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SPATIAL VARIATIONS IN WATER ACCESSIBILITY AND CONSUMPTION CAPACITY AMONG THE HOUSEHOLDS IN LAGOS METROPOLIS

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Abstract
The problem of inequality in accessing water is one of the major challenges facing the urban residents living in the low-income areas, which has led to inadequate and poor quality of water supply. The main thrust of this research is to access the spatial variation in the water accessibility and the consumption capacity of households in the low-income areas of Lagos Metropolis, established relationship between the quantity of water used and frequency of water accessibility from the available water facilities. Multipurpose sampling method was adopted, where 4 local governments were sampled from the 16 that made up Lagos Metropolis. From these, 12 low-income wards were selected, where 1,532 household's heads were sampled for data collection. The study found that there was 100% level of water coverage from the alternative, while both piped and other public water facilities have just 26.9% and 29.6% respectively, with variations among the wards. None of the sampled wards could meet the water consumption quantity recommended by the authorities. Due to low level of coverage, the test of relationship established that an increase in the frequency of accessibility from both piped and other public water will bring a correspondence increase in the quantity of water used. Reverse was the case for the alternative to public water facilities. It means that an additional increase in the level of coverage of piped and other public water facilities will increase the level of consumption of water from the facilities. Hence, investment in the provision of more piped and other public water facilities is hereby recommended, towards bridging the gap in water availability.

Keywords: accessibility, household, inequality, marginality, urban dualism, water facilities.

INTRODUCTION

Inequality in the provision of water facilities has a significant impact on the variation in the level of accessibility among the urban households, particularly of the giant city. This challenge may be attributed to government neglect of the people living in the low-income areas, because of spatial location and the status of informal settlement, where these households are located. Fita (2011) has itemised the challenge of inadequate provision of water accessibility to include capacity of a nation, in the area of technological and institutional development, good governance, finance, rapid urbanisation, among others.

When there is inadequate provision of water facilities to serve the populace, specifically in the low-income area will definitely affect their consumption capacity. Due to the importance of water to human life, World Health Organisation (2011, WHO) recommended a minimum of 50 litres for an urban dweller per day. Lagos State Policy (2013) recommended 60 litres for peri-urban dwellers, 100-120 for urban dwellers (Lagos State Government, 2013).

With the challenge of inadequate provision of water facilities, it is only a few households that could be able to meet the use of the required quantity. This will eventually have a negative impact on their health and livelihood. It is on this basis Liangxin *et al* (2014) concluded that a household with limited or intermittent water supply would use less quantity of water. In order to overcome the injustice faced by those who live with intermittent water supply, there is a need to address the problem of inequality in the level of water facilities provision.

The main thrust of this study is to assess the level of variation in the accessibility to water facilities among the households living in the low-income areas of Lagos metropolis, determine the effect of the variation on their water consumption capacity. Also, an attempt was made to establish the correlation between the frequency of water availability and the quantity of water used by the households.

LITERATURE REVIEW

Access to safe water is a universal need and essential for human development; its availability contributes positively to improve public health and economic development (Fagbohun, 2018; Nyarko, 2007). Thus, effective contribution of people to socio-economic development highly depends on the quality of their life and the environment. For this to be attained, adequate attention has to be given to the provision of basic needs, where water is central (Fita, 2011). Therefore, adequate access to safe and sufficient drinking water is an important investment, which safeguards health and wellbeing of the inhabitants and remove the inequality.

WHO (2011) grouped water sources into three main categories; these include rainwater, surface water and groundwater. Fagbohun (2018) grouped source of water in the metropolitan Lagos, based on the facilities provider. These include piped born water, provided by the Lagos State Water Corporation and other public water facilities, such as wells and boreholes, provided by the government, the NGOs, philanthropists or corporate organisations. Alternative to public water facilities are not different from the other public water facilities, except that the former were provided by the private individual landlords or households.

Households may assess piped borne water through three main methods. These include standpipes or public tap, yard and house connections. Other common methods in developing countries include dispensing by water tanker and bucket or keg, water provision through digging of borehole and deep well (WHO, 2011). Oyegoke *et al* (2012) noted that water supply to different households in Lagos metropolis is dominated by water vendors. It was on this basis Mughogho and Kosamu (2012) argued that most of the urban population, especially in the unplanned areas rely on small scale informal service providers, where such arrangement are unreliable and lead to intermittent water supply. This has created urban inequality to water accessibility, where some households consumed water in excess, where some do not have enough.

WHO (2011) expected the quantity of water need for domestic purpose to be 50 litres per capita per day. The Lagos State Policy on water 2013 prescribed a quantity of 100-120 litres per capita per day for urban dwellers (Lagos State Government, 2013). Hence, there is a strong relationship between the distance of water facilities and the quantity of water used. WHO (2010) pointed it out that a household that has no access often use 5 litres of water per capita per day. Such a household will likely make a distance journey of 1000 metres, or spend 30 minutes before accessing water. Hence, consumption need cannot be met in that situation. In contrary, a household with optimum access will usually use an average quantity of 100 litres per capita per day and above. In this situation, such a household will have access to water supply through multiple taps supplying water continuously. The household will definitely meet all needs in the use of water, while the level of health challenge will be very low; unlike no access that often use 5 litres of water. Ironically, both the household with adequate consumption capacity and the one that has inadequate capacity reside in the same city.

Base on the above background, Liangxin *et al* (2014) concluded that a household with limited or intermittent water supply would use less quantity of water, unlike a household with continuous and uninterrupted water supply. Hence, a household with an intermittent water supply faces injustice and deprivation in term of water accessibility.

CONCEPTUAL FRAMEWORK

The relevant theory and concept for this study include marginality, vulnerability, polarization, dualism and the core-periphery model. Marginality is a common feature of large metropolitan cities. Being a large settlement, a metropolitan city is characterized by dual city formations: formality and informality. The former produced a planned and paved environment, while the latter is an illegal settlement, a poor living environment, popularly known as informal settlement (Hofmann, et al, 2006). The informal settlements are characterised by a dense proliferation of small, makeshift shelters built from diverse materials, confronted by degradation of the local ecosystem, such as erosion and poor water quality and sanitation, and by severe social problems. Hence, the occupants are vulnerable to a number of urban problems (Bohle, 2001). Hence, they are

marginalized.

However, the concept of marginality can be used in examining the rationale behind spatial, economic and social and cultural disparities within and between regions or countries and individuals or communities in the light of legitimacy, equity and social justice (Muhi and Mahadi, 2011). Thus, marginalised people might be socially, economically, politically and legally ignored or neglected, and are therefore vulnerable to livelihood change; because they lack social protection. International Geographical Union (2003) defined marginality as the temporary state of having been put aside of living in a relative isolation, at the edge of a system; cultural, social, political or economic.

Succinctly put, marginality can be primarily described by two major conceptual frameworks: societal and spatial (Davis, 2003). The societal framework focuses on human dimensions such as demography, religion, culture, social structure, economics and politics in connection with access to resources by individuals and groups. Thus, societal marginality creates urban dualism, a condition where there is a mainstream and marginalized groups living side by side in the city. In the study of marginality and vulnerability, emphasis is placed on understanding of the underlying causes of exclusion, inequality, injustice and spatial segregation of people (Mercedes et al, 2004). However, Pilecek and Jancak (2011) employed the concept of polarisation and core-periphery model to explain marginality, and explained that marginality and peripherality are synonymous.

The Study Area

Lagos Metropolis is located within Lagos State, Nigeria. The process of its metropolitan development had commenced after the full colonization in 1861. The metropolitan area was limited to the twin city of the Mainland and Island, where the colonial residential quarters were built in such places like Ikoyi, Ebute-Metta, and Yaba, and later extended to Apapa, Surulere, and Ilupeju. In the process, the metropolis has been expanding to cover its initial suburban areas, such as Ajegunle, Ijora, Alaba-Amkoko, Shomolu, Mushn, Ikeja, Agege, Ijaye, Agbado, among other independent settlements (Fagbohun, 2018). This was associated to rapid urbanization.

As of 2006, Lagos Metropolis comprised 16 local governments of out of 20 Lagos State. Following the definition given by the Lagos State Government of the Metropolis as a continuous built up urban area (Abosede, 2006), Lagos metropolis might have covered more local governments in its state and some others in Ogun State. Based on 2006 population census, the population of Lagos metropolis was 7.94 million. The population was estimated to be 14.37 million by 20020 (Fagbohun, 2018). Definitely, the rapid increase in the population will have a significant impact in the level of water challenge.

The history of government intervention in water and other facilities provision in Lagos described the process of its urbanization and metropolitan growth. The construction of water dams in Lagos, particularly before independent was to supply water majorly to the Metropolitan area. For instance, Iju and Akute waterworks constructed in 1901 and 1954 were developed purposely to serve Lagos Island and Mainland, Apapa and Ilupeju industrial zone. Although, as more suburban areas were absorbed into the Metropolis was the government intervention increased. However, the pace of intervention has not been sufficient enough to address the challenge of rapid increase in the water demand, occasioned by rapid population growth and urban sprawl (Fagbohun, 2018). However, Table 1 shows the list of the major and mini waterworks developed to serve Lagos, their production capacity and the actual production level.

Table 1: Lagos State Waterworks Production in Million Litres per Day (MLD)

Waterworks	Capacity in MLD	Actual Production	
		MLD	%
Iju	170.33	147.62	88.30
Ishasi	15.14	12.15	82.30
Agege	9.84	5.56	61.30
Ojokoro	7.57	1.63	72.20
Shomolu	9.08	9.27	10.21
Badagry	9.08	3.79	41.70
Apapa	9.08	8.93	98.30
Aguda	9.08	7.12	78.30
Shasha	9.08	4.20	46.30
Isolo	11.36	10.60	93.30
Amuwo	11.36	9.73	85.70
Epe	11.36	3.10	27.30
Ikorodu	11.36	6.40	56.30
Ikorodu (old)	1.36	0.23	16.70
Agbowa	3.79	0.23	6.00
Eredo	3.79	0.10	2.00
Total	302.69	231.83	78.87

Source: Fagbohun (2018)

RESEARCH METHODOLOGY

This study was empirically conducted on Lagos metropolitan area Nigeria. The metropolis was defined as a continuous built up area that comprised 16 local governments, out of 20 that made of Lagos State (Abosede, 2006). It was this definition that was adopted.

Multistage sampling method was adopted, where the Metropolis was divided into 4 components. Each component comprised 4 local governments, from where one was sampled from each. The sampled local governments include Lagos Mainland, Ajeromi-Ifelodun, Shomolu and Agege.

Since the focus of study was low-income areas, the political wards created on densities by Independent Electoral Commission in 1998 were utilized, where all 84 high density wards were selected for a chance of being finally sampled for the study. High density wards have been identified as a place of residence for the low-income (Fagbohun, 2018). For adequate representation, the study sampled a minimum of 50% of the low-income wards from each selected 4 local governments. Hence, 12 wards were eventually sampled.

Systematic random sampling was used to sample 376 streets, from where about 10,047 residential buildings could be found. Hence, 1,649 were sampled, from which a household head was sampled from each for data collection. At the end, the designed questionnaire was successfully administered on 1,532 respondents. Categorical regression model was used to test the relationship between water accessibility level and water consumption.

DATA ANALYSIS AND DISCUSSION

This section is divided into two major subsections: analysis of data on socio-economic characteristics of the respondents; the nature of water accessibility and consumption. Thee last but not the least is the statistical analysis to establish the relationship between the level of water accessibility and the level of water consumption among the households.

SOCIO-ECONOMIC CHARACTERISTICS OF THE INHABITANTS

The variables of socio-economic characteristics analysed for this study include; gender, age, educational qualification and marital status. Others include occupation, household's monthly income, households'

number per a residential building and household size. The study found that 50.46% of the sampled respondents were male while, 49.54% were females, with a little variation among the 12 sampled wards, while 62.9% of them were married. However, 10.3% of the respondents were around 20 years of age, 34.3% were in age group 21-30, while 34.6% were in age group 31-40. However, 16.7% and 7.6% were in age group 41-50 and 51-60 respectively, while 2.2% and 0.9% of them were in age group 61-70 and 71 years above respectively. It can be concluded that higher proportion of the respondents were in the young adult age groups.

Looking at data on education, 94.31% of the respondents from have a minimum of primary school education, while 60.24% of them have a minimum of secondary school education. Finding on education showed that 28.1% of them were in to teaching and other salary jobs, 25.5% were artesian, who were into different handiworks and technical works, while 14.3% were traders in foodstuff and other farm products. Also, 10.9% of the respondents were traders in manufactured goods, 2.4% were into sanitary, and laundry services, while 5.0% were into catering. Also, 15.1% were into different other occupations, such as driving, house help, apprenticeship and schooling.

The estimated monthly income indicates that 20.8% of the sampled households heads earned less than ₦18, 000 per month, 47.5% earned ₦18, 000-₦50, 000, while 17.8% earned ₦51, 000-₦100,000 per month. Furthermore, 7.1% of them earned ₦101, 000-₦150, 000, while 4.3% and 1.3% earned ₦151, 000-₦200, 000, and ₦201, 000-₦250, 000 per month respectively. It was only 1.3% and 0.6% that earned ₦251, 000-₦300, 000 and above ₦300, 000 per month respectively.

The study discovered that 9.40% of the residential buildings in the study area were occupied by (1-2) households, while 25.33% were occupied by (3-4) households. However, 25.39% were occupied by (5-6), while 17.43% of the residential buildings were occupied by (7-8) households. On the other hand, 10.71% of the buildings were occupied by (9-10), while 21.15% were occupied by 11 or more households. Apart from Alaba-Amukoko that has 7, as an average household size, other ward have the same size of 6 members.

THE NATURE OF WATER ACCESSIBILITY AND CONSUMPTION

Types of the Available Water Facilities

The study discovered three major categories of water facilities, which include public piped, other public water and alternative to public water facilities. Lagos Water Corporation provided the piped water facilities. Other public water facilities, which include wells and boreholes were provided by the government agencies, NGOs, religious organisations, corporate organisations, among other donors.

The Geography of Water Facilities Provision

Table 2 described the level of water accessibility from the 3 main categories of the available water facilities. All the sampled wards in Agege Local Government area (LGA) have low level of piped water coverage. It was only 8.94% of the households in Oniwaya ward that have access to piped water, while 17.42% have the access in Papa Ashafa. In Shomolu LGA, 12.63% of the sampled households in Bariga ward have access to piped water, while 37.50% and 18.03% have the access in Bajulaye and Fadeyi respectively. Ironically, there was improvement in Lagos Mainland LGA, where 46.75% and 83.44% of the households in Makoko and Ido-Otto wards have the access respectively. The situation was very pathetic in Ajeromi Ifelodun, where it was only 15.32% and 5.09% of the households in Tolu-Ajegunle and Alaba-Amukoko that have access to piped water respectively. The same situation repeated in Olodi Apapa, which was 11.72% of the households. In overall, only 26.9% of the households in the low-income areas of Lagos Metropolis that have access to water from piped borne water facilities.

From other public water facilities, in Agege local government, apart from Papa Ashafa, where 71.97% of the households have the access, other wards, such as Oniwaya, Okekoto, and Orile-Agege have low level of accessibility due inadequate coverage, as shown in Table 2. The scenario was not the same in Shomolu LGA, where none of the sampled wards have less than 49.11% level of coverage. The case of Lagos Mainland was not too different from that of Agege LGA. It was 33.77% and 13.25% of the households in Makoko and Ido-Otto that have access to water from other public water facilities. The case of Ajermi

Ifelodun LGA was the worst, where none of the sampled wards have up to 20% level of access to water from other public water facilities. In overall, it was 29.64% of households of the study area that have access to water from other public water facilities.

Table 2: Type of Public Water Facilities and Households' Accessibility

Types of Water Facility		Agege				Shomolu			Lagos-Mainland		Ajeromi-Ifelodun			Study area
		Oniwaya	Papa-Ashafa	Okekoto	Orile-Agege	Bariga	Bajulaiye	Fadeyi	Makoko	Ido-Otto	Tolu-Ajegunle	Alaba-Amukoko	Olodi-Apapa	
Piped	Freq	11	23	29	36	11	42	22	72	126	19	6	15	412
	%	8.94	17.42	18.47	31.03	12.63	37.50	18.03	46.75	83.44	15.32	5.09	11.72	26.9
Other Public	Freq	18	95	23	9	74	55	76	52	20	12	4	16	454
	%	14.63	71.97	14.65	7.76	77.90	49.11	62.30	33.77	13.25	9.68	3.39	12.5	29.64
Alternative to Public	Freq	123	132	157	116	95	112	122	154	151	124	118	128	1532
	%	100	100	100	100	100	100	100	100	100	100	100	8.35	100.00

The level of accessibility to water facilities categorised under alterative to public was very interesting. All the sampled wards from the selected local governments have access to water from these facilities. Although, there were some limitations and barriers to the accessibility, which include distance, time spent to access water, cost of water and risk of accident in making trip to access water (Fagbohun, 2018). These were applicable to other categories of water facilities.

Although, there were cases of multiple accesses, a situation where some households have access to more than one category of water facilities, while some did not have enough access. It can be concluded that the level of coverage of water facilities provided by the government including piped was very low. This suggests that government intervention in water facilities provision was very inadequate. Because of this neglect, water facilities provision became what was being handled by individual household. This made water to become private commodity, rather than public. The situation made water to become a product with lack of unique method of production.

Daily Frequency of Water Availability from the Facilities

The daily frequency of water availability explains the number of hours per week a household have access to water. As it can be seen from Table 3, out of the 412 households that have access to piped water facilities, 23.3% have access to water for less than 2 hours per day, 13.8% and 18.2% have access to water for 2-4 and 5-7 hours per day respectively. On the other hand, 22.3% and 13.1% of the households have access to piped water for 8-11 and 12-14 hours per day respectively, while 9.2% have access for up to 24 hours.

Table 3: Daily Frequency of Water Availability Water Facilities

Hours	<2	2-4	5-7	8-11	12-14	15-24	Total
Piped Water							
Freq.	96	57	75	92	54	38	412
%	23.3	13.8	18.2	22.3	13.1	9.2	26.90
Other Public Water							
Freq.	85	104	126	89	35	8	454
%	18.7	22.9	27.8	19.6	7.7	1.8	29.64
Alternative To Public Water							
Freq.	93	81	184	551	479	153	1532
%	6.1	5.2	11.6	36.0	31.3	10.0	100

In the case of other public water facilities, the frequency of daily accessibility was lower than that of piped water. hence, 18.7% of the 454 households that have access to other public water facilities have access to water for less than 2 hours per day from these facilities, 22.9% have just 2-4 hours, while 27.8% and 19.6%

have 5-7 and 8-11 hours per day respectively. It was only 7.7% and 1.8% that have access to water for 12-14 hours and throughout the day respectively. Succinctly put those who have access to water for 5-7 hours was the highest, followed by 2-4 and 8-11 hours per day.

Similarly from Table 3, 6.1% of the total sampled households have access to water from the alternative to public water facilities for less than 2 hours per day, while 5.2% and 11.6% have access for just 2-4 and 5-7 hours per day respectively. Those households who access for 8-11 and 12-14 hours per day were 36.0% and 31.3% respectively, while 10.0% have access throughout the day from these facilities. It can be observed that higher proportion of the households have high frequency of accessibility to water from the alternative to public water facilities.

Average Daily Frequency of Water Accessibility from the Available Water Facilities

As shown in Table 4, the average daily frequency of water accessibility from the alternative to public water facilities was higher in the study area, except in Papa-Ashafa with 5 hours. Bajulaiye and Fadeyi with 9 hours have the highest daily frequency of accessibility. For other public water facilities, Tolu-Ajegunle with 8 hours has the highest frequency, while Alaba-Amukoko and Olodi-Apapa with 3 hours have the least. Also, for piped water, Tolu-Ajegunle and Alaba-Amukoko with 7 hours daily frequency of accessibility have the highest, while Oniwaya with 2 hours average frequency has the least. Regardless of the type of water facility, the same Tolu-Ajegunle with 8 hours has the highest frequency of accessibility per day, while Oniwaya, Papa Ashafa, and Olodi-Apapa have the least.

Table 4: Average Hour of Daily Frequency of Water Availability

Wards	**Piped water**	**Other Public Water**	**Alternative Water**	Sampled Ward
Oniwaya	2	6	8	5
Papa-Ashafa	5	4	5	5
Okekoto	6	5	8	6
Orile-Agege	6	4	8	6
Bariga	5	5	8	6
Bajulaiye	4	4	9	6
Fadeyi	6	5	9	6
Makoko	6	5	7	6
Ido-Otto	5	6	7	6
Tolu-Ajegunle	7	8	8	8
Alaba-Amukoko	7	3	8	6
Olodi-Apapa	4	3	8	5

Weekly Frequency of Water Availability

The analysis on weekly frequency of accessibility to water described the number of days per week the households have access to water from the available water facilities. As in Table 5, 32.3% of the 412 households that have access to piped water facilities have access to water for 1-2 days per week, 25.2% have access for 3-4 days, while 28.6% could only have access to water for 5-6 days per week. Only 13.8% have access to water from the facilities throughout the week.

Frequency of water availability for other public water was significantly different from that of piped water. Also from Table 5, 28.4% of the 454 households that have access to other public water facilities have access to water from these facilities for just 1-2 days per week, 36.8% have 3-4 days, while 16.3% have access to water for 5-6 days. Only 18.5% of the households have access to water from other public water facilities throughout the week.

Table 5: Weekly Frequency of Water Availability

Days	1-2	3-4	5-6	7	Total

Piped Water					
Freq.	133	104	118	57	412
%	32.3	25.2	28.6	13.8	26.90
Other Public Water					
Freq.	129	167	74	84	454
%	28.4	36.8	16.3	8.5	29.64
Alternative To Public Water					
Freq.	112	94	322	1004	1532
%	7.3	6.1	21.0	65.5	100

As shown in Table 5, only 7.3% and 6.1% of the total sampled households who have access to water the alternative to public water facilities have access to water for 1-2 and 3-4 days per week respectively, 21% have access for 5-6 days weekly. Interestingly, 65.5% of them, which accounted for the total sampled households, have access to water every day from these facilities.

Average Weekly Frequency of Accessibility to Water

Also, there were variations among the 12 sampled wards in the frequency of water availability from the available facilities. As indicated in Table 6, Oniwaya has the lowest average weekly frequency of water accessibility of 2 days from piped water facilities, Bajulaiye, Fadeyi, Makoko have the highest of 4 days, while other wards have 3 days.

From other public water facilities, Tolu-Ajegunle and Alaba-Amukoko have the lowest average weekly frequency of 2 days water accessibility, while Fadeyi, Makoko, and Ido-Otto have the highest of 4 days. Other wards, such as Oniwaya, Papa-Ashafa, Okekoto, and Orile-Agege have 3 days average weekly frequency of water accessibility.

Table 6: Average Weekly Frequency of Water Availability from the Available Sources

Wards	**Piped water**	**Other Public Water**	**Alternative Water**
Oniwaya	2	3	7
Papa-Ashafa	3	3	4
Okekoto	3	3	6
Orile-Agege	3	3	6
Bariga	3	3	6
Bajulaiye	4	3	6
Fadeyi	4	4	6
Makoko	4	4	6
Ido-Otto	3	4	5
Tolu-Ajegunle	3	3	7
Alaba-Amukoko	3	2	7
Olodi-Apapa	3	2	6

The average weekly frequency of water accessibility from the alternative to public water facilities was significantly higher than that of both pipe and other public water. Oniwaya, Tolu-Ajegunle and Alaba-Amukoko have the highest of 7 days, implies that the households in these wards have access to water from this category of water facilities every day. Ironically, Papa-Ashafa has the lowest of 4 days, followed by Ido-Otto, 5 days, while other wards have 6 days average. Thus, the households in the study area have higher average frequency of water accessibility from the alternative to public water than the 2 categories of water facilities.

Average Quantity of Water Used Per Day

Table 7 shows the average quantity of water used per day by the households in each political ward. Households in Oniwaya used an average quantity of 153 litres of water per day, while those in Papa Ashafa, Okekoto, and Orile-Agege used 156, 140 and 160 litres per day respectively. However, the households in Makoko used 122 litres, which was the lowest average quantity, while those in both Orile and Tolu-Ajegunle used 160 litres, which was the highest in the study area.

Table 7: Average Quantity of Water Used Per Day in Litre

Political Wards	Average Household Size	Per Household per Day	Per capita per Day	Rank
Oniwaya	6	153	25.5	5th
Papa-Ashafa	6	156	26.0	3rd
Okekoto	6	140	23.3	8th
Orile-Agege	6	160	26.7	1st
Bariga	6	159	26.5	2nd
Bajulaiye	6	138	23.0	9th
Fadeyi	6	130	21.7	11th
Makoko	6	122	20.3	12th
Ido-Otto	6	154	25.7	4th
Tolu-Ajegunle	7	160	22.9	10th
Alaba-Amukoko	6	148	24.7	7th
Olodi-Apapa	6	150	25.0	6th

Table 7 also shows the daily average quantity of water used per capita per day. This was arrived at by using the average household size for each ward to divide the average quantity of water used per household per day. The household's size has been discussed under subheading socio-economic characteristics. Orile-Agege used the highest quantity of 26.7 litres of water per capita per day, followed by Bariga, 26.5%, while Makoko, 20.3 litres used the lowest. Hence, none of the 12 sampled wards met the 50 litres minimum quantity of water per capita per day, prescribed by the WHO (2011). When these water consumption per capita per day were ranked, as in Table 6, Orile-Agege with 26.7 litres came first, followed by Bariga, 25.6 litres, while Ido-Otto, 20.3 litres came last.

Relationship between Quantity of Water Used and Frequency of Water Accessibility

The study investigated into the level of relationship between the frequency of water accessibility and the quantity of water used by the sampled households using the categorical regression model of statistical analysis. This enabled the study to determine the effect of the level of water accessibility on the quantity of water used per day by the households investigated. The analysis was carried out by correlating the data collected on the daily frequency of water accessibility and the quantity of water used per day by the sampled households. With these data, a categorical regression analysis was carried out to describe how the quantity of water used by the sampled households has depended on the frequency of water availability from the available water facilities: - piped borne water (X_1), other public water(X_2) and alternative to public water(X_3).

The categorical regression model is given as Y= $b_1X_1 + b_2X_2 + b_3X_3$ + e, where b_1, b_2, b_3 are the regression parameters; e is the error term that describes the effects of all factors other than the value of the independent variables. Y is the dependent variable while, X_1, X_2, X_3 are independent variables of the regression model. When the regression model was used, the results are as shown in Table 7, where:

- Quantity H_20=0.349,
- *Piped borne H_20+0.311,
- *Other Public = H_20+0.220,
- *Alternative to Public =H_20-0.220

Interpretation of the Model

The results of the model above implies that the quantity of water used increased by 0.349 and 0.311 for a unit increase in accessing piped borne water and other public water facilities respectively, while a unit increase in accessing other public water facilities leads to an increase in the quantity of water used by 0.220. Thus, an increase in the frequency of accessibility to both piped and other public water will bring a correspondence increase in the quantity of water used by the sampled households.

This is not so in the case of alternative to public water, instead it leads to decrease in the quantity of water used by -0.220. This is because alternative to public water facility has high level of spatial spread, which has become a regular in nature, when Nearest Neighbour analysis model was used to analyse the spatial spread of the available water facilities in the study area (Fagbohun, 2018). Therefore, any additional increase in the quantity of water from this type of water facility will not, in any way lead to a correspondence increase in the quantity of water used by the households.

Testing the Significant Level

When testing the significance of the regression relationship, where H_o: $\beta_1 = 0$ and H_a: $\beta_1 \neq 0$, decision criteria rejected the null hypothesis (H_o), if the p-value < α (level of significance). Since the p-value can be shown to be <0.01, we can reject H_o in favour of H_a at a significance level of 0.05. Therefore, there is a strong evidence that the estimate quantity of water used is significantly related to the frequency of piped borne water (p< 0.008) and public water (p< 0.020) accessibility, but not significantly related to the frequency of accessibility from the alternative to public water facilities (p= 0.539) using information provided in Table 7. In other word, there is significant relationship between the frequency of water accessibility and the quantity of water used by the households of the study area for using piped and other public water facilities. Nevertheless, variation exists among the 3 categories of water facilities in the level of significance, as shown in Table 8.

Table 8: Regression Parameters

Variables	Standardized Coefficients		df	F	Sig.
	Beta	Bootstrap (1000) Estimate of Std. Error			
Number of hours per day of access to water from Piped borne Water facilities	0.349	0.183	4	3.649	0.008
Number of hours per day of access to water from Other Public Water facilities	0.311	0.169	3	3.413	0.020
Number of hours per day of access to water from Alternative Water facilities	-0.220	0.280	2	0.622	0.539

Note: Dependent Variable: Estimate the quantity of water used per day by your household in litre, excluding drinking water.

Overall Regression Relationship

Using categorical regression analysis, regardless of water facility type, the result, as in Table 8 shows that there is a significant relationship between the quantity of water used per day and the frequency of daily water accessibility. Hence, the regression model, as shown in Table 8 is given by (Quantity H_20 = 0.381* H_20 Accessibility). The implication is that the quantity of water increased by 0.381 for a unit increase in the frequency of access to water, with p<0.001. Therefore, there is a significant relationship between the quantity of water used and the frequency of access to water regardless of the type of water facility available in the study area. Consequently, the frequency of water accessibility has effect on the quantity of water used per day by the households in the study area.

Table 8: Regression Parameters Regardless Of Water Facility Available For Use

Variables	Standardized Coefficients		df	F	Sig.
	Beta	Bootstrap (1000) Estimate of Std. Error			
Overall number of hours per day you have access to water	0.381	0.073	1	27.054	0.000

Note: Dependent Variable: Estimate the quantity of water used per day by your household in litre, excluding drinking water.

Reasons for Variations in the Significance Level of the Regression Relationship

Variation in the daily frequency of water accessibility in hour, as shown in Table 3 can be attributed to variations in the significance level of the regression relationship. Piped and other public water facilities that have an average of 5 hours daily frequency of accessibility, with 26.9% and 29.6% level of coverage respectively have a slight difference in the result of the effect using regression model, as shown in Table 7. Alternative to public water with 8 hours daily frequency, with 100% level of coverage has the least; implies that the higher the level of frequency, the lower the significance level of relationship. In other word, if all households have adequate daily frequency of accessibility to water, the level of frequency will not have significant effect on the quantity of water used.

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

Water facilities provision in the low-income areas of Lagos Metropolis is dominated by private individual. The facilities are of various types, mostly wells and boreholes. Hence, all the households have access to the facilities, with different limitations and challenges. The available public water facilities, particularly piped covered just 26.9%, while other public covered just 29.6% of the households. Hence, the households' residential location status reflects in the level of their accessibility to water. Despite the uniformity in the households' residential location, there were still variations in the level of their water accessibility.

The neglect of intervention by the government made water facilities provision to become a private individual household approach, while water became a private commodity from different sources. Hence, the frequencies of water accessibility, per week and per day from these facilities were very low. None of the 12 sampled wards have an appreciable number of households that have 24 hours and everyday water accessibility. The limitations and barriers that were in existence in the available water facilities did not give room for a free ride access to water in the Metropolis.

The study concluded that an increase in the frequency of accessibility to both piped and other public water will bring a correspondence increase in the quantity of water used by the sampled households. The case is the reverse for alternative to public water facilities, where any additional increase in the quantity of water from this type of water facilities will not, in any way lead to a correspondence increase in the quantity of water used by the households. Therefore, there is a significant relationship between the frequency of water accessibility and the quantity of water used by the households.

It is hereby recommenced that more attention should be paid to piped borne water facilities in the study area, in order to increase the coverage. This will help in no small scale to close the gap of inequality in water accessibility in the in Lagos Metropolis. Public taps should be provided across different neighbourhood areas to make more households have access to piped water, towards ensuring sustained consumption quantity of water.

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