Inequalities in Access to Water and Sanitation in Rural Settlements in Parts of Southwest Nigeria

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Abstract

Access to water, sanitation, and hygiene is a major human right necessary for achieving Sustainable Development Goals. The study examined inequalities in access to water and sanitation in rural settlements covering Apa, Ikoga, Ibeshe, Itori, Eruwa, and Lanlate in parts of Southwest Nigeria. Purposive and random sampling techniques were employed to select six settlements and administered 400 questionnaires to households respectively. Descriptive statistics, chi-square, and factor analysis were employed for data analysis. The result shows that the majority of the households interviewed are adults with secondary school certificate. The major available water supply and sanitation facilities in the study area are boreholes and an open pit latrine. About 50.8% and 48.1% of the households gained access to improved water and sanitation respectively in the study area. Badagry and Ewekoro recorded the highest access for improved water and sanitation respectively. Only 8% of the households gained access to safe water supply in the study area. The sanitary condition in the study area is poor. The chi-square shows a significant relationship between the dependent variables (water sources/types of toilet facilities) and independent variable (marital status, age, and income) at $p<0.01$. Factor analysis explained 68.86% of the total variance and extracted five components. The five factors revealed three major factors namely; demographic, environmental and water source as the main factors affecting household access to water and sanitation. The study is significant because it contributes to knowledge in the areas of WaSH and environmental sustainability. The study concluded that access to improved water and sanitation in Eruwa and Lanlate is poor. Sustainable rural water supply and sanitation policies that will guarantee effective environmental sanitation, monitoring and provision of safe water supply and decent sanitation facilities were recommended. The study suggests that priority is given to Eruwa and Lanlate for intervention due to its weakest water and sanitation access.

Keywords: Access, inequalities, rural settlement, Southwest-Nigeria, water and sanitation

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Ghana Journal of Geography Vol. 11(2), 2019 pages 158-184

Introduction

The significance of water to the existence of man cannot be overemphasized. This is because access to improved water and sanitation is a vital component for achieving the Sustainable Development Goals (SDGs) including good health, education, poverty and gender equality (Hutton and Varughese, 2016). Since the declaration of International Drinking Water Supply and Sanitation Decade in the 1980s and the Human Development Report (HDR) in 2006, access to water and sanitation has been recognized as the basic needs for human life and progress; therefore, the need for the eradication of inequality in access to water and decent sanitation across the globe has become a vital goal of the SDGs (UNDP, 2006; Calow and Mason, 2014).

Despite these giant strides, the future looks very bleak and daunting due to the disparities in access to water and sanitation services especially amongst the poor in developing countries, the rural dwellers, the ethnic and religious minorities and the women respectively (WHO/UNICEF, 2014; Aleixo et al., 2016). The disparities in access to improved water and sanitation can be attributed to several factors such as; geographical areas (region, urban/rural), social class (rich and poor), race, ethnicity and gender (Abrams et al., 2012; Ribeiro Sarmento, 2015). Poor access to water, sanitation and hygiene facilities is one of the major contributors to the global burden of diarrhea disease. This health challenge impacts significantly on the social, economic and environmental well-being of the vulnerable groups, especially children from poor families (Lim et al., 2012; Roche et al., 2017).

The SDG 6 emphasized the need for reducing the inequalities that exist among countries regarding access to safe drinking water, basic sanitation and hygiene as a basic human right (Aleixo et al., 2016). In Nigeria, the formulation of a National Water Supply Policy (NWSP) has been instrumental to the progress recorded so far in the decline in the proportion of the population without access to improved sanitation from 38% to 29% between 1990 and 2015 (WHO and UNICEF, 2017). Globally, about 1.2 billion people still lack access to safe water while 2.6 billion people do not have access to basic sanitation (Cairncross et al., 2010; WHO and UNICEF, 2014).

In sub-Saharan Africa, the situation is more worrisome due to the high inequalities observed among the low-income groups, the rural and peri-urban dwellers (WHO and UNICEF, 2014).

Access to improved water and sanitation has a strong relationship with a healthy and productive life as well as environmental sustainability (UNICEF, 2014). Worldwide, approximately 6.3% of the deaths recorded result from poor drinking water, sanitation facilities, and hygiene practices (Emenike et al., 2017). In Nigeria, lack of access to clean water has gross implications on the socio-economic development, personal hygiene and consequently, places the health of about 40 million Nigerians at risk (Gbadegesin and Olorunfemi, 2009; UNICEF and WHO, 2012). It is estimated that about 122,000 Nigerians including 87,000 children less than 5 years die annually due to diarrhoea. Most of these deaths have been linked to poor water, sanitation, and hygiene (Sodeinde et al., 1997; Nyong and Kanaroglou, 1999; Nwankwoala, 2011). Poor sanitation in Nigeria has resulted in huge losses running to almost US$ 3 billion annually (FMWR, 2014). Therefore, for Nigeria to achieve the sustainable development goal 6 by 2030 in the rural areas, about 8 million people would be required to be reached annually (Hutton & Varughese, 2016).

Literature review

Research has shown that a greater proportion of the rural populations in developing countries are exposed to inadequate water supply and poor sanitary conditions (Shaban and Sharma, 2007; Ayeni and Soneye, 2011). In most parts of the rural settlements in Southwest Nigeria, the problem of water, sanitation, and hygiene (WaSH) is worsened by the limited number of residents with access to potable water and sanitation. Also, the distance to water source increases the time required for income-generating activities, household chores, and childcare (Ilahi and Grimard, 2000).

Semmelweis & Semmelweis (1983), Rabie and Curtis (2006) argued that lack of hygiene practices such as non-availability of handwashing facility can induce infection during childbirth. Howard et al. (2003), Haller et al. (2007), Nketiah-Amponsah et al. (2009), Olajuyigbe (2010), Benova et al. (2014) and Tuyet-Hanh et al. (2016) opined that access to safe water supply (piped water connection into dwelling) and good sewage connection system play significant role in improved

health conditions of households globally. Checkley et al. (2004) noted that lack of access to improved drinking water and sanitation children from poor families with unimproved drinking water and sanitation services result in a high rate of morbidity and mortality due to water-related diseases such as diarrhea among the low-income group. Blakely et al. (2005), Mahama et al. (2014) and Angoua et al. (2018) in their studies inferred that socio-economic status of the household has a significant relationship with access to improved water and sanitation with socioeconomic determinants e.g. income status and access to improved water and sanitation.

Study by Obute (2010), Ibok et al. (2014), Ribeiro Sarmento (2015), and Abui et al. (2016), Chukwuma, (2017), observed that poor funding, lack of clear policy direction, poor water infrastructural maintenance culture, poor community participation, lack of coordination and co-operation among the stakeholders and weak institutional framework significantly affect access to potable water supply and sanitation rural settlements. Rowan (2011) reported that poverty, unemployment and water infrastructure failure are major factors responsible for poor access to water and sanitation in Bushbuckridge, South Africa. Akpabio and Brown (2012) opined that the nature of the physical environment and socio-cultural status significantly affect daily water supply and sanitation practices among households in coastal settlements in Nigeria. In furtherance, Koskei et al. (2013) argued that the type of water supply source household has access to is a function of their occupation and educational status.

Irianti et al. (2016) argued that access to improved water source and sanitation is best explained by disparities in geographical location, gender, and economic status in Indonesia. A similar study by Mulenga et al. (2017) reported that access to improved water and sanitation is concentrated among the wealthier households in Zambia. Emenike et al. (2017) posit that public water supply has dwindled drastically in Ado-Odo, Nigeria. They argued that the inclusion of subsidy, cost recovery and rainwater harvesting options will enhance access to an improved water supply. Andres et al. (2018) observed that there exists a sharp urban-rural divide in Nigeria terms of access to improved water and basic sanitation facilities within premises. They noted that effective policy formulation will guarantee access to basic services in the country.

Despite these studies, there is scanty literature on inequality on access to water and sanitation in the study area. Therefore, this study seeks to fill this gap in knowledge by examining inequality in access to water and sanitation in rural settlements in parts of the Southwest, Nigeria. The study is of immense significance due to its implications for socio-environmental sustainability. The study provides information on communities that require greater intervention in terms of WaSH for prioritization by stakeholders and relevant agencies in their support towards achieving SDG 6 particularly target 6.2.

Study area

The study area covers Badagry, Ewekoro and Ibarapa East Local Government Areas (LGAs) of Lagos, Ogun and Oyo state in southwest Nigeria. The study area region lies between Longitudes 2°31' and 6°00' East and Latitudes 6°21' and 8° 37' N (Agboola, 1979; Faleyimu et al., 2013). It occupies an approximate land area of 1,613km^2 with a population of about 414,475 people (NPC, 2006). The projected population is estimated at 666,159 people based on the annual growth rate of 2.6. The study area is bordered by Ondo and Osun states in the East, in the North by Kwara state while it is bounded by the Republic of Benin in the West and in the South by the Gulf of Guinea (Fig. 1).

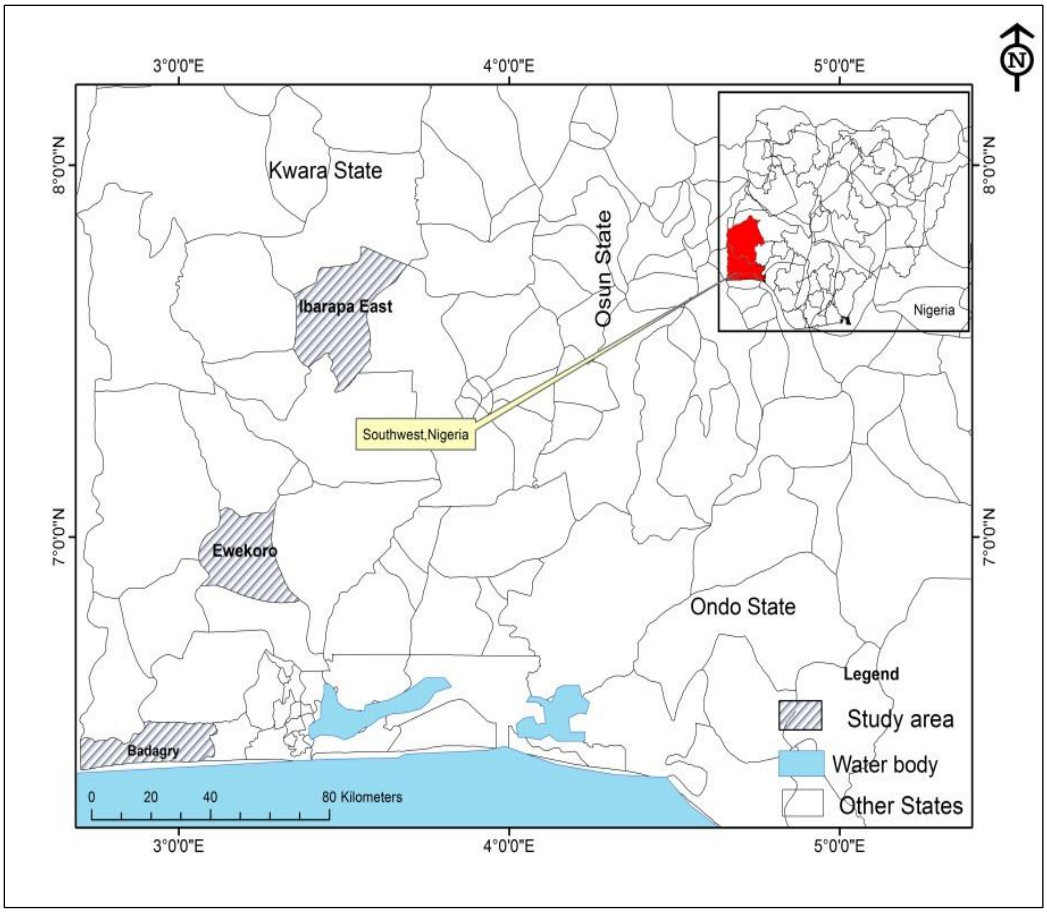

Figure 1. Study area

The climate is tropical in nature and it is characterized by wet and dry seasons. The temperature ranges between 21 and 34°C while the annual rainfall ranges between 1500 and 3000 mm (Agboola, 1979; Faleyimu et al., 2013). The wet season is associated with the Southwest monsoon wind from the Atlantic Ocean while the dry season is linked with the Sortheast trade wind from the Sahara Desert. The vegetation is made up of freshwater swamp and mangrove forest (Agboola, 1979; Faleyimu et al., 2013). Due to the rapid rate of population growth and the alarming rate of rural-urban migration, there has been deterioration of basic amenities and deplorable living conditions in most of the settlements around the urban fringes. In most of the urban fringes, lack of access to safe drinking water, sanitation, and hygiene constitute major environmental and health challenges. For instance, at Apa and Ikoga in Badagry LGA, most of the water infrastructure is no longer functioning due to poor maintenance and aging. This problem has resulted in the loss of

man-hour in sourcing for water. Also, improved sanitation facilities are lacking? in most of the households. In Itori and Ibeshe of Ewekoro LGA, the available streams that serve as a source of water supply have been populated due to industrial activities in the area. In Eruwa and Lanlate of Ibarapa East LGA, access to water poses a major challenge due to the nature of the terrain. Open land defecation is still practiced among households. Most of the public piped water supplies have broken down due to poor maintenance. The majority of the low-income earners depend on stream and rainwater for their daily water supply needs.

Generally, two major sources of water can be identified in the study area according to WHO and UNICEF (2014). They are improved and unimproved. Examples of improved sources include; borehole (BH), piped water connection (PHWC), public standpipe (PS), protected dug well (PDW) and rainwater harvesting (RH). According to WHO and UNICEF, (2014), improved water can be classified into two types namely; water supply source piped into dwelling known as safe water supply and improved source that is not piped into dwellings. The unimproved source includes; unprotected dug well (UDW), Stream/River and vendor-provided water (VPW), sachet water, bottled water. Similarly, sanitation facilities in the area falls under two types namely; improved sanitation e.g. connection to public sewer, connection to septic system(CSS), pour-flush latrine (PFL), simple pit latrine (SPL) and ventilated improved pit latrine (VIPL) and unimproved sanitation such as; public or shared latrine (PSL), and bucket latrine (BL) (WHO and UNICEF, 2014).

According to NBS and UNICEF (2017), the proportion of the household population in Nigeria with access to improved drinking water sources is estimated at about 64.1%. The predominant improved water source is tube-well/borehole (32.3%) while unprotected sources representing 18.5% account for the dominant unimproved source in Nigeria. Based on the settlement types, approximately 82.9% and 54.6% gained access to improved drinking water sources in the urban and rural areas of Nigeria respectively. Previous household survey on access to improved drinking water sources in the region shows that 93.6, 88.6 and 82.8% gained access in Lagos, Ogun, and Oyo states respectively (NBS and UNICEF, 2017). Regarding access to sanitation in the region, 44, 31.5 and 21.6% of the households use improved sanitation facilities in Lagos, Ogun and Oyo

state respectively. Approximately 42.5, 19.6 and 2.5% still practice open defecation in Oyo, Ogun, and the Lagos States respectively (NBS and UNICEF, 2017).

Materials and Methods

Study population, design and sample size

The study population comprised household heads from two settlements each as presented in Table 1. The settlements were chosen using purposive sampling techniques based on the geographical nature of the settlements which are predominantly rural in nature. The study employed the administration of a structured questionnaire using random sampling techniques. The study focused on inequalities in access to water and sanitation facilities in the study area. A total sample size of (n= 400) was designed across the six settlements according to Yamane (1967). The Yamane formula is given in equation 1.$\mathbf{n = N/1 + N(e)2}$ Eq.1

Where

n= the sample size

N= the finite population

e = level of significance (or limit of tolerable error) (0.05)

1= unity (a constant)

Table 1: Population distribution in the study area

State	LGAs	Settlements	Population	Sample size
Lagos	Badagry	Apa & Ikoga	241,093	200
Ogun	Ewekoro	Ibeshe & Itori	118,226	100
Oyo	Ibarapa East	Eruwa & Lanlate	55,156	100
Total			**414,475**	**399.68**

Source: Author's (2016)

The proportional method was employed for the sample size selection based on the uneven distribution of population across the LGAs (Kothari and Garg, 2014). Thus, a total of 200, 100 and 100 totaling four hundred questionnaires were administered to the household's heads as indicated in Table 1.

Data analysis

The data obtained from the survey were coded and analyzed using IBM statistical package for social sciences version 22.0. The data were coded using the following measures; sex (female=1, male=2), marital status (single=1, married=2, divorced=3, widow=4), age (20-25yrs=1, 26-30yrs=2, 31-35yrs=3, above 35yrs=4), education (no formal education =0, primary = 1, secondary = 2, tertiary = 3), occupation (farming=1, artisan=2,civil servant=3 and traders=4), income (no response=0, < ₦10,000=1, ₦10,000-20,000=2, ₦20,000-30,000=3 and above ₦30,000=4), household size (no response=0, 1-5 persons=1, 6-10 persons=2, 11-15 persons=3 and above 15 persons=4), access to improved water/sanitation water.

Descriptive, bivariate (chi-square) and multivariate (factor analysis) statistical techniques were employed. The descriptive statistics (frequency/ percentages) to describe the measures of location of the data set. Chi-square test was used to establish the interdependence between water sources/toilet facilities and socioeconomic variables. It is given as:

$$\chi^2 = \sum (O-E)^2/E \quad \text{……..Eq. 2}$$

Where:

χ^2 = chi-square statistics

O= observed frequency

E= expected frequency

Factor analysis (FA) was applied for data reduction and simplification of less significant variables affecting household access to water supply and sanitation in the study area using the formula in equation 3.

$$Zji = af1fIi + af2f2i + af3f3i + afmfmi + efi..$$

(Eq.3)

Where:

zji= the measured variable, a= the factor loading, f= the factor score, e = the residual term accounting for errors, i= the sample number and m = the total number of factors.

The WHO and UNICEF (2014) benchmark were adopted for the definitions of improved water sources and improved sanitation facilities. The results were presented using Tables and charts while ArcGIS software versions 10.3 were employed to generate the study area map. The term 'safe water' used in this study implies population having access to piped water (i.e. piped water connection and public standpipe) (Sullivan et al.2003). On ethical consideration, respondents were assured of their anonymity and confidentiality of the survey. They were also assured of the right to decline the researcher's information at any time without providing justification during the interview process.

Results and Discussion

Socio-economic characteristics of the respondents

The descriptive statistics of the socio-economic characteristics of the households is presented in Table 2. The result shows that approximately 50% of the respondents were either male or female based on gender distribution. On the marital status, the majority representing 77.5% of the households were married. The age distribution of households interviewed indicated that the greater proportion (45.3%) were above 35 years old. The educational attainment revealed that the majority of the (42.30%) were secondary school certificate holders. The occupational distribution showed that trading activity accounted for the highest percentage representing 45.5% in the study area. About 29 percent of the members of the households fall under low-income groups while the

household size was generally low with the majority (64.5%) in the category of 1-5 persons/household.

The variations of the socio-economic characteristics of the households show that settlements from Badagry LGA recorded the highest proportion of gender, married couples, educational attainment across the three LGAs (Table 2). Ibarapa East and Ewekoro recorded the highest proportion of households regarding their marital status and income respectively. Ibarapa East/Badagry LGAs have the highest percentage for occupational distribution while Badagry LGA recorded the highest level of tertiary degree certificate holders in the study area. The HHS is generally low in the study area.

The income of the households was generally low under the category of (₦10-20,000). This is expected because of the rural nature of the area. Ibeshe and Itori settlements within Ewekoro LGA recorded the highest percentage of households under the low-income group earners. One would have expected and appreciable level of income among the households around the settlements due to their proximity to the cement manufacturing factory around the area. Low-income level of households creates some kind of disparity in accessing improved water and sanitation facilities among the poor and the rich. The study by NPC and ICF (2009) noted that low income is responsible for approximately 80% of the household's inability to pay for water supply services in the rural Southeastern of Nigeria. This is also in consonance with the previous study by Johnson et al. (2015).

Table 2: Descriptive statistics of the socio-economic characteristics of households

Variables	**Options**	**Ibarapa East LGA**	**Ewekoro LGA**	**Badagry LGA**	**Total**
Sex	Female	46(11.5)	55(13.8)	97(24.3)	198(49.5)
	Male	54(13.5)	45(11.3)	103(25.8)	202(50.5)
Marital status	Single	10(2.5)	6(1.5)	54(13.5)	70(17.5)
	Married	82(20.5)	88(22.0)	140(35.0)	310(77.5)
	Divorced	0(0.0)	5(1.3)	4(1.0)	9(2.3)
	Widow	8(2.0)	1(0.3)	2(0.5)	11(2.8)
Age	20-25yrs	2(0.5)	2(0.5)	39(9.8)	43(10.8)
	26-30yrs	11(2.8)	29(7.3)	47(11.8)	87(21.8)

	31-35yrs	20(5.0)	18(4.5)	51(12.8)	89(22.3)
	>35yrs	67(16.8)	51(12.8)	63(15.8)	181(45.3)
Education	No formal education	17(4.3)	18(4.5)	14(3.5)	49(12.3)
	Primary	32(8.0)	46(11.5)	59(14.8)	137(34.3)
	Secondary	40(10.0)	30(7.5)	99(24.8)	169(42.3)
	Tertiary	11(2.8)	6(1.5)	28(7.0)	45(11.3)
Occupation	Farming	21(21.0)	32(32.0)	23(11.5)	76(19.0)
	Artisans	14(14.0)	25(25.0)	67(33.5)	106(26.5)
	Civil servant	17(17.0)	5(5.0)	14(7.0)	36(9.0)
	Trading	48(48.0)	38(38.0)	96(48.0)	182(45.5)
Income (₦)	No response	21(21.0)	17(17.0)	13(6.5)	51(12.8)
	<10,000	14(14.0)	15(15.0)	45(22.5)	74(18.5)
	10-20,000	15(15.0)	41(41.0)	60(30.0)	116(29.0)
	20-30,000	33(33.0)	23(23.0)	59(29.5)	115(28.8)
	> 30,000	17(17.0)	4(4.0)	23(11.5)	44(11.0)
	No response	10(10.0)	2(2.0)	4(2.0)	16(4.0)
Household size	1-5	61(61.0)	59(59.0)	138(69.0)	258(64.5)
	6-10	29(29.0)	31(31.0)	52(26.0)	112(28.0)
	11-15	0(0.0)	6(6.0)	2(1.0)	8(2.0)
	>15	0(0.0)	2(2.0)	4(2.0)	6(1.5)

Source: Author's (2016)

Sources of water and sanitation facilities in the study area

The available sources of water for household uses are presented in Figure 2. The result shows that borehole is the dominant source of water supply representing 31.5% while unprotected dug well is the least with about 10.5%. Across the settlements, Apa and Ikoga in Badagry LGA recorded the highest for piped household water connection, borehole, unprotected dug well and rainwater harvesting.

Similarly, the observed dominance of groundwater utilization through individual/ commercial borehole and unprotected dug well clearly shows the absence of public water supply in the area. This has implications on the quantity of water consumption among households and consequently could jeopardize sanitation and hygiene practices due to the cost that may be incurred in buying water considering the low-income level of the household. The observed predominance of vendor-provided water around Eruwa and Lanlate in Ibarapa East LGA clearly shows that the majority of the households rely on unimproved sources. This has great implications on household hygiene

practices because of the cost implication since the majority of the households are low-income earners. As a result of this, there is the tendency to ration water for various uses thereby, compromising hygienic practices such as cooking, hand washing among others. In a study by Akintola (1994), he noted that the geological formation of the area is dominated by poor aquifer hence, the challenges of persistent water shortages in the area. This result is in agreement with the findings of Bartram and Cairncross (2010). They argued that water scarcity and poor access to improved sanitation facilities pose a significant impact on infectious diseases.

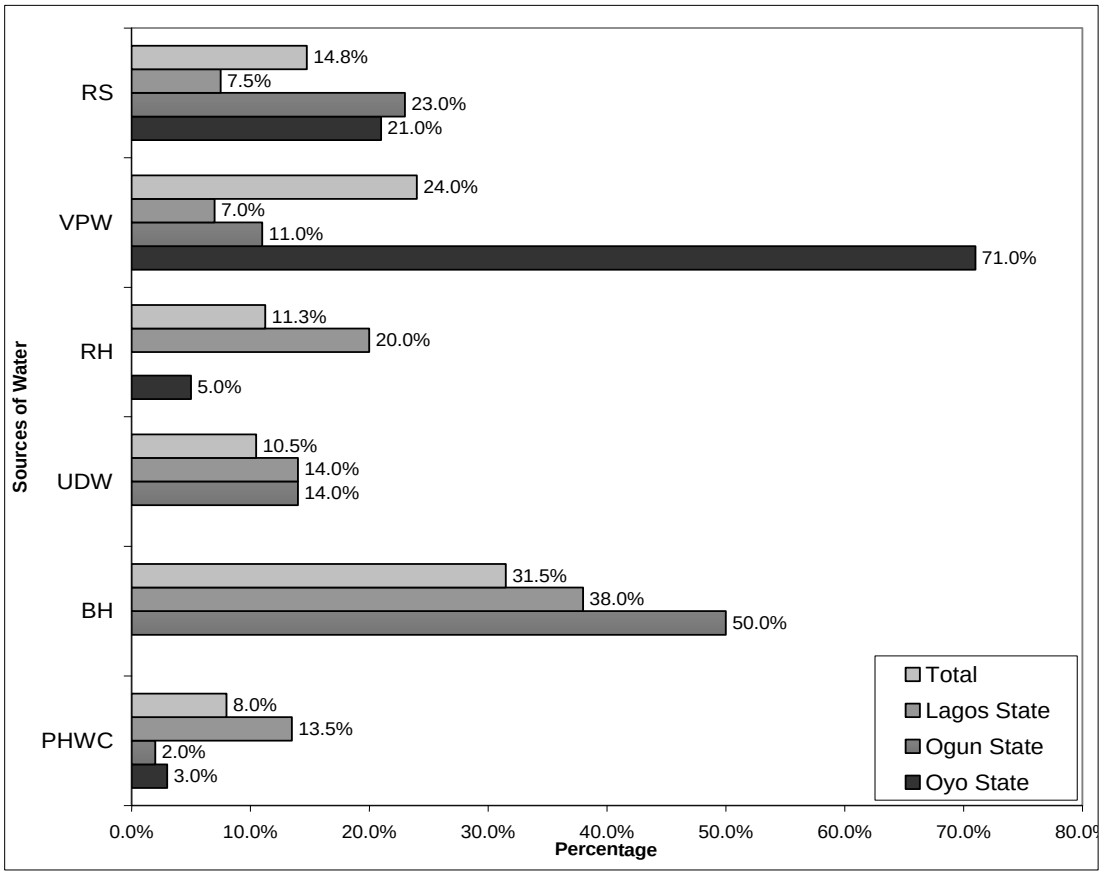

Figure 2. Sources of water in the study area

PHWC-piped household water connection, BH-borehole, UDW-unprotected dug well, RH-rainwater harvesting, VPW-vendor-provided water

The available sanitation facilities in the study area revealed that open-pit latrine predominates representing 23.0% while simple pit latrine is the least with 3.3% (Fig.3). The result is in

consonance with the findings of Akpabio et al. (2015) and Alepu et al. (2016) and where the majority of the households in Akwa-Ibom and Calabar rely more on pit latrine system respectively. Across the study area, the result shows that the majority of the households from Eruwa and Lanlate relied on OPL and PSL sanitation facilities. The practice of OPL poses a greater health risk to feco-oral transmission and waterborne diseases, such as cholera, diarrhea, and dysentery (Tuyet-Hanh et al. 2016). Hopewell and Graham (2014) also noted the continuous rise in open defecation among the major sub-Saharan African cities is responsible for some of the reasons for the slow progress made in SDG 6.

Similarly, the agrarian nature of the communities around Lanlate and Eruwa supports open pit latrine. Around Apa and Ikoga in Badary LGA, PFL, SPL and BL sanitation facilities predominate. The dominance of BL sanitation can be attributed to the riverine nature of the area which allows for the use of BL that can later be emptied in the surrounding water body. This method is common in most riverine communities in developing countries. Considering the current executive order 009 signed by the president to tackle open defecation and other related matters in Nigeria, it will go a long way in addressing the problem of poor sanitation in the country.

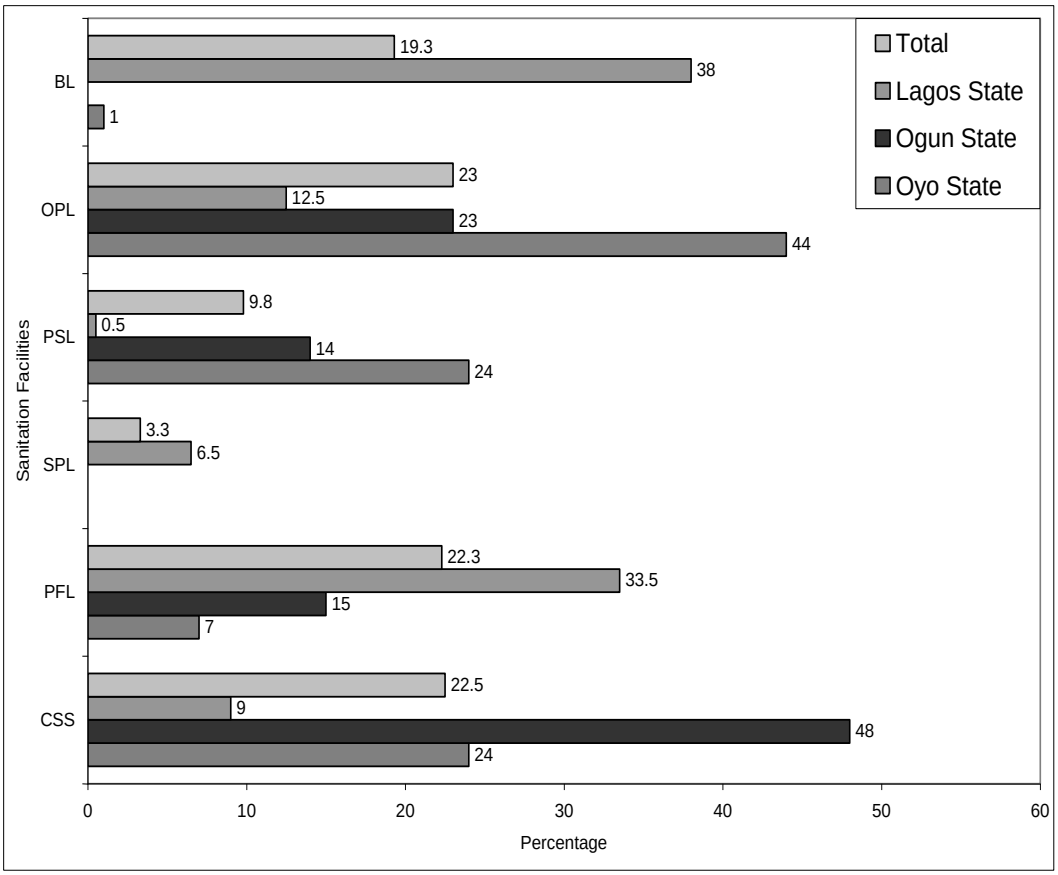

Figure 3. Sanitation facilities in the study area

Connection to septic system (CSS), Pour-flush latrine (PFL), Simple pit latrine (SPL), Public or shared latrine (PSL), Open pit latrine (OPL), Bucket latrine (BL).

Access to water and sanitation

Household access to improved water and sanitation in the study area shows that approximately 50.8% and 48.1% have access to water and sanitation respectively (Table 3). The statistics on the members of the household who have access to improved water and sanitation service is very poor. This calls for a major concern in order to avert outbreak of epidemics in the area. Lack of access to potable water and poor sanitation services pose significant health challenges for school children. According to WHO (1999), poor water supply, sanitation, and hygiene pose serious health hazards for human populations since many vector diseases tend to thrive where these services are not available. Studies have shown that most school children miss classes because they get sick due to water-borne illnesses such as dysentery, diarrhea, typhoid, and malaria. (Bhargava, 2006;

Oloruntoba et al. 2014; Alam et al. (2017) and Angoua et al. 2018). Similarly, Hutton and Chase (2016) noted that poor WaSH facilities have significant health and socio-economic consequences which may result in poor nutritional status, child growth and low school performance.

The variations in access to improved water source across the LGAs shows that settlements around Badagry LGA recorded the highest access to improved water with about 71.5% Unlike Ibarapa East LGA, the majority representing 92% of the households from Eruwa and Lanlate relied on unimproved sources. Access to safe water supply indicates that only 8% of the households gained access to safe water supply in the study area as indicated in asterisk. Satterthwaite (2003) noted that inadequate piped water and decent sanitation constitute one of the major problems affecting rural dwellers in developing countries. Previous studies have shown that access to safe water supply reduces the problem of waterborne diseases. It also reduces the time spent and the frequency of water collection in household (Sullivan et al. 2003). This result is in consonance with the findings of Nketiah-Amponsah et al. (2009) who observed that owning a decent sanitation facility correlates with a higher likelihood of access to piped water connection compared to other sources of water. Similarly, Hunter et al. (2010) noted that inadequacies in water supply affect human health adversely both directly and indirectly. They argued that improvements in various aspects of water supply and sanitation services are vital for enhanced public health.

Table 3: Access to water and sanitation in the study area

Sources of water		**Ibarapa East LGA**	**Ewekoro LGA**	**Badagry LGA**	**Total**
Improved source	PHWC	3(*3.0)	2(*2.0)	27(*13.5)	32(*8.0)
	BH	0(0.0)	50(50.0)	76(38.0)	126(31.5)
	RH	5(5.0)	0(0.0)	40(20.0)	45(11.3)
		8.0%	52%	71.5%	50.8%
Unimproved source	UDW	0(0.0)	14(14.0)	28(14.0)	42(10.5)
	VPW	71(71.0)	11(11.0)	14(7.0)	96(24.0)
	Stream	21(21.0)	23(23.0)	15(7.5)	59(14.8)
		92%	48%	28.5%	49.2%
Sanitation facilities		**Ibarapa East LGA**	**Ewekoro LGA**	**Badagry LGA**	**Total**
Improved source	CSS	24(24.0)	48(48.0)	18(9.0)	90(22.5)
	PFL	7(7.0)	15(15.0)	67(33.5)	89(22.3)
	SPL	0(0.0)	0(0.0)	13(6.5)	13(3.3)
		31%	63%	49%	48.1
Unimproved source	PSL	24(24.0)	14(14.0)	1(0.5)	39(9.8)
	OPL	44(44.0)	23(23.0)	25(12.5)	92(23.0)
	BL	1(1.0)	0(0.0)	76(38.0)	77(19.3)
		69%	37%	51%	51.9%

Source: Author's (2016)
**safe water supply*

Concerning access to sanitation across the LGAs, Ewekoro recorded the highest for improved sanitation with 63%, while a greater proportion of the households representing 69% relied on unimproved sanitation in Ibarapa East (Table 3). Furthermore, the sanitary conditions in the study area show that approximately 66 and 12% of the households reported the presence of solid waste piles and stagnant water around their dwelling. The result is in agreement with the findings of Cookey et al. (2008) and Tadesse et al. (2013).

The chi-square test between water sources and socio-economic variables of the households shows that there is a significant correlation between marital status, age, education, occupation and income in the study area (Table 4). The result is consistent with previous studies by Fotuè and Sikod (2012), Adams et al. (2016), Johnson et al. (2015), Behera & Ali (2015) and Irianti et al. (2016). The cross-tabulations between the toilet facilities and socioeconomic attributes of households revealed that a significant relationship exists between marital status, age, and income of the households in the study area (Table 5). Previous studies by Kimenyi and Mbaku (1995), Lawrence

et al. (2002), Dungumaro (2007), Tuyet-Hanh et al. (2016) and Abubakar (2018) are in line with the current study. They opined that socio-demographic attributes influence household access to sanitation facilities.

Table 4: Relationship between socio-economic factors and water sources in the study area

Dependent variable		Independent variables						
		Sex	Marital status	Age	Education	Occupation	Income	Household size
Water sources	χ^2	8.76	47.78	49.99	22.68	27.39	52.98	27.64
	Df	5	15	15	15	15	20	20
	p-value	0.12	0.01	0.01	0.09	0.03	0.01	0.12

(n = 400) Degrees of freedom (df); Pearson chi-square (χ^2)

Table 5: Relationship between socio-economic factors and toilet facilities in the study area

Dependent variable		Independent variables						
		Sex	Marital status	Age	Education	Occupation	Income	Household size
Toilet facilities	χ^2	7.35	28.71	39.39	9.44	21.43	36.23	25.54
	Df	5	15	15	15	15	20	20
	p-value	0.19	**0.02**	**0.01**	0.85	0.12	**0.01**	0.18

The result of the factor analysis explained 68.86% of the total variance and extracted five components (Table 6). Factor I has high positive loadings on household size (0.799) with moderate loadings on marital status. Household income and educational status have high positive loading on factor II. The result is in line with the findings of Keshavarzi et al. (2006); Ayanshola et al. (2010) and Koskei et al. (2013). They argued that income and household size to a large extent determines domestic water demand. Factor III has high positive and negative loadings on gender and occupation respectively while factor IV shows high loading on wastewater network and moderate loading on stagnant water. A previous study by Nayebare et al. (2014) noted that potable water

quality is negatively affected by the disposal of sewage, industrial effluents, agricultural pesticides and fertilizers, and surface run-off.

Factor V has only one water source with high loadings. The result of the FA further supports the chi-square result indicating a significant relationship between socio-economic characteristics and water/sanitation facilities in the study area. All the five factors were grouped into three major factors namely demographic, environmental and water sources. It was inferred that demographic, environmental and water sources are the main factors affecting household access to water and sanitation in the study area.

Table 6: Factor analysis matrix of variables

	Component				
Variables	1	2	3	4	5
Sex	0.072	0.318	**.783**	0.050	0.240
Marital status	**0.658**	-0.027	-0.058	-0.305	0.165
Education	-0.358	**0.723**	0.049	0.217	-0.005
Occupation	-0.010	0.271	**-0.758**	0.075	.205
Income	0.264	**0.771**	-0.042	-0.114	-.080
Household Size	0.**799**	0.047	0.138	0.210	-.151
Water Sources	-0.012	-0.071	0.008	0.000	**0.938**
Stagnant/Sewage water	-0.212	-0.032	0.103	**0.621**	-0.166
Wastewater Network	0.184	0.091	-0.163	**0.766**	0.203
% of variance	15.05	14.55	13.91	13.08	12.28
Cumulative %	15.05	29.59	43.49	56.58	68.86

Conclusion

Inequality in access to water and sanitation in rural settlements in parts of Southwest Nigeria. Purposive sampling technique was adopted in the selection of six settlements while questionnaire was administered to households using a random sampling method. The result shows that 45.3% of the households interviewed are adult i.e. above 35 years with about 42.3% having secondary school certificates. The dominant occupation is trading representing 45.5% while more than one-quarter of

the households are low-income earners. The household size was generally low with about 64.5% in the category of 1-5 persons/ household.

The major water supply source is borehole in the study area. The variations across the LGAs, indicate that settlements from Badagry recorded the highest for piped household water connection, borehole, unprotected dug well and rainwater harvesting. The predominant water supply source around Eruwa and Lanlate is vendor-provided. The main sanitation facility in the study area is the open-pit latrine. The disparity across the settlements shows that households from Eruwa and Lanlate use open-pit latrine/ public or shared latrine.

Approximately 50.8% and 48.1% of the households have access to water and sanitation respectively in the study area. The variations across the settlements indicate that Apa and Ikoga in Badagry LGA recorded the highest access to improved water while the majority of the households from Eruwa and Lanlate in Ibarapa East LGA, relied on unimproved source. Access to safe water supply indicates that only 8% of the households gained access in the study area. Regarding access to sanitation facilities across the specific settlements, 63% of households from Ibeshe and Itori in Ewekoro LGA recorded the highest access to improved sanitation while 69% of the households from. Eruwa and Lanlate use unimproved sanitation facilities. The chi-square test between water sources and socio-economic characteristics show a significant association between marital status, age, education, occupation and income of the household. Also, a significant relationship was established between toilet facilities and marital status, age, and income of the households at $p<0.01$.

Five factors representing 68.86% of the total variance were extracted based on the FA. Factor I has high positive loadings on household size while income and educational status loaded positively on factor II. Factors III and IV have high loading on gender and wastewater network respectively. Factor V has a high loading on water supply source. The five factors were grouped into three major factors namely demographic, environmental and water supply source. The study contributes to the literature and a gap in knowledge in the areas of WaSH and environmental sustainability. It also provides information on specific WaSH intervention needs for prioritization purposes in the study area. The study concluded that the sanitary condition, access to improve water supply and

sanitation facilities in Eruwa and Lanlate is poor. Regular and effective environmental sanitation, provision of safe water supply and decent sanitation facilities were recommended with priority given to Eruwa and Lanlate in Ibarapa East LGA for intervention in the areas of WaSH because of its weakest water and sanitation access.

Acknowledgment

The author is grateful to the anonymous reviewer whose comments, suggestions, and contributions have greatly improved the initial version of the manuscript.

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