which might be as a result of low political commitment, lack of maintenance culture for existing facilities and sometimes poor workmanship and prevailing corruption by the contractors and government workers.

In a research conducted on water and electricity in Nigeria, Hall (2006) was of the opinion that between 60 percent and 70 percent of the population is currently without either water or waste water services. It was found that in the rural areas, about 49 percent of the population have access to safe water. Areas where low coverage of water supply is felt especially in the rural areas is in terms of community health and productivity as majority of rural people resort to unhygienic sources of water for drinking and other domestic uses. As a result of lack of access to safe water, people suffer from water-borne diseases such as typhoid, cholera, and dysentery etc., leading to the observed mortality rates in the rural areas.

Favourable advances in many fields have been made in the global community but the basic needs of man; which are clean water and basic sanitation continues to be a mirage. Safe drinking water, sanitation and good hygiene are fundamental to health, survival, growth and development. However, these basic necessities are still a luxury for the world's poor. Safe drinking water and basic sanitation are so obviously essential that it becomes a risk if taken for granted. For many in the rural areas, access to clean, safe water and basic sanitation remain a luxury. Lack of safe and improved water supply and basic sanitation had in more than one way inhibits the productivity of the rural people who are mostly farmers. These are people charged with the "most important" work of providing food for the global population. In addition, the learning abilities of millions of school-aged children who are infested with intestinal worms transmitted due to inadequate sanitation facilities leading to the prevalence of water-borne diseases and poor hygiene is seriously affected.

Water coverage in rural areas in virtually the entire developing world remains unacceptably low. Urban drinking water coverage remained the same from 1990 to 2004 at ninety five percent, whereas, in rural areas, coverage increased to seventy three percent in 2004 from sixty four percent in 1990. This is still low considering the fact that in 27 developing countries, less than fifty percent of the rural population has access to improved drinking water. Rural areas still lag far behind urban areas in terms of drinking water coverage and in terms of drinking water supply from improved sources, so efforts and investments need to be intensified to decrease the back log of rural people who remain without access to safe water and reduce the huge health risks brought about by the absence of improved drinking water infrastructure in rural areas.

The regions representing the lowest coverage of sanitation has as an example of sub-Saharan Africa, where many are obliged to defecate in the open or use unsanitary facilities, with a serious risk of exposure to sanitation related diseases. If the MDG water and sanitation target is to be achieved, innovative approaches need to be developed for efficient service delivery. While believing that human welfare and general economic development depends on the use of water and that water resources management and utilization is crucial to the nation's efforts to reduce poverty, grow the economy, ensure food security and maintain the ecological systems, Gbadegesin *et al* (2007) earlier cited, said that the issue of water resources management in the country focuses mainly on water supply and it receives only minimal attention by government. This approach may be attributed partly to the disjointed sectoral approach to development planning in the country and the idea that water is a public good.

The objective of this paper is to examine the factors influencing access to safe water by rural dwellers in Nigeria. This is vital because the former Secretary-General of the United Nations, Mr. Kofi Annan, in March 2005, in a bid to emphasize the urgency and immediacy that access to safe water deserves, said that "We shall not finally defeat AIDS, tuberculosis, malaria, or any of the other infectious diseases that plague the developing world until we have also won the battle for safe drinking water, sanitation and basic health care." However, the problem is far from being over in Nigeria, especially in the rural areas. In the remaining parts of the paper,

materials and methods, results and discussions and conclusion and recommendations have been presented.

Materials and Methods

Study area

The area of the study is the Federal Republic of Nigeria. The Federal Republic of Nigeria, with an area of 923,769 square kilometres (made up of 909,890 Square kilometres of land area and 13,879 square kilometres of water area), is situated between 3^0 and 14^0 East Longitude and 4^0 and 14^0 North Latitude. The longest distance from East to West is about 767 kilometres, and from North to South 1,605 kilometres. The country is bordered on the west by the Republics of Benin and Niger; on the east by the Republic of Cameroon; on the north by Niger and Chad Republics and on the south by the Gulf of Guinea.

Nigeria is divided into 36 states and stratified into 6 geo-political zones, which are: Southwest, South South, Southeast, North Central, Northwest, and Northeast. The rural-urban distribution of the country is 56 percent and 46 percent respectively. The major occupation of the rural people being agriculture, cultivating food crops such as maize, cassava, millet, among livestock and other crops, just to mention a few.

Methods of Data Collection

This study made use of survey-based secondary data that were collected by the National Bureau of Statistics (NBS) as the Demographic Health Survey (DHS) 2008. The data consist of a total sample size of 34,070 respondents which includes both urban and rural Nigeria. The rural respondents were purposively selected from the whole data and consist of 23,346 respondents.

Analytical Approaches

Descriptive statistics such as frequency distribution tables, mean and standard deviation were used to analyse the data. The Probit model or equally known as the Normit model, which is based on the cumulative distribution function, was adopted for the analysis of the factors influencing rural households' accessibility to safe water. The Probit model is a regression model for situations in which the dependent variable is a discrete outcome, such as a "yes" or "no" decision. The Probit model examines the effects of a set of independent variables (Xs) on the probability of success or failure on the dependent variable P(Y). The observed occurrence of a given choice (i.e., success or failure) is taken as an indicator of an underlying, unobservable continuous variable, which may be called "propensity to choose a given alternative." Ordinary Least Squares (OLS) is not appropriate for this because in OLS, the variable that we seek to explain must have real values and can run from positive infinity to negative infinity. If OLS is inappropriately applied in this situation, the estimates from this `linear probability model' are inconsistent.
The model is stated as

$$Y_{ij} = \alpha_j + \beta_j \sum_{j=1}^{n} X_{ij} + e_i$$

The major challenge is how to determine the factors that would influence access to improved water sources. However, Larson *et al*. (2006) hinted that the type of water source used by households in developing countries is related to their socioeconomic status, among other factors. In this study, we have postulated that access to improved water can be influenced by X_{ij} which comprise of geopolitical zones {North Central zone (yes = 1, 0 otherwise), North East zone (yes = 1, 0 otherwise), North West zone (yes = 1, 0 otherwise), South East zone (yes = 1, 0 otherwise), South South zone (yes = 1, 0 otherwise), time to get to water source (minutes), sex of household head (male =1 0 otherwise), age of household head (years), share toilet with other households (yes = 1, 0 otherwise), location of source of water (in building =1, 0 otherwise), person fetching water, water treatment (yes = 1, 0 otherwise), number of households sharing toilet, member of household died last 12 months, education, marital status (married =1, 0 otherwise), member sick last 12 months (yes = 1, 0 otherwise), suffer from river blindness (yes = 1, 0 otherwise), any drug taken for guinea worm (yes = 1, 0 otherwise), main floor material (improved =1, 0 otherwise), any drug taken for bilharzias (yes = 1, 0 otherwise) and wealth index.

Results and Discussions

Sources of drinking and non-drinking water

Table 1 shows the distribution of the sources of drinking water in rural Nigeria. Specifically, for the sources of drinking water, our definition of improved sources is derived from UNICEF (2010) as households' pipe connections, public standpipes, borehole, protected dug wells, protected springs and rainwater, while unimproved sources are unprotected wells, unprotected springs, vendor-provided water, bottled water and tanker truck provided water}. The results reveal that about 57.30 percent of the households obtained their drinking water from sources that are unimproved. Abebaw *et al.*, (2010) found that in Ethiopia, 28.90 percent of rural households had access to improved water sources. Specifically, only 5.30 percent had access to piped water either in the dwellings, yard or in public. Tube well and protected well was used by 33.6 percent, while 22.6 obtained water from unprotected wells. It should also be noted that 27.7 percent of the rural respondents obtained

their drinking water from flowing or stagnant water sources such as rivers, dams, lakes, streams.

Vasquez *et al*. (2009) and Kleemeier (2000) indicated that in many developing countries, improved water supply is no longer functioning properly. Our findings can be buttressed by the assertion of Afripol (2010) that access to improved water sources by Nigerians in the 1960s to early 80s was far better than what obtained in the 1990s and upward. The problem was blamed on inadequate planning to cater for the water needs of the rapidly growing population. With dilapidating water infrastructure, many rural households that often lack the financial means of getting connected to government water services are now abandoned to depend on unclean waters from ponds, rivers and lake.

Table 1: Sources of drinking water

Water sources	Frequency	percent
Piped into dwelling+	200	0.9
Piped to yard/plot+	128	0.5
Public tap/standpipe+	900	3.9
Tube well or borehole+	4,917	21.1
Protected well+	2,918	12.5
Unprotected well	5,279	22.6
Protected spring+	139	0.6
Unprotected spring	1,085	4.6
River/dam/lake/ponds/stream/canal/ irrigation channel	6,461	27.7
Rainwater+	776	3.3
Tanker truck	117	0.5
Cart with small tank	160	0.7
Bottled water+	108	0.5
Other sources	152	0.7
Total	23,340	100.0

+ improved water sources

Table 2 shows the distribution of the sources from where rural households obtained non-drinking water. It shows that about 57.6 percent of the households obtained their non-drinking water from sources that are unimproved. About 5.40 percent of the respondents had access to piped water either in the dwellings, yard or in public for non-drinking purpose. Tube well and protected well was used by 33.8 percent, while 22.6 obtained non-drinking water from unprotected wells. It should also be noted that 27.8 percent of the rural respondents obtained their non-drinking water from flowing or stagnant water sources such as rivers, dams, lakes, streams.

Table 2. Source of non drinking water

Water sources	Freq	%
Piped into dwelling+	200	0.9
Piped to yard/plot+	129	0.6
Public tap/standpipe+	903	3.9
Tube well or borehole+	4,944	21.2
Protected well+	2,942	12.6
Unprotected well	5,285	22.6
Protected spring+	141	0.6
Unprotected spring	1,086	4.7
River/dam/lake/ponds/stream/canal/ irrigation channel	6,481	27.8
Rainwater+	784	3.4
Tanker truck	119	0.5
Cart with small tank	160	0.7
Other	153	0.7
Total	23,327	99.9

Table 3 shows the distance of water in rural Nigeria. It shows that 20.50 percent of the respondents had the water in premises of their houses. However, 39.26 percent would have to trek less than 20 minutes to the water sources, while 23.59 percent would trek between 20 and 40 minutes.

Table 3: Distribution of time to water sources

Distance	Freq	%
On premises	4,787	20.50
<20	9,165	39.26
20<40	5,507	23.59
40<60	1,286	5.51
60<80	1,468	6.29
>=80	871	3.73
Don't know	136	0.58
No response	126	0.54
Total	23,346	100.00

Table 4 shows the distribution of person fetching water in relation to the distance of the water sources. It shows that sources where adult women fetch water from had the lowest average trekking time of 29.85 minutes. Water sources where adult men fetch water have average trekking distance of 33.28 minutes. Sources that were used by female children under the age of 15 years had average time of 29.99 minutes to trek, while that for male children less 15 years is 30.61 minutes. It is to be noted that adult women and men constitute the highest proportion of household members that were fetching water.

Table 4: Distributions of Household Members Fetching Water in Relation to Time to Water Sources

Person fetching water	Freq	Average time	Std dev
Adult women	6,360	29.85	63.467
Adult men	5,118	33.28	91.961
Female child under 15 years old	918	29.99	77.194
Male child under 15 years old	888	30.61	84.430
Adult woman with child	1,652	31.90	54.066
Others	428	107.29	275.458
Female and male child under 15 years old	748	35.18	97.647
Any household member	2,304	35.82	90.093
Total	18,416	33.79	89.092

Table 5 shows responses of rural people to whether they were treating their water before use or not. It shows that 13.9 percent were treating water before use. The table further shows that 1.8 percent were using chlorine while 0.8 percent were using water filter. Also, 1.1 percent would leave the water to settle while 4.6 percent used alum. Only 2.1 percent were boiling the water while 4.3 percent were straining the water through cloths.

Table 5: Water treatment methods used by rural households

Treatment methods	Freq / %	No	Yes	Don't know	Missing	Total
All methods	Fref	20,046	3,248	21	31	23,315
	%	85.9	13.9	0.1	0.1	99.9
Bleach/Chlorine	Fref	22,869	415	21	41	23,305
	%	98.0	1.8	0.1	0.2	99.8
Water filter	Fref	23,106	178	21	41	23,305
	%	99.0	0.8	0.1	0.2	99.8
Solar disinfection	Fref	23,270	14	21	41	23,305
	%	99.7	0.1	0.1	0.2	99.8
Stand and Settle	Fref	23,038	246	21	41	23,305
	%	98.7	1.1	0.1	0.2	99.8
Alum	Fref	22,213	1,071	21	41	23,305
	%	95.1	4.6	0.1	0.2	99.8
Boil	Fref	22,788	496	21	41	23,305
	%	97.6	2.1	0.1	0.2	99.8
Strain through a cloth	Fref	22,270	1,014	21	41	23,305
	%	95.4	4.3	0.1	0.2	99.8

Factors explaining access to portable water

Probit model was estimated for rural households' access to safe water. Drinking water was used as the dependent variable when estimating rural households' access to safe water. From table 6, out of twenty-two independent variables used, fifteen had coefficients significantly different from zero ($p<0.10$). A negatively significant relationship ($p<0.01$) exists between rural households' access to safe water and residence in North East zone. This implies that respondents from North-East have significantly lower probability of having access to portable water. However, the parameter of North West zone dummy variable is with positive sign and statistically significant ($p<0.01$). This implies that residents from North-West zone have significantly higher probability of accessing portable water. The parameter of South East dummy is with negative sign and statistically significant ($p<0.01$). This shows that residence in the South East zone significantly reduces the probability of having access to portable water. Also, the parameter of South South zone dummy is with negative sign and statistically significant ($p<0.01$). This shows that residence in the South South significantly reduces access to portable water.

Table 6: Probit model estimation on rural households' access to safe water

Number of Obs = 23346

Log likelihood = -13139.993

Variables	Coefficients	Z	Coefficient of marginal effect	Z
North Central	.0285181	0.82	.0110036	0.82
North East	-.1148676*	-3.10	0437332	-3.13
North West	.2506997*	7.15	.0977717	7.10
South east	-.1420482*	-3.78	-.053757	-3.85
South South	-.4316461*	-12.39	-.1572697	-13.32
Time to get to water source	-.0036093*	-10.25	-.0013894	-10.26
Sex of household head	-.1538164*	-5.56	-.0598781	-5.51
Age of household head	.0014159**	2.34	.000545	2.34
Share toilet with other H/h	-.092848**	-2.48	-.0354612	-2.50
Location of source of water	.2082464*	7.68	.0813574	7.60
Person Fetching water	.2020412*	8.90	.0785743	8.84
Water treatment	-.4723601*	-17.00	-.1699481	-18.67
Number of H/h sharing toilet	.0019972	0.34	.0007688	0.34
Member of H/h died last 12 months	.0046062	0.24	.0017731	0.24
Education	-.006617*	-3.22	-.0025472	-3.22
Marital status	-.0004206	-0.02	-.0001619	-0.02
Member sick last 12 months	.0100841	0.15	.0038868	0.15
Suffer from river blindness	-.0956051**	-2.50	-.0363561	-2.54
Any drug taken for guinea worm	.0322961	0.31	.0124829	0.31
Main floor	-.331212*	-	-.1266336	-

material		12.62		12.75
Any drug taken for bilharzias	.0121327	0.16	.0046777	0.16
Wealth index	9.72e-06*	47.83	3.74e-06	47.40
Constant	.485606	9.02	-	-

*denotes significance at 1 percent, ** significance at 5 percent, *** significance at 10 percent

The relationship between distance from main source to house, average time spent to fetch from water main source to house and average number of trips per person per day to main source has been well emphasized in literature (Franceys, 1993; WHO and UNICEF, 2004). In the results, time to get to water source and rural households' access to safe water has a negatively significant relationship ($p< 0.01$). As the time it takes households to get to water source increases, the accessibility of rural households to safe water declines. The marginal effect analysis revealed that the likelihood of rural households' access to safe water decreases by 0.001 as time to get to water source increases by one minute.

Sex of household head negatively affects rural households' access to safe water. The variable is a dummy. It implies male headed households have significantly lower ($p<0.01$) access to portable water. This is expected because women are domestically more inclined towards water fetching. Abebaw *et al*. (2010) similarly found that in Ethiopia, female headed household heads have higher probability of having access to improved water sources. One of the reasons adduced was the fact that women and children are directly responsible for fetching water and as heads and decision makers, they may be more inclined to invest in the effort of fetching clean water. Also, it was noted that because women are likely to be more risk-averse than men, there is likelihood of minimizing water-borne diseases by using improved sources of water.

Location of source of water is positively related to rural households' access to safe water and is significant at 1percent. As the location of source of water tends to be in the households' yard or plot, households' accessibility significantly increases. Rural households' access to safe water and person fetching water has a positively significant relationship ($p< 0.01$). Its implication is that as more persons are engaged in the fetching of water for the household, the accessibility of the household to water increases.

Water treatment is negatively related to rural households' access to safe water and significant at 1 percent. Its implication is that as water treatment increases, the accessibility to safe water by rural households in Nigeria decreases. Educational attainment of household head and rural households' access to safe water has a negatively significant relationship ($p<0.01$). This implies that as educational attainment of household head increases, the accessibility decrease. Main floor material is significant at 1percent and negatively affects rural households' access to safe water. It implies that an increase in main floor material of households decreases the accessibility of rural households to safe water. There exists a positively significant relationship ($p<0.01$) between Wealth index and rural households' access to safe water and implies that an increase in the wealth index of the households increases their accessibility to safe water.

Age of household head is significant at 5 percent, positively affects rural households' access to safe water and implies that an increase in the age of household head households increases the households' accessibility to safe water. Its marginal effect analysis shows that an increase of one year in household head's age increases accessibility by 0.0005. There exists a negatively significant relationship ($p<0.05$) between share toilet with other households and rural households' access to safe water. It implies that an increase in toilet sharing with other households decreases accessibility to safe water of rural households. Suffer from river blindness negatively affects rural households' access to safe water and significant at 5percent. It implies that an increase in members of household suffering from river blindness decreases the households' accessibility to safe water.

Conclusion

Water is essential for domestic and production activities in rural Nigeria. When households lack access to safe water, several health consequences can result. Inability to access safe drinking water is one of the strongest indicators of underdevelopment because it is basic need of man. In Nigeria, compared to pre-independence era, access to safe water has drastically declined, despite the country's assent to the Millennium Development Goals (MDGs). This study has shown that majority of rural dwellers do not have access to portable water and they were not treating the water before using. Some policy issues can be derived from the findings. There is the need for government to put in place awareness programmes to sensitize rural households on the need to treat their water before using. Government should also reawaken her commitment towards provision of portable water.

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