



## **Evaluation of Household Water, Sanitation, and Hygiene Management in a Nigerian Rural Community**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author OZW designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors DBO and OA managed the analyses of the study and wrote the protocol. Authors FTM and IA managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The Water, Sanitation, and Hygiene (WASH) disparities between the rural and urban areas have hindered the Sustainable Development Goal 6. Recent data is required in our bid to tackle this menace effectively. This study aimed to provide data on the status of household WASH facilities in a remote village in Southwestern Nigeria. The survey was cross-sectional in design, and total sampling was used to select 70 household respondents. Data were obtained via observational checklists, questionnaire, and key informant interview guide. Data was entered and analyzed using SPSS 20. Descriptive statistics like measures of frequency and proportions were used. The respondents had a mean age of  $43.1 \pm 16.4$  years, only 2.9% had tertiary education. The village had two handpump boreholes provided by the Water Supply and Sanitation Sector Reform Programme (WSSSRP)-II. All the respondents reported that the boreholes were their primary

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drinking water source, and water was available all through the year. In over 80% of households, females were assigned the duty to fetch water, while most households had the boreholes within 30 minutes from their houses. The sanitation facilities were also provided via the WSSSRP-II. The majority (90%) of the respondents owned pit latrine with slab, of which only 10% shared their facilities with other households. Most (95.7%) of the respondents still practised open defecation at instances they could not access their household latrines. All the toilets had water for handwashing, and the soap commonly used by community members was palm kernel ash. The condition of water and sanitation in the village was quite progressive. However, subsequent interventions should ensure toilet facilities are available in non-household settings like farms and markets.

*Keywords: Sustainable development goal 6; water; sanitation and hygiene; water supply.*

## 1. INTRODUCTION

Sustainable Development Goal (SDG) 6 aims to 'Ensure availability and sustainable management of water and sanitation for all' and comprises WASH-related indicators such as population-open defecation practice and household accessibility to basic WASH services. So far, the achievement of this global goal has been marred with disparities. As of 2017, it was estimated that 758 million people were without access to safely managed drinking water services. Around 3.5 billion people lacked access to safely managed sanitation services, while 3 billion people had no access to essential handwash services at home [1].

The disparities between low-income and high-income countries and between urban and rural regions have been clearly revealed. Based on a WASH Watch report [2] in 2017, around 94% of the population in Northern America and Europe had access to safely managed drinking water. Only around 24% of the population in Sub-Saharan Africa (SSA) had such access. The SSA region has been estimated to have the highest number of people without access to safe water [3]. Furthermore, a report by the United Nations Children's Fund and World Health Organization (WHO) revealed that nine from every ten persons that lacked access to basic water services resided in rural areas. Also, nine out of every ten open defecators resided in the rural area [1].

Narrowing the situation to Nigeria, the situation seems despicable. In September 2018, the Nigeria Government declared Emergency in the WASH sector due to the deplorable state of her Water, Sanitation, and Hygiene services. The relatively poor progress the country has made can be seen from the fact that only 27% of the Nigerian population used improved drinking water sources and sanitation facilities, while 23.5% of her citizens practised open defecation, making Nigeria the global capital of open

defecation [4-6]. Around 64,000 under-5 children in Nigeria have been estimated to die yearly due to the lack of access to safe water, sanitation, and poor hygiene practices [7]. The vulnerable groups have also been identified as those living in low-income and rural areas [8]. Studies recently conducted among rural schools in Southwestern Nigeria reported a paucity of WASH facilities. Only 15% of the available school sanitation facilities provided basic sanitation service, while none of the hand wash facilities provided basic hygiene service. Also, the open defecation rate among students in the community was over 35%, while only 10% of the schools were open defecation free [9,10]. Another study that assessed WASH facilities in 5 communities in Northern Nigeria reported that over half of the respondents' major drinking water source was surface water, while over 75% used pit latrines. The open defecation rate in the communities was estimated to be around 41% [11]. Furthermore, an exploratory survey recently conducted to assess WASH inequalities in Sub-Saharan Africa revealed that the disparities between rural and urban communities in the region are still widespread, thereby impeding the ability of the region to attain the related SDGs [12].

When considering the progression in global WASH from 2000 to 2017, rapid improvement had been recorded. The global urban coverage of basic water services increased from 95% to 97%, while that of the rural areas increased from 69% to 81%. The global rate of open defecation dropped from 21% to 9%, shifting from 1.3 billion people to 673 million people [1]. However, the WASH situation in the world's largest black nation, Nigeria, seems to be peculiar. A recent report by the World Bank revealed that the country is significantly lagging in the WASH sector, and recommended proactive measures should be taken to ensure rural areas have access to basic WASH facilities [13].

Hence, this study was conducted to assess the state of WASH services in a distant rural community in Southwestern Nigeria to provide recent and relevant data about the potential WASH inadequacies and inequalities in some areas today.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The survey was conducted in Abimbola, a rural village located in Ayedaade Local Government Area, Osun State. It has an area of 1,113 km<sup>2</sup> and a population of 150,392 at the last Nigerian census. It is located at coordinate 7°19'N°21'E 4. The Local Government Area (LGA) shares its boundaries with Isokan, Irewole, and Aiyedire LGA to the East and Ife North to the West. It consists of over 50 districts and villages, including Abimbola. Abimbola village is an agrarian community; prominently known to produce palm oil. There are about 500 villagers and around 70 households in the area.

### 2.2 Study Design and Sampling Procedure

The study was cross-sectional in design. The study population consisted of members of the Abimbola rural village. Purposive sampling was used to select a household member from each of the household presents. A total of 70 respondents were selected.

### 2.3 Inclusion Criteria

1. The respondents selected were not less than 15 years
2. The respondent must be a member of a household in the community
3. The respondents must have lived in the community for at least 1 year

### 2.4 Exclusion Criteria

1. Respondents less than 18 years, whose parents did not permit to participate were excluded.
2. Community members that were not permanent residents in the village were exempted.

### 2.5 Data Collection Procedure

An instrument for data collection

1. Observational Checklist: This was used to assess the status of WASH facilities

available to the households in the community.

2. Interviewer administered questionnaire: This was used to collect data about the management of the WASH services accessible to the villagers. One household member was selected from each home. The questionnaire was divided into four sections: A. Socio-demographic Characteristics B. Household Water Supply Management C. Household Sanitation Management D. Hand Hygiene Practices
3. Key Informant Interview: This was used to collect information pertaining to the Government's involvement in the Local Government's WASH sector. The LGA Sanitary Inspector Officer was engaged in the interview. Due to the possibility of a response bias, data obtained from the other instruments was used to verify some of the inspector's information.

### 2.6 Community Entry

A United Kingdom registered humanitarian NGO: Livingstone Explorer Initiative conducted a health outreach in the distant community. Resource persons in the NGO had met with the community leaders and other key members to inform them about the survey. The community members welcomed the research team warmly as they were aware that such research would help maintain and improve their health and put their distant community in the global atmosphere.

### 2.7 Data Collection

An interviewer-administered questionnaire was administered to 70 community members, each from a different household within the village. The researcher assistants or fellow villagers did not coerce the respondents into filling the questionnaire. The researcher assistants ensured the entire questionnaire was adequately and correctly filled. The observational checklist was also used to assess the status of the WASH facilities available to the villagers.

### 2.8 Data management and Analysis

There was a 100% response rate. The data were properly cleaned for inconsistencies, then entered into SPSS version 20. The files were safely kept ensuring the confidentiality of data. Only descriptive statistics were used for analysis since total sampling was used, and only little

variations existed between the responses. Descriptive statistics were used to determine the measures of frequencies and proportions of WASH facilities, while graphs and charts were used to reveal the different types of services provided by the facilities. The WASH facilities available were classified based on the JMP ladders into safely managed basic, limited, and no service.

### 3. RESULTS

#### 3.1 Sociodemographic Characteristics

The mean age of the respondents was 43.1 ± 16.4; details of their sociodemographic characteristics can be found in Table 1.

#### 3.2 Status of Water Facilities

The village had two handpump boreholes within their vicinity. These boreholes were near all the households within the village. The boreholes were constructed by collaboration between the Government of Nigeria, the European Union, and UNICEF under the Water Supply and Sanitation Sector Reform Programme (WSSSRP)-II. This was boldly displayed on a billboard behind the

pumps. The boreholes were in functional condition and were in use during the survey. An electricity pump borehole was also present in the village, another organization constructed this. However, this facility was not functional during the survey as the community had limited access to power. Pictures of the boreholes can be seen in Plate 1.

#### 3.3 Status of Sanitation Facilities

A majority (90%) of the households had pit latrines as their toilet facilities, while the remaining 10% had no facility available at the time due to the unavailability of funds. The sanitation facilities owned by all the households were similar. They were all located outside their homes but nearby. They were all built with materials like wood, palm front, and roofing sheets. All the facilities were without a covering (roof), and privacy could not be guaranteed as the structures were in the open and with a height of less than 2 meters. All the facilities visited had water available. However, during community surveillance, it was observed that there were no toilets in the farms and palm oil processing centres. Pictures of some of the facilities are shown in Plates 2 and 3.

**Table 1. Sociodemographic characteristics of respondents**

<b>Characteristics</b>	<b>Frequency (N=70)</b>	<b>Percentage (%)</b>
<b>Gender of respondent</b>		
Male	24	34
Female	46	66
<b>Age of Respondent</b>		
15 years to 35 years	23	33
36 years to 55 years	29	41
56 years to 75 years	18	26
<b>Marital Status</b>		
Married	57	81
Single	13	19
<b>Level of Education</b>		
No Formal Education	16	23
Primary Education	11	16
Secondary Education	41	59
Tertiary Education	2	3
<b>Ethnic Group</b>		
Yoruba	66	95
Igbo	3	4
Hausa	1	1
<b>Religion</b>		
Christianity	42	60
Islam	28	40
<b>Occupation</b>		
Farmer	27	39
Trader (farm produce)	29	41
Civil servant, lumber, self-employed	14	20



Plate 1. Handpump boreholes within the village



Plate 2. Exterior (A) and interior (B) of wooden frame pit latrine

The Sanitation Inspector for the Local Government shed more light on the water and sanitation project. Here were some of his comments:

Question (Q): When did the water and toilet projects start?

Response (R): *“about 8 years ago (2011) as they (Government and donor agencies) made*

*2 to 3 manual borehole facilities available in each community and ensured that a household is entitled to one toilet facility which is the covered pit latrine across the thirteen (13) villages in the Local Government. Representatives from the agencies and ministry of the environment from the State come around for inspection and maintenance.”*

Q: How often do they come for inspection?

R: **“Once in a month for inspection and health education.”**

Q: Did the agencies sponsor the building of all toilet facilities?

R: **“every household dug the toilet pits but the agencies helped to seal and cover it as supposed.”**

### 3.4 Status of Handwash Facilities

There were no conventional handwash stations present in any of the households. The conventional handwash containers present were kettle and open buckets. The soap commonly owned by community members was palm kernel ash, a byproduct of one of their significant farming activities. Plate 4 shows of palm kernel ash byproducts at a palm oil processing plant within the village.



Plate 3. Pit latrines built with thatched leaves (C) and roofing sheet (D) frames



Plate 4. Palm kernel ash being processed for further use

### 3.5 Water Supply Management

All the respondents reported that their main source of drinking water was the community boreholes; they all also affirmed that water from the borehole is available all through the year. Details of the respondents' responses can be found in Table 2. The Local Government Sanitary Inspector corroborated the respondents' collective responses about the conditions of the water provided. Here are his responses when asked the following relevant questions:

Q: What was the source of water in the villages before the intervention of the water scheme?

R: ***“we use the river and rain harvesting which we do not use again since the availability of the facilities.”***

Q: Have there been times when there was no water from the pump?

R: ***“No, water is always available both in rainy and dry season except when the pump is faulty.”***

Q: How often does the water pump have issues and how soon do you get a response to fix it from those concerned?

R: ***“The water pumps do not really have issues frequently, but when we make a***

***complaint, they come around to fix it in about three days after we reach them.”***

Q: Have there been any outbreaks or prevalence of any water-borne disease?

R: ***“Not recently. There was an outbreak of guinea worm infections and Cholera sometimes ago but that was before the water facilities were made available.”***

Q: Like how many years ago?

R: ***“About 16 years ago. Since the intervention, when we observe any abnormalities in the physical status of the water like colour, odour, insects in the water, we send a notice to the agencies as they come around to treat the water.”***

Q: How often do they come around?

R: ***“Monthly as a treat with chlorine powder and other things.”***

Q: Is it the same set of people that come for water management inspection that does toilet sanitary and hygiene inspection?

R: ***“No. For water inspection, representatives come from the state once in a month as they check the facilities. They service and repair the pumps when necessary as they also make available their phone numbers if we have any complaint afterwards.”***

Table 2. Water Supply Management

Variables	Frequency (N=70)	Proportion (%)
<b>Main Source of Drinking Water</b>		
Borehole	70	100
<b>Availability of Water all through the year</b>		
Yes	70	100
<b>Distance to a water source</b>		
Less than 30 minutes	69	99
Over 30 minutes	1	1
<b>Storage of Drinking Water</b>		
Plastic Container	46	66
Clay Pot	24	34
<b>Personnel-in-charge of Fetching Water</b>		
Father	1	1
Mother	44	63
Female Child Under-18	14	20
Young Adult	11	16
<b>Treatment of Drinking Water</b>		
Chlorination	69	99
No Treatment	1	1
<b>Experience of Waterborne Disease within Family</b>		
Yes	1	1
No	69	99

### 3.6 Household Sanitation Management

Table 3 consists of the respondents' responses about their household sanitation management.

The Sanitation Inspector was also asked about their role in ensuring adherence; here are the relevant questions and responses given-

Q: Do you observe routine sanitation inspection?

R: ***"Yes. We do environmental sanitation weekly on Wednesdays for the market and last Saturdays of the month we do generally for households in the communities."***

Q: Do the sanitation inspectors emphasize handwash?

R: ***"Yes. They teach the villagers in the communities by demonstrating how to hand wash is properly done, emphasizing that each***

***toilet should have soap available as they inspect."***

### 3.7 Respondents' Handwash Practice

All (100%) the respondents reported that they washed their hands after using the toilet, while 99% affirmed that they practice handwashing before eating. A majority (97%) reported using soap and water to wash their hands. The two reasons outlined by some respondents for skipping handwashing were the absence of handwash stations at home (1%) and the feeling that handwashing is not an important activity (9%). The Sanitary Inspector was also asked about handwashing, here is the conversation:

Q: Were the villagers taught how to engage "hand wash" and how often do you observe health education?

R: ***"Yes (they are taught), (health education is observed) on a monthly basis."***

**Table 3. Respondents' household sanitation management**

<b>Variable</b>	<b>Frequency (N=70)</b>	<b>Proportion (%)</b>
<b>Type of Toilet Facility</b>		
Pit Latrine (with slab)	63	90
Bucket Latrine	6	9
None	1	1
<b>Condition of Toilet Facility</b>		
Shared with other households	7	10
Not Shared	63	90
<b>Personnel in charge of cleaning a toilet</b>		
Mother	32	46
Young Adult	38	54
<b>How often toilets are cleaned</b>		
Daily	52	74
At least once weekly	15	22
Once in a while	3	4
<b>Availability of water in the toilet</b>		
Yes, Always available	70	100
<b>Is the toilet comfortable to use</b>		
Yes, it is	55	79
No, it is not due to offensive odour	15	21
<b>Defecate in other places besides the facility at home?</b>		
Yes, I do	67	96
No, I do not	3	4
<b>If yes, where do you defecate (N=67)</b>		
Bush	67	100
<b>Injury/attack during open defecation practice</b>		
Scorpion bite	1	2
Wounds due to sharps in the bush	2	3.0



## 4. DISCUSSION

### 4.1 Sociodemographic Characteristics

The rustic nature of the village could be easily inferred from some of their sociodemographic characteristics. Only 2.9% of the respondents had attained tertiary education, and their major occupations were farming (38.6%), and trading of farm produce (41.4%). These statistics are like those obtained in some other surveys conducted in rural areas [14,15].

### 4.2 Water, Sanitation and Hygiene Management in Abimbola Village

The Government of Nigeria, the European Union, and UNICEF's collaboration to ensure that villages in the Local Government had access to improved water and sanitation facilities is quite commendable. The strategy employed by the agencies is also worthwhile. The provision of manual handpumps as opposed to electricity-powered boreholes with elaborate piping systems ensured that the villagers had constant access to a water supply. This is indeed a much more sustainable means of ensuring rural communities with zero or limited to electricity could have access to water all year round. Another survey that assessed the quality of the water supplied by the handpumps in the study location revealed that based on the drinking water parameters assessed, the water was safe for drinking [16]. The technical know-how and resources required to maintain an electric borehole pump and the pipe networks cannot be compared to that of a handpump [17]. The presence of resource persons within the LGA to carry out maintenance activities on the handpumps also ensured the facilities were long-lasting. Results from a rural water survey in Swaziland also affirmed that the imposition of facilities that required a level of technical know-how beyond the rural dwellers' capacity. The unavailability of spare parts was a key factor contributing to why many rural water supply schemes were not sustainable [18].

Examining other rural water supply studies in Nigeria, the situation in Abimbola village was better. Among rural communities in Ibadan, the most accessible water source reported was surface water [19]. A study by Okafor and Nwude examining the water supply of communities in Akwa Ibom State, Nigeria, revealed that the motorized pump boreholes provided by the State

Government in Ibaka community were not functional due to erratic power supply and poor maintenance. The locals were left with no choice but to depend on privately owned boreholes and a stream [20]. Another study examining the progress of the Oyo State Rural Water and Sanitation (WATSAN) Project revealed that a major challenge with the boreholes provided for rural areas in Oyo State was the absence of maintenance structures. It was also noted that the handpump facilities provided in one of the communities visited had lasted for close to a decade, while the motorized pump borehole provided could not even last up to a year due to poor maintenance [19]. Rural areas are typically known to lack basic infrastructures like good road networks, basic healthcare facilities, and power supply [15, 21]. This makes it important for future rural interventions in other communities to build locally sustainable facilities.

Furthermore, the nearness of the water sources to the villager's houses was also praiseworthy. A review paper by Ishaku reported that 70% of rural households in Nigeria were without access to improved water supply and that this fraction depended on unimproved sources like streams and water ponds. The same review also reported that the majority of the women and children in these affected communities walked for over 3 km to obtain water for domestic purposes [22]. Another review on rural WASH in Sun-Saharan Africa in 1999 reported that the average amount of time expended on fetching water was 134 minutes/day, and the average amount of water available for use was 10 L/person/day [23]. However, in recent times notable progress has been made in increasing the accessibility of rural areas in Sub-Saharan Africa to WASH facilities. The African Developmental Bank Group has attributed a significant part of this progress to increased investment by Governments and donor organization, as observed in the study location [24].

The partnership between the organizations and the villagers in ensuring each household had access to improved sanitation facilities was also astounding. This relieved the pressure on the villagers, who would have probably found it difficult to construct concrete pit latrine slabs and seal the pits appropriately. The construction of sanitation facilities with readily available materials like wood and palm fronts makes maintenance less of a burden. However, there could be challenges accessing the facilities accessed while it rains or at night. The simple pit

latrine has been classified as the cheapest form of improved sanitation [25]. The majority (90%) of the villagers had toilet facilities (pit latrine) which doubled the 45% accounted in a study by Umegbolu et al. for some communities in Enugu State, southeastern Nigeria [26]. Another study by Nwocha et al., in the same State reported that 62.5% of rural dwellers used pit latrine toilers, 19.4% used poor flush toilets, while the remainder disposed of their feces in the open [22]. Another survey conducted in oil-producing communities in Bayelsa State reported that 45% of the dwellers used pour-flush toilets, 4% used VIP latrines, while 52% practiced forms of open defecation [27].

Moreover, the availability of improved sources of water supply, improved sanitation at home, and routine sanitation and hygiene talks by the sanitary inspector are factors that encouraged healthy sanitation and hygiene practices at home. However, most of the respondents still practised open defecation because there were no toilets on their farms and other places of work. Access to WASH services goes beyond the homes, as a reasonable amount of time is spent outside the home. The provision of basic WASH services at workplaces, hospitals, and schools is integral in meeting the SDG 6 [1, 28]. Complaints by less than a quarter of the respondents about the latrines being uncomfortable due to offensive odour have been identified as drawbacks of using pit latrines; converting such toilets to VIP latrines could make them more comfortable to use [25].

Due to the steady availability and access to water supply, 100% of the respondents in this study washed their hands after using the toilet, which was higher than the proportions reported in other rural surveys [9, 22, 27]. In addition, 97% of the respondents washed their hands with soap and water, which was also higher than reports from other rural communities [9, 20]. The use of ash from palm kernel ash as a local soap is not generally acceptable. The WHO/UNICEF JMP does not classify ash as a form of soap [1]. Some soaps are made from ash-derived alkali, which is contained in agricultural wastes like palm bunch, maize cob, and wood [29]. However, the alkali extracted from the ash is only used as one of the raw materials in soap production.

## **5. CONCLUSION AND RECOMMENDATION**

The condition of water and sanitation in the village was quite impressive. A report by the

World Bank estimated that over 50% of rural areas did not have access to improved drinking water sources and sanitation [19]. Another estimate by the Federal Government of Nigeria via the Ministry of Water Resource reported that the coverage for basic sanitation service in rural areas to be at 27% [30]. However, 90% of the households in this village had access to unshared improved sanitation, and all the community members had access to improved drinking water sources. Both the water and sanitation facilities available in the village provided at least basic service. Moreover, the donor agencies' noble assistance to provide sustainable facilities (made with locally available materials) in the form of manual handpump boreholes and pit toilets should be imbibed by other organizations. This ensures the local communities can maintain the facilities with little or no assistance long after the project. The cost of building, utilizing, and maintaining facilities like electric boreholes and pour-flush or septic latrines commonly found in urban areas is significantly higher. An upgraded traditional pit latrine has been estimated to cost less than USD 50, while three compartments of pour-flush toilets combined with urinary and washing facilities cost between USD 10,000 to USD 15,000 [31].

Furthermore, future community-based sanitation interventions should account for the availability of sanitation facilities in non-household areas like farms, worship centres, markets, and other institutions. This ensures open defecation is not practised when locals are outside their homes. Therefore, institutional leaders like religious leaders and market heads need to be consulted alongside the community leaders. Also, the use of ash as soap for handwash could be addressed by educating the villages about local ways to make soap. A more acceptable soap can be made with local materials such as ash, soft water, fat, and soap molds which are all locally available [32].

## **CONSENT**

Verbal and written consent approval was obtained from the village head and every study participant to engage the villagers in the survey. Parents of respondents gave consent under the age of 18; assent was also gotten from such individuals.

## **ETHICAL CONSIDERATION**

An ethical approval could be obtained from a review board due to the time constraint; the

research took place during a health outreach in a distant village. We only had a narrow timeframe to collect sufficient information to collect valuable data and create awareness about the current state of rural WASH in Nigeria.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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