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## ASSESSING THE PUBLIC HEALTH IMPLICATIONS OF URBAN WASH INFRASTRUCTURE IN LAGOS, NIGERIA

<sup>1</sup>Aisha Nneka Mohammed and <sup>2</sup>Samuel Chukwudi Okeke

<sup>1</sup>University of Lagos, Department of Geography, Akoka-Yaba, Lagos, Nigeria

<sup>2</sup>Lagos State University, Faculty of Environmental Sciences, P.M.B. 1012, Epe, Lagos, Nigeria

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**Abstract:** The study examined water, sanitation, and hygiene conditions in Lagos State University, Yaba College of Technology, and Adeniran Ogunsanya College of Education tertiary institutions in parts of the Lagos metropolis using field observation and social survey. A total of 220 structured questionnaires were administered to students and staff across the institutions using a random sampling technique. Descriptive statistics and ANOVA was employed to analyse the data. The result shows that approximately 54% of the respondents are acquainted with the WaSH program. The significant water supply sources include borehole and public piped borne water representing 86 and 13%, respectively. About 96, 94, 91 and 37% of the respondents gained access to waste bins, sanitation, water, and handwashing materials. The ANOVA shows a significant difference between the dependent variables across the institutions. At the same time, the post-hoc tests confirm a significant difference between YABATECH and the other two institutions at  $p < 0.05$  level of significance. The study provides baseline information on WaSH conditions for effective planning and managing WaSH facilities by policymakers in Nigerian public tertiary institutions. The study concluded that safe water supply and access to handwashing facilities is low in the area. YABATECH has the worst WaSH condition. We recommended investment in WaSH services in tertiary institutions with greater priority at YABATECH, considering its poor WaSH amenities.

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**Keywords:** Hygiene, Lagos-metropolis, Non-household, Sanitation, Tertiary institution, Water

### Introduction

The performance of the water, sanitation, and hygiene (WaSH) services sector in Nigeria has been poor based on the statistics. For example, in 2000, the proportion of the population with access to water on-premises was 17%, while only 29% had access to improved sanitation. The observed poor performance can be attributed to socioeconomic and political factors, cultural values and religious beliefs, and the capacity of existing institutional arrangements (Akpabio & Rowan, 2021). In addition, the various national and sub-national government agencies pursue disparate, competitive, and overlapping goals with limited coordination (Akpabio, 2012). Public policies are top-down and rarely reflect local circumstances and realities due primarily to political-economic interests, inter-agency competition, and poor bureaucratic capacity (Akpabio & Rowan, 2021).

The policies, regulations, and programmes relevant to WaSH in Nigeria fall under three significant epochs, namely, the colonial administration (pre-1960), the independence era (1960–1969) and the post-independence era (1970–1999) (Akpabio & Rowan, 2021). Most of the existing policy and

regulatory tools in the WaSH sector are broad, vague, repetitive, old, and unrealistic (Akpabio & Rowan, 2021). For instance, the legislation was framed during the independence era in response to the anticipated consequences of petroleum oil exploration on the environment and the postindependence regulatory and policy practices (Akpabio & Rowan, 2021). However, significant progress was recorded in 2019 when the President declared a state of emergency on the WaSH sector, which has successfully catalysed a series of action plans to achieve open defecation-free status for Nigeria by 2025 (The Nation, 2018; Richard et al., 2019). The present constitutional, legal, and administrative responsibilities for the WaSH sector in Nigeria rest on several ministries and agencies at national, regional, and local levels. The sector has suffered greatly from a lack of cooperation and interest from other relevant stakeholders, including the three tiers of government (national, subnational, and local), knowledge communities, and the public, probably related to socio-economic, political, and cultural factors. Nigeria's WaSH sector policies have no benefit from local scientific inputs.

The lack of adequate WaSH infrastructure in Nigerian tertiary institutions remains a significant challenge. Dilapidated WaSH amenities characterise a greater percentage of the public tertiary institutions in the country apart from the newly established private ones. If the situation is not abated, it could result in health challenges that will affect the students' academic and socio-well-being of staff. Most schools face deteriorating WaSH conditions (Ana, 2008). Some of these can be attributed to the unreliable water supply because of erratic power supply, overpopulation of latrine-to-student ratios, frequent disappearance of soap and hand sanitisers, neglect, poor maintenance due to pressure on the limited facilities, and corruption, among others (Egbinola & Amanambu, 2015).

On-the-spot assessment of the WaSH facilities across institutions shows that the majority of the academic and non-academic staff members lack private toilets. At the same time, there is no dedicated toilet facility for male and female students. Where such facilities are provided, it is usually under lock and key because of its filthy condition. This situation is a challenge for public tertiary institutions considering the current covid-19 pandemic ravaging the entire globe. The poor WaSH condition in most of the tertiary institutions in Nigeria is aggravated due to lack of budgetary provision, nonavailability of a dedicated place for handwashing until the outbreak of Ebola some years back, and the recent outbreak of the Covid-19 pandemic. Efforts by various tertiary institutions were fire brigade approaches and, as a result, were not sustained.

The lack of budgetary provisions for WaSH services is a significant challenge in most Nigerian tertiary institutions coupled with the monthly subvention problems to cater for the staff member's emoluments. At the same time, some institutions are confronted with incessant strikes due to a backlog of unpaid salaries arrears of staff members. This condition makes it practically impossible for most institutions to implement an effective intervention in WaSH facilities.

Despite these challenges, the federal government of Nigeria has taken some proactive steps in the area of the National Water, Sanitation and Hygiene Capacity Building and Research Programme to strengthen human capacity for sanitation and provide universal access to water and sanitation by 2030. These efforts are in tandem with the National WaSH Action to accelerate progress on ensuring water, sanitation, and hygiene for all Nigerians. Examples of such measures include a workshop in capacity

building and research for M.Sc. programmes in sanitation across the country's six geopolitical zones and at the Institute for Water Education, Netherlands. Also, the declaration of a 'State of Emergency in Nigeria's water and sanitation sector by the President in 2018 demonstrates the Federal Government' political will to address Nigeria's water and sanitation crisis (The Nation, 2018; Richard et al., 2019).

The challenges of WaSH amenities in each of the tertiary institutions under study are similar, with minor differences. For example, most institutions are confronted with poor maintenance, attitude to public amenities, erratic power supply, incessant strikes, and over-population. These factors cut across all the institutions. However, the management approaches of the WaSH facilities vary from one institution to the other. For example, at Lagos State University (LASU), each faculty have constructed a borehole for water supply. Similarly, at Adeniran Ogunsanya College of Education (AOCOED), a centralised water supply system is put in place. However, regular power supply has significantly hampered adequate water supply in the two institutions. This problem has implications for sanitation and hygiene practices to a large extent. Moreover, unlike Yaba College of Technology (YABATECH), the scenario is more of total neglect by the Federal government, resulting in the deterioration of WaSH facilities in the institution.

Therefore, this study seeks to examine water, sanitation, and hygiene in tertiary institutions in parts of Lagos metropolis to identify critical areas of WaSH that needs necessary intervention to strengthen the WASH conditions in the study area.

### **Theoretical perspectives and Literature Review**

Various concepts relevant to the study abound in the literature. For example, the concepts of adequacy and satisfaction on basic human needs and the health belief and trans-theoretical models. The two concepts employed in this study include the concept of adequacy and satisfaction. The two concepts were adopted in this study because they serve as veritable tools to identify and monitor progress on accessibility to basic human needs at the local level. They also provide a better understanding of the relationship between the physical extent of basic human needs for prioritization (Feitelson and Jonathan, 2002; Lawrence et al., 2002; Sullivan et al., 2003). The idea of adequacy can be explained from diverse angles. For example, Longman (2003) and Obute (2017) viewed adequacy as a means of quality and quantity under any given condition. Equally important is the concept of satisfaction with basic human needs, which is crucial to the welfare of an individual. Longman (2003) and Obute (2017) noted that satisfaction is a feeling of happiness when someone gets what they want. Hornby (2005), Obute (2017) also observed that satisfaction is a feeling of pleasure because one has achieved something. Pereault & McCarthy (1996), Obute (2017) opined that satisfaction is the ability of service providers to render specific services to the target population to satisfy their needs. They argued that if the expected level of quality service is obtained, the beneficiaries are satisfied. Semenik & Bamossy (1995) conceptualised satisfaction as a utility. They noted three types of utility: form utility created when a valuable commodity is provided, time utility refers to the satisfaction derived from timely service, and place utility, the satisfaction beneficiaries get when a service is located where the people wanted it.

Rosenstock et al. (1994) and Obute (2017) used the health belief model to explain the preventive and curative health behaviour of the failure of people to participate in preventive health programmes that would protect them from diseases and health-related problems. The health belief model is comprised of four major components, namely, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Rosenstock et al., 1994; Obute, 2017). Prochaska et al. (1993), Velicer et al. (1998), and Obute (2017) applied the trans-theoretical model to explain the influence of behavioural change associated with the problem in respect of water and sanitation-related diseases. They noted that an individual passes through six logical stages of the decision-making process, e.g. precontemplation, contemplation, preparation, action, maintenance, and termination, before adopting a particular health behaviour (Prochaska et al., 1993; Velicer et al. 1998; Obute, 2017). They inferred that the position of stages of behaviour, in theory, allows individuals to weigh dangers associated with a health problem in respect to water and sanitation-related diseases.

Access to adequate WaSH facilities and quality education is a fundamental right of every schoolchild. Students spend a significant time at school where WaSH services play a critical role in learning, health, and dignity. Therefore, apropos, the inclusion of WaSH in schools is a significant component of a safe and effective learning environment. The SDG's goal number 6 cannot be overemphasized as part of universal access to WaSH as contained in the Sustainable Development Goals (SDGs). UNICEF (1998) and WHO (2000) noted that adequate sanitation and environmental hygiene are crucial measures for the safe disposal of human excreta, vector control, and personal and environmental hygiene to prevent diseases.

Previous studies have shown that students' performance in school depends on several factors such as access to safe drinking water, and clean, accessible, and functional toilets with handwashing facilities, among others. Improved WaSH conditions in schools can enhance the quality of education across the globe and consequently promote school attendance, health, nutrition, gender equity, etc. (UNICEF, 2011; Adukia, 2017). Adams et al. (2009) opined that adequate WaSH facilities influence peoples' handwashing behaviour. Hence, schools with inadequate handwashing facilities within their school premises violate the established guidelines for the WaSH program in the school's environment. In addition, studies by Barnes & Maddocks (2002), Lundblad & Hellstrom (2009) noted that the avoidance of toilets by students due to stinking odour and lack of privacy is a significant challenge in developing countries. Similarly, Duran-Narucki (2008) reported that the condition of schools using multiple indicators such as school sanitation facilities correlates with student academic success and school attendance. Studies have also shown that access to adequate WaSH facilities in the school environment positively influences the student's education and health performance by reducing the number of days missed due to WaSH-related illnesses (Antwi-Agyei et al., 2017; Gebreeyessus & Adem, 2018). Gebreeyessus & Adem (2018) noted that handwashing with soap; appropriate water treatment and efficient waste disposal methods would reduce the risk of diarrhoea and eye infections. Deplorable water quality and poor access to WaSH services can result in various diseases with significant health, economic and social consequences on the human population. Poor water quality is one of the significant threats to human health and is responsible for the death of about 760,000 children globally (WHO,

2013). It was also estimated that one-third of all schools worldwide lack access to safe water and decent sanitation, with the worst scenario being from developing countries (UNICEF, 2010). Hence, adequate and efficient provision of WaSH amenities in the school environment will help curtail the spread of infectious diseases among the students.

Similar contributions from scholars on improved WaSH services in various parts of the world also abound in the literature. For example, in China, WaSH programmes reduced the number of missed school days by 54% per year and reduced absenteeism by 42 % (Bowen et al., 2007). Similarly, in Kenya, the WaSH strategy led to a 50% reduction in diarrhoea illness (Freeman et al., 2012). Improved sanitation programme has also helped increase girls' enrolment and academic performance in Alwar district, India (UN-Water, 2008). In addition, Monse et al. (2013) reported a 27% reduction in school absenteeism through daily hand washing, deworming programmes and improved oral hygiene in the Philippines. Other relevant studies include; Aremu, 2012; Bablobi, 2013; Waga, 2013; Seid & Kumie, 2013; Giardina et al., 2013; Freeman et al., 2014; Alexander et al., 2014; Barasa et al., 2016; Antwi-Agyei, 2017 on WaSH in primary schools and vulnerable communities. Alexander et al. 2014; Jordanova et al. 2015 studied WaSH in refugee camps. Hsan et al., (2019) assessed how WaSH affects human health and pupils' performance (Gottfried, 2010; Lau et al., 2012; Joshi & Amadi, 2013; Freeman et al., 2014). A study by Alaba & Alaba (2002), Obute (2017) inferred that the service delivery of potable water supply and sanitation enhances productivity and contributes to the standard of living. They opined that adequate and satisfactory water supply has socio-economic benefits, viewed from three major perspectives. First, it has consumption value. Secondly, their availability leads to increase productivity and utilisation by households and thirdly, it leads to the acquisition of national stock of wealth in urban economies. Previous studies have focused on the role of WaSH conditions in primary schools, residential areas, and informal settlements both at local and international levels. For example, the assessment of WaSH and housing quality (Akoteyon & Aliu, 2020), the role of water and sanitation in the coastal and urban region (Ekong, 2015), housing quality deterioration and WaSH (Milroy et al., 2001).

Despite the valuable contributions of various scholars on WaSH issues, there is scanty literature on WaSH conditions in non-household settings in the study area. Most studies focused on household settings across varied residential areas while the few ones on non-household settings with emphasis on primary schools in rural and peri-urban areas. In addition, the majority of these studies did not cover the three major categories of tertiary institutions in the Nigerian educational system.

Therefore, this study seeks to fill this gap in knowledge to provide baseline information on WaSH conditions for effective planning and management by policymakers in Nigerian public tertiary institutions. The study also offers informed decisions for prioritisation in areas of critical WaSH needs for the enhanced healthy school environment and optimum academic performance and well-being.

## **Materials and Methods**

### ***Study area***

The study area is approximately located on longitude 3°6' 30"E to 3°23' 0"E and latitude 6°24'30" N to 6°33'30"N within the metropolitan area of Lagos, Nigeria, covering three tertiary institutions (Figure



The Lagos State University was established as a public university in 1983 by the enabling law of Lagos State for teaching, research, and community service to humanity (LASU Annual report, 2018). Currently, the university operates three main campuses: Ojo, Ikeja, and Epe. The Ojo campus is the seat of the central administration, which houses six faculties, two schools, two centres, and the Postgraduate School. The Ikeja campus houses the College of Medicine (LASUCOM), whereas the Epe campus hosts the Engineering faculty, the School of Agriculture, and the Institute for Organic Agriculture and Green Economy (LASU Annual report, 2018). The university operates various

programs such as full-time undergraduates, Postgraduates, Sandwich, Diplomas, Entrepreneurial, Joint University Preliminary Examination Board (JUPEB), and Pre-Degree Science (PDS) courses.

Yaba College of Technology came into existence based on the promulgation of Degree 23 of 1969 to train the technical workforce for the economic and social development of the nation. The College has eight schools and thirty-four academic departments with seventy programmes, across National Diploma (ND), Higher National Diploma (HND), and Post-HND levels. The College also offers certificate and degree courses. The degree courses are in conjunction with the University of Nigeria, Nsukka, and the Federal University of Technology, Akure.

The Lagos State College of Education, now Adeniran Ogunsanya College of Education (AOCOED), was established under Law No. 23 of 1980. The College offers teacher-training courses leading to the National Certificate of Education (NCE) and has six schools (AOCOED, 2018).

### **Study design and sample size determination**

The WaSH conditions in tertiary institutions in parts of Lagos was assessed using field observation and social survey in parts of the Lagos metropolis were assessed using field observation and social survey. A random sampling technique was employed to select three public tertiary institutions in the study area. The institutions were chosen because they are the major public tertiary institutions within the metropolis, which capture the three main categories of tertiary institutions (University, College of Education, and Polytechnics) in the Nigerian educational system. A sample size of 220 was designed for convenience purposes as indicated in Table 1 using Yamane (1973) formula (See equation 1). In addition, a random sampling method was employed to select the tertiary institutions while the data were analyzed quantitatively.

**Table 1.** Population sample of the respondent in the study area

Institution	Categories of respondents	of Population (a, b & c)	Number of administered Questionnaire	Total
LASU	Student	16322	25	74
	Academia	493	24	
	Non-academic staff	1813	25	
AOCOED	Student	716	24	71
	Academia	272	23	
	Non-academic	522	24	
YABATECH	Student	716	25	75
	Academia	272	25	
	Non-academic	522	25	
Total				220

Source: (LASU Annual Report 2018<sup>a</sup>; AOCOED Annual Report 2018<sup>b</sup> & Oral interview (The Registrar, YABATECH, 2020<sup>c</sup>).

A sample size of 220 in the proportion of 74, 71, and 75 for the questionnaire administration at LASU, AOCOED, and YABATECH respectively from a study population of [(16322, 716, 716); (493, 272,

272) and (1813, 522, 522)] representing student, academia and non-academic staff from LASU, AOCOED, and YABATECH respectively using Yamane (1973) formula (See equation 1). A random sampling method was used to administer the questionnaire to the respondents in each institution.

$$n = \frac{N}{1 + Ne^2} \quad \text{Eq. 1}$$

Where: n = corrected sample size, N= population size, e= Margin of error which is based on the research condition 5% (0.2).

The reliability of the instrument was determined using the Cronbach alpha technique. Data obtained from the field were processed using Statistical Package for Social Sciences (SPSS) version 22. Frequency and percentages were employed to describe the data. In contrast, one-way ANOVA was employed to compare the level of accessibility, adequacy, and quality satisfaction of WaSH facilities across the three institutions. The study area map and WaSH attributes were plotted using ArcGIS versions 10.3.1 and Excel software. The coding measures/scale of the variables is presented in supplementary data (Table 2).

Table 2. Coding measures/scale of variables

S/n	Variable	Measure/scale	Options
1	Awareness about WaSH, availability of WaSH facilities, the functionality of WaSH facility, availability of handwashing materials, separate toilet for students and staff, availability of waste bin facility, suitability of water, treatment of water	Binary	0=No 1=Yes
2	Sex	2-point	1= Male, 2= Female
3	Age, Religion, Status	3-point	Age (1= Below 25 yrs., 2= 25-35 yrs., 3= Above 35 yrs.) Religion (1=Africa Traditional Religion, 2= Christianity, 3= Islam) Status (1= Student, 2=Non-Academic Staff, 3= Academia)
4	Adequacy of WaSH facilities	3-point	1= inadequate, 2 = fairly adequate & 3 = very adequate
5	Type of waste bin	4-point	1= piled within the premises, 2 = open drum, 3 = sack & 4 = covered drum
6	Method of waste disposal	4-point	1= Open drum, 2= Covered drum, 3= Through LAWMA, 4= Through PSP by the school management
7	Accessibility to WaSH	4-point	1= not accessible, 2 = difficult to access, 3 = accessible & 4 = very accessible
8	Quality satisfaction of WaSH facilities	4-point	1= not satisfactory, 2 = fairly satisfactory, 3 = satisfactory & 4 = very satisfactory



9	Marital status, water treatment method	4-point	Marital status (1=Widowed, 2= Divorced, 3= Single, 4= Married) Water treatment method (1= Filtration, 2= Boiling, 3= Chlorination, 4= Ultraviolet disinfection)
10	Materials for hand washing	6-point	1= none, 2= water only, 3= soap and water, 4= soap only, 5= Sanitizer, 6= Disinfectant
11	Qualification, Source of water supply, Source of information on WaSH	6-point	Qualification (1=ND, 2= NCE, 3= HND, 4= First Degree, 5= Master Degree, 6= PhD) Source of water (1= Open dug well, 2= Protected dug well, 3= Borehole, 4= Public piped water borne) source of information on WaSH (1= radio, 2= television, 3= pamphlets, 4= billboard, 5= community, 6= friends/relative)
12	Sources of toilet facilities	10-point	1= connection to septic system, 2 = pour-flush latrine with connection, 3= simple pit latrine, 4= ventilated improved pit latrine, 5= public or shared latrine, 6= open pit latrine, 7= bucket latrine, 8= pour-flush latrine without connection, 9= surface water & 10= open field space

**Ethical consideration**

The researcher obtained the oral consent of the respondents and ethical clearance from the ethics committee of Lagos State University. The respondents were notified that their involvement in the survey was voluntary. However, they were not obliged to attempt any questions they did not like or were at liberty to decline the interview without any justification.

**Results and Discussion*****Socio-demographic attributes of the respondents***

Table 3 presents the result of the socio-demographic attributes of the respondents. The result shows that female is the dominant respondents, representing 47.9% with ages above 35 years. The marital status indicates that 53% of the respondents are married. About 60.8% and 77.0% are Christian and Yoruba, ethnic tribes. A similar pattern was obtained across the various institutions (See Table 3). The status of respondents indicates that 33% of the students, non-academic and academic staff were interviewed in the study area. The qualification of the respondents shows that the majority representing 57%, holds a master's degree certificate, with only 0.5% having a first-degree certificate.

**Table 3.** Socio-demographic attributes of the respondents

<u>Variables</u>	<u>options</u>	<u>YABATECH</u>	<u>AOCOED</u>	<u>LASU</u>	<u>Total</u>
Sex	Male	31(42)	31(44)	37(50)	99(45)
	Female	43(58)	40(56)	37(50)	120(55)
Age	Below 25 yrs. 25-35 yrs.	23(31)	22(31)	20(27)	65(30)
		15(20)	19(27)	15(20)	49(22)
	Above 35 yrs.	36(49)	30(42)	39(53)	105(48)
Marital status	Widowed	5(7)	2(3)	4(5.4)	11(5)
	Divorced	1(1.4)	0(0.0)	0(0.0)	1(0.5)
	Single	29(39)	30(42)	32(43)	91(42)

Religion	Married	39(53)	39(55)	38(51)	116(53)
	Christianity Islam	52(70)	49(69)	45(61)	146(67)
		22(30)	22(31)	29(39)	73(33)
Ethnicity	Foreigner	5(7)	2(3)	5(7)	12(6)
	Hausa	3(4)	4(6)	2(3)	9(4)
	Igbo	13(18)	8(11)	10(14)	31(14)
	Yoruba	53(72)	57(80)	57(77)	167(76)
Status	Student	25(34)	24(34)	25(34)	74(34)
	Non-academic staff	24(32)	23(32)	25(34)	72(33)
	Academia	25(34)	24(34)	24(32)	73(33)
	ND	26(35)	0(0.0)	0(0.0)	26(12)
Qualification	NCE	1(1.4)	25(35)	0(0.0) 2(3)	26(12)
	HND	10(14)	7(10)	1(1.4)	19(9)
	First degree	0(0.0)	0(0.0)		1(0.5)
	Master degree	32(43)	32(45)	61(82)	125(57)
	PhD.	5(7)	7(10)	10(14)	22(10)

Percentages are in parentheses

**Source:** Author's (2019)

### ***Awareness about WaSH, sources of water supply and toilet facilities***

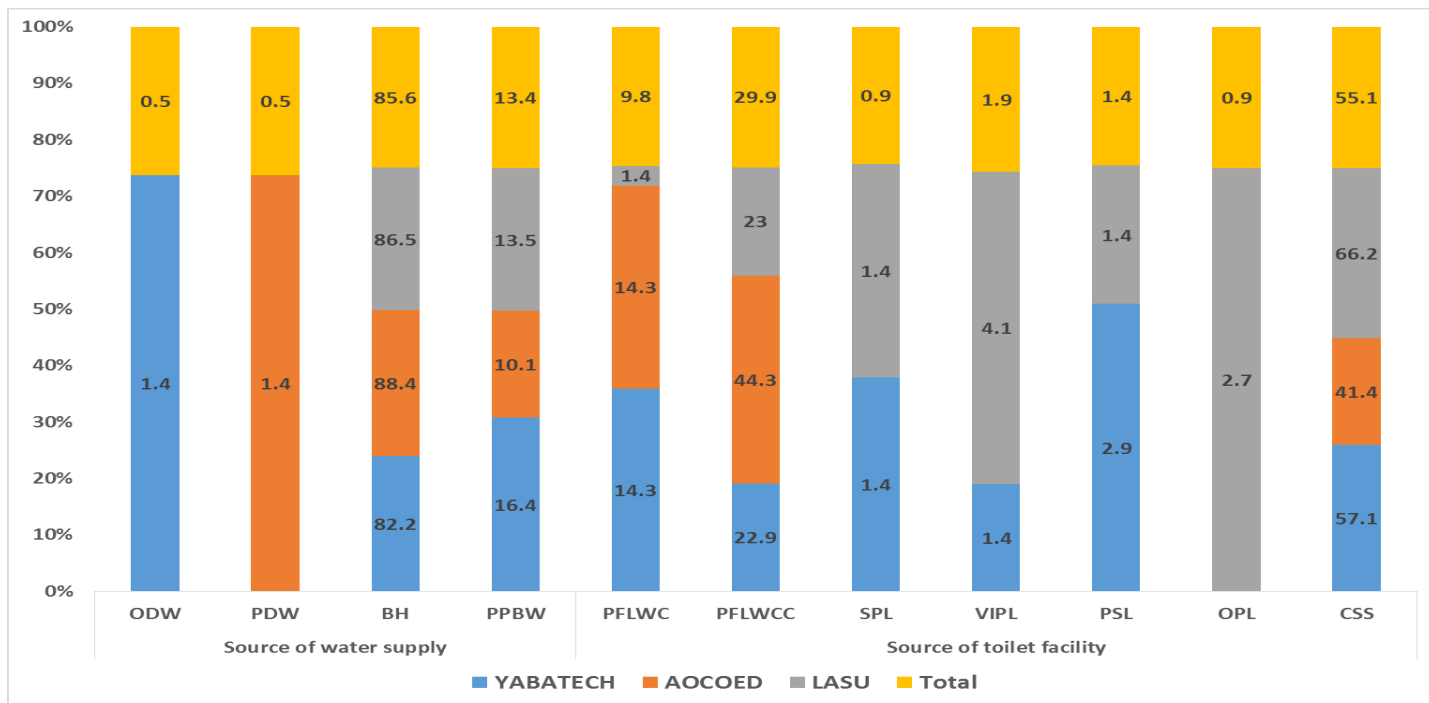
The result shows that about 54% of respondents are aware of WaSH. The disparity indicates that AOCOED has the highest level of awareness. The primary source of water supply in the area is the borehole (86%). This result is further supported by the predominance of boreholes across the various locations, with AOCOED recording the highest (Fig. 2). Only 13% of the respondents relied on public piped-borne water for multiple uses. The highest proportion of respondents using this source of water supply is from LASU, with just 14%. The available sources of sanitation facilities show that connection to the septic system (CSS) predominates with about 55%. The variations across the institution show a similar pattern, with LASU having the highest percentage (Fig. 2). Regarding the method of waste disposal in the study area, the covered drum is the most widely used technique.

Across the locations, covered drums, Lagos Waste Management Authority (LAWMA), and Private Sector Participation (PSP) predominate in YABATECH, AOCOED, and LASU, respectively.

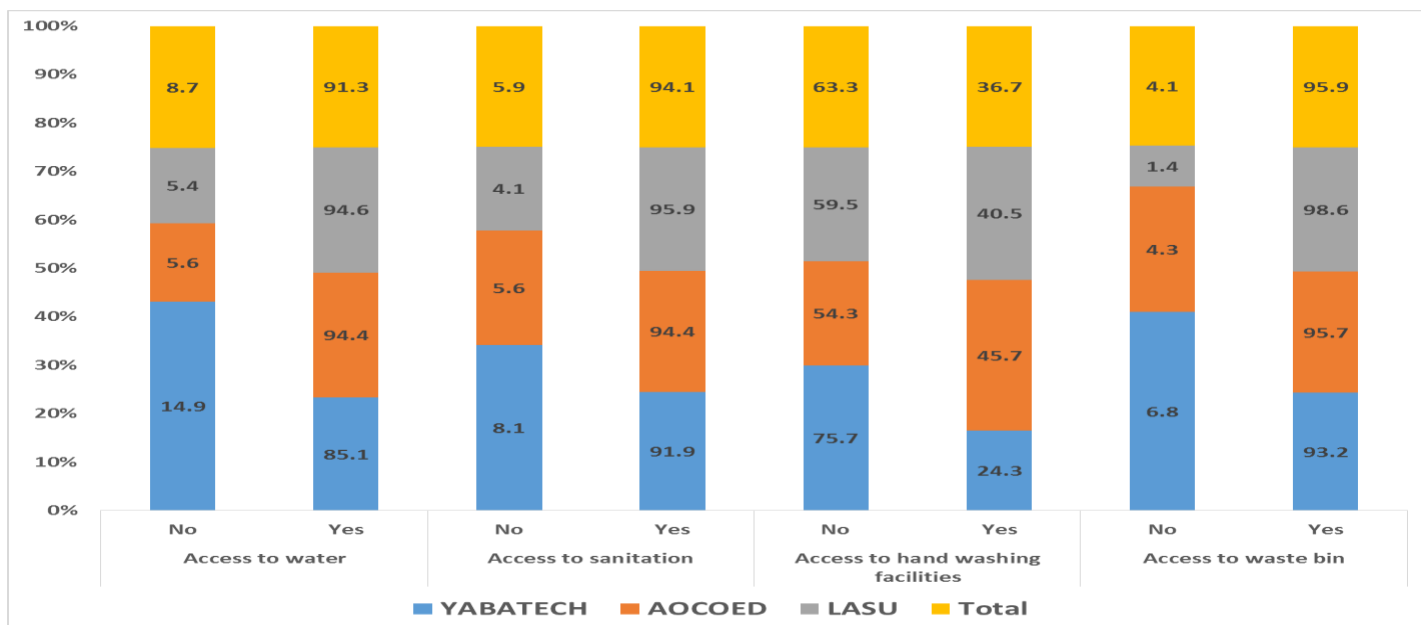
### ***Access to WaSH facilities in the study area***

Access to WaSH is shown in Figure 3. A greater proportion of the respondents gained access to water, sanitation, and waste bin disposal facilities in the study area. A similar pattern regarding access to water, sanitation, and waste disposal amenities was observed across the institutions, with LASU having the highest access to water, sanitation, and waste disposal amenities. Access to handwashing facilities is generally low, with just 37% (See figure 3). The dominant handwashing material shows that 60 and 25% of the respondents used only water and soap and water. A similar trend across the various institutions was recorded, with YABATECH having the highest percentage of respondents without handwashing facilities. The observed disparities in the materials can be attributed to the students' attitude because oftentimes, the soap provided at the handwashing stand usually disappear.

Hence, the provision of soap at handwashing points has declined over time.



**Figure 2:** Sources of water and toilet facilities



**Figure 3:** Access to WaSH facilities

### ***Rating of accessibility, adequacy and quality satisfaction of WaSH facilities***

Table 4 presents the respondents' rating of accessibility, adequacy, and quality satisfaction of WaSH facilities in the study area. The result shows that 67.4% rated access to WaSH as accessible while 21.6 and 11.0% rated it as difficult to access and not accessible, respectively. The variations show that the

highest level of accessibility to WaSH facilities was recorded at AOCOED with 75.7%. It was noted that YABATECH has the highest percentage (14.9%) of the respondents without WaSH facilities. The adequacy of the WaSH facility revealed that only 14.7% of the respondents rated it very adequately. About 65.1 and 20.2% rated it fairly adequate and inadequate, respectively. Respondents from AOCOED reported the highest level of adequacy with 21.4%, while YABATECH recorded the highest level of the inadequacy of WaSH facilities.

Regarding the quality satisfaction of WaSH facilities, 34.9, 47.2, and 17.9% of the respondents rated it satisfactory, fairly satisfactory, and not satisfactory, respectively. The variations across the institutions show that LASU recorded the highest quality rating for WaSH facilities, with about 39.2%. In comparison to 28.4% of the respondents from YABATECH, rated it unsatisfactory.

**Table 4:** Rating of accessibility, adequacy and quality satisfaction of WaSH facilities

Variables option			YABATECH	AOCOED	LASU	Total
Accessibility of WaSH facilities	Not accessible		11(14.9)	6(8.6)	7(9.5)	24(11.0)
	Difficult to access		23(31.1)	11(15.7)	13(17.6)	47(21.6)
	Accessible		39(52.7)	49(70.0)	52(70.3)	140(64.2)
Adequacy of WaSH facilities	Very accessible		1(1.4)	4(5.7)	2(2.7)	7(3.2)
	Inadequate		20(27.0)	10(14.3)	14(18.9)	44(20.2)
	Fairly adequate		49(66.2)	45(64.3)	48(64.9)	142(65.1)
Quality of WaSH facilities	Very adequate		5(6.8)	15(21.4)	12(16.2)	32(14.7)
	Not satisfactory		21(28.4)	7(10.0)	11(14.9)	39(17.9)
	Fairly satisfactory		33(44.6)	36(51.4)	34(45.9)	103(47.2)
	Satisfactory		20(27.0)	23(32.9)	28(37.8)	71(32.6)
	Very satisfactory		0(0.0)	4(5.7)	1(1.4)	5(2.3)

Source: Author's (2019)

### ***One-way ANOVA of accessibility, adequacy and quality satisfaction of WaSH facilities***

The result of the One-way ANOVA is presented in Table 5. The result shows a significant difference between the mean scores of the dependent variables (accessibility, adequacy, and quality satisfaction of WaSH facilities) across the three institutions. The post-hoc tests confirm the exact differences across the institutions and are statistically significant at  $p < .05$  level, as indicated in Table 6. This result shows a significant difference between YABATECH and the other two institutions

(AOCOED/LASU) based on accessibility, adequacy, and quality satisfaction of WaSH facilities. However, no significant difference exists between AOCOED and LASU based on dependent variables. The study concluded that AOCOED/LASU has a similar satisfaction level of WaSH attributes to YABATECH with the worst attributes.

**Table 5:** One-way ANOVA of the dependent variables

Variables		Sum of Squares	df	Mean Square	F	Sig.
Accessibility to WaSH facilities	Between Groups	4.242	2	2.121	4.137	.017
	Within Groups	110.235	215	.513		
	Total	114.477	217			
Adequacy of WaSH facilities	Between Groups	2.791	2	1.396	4.136	.017
	Within Groups	72.548	215	.337		
	Total	75.339	217			
Quality satisfaction of WaSH facilities	Between Groups	5.029	2	2.514	4.625	.011
	Within Groups	116.880	215	.544		
	Total	121.908	217			

**Table 6:** Post-Hoc test of the multiple comparisons of the mean difference

Tukey HSD							
Dependent Variable	(I) Institution	(J) Institution	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Accessibility to WaSH facilities	YABATECH	AOCOED	-.32317*	.11939	.020	-.6049	-.0414
		LASU	-.25676	.11772	.077	-.5346	.0211
	AOCOED	YABATECH	.32317*	.11939	.020	.0414	.6049
		LASU	.06641	.11939	.843	-.2154	.3482
	LASU	YABATECH	.25676	.11772	.077	-.0211	.5346
		AOCOED	-.06641	.11939	.843	-.3482	.2154
Adequacy of WaSH facilities	YABATECH	AOCOED	-.27413*	.09685	.014	-.5027	-.0456
		LASU	-.17568	.09550	.159	-.4011	.0497
	AOCOED	YABATECH	.27413*	.09685	.014	.0456	.5027
		LASU	.09846	.09685	.567	-.1301	.3270
	LASU	YABATECH	.17568	.09550	.159	-.0497	.4011
		AOCOED	-.09846	.09685	.567	-.3270	.1301
Quality satisfaction of WaSH facilities	YABATECH	AOCOED	-.35637*	.12293	.011	-.6465	-.0662
		LASU	-.27027	.12121	.069	-.5563	.0158
	AOCOED	YABATECH	.35637*	.12293	.011	.0662	.6465



	LASU	.08610	.12293	.764	-.2040	.3762
	YABATECH	.27027	.12121	.069	-.0158	.5563
	AOCOED	-.08610	.12293	.764	-.3762	.2040
*. The mean difference is significant at the 0.05 level.						

## Discussions

The level of awareness of WaSH in the study area is relatively high, with 54% in the study area. The result is consistent with previous studies by Nair et al., 2014. Knowledge about WaSH is vital to equip individuals with proper sanitation and hygiene practices, prevent epidemics, and control non-epidemic and hygiene-preventable cases (Plaster et al., 2018). The status of WaSH facilities in the area indicates that most of the facilities are functional with YABATECH having the highest number of non-functional WaSH amenities. Studies have shown that the provision of functional water points, toilets, and handwashing facilities in the school environment enhances and promotes the sustainability of WaSH services.

Access to handwashing facilities in the study area is generally low about 37%, with YABATECH having the highest percentage of respondents without access to a handwashing facility in the study area. An earlier study by Sibiya et al. (2013) reported 100% coverage of handwashing facilities in Limpopo, South Africa. Only 25% of respondents use water and soap in the study area for handwashing. The result agrees with the findings of Thanh-Xuan and Hoat (2013), who reported a low proportion of students using soap at a washing facility at a Viet Nam school, and Egbinola & Amanambu (2015) in Ibadan, Nigeria. The study by Appiah-Brempong et al. (2018) noted that proximity to functional WaSH facilities such as water and soap for handwashing could significantly influence adherence to WaSH guidelines on handwashing with soap (HWWS) after toilet use. Though water supply sources in the study area are relatively high, with the majority relying on borehole, a similar result was reported by Egbinola & Amanambu (2015), where about 94% of available water point is from borehole within the school premises. However, the perceived poor quality for human consumption is a major concern, coupled with poor access to the public piped water supply in the study area. This indicates the low coverage of safe water supply in the area. Previous studies by O'Reilly et al. 2008 and Blanton et al. 2010 agree with the current findings. Lack of safe water supply and inadequate sanitation facilities in schools is associated with the risk of gastrointestinal and communicable infections (Jewkes & O'Connor 1990, Fujiwara-Pichler et al. 2006; Perez, 2010). Poor or lack of adequate water supply in schools can result in toilet floors being covered with urine. The availability of improved toilet facilities in the study area is relatively high, with approximately 55% using CSS toilet systems. There exists the provision of separate toilet facilities for both the male and female gender with water being the major handwashing material. A careful analysis shows that LASU recorded the highest percentage in this regard. This result contradicts Egbinola & Amanambu (2015) findings where a low percentage of students using improved toilet facilities was reported.

Though there are provisions for improved toilet facilities in the study area, cleanliness is a significant challenge. Unimproved toilet systems constitute an important cause of diarrhea in developing countries (Postma et al., 2004). The high rate of respondents who gained access to water, sanitation, and waste bin disposal facilities in the study area indicates the quest for healthy living. The variations in waste disposal facilities shows that covered drum, patronage of LAWMA, and PSP predominate at YABATECH, AOCOED, and LASU, respectively. World Health Organization (2009) and Dynes et al. (2015) reported that adequate running water is a major key factor in practising proper handwashing with soap. Handwashing with soap, water treatment, and appropriate disposal, among others, also help to reduce the risk of diarrhea from 17% to 48% and reduce eye infections (conjunctivitis and trachoma) (Cairncross et al., 2010; Gebreyesus & Adem, 2018; Ginja et al., 2019).

The current study is in tandem with Parkinson et al. (2018), who noted that virtually all schools lack soap for handwashing in Malawi. Similar findings have been reported by Scott and Vanick (2007), Lopez-Quintero et al. (2009), who noted that schools with scarce supplies for hand washing, such as water and soap, recorded low hand washing. These findings were corroborated by Lundblad & Hellstrom (2005), where 31% of the respondents indicated they did not wash their hands due to a lack of handwashing materials. The findings support the argument that there is a link between handwashing services and handwashing behaviour in school environments. A similar study by Hughes et al. (2004) noted that increased access to water and soap for handwashing reduces the risk of helminthic infections among schoolchildren. In addition, studies have shown that schools with better hygienic conditions have fewer problems with disease-causing organisms UNICEF (2008). Though the provision of waste disposal bins is relatively fair, unconventional waste disposal methods that predominate in YABATECH for example can result in unhygienic and poor sanitation conditions (Samwel & Gabizon 2009).

Adequate and efficient provision of WaSH amenities in the school environment has been linked to reducing the spread of infectious diseases in the school environment. It is also one of the strategies for minimising the burden of infectious disease among students. The post-hoc test confirmation clearly shows the deplorable conditions of accessibility, adequacy, and quality satisfaction of WaSH facilities considering the significant difference between YABATECH and the other two institutions (AOCOED and LASU) in the study area. Based on the ANOVA result there is a significant difference between the mean scores of the dependent variables (accessibility, adequacy, and quality satisfaction of WaSH facilities) across the three institutions. This is supported by the post-hoc confirmatory tests at  $p < 0.05$  level. This result implies that AOCOED and LASU have similar WaSH satisfaction levels compared to YABATECH, with the worst attributes based on service satisfaction of accessibility, adequacy, and quality satisfaction of WaSH facilities.

This result agrees with the previous study by McMichael (2019), who reported inadequacy of WaSH facilities in schools in low-income countries with significant impacts on health and school attendance. A similar study by UNICEF (2012) also revealed that only 51% and 45% of schools in low-income countries have access to adequate water facilities and sanitation. Similarly, Ohwo & Agusomu (2018) opined that 80% of illnesses in developing countries are linked to inadequate availability and accessibility to WASH facilities and practices. Inadequate access to WaSH services and poor water

quality have been linked with the health and socio-economic challenges of the human population and could result in death (WHO, 2013).

### **Conclusion**

The present study examined water, sanitation and hygiene in tertiary institutions in parts of Lagos metropolis. The study revealed that the main water supply is a borehole, with less than one-quarter having access to public piped-borne water. The majority of the respondents gained access to water, sanitation, and waste bin facilities, while access to hand washing facilities was generally low. The status of WaSH facilities in the area indicates that YABATECH have the highest number of nonfunctional WaSH amenities. The variations in waste disposal facilities shows that covered drum, patronage of LAWMA, and PSP predominate at YABATECH, AOCOED, and LASU, respectively. The assessment of WaSH service satisfaction shows that about one-quarter and below one-quarter rated it difficult and not accessible, respectively. While less than one-quarter rated it inadequate. Approximately one-quarter and half of the respondents rated it fairly satisfactory and not satisfactory, based on WaSH facility adequacy and quality respectively.

The One-way ANOVA shows that there is a significant difference between YABATECH and the other two institutions (AOCOED and LASU) based on WaSH service satisfaction. The study concluded that AOCOED and LASU have similar WaSH satisfaction rating compared to YABATECH, with the worst attributes. The study provides baseline information on WaSH status for effective planning and management by policymakers in Nigerian public tertiary institutions. The study also offers informed decisions for prioritisation of critical WaSH needs for enhanced healthy school environment and optimum academic performance. The study recommended adequate safe water supply and hand washing materials with a greater priority at YABATECH due to its poor WaSH facility status.

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