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Research Article

Analysis of the Relationship between Households' Socio-Economic Characteristics and Domestic Water Demand in Enugu

BY

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ABSTRACT: *In Enugu metropolis, the high rate of residential housing facilities to accommodate the growing human population means that more demand for water is required by the households. The influx of people from different part of the country into the various residential density areas in Enugu metropolis has some far reaching planning implications. The extent of the relationship of these household characteristics with water demand in Enugu metropolis has not been empirically determined. The study analysed the socio- economic characteristics of household and their relationship with household daily water demand in Enugu metropolis. The study also analyses how demographic characteristics of household relate with household water demand in three residential areas, in Enugu metropolis. Both primary and secondary data were obtained from 400 households using opened ended questionnaire and an in-house observation guide across the three residential areas of Enugu metropolis, Enugu. The study not only showed that there was a moderate relationship between households' demographic features and water demand, but that household size and age of household (35.1%), household size and sex of the household (38.0%) and household size (46.1%) were the predictors of household daily water demand for high, middle and low residential areas respectively. Household water demand does significant differ across the various residential densities in the study area at significant of p>0.05. The findings indicate that water is not used efficiently in the metropolis. The study recommends for policy that will integrate household variables in the estimation of water consumption in Enugu. Again there should be differential water supply system among the residential densities in the study area*

KEYWORDS: *Demands, Household, Housing facilities, Residential, Water.*

1. INTRODUCTION

In many parts of Africa, domestic water supply is mainly an inter play of different traditional water supply sources [1]; which often poses challenges to households as supply is affected by such factors like income, household size, gender, age, educational level of the households and to a lesser extent distance. The impact of

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inadequacy, manifest strongly on households in terms of time and distance taken to obtain water. According to [2], adequate access to social welfare services, including potable water supply, is a strong index of development. Access to water connotes physical availability. It lays credence on the extent to which factors like distance, time and cost have decayed. Measuring access to water therefore, transcends just 'physical' accessibility. It includes cost (direct and indirect) borne by people in their quest for water [1]. Optimum accessibility in the case of water therefore must be related to effectively over coming factors like distance, time and cost as well as an understanding of the economic implications of these variables [1]. Many of the explanatory factors affecting residential water demand reflect choices made by households. Household choices are constrained by expenses that they face and the income they receive. External factors affecting water demand are weather variables such as precipitation and temperature. The choices made by households and the income constraint they face are captured in variables that describe house and household characteristics. Weather and price information is common to all households within a defined area and would be included in a model of household water demand that is projected through time. The likelihood of using water from improved sources increased with increasing level of education. Studies on the determinants of households choice of water source in developing countries have proved that household education have a strong influence on households choice [3]. This is not surprising, since more educated households are probably more aware about adverse health effects from ingestion of poor water quality.

Enugu metropolis has been characterized by recurrent water scarcity as is the case with most cities of developing nations. As the metropolis grows, the limitation in water available to competing regions becomes more obvious. While some parts of Enugu metropolis have water occasionally, some areas are yet to be included in the water supply scheme. The use of water in households within Enugu incurs variations in cost with few areas having access to the supply. Problems occur in the supply of domestic and municipal water because of climatic variations, since water shortages occur in both dry and rainy seasons. Inadequacies in collection to meet maximum demands throughout the year are the principal factors of these shortages. It is imperative to study the contribution and activities of water vendors whose patronage are now gaining grounds in Enugu city as a result of the failure of government to provide adequate water supply to the people.

Reliable estimates of residential water demand, water source choice decisions and the factors affecting this water demand have become important for policy making in the water supply sector [4]. In Enugu metropolis, the high rate of residential housing facilities to accommodate the growing human population means more demand for water is required by households. The influx of people from different part of the country into the various residential density areas in Enugu metropolis has some far reaching planning implications. However, there are no adequate measures put in place to improve water use practices.

Household characteristics have been identified to be among the factors that have relationship with household water demand in various studies done in developed countries [5]. The extent of the relationship of these household characteristics with water demand in Enugu metropolis has not been empirically determined. Moreover, how these demographic characteristic relates with household water demand in the various residential densities in Enugu metropolis is yet to be determined. Hence, the essence of the study is to investigate the relationship between the household socio-demographic characteristics and domestic water demand in the study area. The study hypothesized firstly, that there was no significant relationship between socio-demographic characteristics and household water demand of dwellers in the various residential densities in Enugu Metropolis, and secondly, the influence of socio-demographic characteristics of dwellers on water demand among the various residential densities was not significantly similar. Reviewed literature show that demographic trends like population growth, number of households, urbanization, migration, population distribution, and mortality affects demand for water resources, two

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of which mortality and migration are themselves affected by water quality and quantity. It was also found that population growth, changes in household size, and urbanization influence land-use changes such as deforestation and land clearance for building and agriculture, which encourage pollution and siltation of water supply systems,[6]. Many other social, cultural, and physical pressures are exacted on the systems, and the combination of all of these pressures can potentially create conditions of scarcity or crisis.

[7] found that the ability of existing residential end-use models to simulate end-use water demands with desired spatial and temporal representation especially at larger scales (city and regional scales and daily to annual scales) is limited. This is because of the use of mean values instead all plausible values for variables, difficulty in managing the complex correlations between number of variables and the lack of sufficient data to represent relationships between individual end uses and the factors that influence water consumption of individual end uses. Therefore, a single end-use model with its basic relationship is not sufficient to describe the complexity present in urban residential water demand.

[8]shows that there is a steady growth pattern based on present demographic and socioeconomic conditions in the Bedford, Marshall, and Maury/southern Williamson water-service areas and steady growth in the Bedford and Marshall water-service areas and additional industrial and residential development in the Maury/southern Williamson water-service area beginning in 2000.

[9] observed the impact of the physical conditions of urban areas can be advantageous in increasing water conservation in urban and urbanizing regions.

[10] found that per-capita water consumption has been an important research area, location factors could impact the per-capita consumption significantly, the nature of the economic activities and climate may influence the consumption to a greater extent and disaggregating of aggregate water consumption has constrained the estimation of demand for individual blocks. The study concluded that per-capita water consumption varies significantly across the regions and as we move from Western to Eastern Kansas, shares of lower consumption block decrease and higher consumption block likely to increase.

[11] observed that household water security issues are not limited to water availability, accessibility and usage. Water quality also plays an important role in determining the overall security of households, communities and nations. The result also found that unsafe or unimproved sources such as rivers and streams, rainwater and hand dug wells represent the most important water sources for rural households in the Ghanaian part of the Volta basin. They also express serious dissatisfaction with these water sources all year round, regarding the fear of contracting infections, colour of water and presence of particles in the water.

[12] observed that projections must be made in terms of both the number and the type of activities; the general trends in the growth of these establishments in a region can be evaluated and used to determine future commercial and industrial water demands. The result also found that future commercial and industrial demands can also be evaluated by looking at current and projected future growth on a statewide or national level and applying that level of growth to similar local activities and some types of businesses such as retail trade and services may mirror changes in population. Therefore, in some cases projected population growth rates can be used to estimate business growth.

[13] found that Portuguese utilities seem to be more sensitive than Italian companies to promoting the reduction of household water consumption through web information campaigns.

[14] indicate that water demand is highly sensitive to population growth, per capita water use and climate change and variability. Annual Water Supply is simulated by considering water storage level.

[15] observed that new residential units have a strong tendency to utilize less water than older units, presumable because of a shift away from water using yards. Both Black and Spanish- surnamed dominated areas tend to consume a lower than expected amount of water for their income and family size characteristics, but the

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coefficients on these variables are not sufficiently strong to accept this relationship. The research concluded that there is strong positive relationship between household size and water use.

II. STUDY AREA

Enugu lies approximately between latitude $06^{o}\ 21^{1}$ N and $06^{o}\ 30^{1}$ N and between longitude $07^{o}\ 26^{1}$ E and $07^{o}\ 37^{1}$ E. It has an estimated land area of about 72.8 square kilometers. Enugu has a total land area of about 12,831-kilo meter. Residential land- use account for the highest land use comprising about 54.3% of total urban area in Enugu. Enugu has about twenty two (22) distinct neighborhoods that may be broadly categorize as low, medium and high-density areas. It is pertinent to note that the housing types are typical of density area. For example, tenants' buildings dominate and are characterized of high-density areas such as Ogui New Layout, Obiagu neighborhoods, while block of flats are prevalent in New Heaven and Achara Layouts. In low-density areas bungalows and duplexes are common. Due to the influences of spread effects, mixed densities exist. Planned and unplanned areas sprang alongside Enugu metropolis as a result of a high demand in residential accommodation. Hence, the urban residential space in Enugu metropolis is not necessary a continuous zone but an arbitrarily defined one circumscribing about twenty neighborhoods and some intervening open spaces. Many informal business sectors grow alongside with the residential units as noticeable in areas like Kenyetta-Edozie streets axis, Agbani-Ziks Avenue Road, Ogui Road, Obiagu Road, Abakpa Road, Emene Road and Chime Avenue.

The Enugu State Water Corporation is the institution charged with the responsibility for water supply in Enugu state. The State Water Corporation stated as water supply division of the public works department, Enugu until 1978 when the water board was then carved out of the Ministry of Works, Housing and Transport. Enugu State Water Corporation Edict, No. 2006 which gave effect of the establishment of the Corporation comes into force on 27th August 1996. The Edict was further amended in 1999. The function of the corporation include among others to develop, provide, conserve and distribute in the state, water for public domestic and industrial purposes and charging adequate fees for the services rendered to the people. The water supply to the city as currently functioning comprises five water schemes, constructed at the various times from 1924 to date. The schemes are:

1. Bore-hole pumping station.
2. From river through treatment plants and reservoirs.

Some of the water schemes that are used for supply of water in Enugu are;

a) Ajali owa scheme – It takes its intake from Ajali River where water is pumped to the treatment plant of about 7km away. There, water is fully treated and is pumped into the reservoir that is located at ninth mile.
b) Oji River scheme – Water is fed from bore hole which is drilled at the bank of the river. It is collected to the reservoir which flows down to Enugu.
c) Iva water works – Here, water is collected from spring into a reservoir where it is treated.

All the schemes pass through gravitation to reservoir where it is distributed to different areas for use. Also, there are set of boreholes that supply water for both Enugu town and ninth mile. The Enugu distribution system is complex due to the city's varied topography. The major storage reservoirs include the 4 million gallon reservoirs on Onitsha Road, the 4.5 million liters storage at the Ekulu Works and the 2.5 million liters reservoirs on Mission Avenue. Other significant storage tanks include the 216,000 liters ground level storage in Independence layout and elevated

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storage at the Women Training College, Queens School, University of Nigeria Teaching Hospital, Parliament building, Airport, and the tank on Park lane. There are additional small reservoirs in various parts of the town.

III. MATERIALS AND METHOD

The study adopted the cross sectional survey design. Primary and secondary data were collected for the study. The secondary data elucidated revealed the household socio-demographic characteristics of Enugu metropolis. The report was sourced from National Population Census (NPC), National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and Nigerian Communication Centre (NCC) published by National Bureau of Statistics (NBS) in 2012. Stratified, systematic and simple random sampling were employed in the study. The study area was stratified into three strata (high, medium and low) residential density. Three neighbourhoods were selected from each of these three residential densities. Systematic random sampling was employed in the selection of the streets for sampling. Sample size of four hundred (400) was obtained using Taro Yamani's formula. Step-Wise regression, ANOVA and Multiple Linear Regression were used to test the hypotheses

IV. RESULTS / DISCUSSIONS

4.1 House Type

The study determined the types of housing across the three residential densities of Enugu metropolis. The study indicates that majority of 46.6% and 45.4% respondents households sampled in the high density area lived in block of flats and tenement buildings respectively as compared to 50.5% and 30.3% for middle density. More so, it was also revealed that 30.4% lived in block of flats and bungalow each whilst 20.2% and 195 lived in duplex and tenement building. Block of flats and tenement buildings were thought to be cheaper and affordable for the low income earners. Furthermore, the size of the house in relation to the number of rooms across the three residential density areas was also established to correlate with its water demand. The results indicate that of the sampled household respondents in the high density area over 70% lived in single rooms without the following sitting room, bathroom, toilet and kitchen. The tenants share common bathroom and toilet located in the compound. On the other hand, the double room houses consist of a sitting room and a bed room with in-built toilet and bath. The middle and low density areas most respondents lived in 3 to 5 bedrooms' houses exclusion of sitting room, bathroom, toilet and kitchen (as was observed).

4.2 Sources of Water

The major sources of water identified in the study area are:
1. Stream,
2. Rain water,
3. Well/borehole ,

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4. Water vendors,
5. Tap water from Enugu State Water Corporation (ENSWC),

The sources of domestic water for the three densities in Enugu metropolis is shown in TABLE 1 below. The analysis shows that the 25.1 percent of the respondents source their domestic water from rain water and well/borehole compared to 11.1% and 11.4% in medium and low density areas respectively. It was also revealed that in high and low density areas 5% and 1.9% source their domestic water only from water vendors while 13.1%, 7.4% and 15.9% 15.9% households sources their domestic water from rain water, well/borehole and water vendors respectively. It further revealed that 14.7% households source their domestic water demand from well/borehole and water vendors compared to its high and medium density counterparts. More so, in medium, low and high density areas, 23.2%, 12.2% and 19.7% households respectively source their domestic water demand from rain water, well/borehole and tap. Then, it was also revealed that in medium, low and high density areas, 20.2%, 14.7% and 14.9% households respectively source their domestic water demand from Tap water.

Water vendors found in Enugu metropolis are privately owned and can be classified into three like: water tankers common in Abakpa, New haven, Trans-Ekulu, Maryland and others, stationary sellers who store water in big tanks and sell in buckets and jerry cans predominant in Maryland, Abakpa, Independence layout, Trans-Ekulu, Achara layout etc., and mobile jerry can water sellers known as Meruwa which is common in Trans-Ekulu and G.R.A. amongst others.

From the survey, it was observed that the typical urban pipe-borne water supply in the study area was characterized by poor and unreliable services. This could be said to be aggravated by number of factors like predominance of non-metered connections, high levels of water loss, conveyance/distribution and use of inefficiency at the users end, low and biased tariff structure with an inherent cross subsidization between users and sub sectors. It was also found that low water charge recovery which makes water provision very turbulent in the study area is aggravated by frequent shut downs of water treatment facilities due to break down. Tap water from ENSWC is common in Asata and Ogui new layout and some part of Independence layout, G.R.A. and New haven.

Table 1: Sources of Water

Source of water	High density	Medium density	Low density
Rain water and well/borehole	25.1	11.1	11.4
Water vendors	1.9	0	5
Well/borehole and tap	6.3	6.1	0
Rain water, well/borehole , tap and water vendors	2.4	0	0
Rain water, well/borehole and water vendors	15.9	13.1	7.4
Well/borehole	5.8	2	0
Well/borehole and water vendors	1.9	5.1	14.7
Rain water, well/borehole and tap	19.7	23.2	12.2
Rain water and tap	3.4	3	17.7
Tap	14.9	20.2	14.7
Rain water, tap and water vendors	1	4	7.4
Tap and water vendors	1.9	4	2.5
Rain and water vendor	0	6.3	8.1
Stream/river and well/borehole	0	0	1.3
Total	**100**	**100**	**100**

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The questionnaire analysis shows the percentage of source of domestic water for high density residents. In Abakpa, 24.1% source their domestic water from rain water and well/borehole while 9.6% in Asata source their domestic water from rain water, well/borehole and tap water from ENSWC and in Ogui new layout 19.2% source their domestic water from rain water, well/borehole and tap water from ENSWC. This implies that households in Asata and Ogui new layout spends less in water than households compare to residents in Abakpa because of the tap water from ENSWC.

Furthermore, the analysis shows that in Achara layout, 20.2% source their domestic water from rain water and well/borehole and tap water from ENSWC and 20.2% source their domestic water only from tap water from ENSWC while in New haven 15.2% source their domestic water from rain water, well/borehole and water vendor and in Maryland 3% source their domestic water from rain water and water vendor. This implies that households in Achara layout have access to tap water from ENSWC while households in New haven and Maryland source their domestic water from rain water (during the rainy season), well/borehole and water vendors. Therefore, households in New haven and Maryland will spend more money for water than households in Achara layout.

Finally, the analysis revealed in Independence layout that 13.9% source their domestic water from tap water from ENSWC and 20.2% source their domestic water only from tap water from ENSWC while in G.R.A. 17.8% source their domestic water from rain water, well/borehole, rain water and tap water from ENSWC and in Trans-Ekulu 7.4% source their domestic water from rain water, well/borehole and water vendor. This implies that households in some part of Independence layout and G.R.A. have access to tap water from ENSWC while households in Trans-Ekulu sources their domestic water from rain water (during the rainy season), well/borehole and water vendors (Meruwa).

Summarily, the main source of high density are shallow well and rain water with 24.1% while the main source of domestic water in medium density is tap water from ENSWC, rain water and shallow well rating 40.4% and the same applies to low density.

4.3 Estimation of Quantity of Water Used Daily

The study determines the quantity of water used daily across the three various residential density of Enugu metropolis. Quantities were estimated in units of standard buckets, jerry cans, and drums of water per day, and these were then converted to litres source by the researcher. A gallon has a capacity of 4.5 litres, a standard bucket has a capacity of 13 litres, while our measure of an average drum is a capacity of 215 litres.

From the analysis, the data shows that 2.6% of the households use less than 100 litres daily while 24.7%, 21.8% and 25.7% households use between 101-200, 201-300 and 301-400 litres respectively and 7.3%, 7% and 5.2% households use between 401-500, 501-600 and 601-700 litres respectively. More so, 2.6% and 3.1% households use between701-800 and above 800 litres.

Summarily, the maximum quantity of water used in high density ranges from 101 to 400 litres compare to the 300 to 400 liters in both medium and low density areas. This is of the implication that the quantity of water used varies among the density and it's also determined by some variables like household size, educational status, income and the occupation each household is engaged with etc.

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Table 2: Estimation of Quantity of Water Used Daily

Quantity (Litres)	High Density		Medium Density		Low Density		Total	
	Total		Total		Total			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Less than 100	5	2.4	5	5.1	-	-	10	2.6
101 – 200	55	26.5	26	26.3	14	17.7	95	24.7
201 – 300	48	23.2	21	21.2	15	19	84	21.8
301 – 400	56	27.1	15	15.1	28	35.4	99	25.7
401 – 500	17	8.2	5	5.1	6	7.6	28	7.3
501 - 600	14	6.8	6	6.1	7	8.9	27	7
601 – 700	6	2.9	8	8.1	6	7.6	20	5.2
701 – 800	4	1.9	2	2	-	-	10	2.6
801 and Above	2	1	3	3	3	3.8	12	3.1
Total	**207**	**100**	**99**	**100**	**79**	**100**	**385**	**100**

Household average quantity of water usage per capita per day as presented in TABLE 2 revealed that respondents use above the WHO/UNICEF critical threshold of 20 litres per capita per day. It is observed that 10% of the respondents consumed up to the 120 litres per capita per day recommended by the Federal Republic of Nigeria's National water supply and sanitation policy document of 2000; for residents of urban areas. An enhancement of the provision of water services most likely will ensure that majority of the residents attain the benchmark and even surpass it. As noted above, one of the major limiting factors for the inadequate quantity of water usage per capita per day by some households in Enugu metropolis is the high cost of water supply in relation to households' disposable income. In spite of the proliferations of well/boreholes in the metropolis, the cost of water is still very high in the absence of a reliable public water supply network. These data reveal that there is spatial variation in the quantity of water usage in the metropolis. The implication is that households with inadequate quantity of water usage may have issues of hygiene.

4.4 Influence of household characteristics on household water demand among the residential densities.

The study revealed that there was a significant relationship between water demand among the various residential densities and the socio-demographic characteristics of dwellers in the study area.(R^2 = 60.4, P= 0.00). Table 3 below shows the details of the regression result

Table 3: Model Summary of regression result

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.604(a)	.365	.354	143.8980	.365	36.146	6	378	.000

a Predictors: (Constant), Income Average, Sex, Educational qualification Average, Household Size, Marital Status, Age. av

B Dependent Variable: Quantity of Water used daily in Litres

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This revelation shows that it was established in the study area that on a composite aggregation, the quantity of water demanded for Enugu is closely related to the dwellers socio economic features. The implication of this is that any planning or design on water consumption strategy or policy in the State should involve the knowledge of the socio economic characteristic of the people. This finding is in line with the study of [6] and [7]

Furthermore, a step-wise multiple regression analysis was performed and seven household demographic attributes: sex, education, occupation, income (expenditure of household), age, household size and marital status were considered while the dependent variable was measured in terms of household water demand across the three residential densities of Enugu metropolis. The results show separate variables of household daily water demand in the three residential densities with unique characteristics. For the high density area, the only significant variables in the model were household size and age of responds while the other variables like marital status, gender, education, occupation and household expenditure (income) were eliminated. This is quite surprising and unexpected. The value of the R^2 = .519 for the household size variable indicated that 51.9% of the variance in this independent variable is explained by the model. The value of the R^2 = .592 for the Ages of the respondents indicated that 59.2% of the variance in this independent variable is explained by the model. See TABLE 4 for details

Table 4: Regression for high density

Model	Variables Entered	Variables Removed	Method
1	Household size	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Ageav	.	Stepwise (Criteria: Probability-Of-F-To-Enter <= .050, Probability-Of-F-To-Remove >= .100).

A Dependent Variable: Quantity of water used daily in litres

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.519(a)	.270	.266	134.8839	.270	76.059	1	206	.000
2	.592(b)	.351	.345	127.4737	.081	25.646	1	205	.000

a Predictors: (Constant), Household size
B Predictors: (Constant), Household size, Ageav

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The medium density area had household size and sex as the predictor variables that were significance in the model. See details in TABLES 5

Table 5: Regression for medium density

Model	Variables Entered	Variables Removed	Method
1	HOUSEHOLD SIZE	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	SEX	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: QUANTITY OF WATER USED DAILY IN LITRES

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.587(a)	.345	.338	167.8858	.345	51.122	1	97	.000
2	.616(b)	.380	.367	164.2490	.035	5.343	1	96	.023

a Predictors: (Constant), HOUSEHOLD SIZE
b Predictors: (Constant), HOUSEHOLD SIZE, SEX

It gave R^2 = 0.587 and 0.616 for household size and sex respectively. The other five variables were eliminated by the model. On the same vein, the low density area predictor variable was only household size. This yielded R^2 =.679. This shows that 67.9% of the variation in the household daily water demand was explained by the household size model. See TABLE 6 for further details

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Table 6: Regression for Low density

Model	Variables Entered	Variables Removed	Method
1	HOUSEHOLD SIZE	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: QUANTITY OF WATER USED DAILY IN LITRES

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.679(a)	.461	.454	132.9143	.461	64.903	1	76	.000

a Predictors: (Constant), HOUSEHOLD SIZE

At this point it is worth noting that household size is a common predictor variable in three areas. Statistically, the result of $F = 64.903$, $p < 0.00$; $F = 29.377$, $p < 0.00$ and $F = 55.403$, $p < 0.00$ for the low, middle and high income areas respectively were obtained. This signifies that there was significant difference in the means of the predictor variables for the high, medium and high density areas of Enugu metropolis.

Furthermore, the study shows that household water demand does significantly differ across the various residential densities in the study area. In Enugu metropolis, the significant socio economic variables that influence water demand among the various residential densities were presented viz: in low residential area (household size, $P < 0.00$), in medium residential area (household size, $P < 0.00$ and sex, $P < 0.23$) and in high residential area ($P < 0.00$ and Age, $P < 0.00$). This means that in low density residential area, whether there is an increase in the household size or change in sex or age of household heads, water supply has to be increased immediately to avoid inadequacy in supply to the residents. Little attention has been paid in published literature on these differences, [16] found that

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household size, age of household head were the predictors of household daily water demand for low, middle and high income areas. Age was also found as a factor that shapes water consumption and that total indoor water use increases as household size increases but use per person decreases.
This means that physical planners should work in conjunction with water resource planners knowing that an increase in the household size or change in sex or age of household heads increases demand. It will even be necessary to calculate water demand in every new urban development scheme. Finally, [17] highlights the importance of gender analysis when developing and implementing water policies due to the important variation of water use along gender lines.

V CONCLUSION

The study investigated the relationship between the household socio-demographic characteristics and domestic water demand in Enugu metropolis with a view to evolving an adaptive guide for efficient water distribution and management in the study area. Furthermore, the study shows that there was significant difference in the means of the variables for household daily per capita water for the low, middle and high residential areas of Enugu metropolis. The findings of the study indicates household size; household size and sex; and household size and age which yielded were the predictors for daily per capita water demand for the low, middle and high residential areas respectively. There were significant differences in how the household socio-demographic characteristics influenced household daily per capita water demand. It further established that there is significant relationship between socio-demographic characteristics and household water demand in Enugu Metropolis. In this regards, household water demand management practices must be dependent on household socio-demographic characteristics of the areas.

VI. RECOMMENDATION

The study made some recommendations and these include the following:

1. There is need for differentiation in the supply of water among the various residential densities in Enugu. It was observed that different residential areas have different demand. Hence the State water cooperation should not arbitrarily supply water to the areas without considering their densities which has direct link with the peculiar household characteristics of the area.
2. The policy of using a modern devices and tools will enable the rationalization of domestic water consumption. This policy can be applied through developing some description for the imported devices that achieve the rationalization of water consumption.
3. Furthermore, ESWC should ensure that there is proper and regular distribution or supply of water to all the neighbourhoods in the study area so as not to neglect equity issues.
4. As a result of irregularity in supply, users are not willing to pay; therefore, there should be improvement in supply. On the order hand, they improve on the quality of tap water supplied. If the quality of tap is improved residents will be willing to pay for any amount of domestic water supplied because quality is a function of willingness to pay.
5. Residential domestic water in the study area should be metered or price volumetrically because its probability of inducing economic efficiency is higher than that of public pricing and the charge will be based on the amount of water delivered.

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