

Spatial Heterogeneity in Open Defecation Practice in Residential Zones of Akure, Nigeria

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Abstract

Open defecation (OD) is the practice of defecating in an open environment rather than using a designated toilet. OD is a fundamental environmental and public health challenge in Nigerian societies. Present estimate revealed that out of 47 million open defecators in Nigeria, at least 1.4 million reside in Ondo State. Therefore, this paper examines the spatial disparity of open defecation practice across residential zones of Akure. The city was classified into the urban core, transition and peripheral residential zones. The 2006 Enumeration Areas (EAs) of National Population Census for Akure were used as the sampling frame. Out of these, 24 EAs were randomly selected for this study. The simple random sampling technique was used to select 15 households per EA, which amounted to 360 households across the EAs for questionnaire administration. The study found out that 34.2% of the respondents were open defecators based on latrine coverage. At full dis-aggregation, where at least a single household member engaged in open defecation practice, the proportion increased to 54.4% of the respondents. The study equally revealed that there was a spatial disparity in the practice of open defecation along residential zones in Akure. The study concludes that the proportion of open defecators in Akure is high and therefore, recommends the acceleration of Community led Total Sanitation (CLTS), Sanitation Marketing (SM), and Behaviour Change Communication (BCC) OD eradication measures. Doing so will likely contribute to the improvement in urban sanitation and health.

Keywords

Akure, Community Led Total Sanitation, Human Waste, Nigeria, Open Defecation, Spatial Disparity

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1. Introduction

The practice of open defecation has locational features and depends on the economic and social cultural inclination of residents in a distinct spatial sphere of the urban ecosystem. WHO and UNICEF described open defecation as the practice whereby people go out in the fields, bushes, forests, open water bodies, or other open spaces rather than using the toilet to defecate or disposing faeces with solid waste [1]. In this context, the spatial disparity is the variation in intensity and scale of open defecation along city development (residential) zones. In the view of Gabriel, the socio-spatial variation of the urban area may result from institutional principles of

social organization, or may be the outcome of individual or collective actions, deliberate or not [2].

Access to safe sanitation is a basic human right, yet 673 million of the global population are open defecators in 2017 [1]. This unwholesome practise of open defecation is rampant in India and Sub-Saharan Africa (where Nigeria lies) [3]. In the submission of Barnard *et al*, 37% of household members in India practise open defecation despite having a toilet in 2013 [4]. In supporting this view, WHO and UNICEF submitted that 26% of India population practice open defecation in 2017 [1]. Nigeria is not an exception, ranking second behind India in the countries practicing open defecation [5]. The latest estimate reported in Water, Sanitation, and Hygiene National Outcome

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Routine Mapping report revealed that at least 47 million Nigerians defecate openly [5].

The practice of open defecation is an age long habit that characterised our ancestors, and passed on from generations to generations. Commenting on open defecation practices in Kenya, Phylis *et al* noted that culture, poverty, level of education of the household head, lack of regulatory framework, and poor institutional support play a catalytic role in the practice of open defecation among the people [3]. In this connection, Osumanu *et al* added that household size, occupation, income, traditional norms and beliefs, and ownership of toilet facility as the determinants of open defecation practice in Ghana [6].

Open defecation portends grave environmental, health and socio-economic implications in both the urban and rural areas. Buttressing this view, Water Research Commission posited that open defecation contaminate soil and the environment when helminthic eggs and other harmful microbes are ejected into the open environment [7]. *Ipsso facto*, open defecation is an indicator of poor sanitation; hence, poor sanitation causes death and diseases [8]. In addition, open defecators are socially stigmatized people. OD heightens gender and sexual based violence against the female child because they are vulnerable to harassment such as physical assault and rape. For instance, as amplified by Nigeria Federal Ministry of Water Resources, a study on Lagos slums shows that one quarter of open defecators who were women experienced harassment such as rape, violence and assault in the previous 12 months [9]. The erosion of human dignity, poverty, and malnutrition are associated with the practice of open defecation [6].

Similarly, human excreta has been associated with the spread of many infectious diseases, including diarrhoea, cholera, typhoid, infectious hepatitis, polio, cryptosporidiosis, schistosomiasis, trachoma and ascariasis [10]. In this connection, it is worrisome that human excreta in the environment is a byproduct of open defecation. Furthermore, open defecation increases the chance of contacting sanitation related diseases such as diarrhoea. It is heartsick that diarrhoea is a major killer of children under five years (U5) in Nigeria. For instance, diarrhoea was responsible for 74,785 under five years old deaths in Nigeria in 2016 [11]. As of September 9, 2018, Cholera was responsible for 517 deaths in Nigeria [12]. Ayadi reported that following Malaria, Diarrhoea and Typhoid were dominant diseases in the core of Akure, Nigeria [13]. The spread of these diseases through faecal oral route has connection with the incidence of open defecation and drinking unsafe water. Given WHO and UNICEF noted that 15% and 7% of the Nigeria population use unimproved and surface water sources respectively in 2017 [1]. Together with an alarming open defecation rate, it

is clear why diarrhoea and other water and sanitation diseases are prevalent in Nigerian societies.

Excretion of human body metabolism is involuntary activity that could not be denied, when inadequate toilet facilities exist, people have no choice than to defecate in the open space. However, the inadequate access to adequate sanitation has been reported as the principal cause of a high proportion of open defecators in Akure [14]. It is quite worrisome that 37% of Nigerian children are stunted, 19% are severely stunted, 7% are wasted, 2% are severely wasted, 23% are underweight, and 8% are severely underweight as contained in Nigeria Demographic and Health Survey 2018 report [15]. These anthropometric indices are indicators of malnutrition in Nigerian children. There is a consensus that malnutrition burdens in children, especially U5 are in part attributed to the unhygienic environment where they grow up [9]. In this connection, open defecation is a principal contributor to unhygienic environment. Open defecation causes worm infestation, which plays a catalytic role in iron deficiency anaemia in adolescent girls and young mothers [9]. Regrettably, the burden that accompanies worm infestation is mostly borne by the children. It is saddening that one in every five Nigerian children dies before the first year birthday, and one in every eight dies before the fifth year birthday [9].

Access to adequate finance is vital to ending open defecation in 2025 as targeted by Nigerian government, but financial incapability from both the government and the governed are banes to recording success in ending open defecation. For example, Nigeria needs an estimated \$2.7 billion to end open defecation by 2025, which government is expected to provide 25% of the fund, and 75% will be incurred by the households [16]. The government at the state and federal levels are working at a snail's rate, as the funding does not match the actions. World Bank water and sanitation program report estimates that open defecation cost the Nigerian government US\$1 billion a year [17]. Nevertheless, the good news is that there is a huge market for sanitation products in Nigeria. Federal Ministry of Water Resources estimates that if 46 million open defecators in Nigeria in 2015 opt for a toilet facility, it will amount to a conservative estimate of ₦1250 billion which is equivalent to over US\$8 billion [9]. If this statistic is applied to the present (2020) estimate of 47 million open defecators in Nigeria, sanitation market potential will rise to over ₦1 trillion.

There are anti-urban interventions, in open defecation particularly in Nigeria since stakeholders see it as a rural inclined problem. However, literature admits that significant deleterious health implications accompany open defecation in areas with high population density [6]. Nigeria Federal Ministry of Water Resources reported that 11.6% of the Nigeria urban population practice open defecation [16].

Buttressing this, Rotowa and Olamiju revealed that 23.2% of Akure population defecates, openly in 2014 [14]. Therefore, it is clear that open defecation is also a critical urban challenge. This paper would in no doubt serve as a veritable document to city administrators in aiding policy formulation, as ending open defecation has become a top priority in Ondo State's government agenda. This was demonstrated when the governor banned open defecation in the state and created a steering committee to create a working mechanism to end open defecation in the state in 2025 [18].

Nonetheless, out of 47 million Nigerians that defecate openly, 1.4 million reside in Ondo State (Akure is the capital city of Ondo State) [18]. Research interventions on adequate sanitation in Nigeria have been limited, even when the matter has become a national challenge. Literature shows that there is a dearth of academic input on the spatial dimension of open defecation practice in Akure, the study area. The concerted efforts of the present government (National and State) to stem the tide of OD and its practice is the thrust of this paper. This is to unravel the variations in open defecation practice along residential zones of Akure city, and present solutions for the present and future. In this connection, this research provides an empirical answer to the following questions: What is the proportion of open defecators in Akure; the social economic attributes of Akure residents in relation to sanitation in general and open defecation specifically; and lastly; is there any spatial disparity in the practice of open defecation along the residential zones of Akure?

2. Conceptual Considerations

This paper adopts the Community Led Total Sanitation (CLTS) as the relevant concept of this study. This is because it is an effective community driven initiative to exterminate open defecation as supported by [19]. A study from WaterAid India made notable strictures on Total Sanitation Campaign (TSC), which began in 1999, as a vague, impracticable idea and frivolous innovation because it is subsidy driven approach with high standards [20]. The feebleness of TSC and other top down sanitation planning approaches led to a paradigm shift, which entails an integrated approach to sanitation planning. Viewing from this perspective, one of the community-based approaches that emerged is the CLTS. Literature posits that Kamar Kar started CLTS in Mosmoi village, Bangladesh in 2000 [21]. While evaluating a subsidy based sanitation programme, he persuaded local NGOs and informal institutions to depart from top down approach in latrine construction that incentivise subsidy to a bottom up participatory approach [22]. He achieved this by advocating for institutional reform and collective individual engagement to enhance decision making on eradication of open

defecation [22].

As amplified by Mara, Menon emphasise the need to adopt community driven approach to eradicate open defecation [23, 24]. On this note, Institute of Development Studies describes the CLTS as a methodological action packed process aimed at extirpating open defecation by mobilising communities [25]. CLTS proposes that sanitation problems should be solved in the community domain by community members using local solutions that are peculiar to them. In the discourse of CLTS, communities are aided by independent facilitators to carry out an open defecation assessment and take pragmatic actions to become open-defecation free (ODF) [23]. CLTS does not support any particular sanitation facility, technology, system or solution, rather it creates sparks in changing sanitation behaviour towards eradication of OD [23]. Importantly, CLTS focuses on animating a change in community sanitation behaviour rather than latrine construction for individual households [21].

A well premeditated, planned and implemented CLTS has significant potential to ameliorate the practice of open defecation to <1% of the population or complete eradication. Its success story include plummeting OD in Bangladesh from 40% in 1990 to 18% in 2000 to less than 1% in 2017 [1]. In Nigeria, CLTS was adopted as far back as 2005, and continue to be in the mainstream of sanitation policies and programmes in Nigeria. The success story in Nigeria includes 9728 communities declared as ODF and 3276 communities certified as ODF, with the country, intensively pursuing the LGA wide approach of CLTS [9].

At the outset of CLTS initiation, it was conceptualised to lessen open defecation fiasco in the rural landscape, but recently, its applicability has been extended to the urban panorama [22]. Chambers highlights that the first publicised case of CLTS application in urban areas was in Kalyani, an urban slum in North Kolkata, India [26]. He stressed that this municipal attained ODF conditions without subsidies through remarkable political involvement that stimulate collective actions of the people. In addition, Kilifi in Kenya with Panipat District in Haryana is urban areas where CLTS has been applied with significant success [27].

There are four broad steps involved in triggering CLTS that were adumbrated by as pre-triggering, triggering, post triggering, and scaling up [21]. CLTS is well established in Akure but its ongoing implementation requires ferocious acceleration through potent facilitation. The combined activities of post triggering and scaling up will undoubtedly eradicate open defecation to some extent and improve urban sanitation significantly in Akure Nigeria. Robust policies to allow the scale up of CLTS to communities/neighbourhoods in the city where CLTS is absent will remarkably contribute

towards the achievement of ODF communities and the open defecation target in sustainable development goals by 2030.

3. Materials and Methods

3.1. Research Locale

The study area is Akure, the political and commercial capital of Ondo State, South West geopolitical region of Nigeria. Just like other cities in Yoruba land, Akure grew from small settlements such as Isolo and Isinkan among others. Akure became the provincial headquarter of the Ondo province in 1939 [28]. On February 3, 1976, Akure was made the capital of the newly created Ondo State of Nigeria and the headquarters of Akure South Local Government Area [29]. Consequently, it led to the heterogeneous agglomeration of people from rural hinterlands. Macmillan reported that Akure lies between 60 95’N and 7 15’N of the equator and longitude 5 15’E and 5 40’E of the Greenwich Meridian [30]. Akure locates approximately 420 kilometres South West of Abuja, the Federal Capital of Nigeria and about 350 kilometres to Lagos the former capital and commercial hub of Nigeria [31]. From the 2006 population of 360,268, Akure has present (2020) population estimate of 673,808 using a population growth rate of 3.18% [32].

The research locale comprises three residential zones viz.

The core, the transition and the periphery [33]. The three residential zones were used in this study. The elitist residential estates are domiciled in the periphery, accordingly; wealthier families reside in the periphery. The plot size is the largest and most spacious, and this part of the city is expected to enjoy more improved sanitation [33]. The transition zone lies between the core and the periphery, and the sanitation infrastructure and practices are expected to be a mixture of what operates in the two other zones.

Meanwhile, the core is the oldest part of the city and largely inhabited by the low-income earners [34]. The same source stressed that the core is characterised with high-density population and poor sanitation. Akure covers an aerial extent of about 340 km² [35]. These authors added that Akure is located on a gently undulating terrain surrounded by isolated hills and inselbergs. River Ala and its tributaries drain Akure. Ajibefun posited that the soil is made up of ferruginous tropical soils [36]. It is the most urbanised city in Ondo State, and the administrative seat of the State. Through the effluxion of time, the city’s morphology has changed to its present status with its attendant housing and environmental problems, which include poor sanitation [33]. Akure in its national, regional, and local settings is graphically illustrated in Figures 1 and 2; while, Figure 3 shows the three residential zones in Akure.

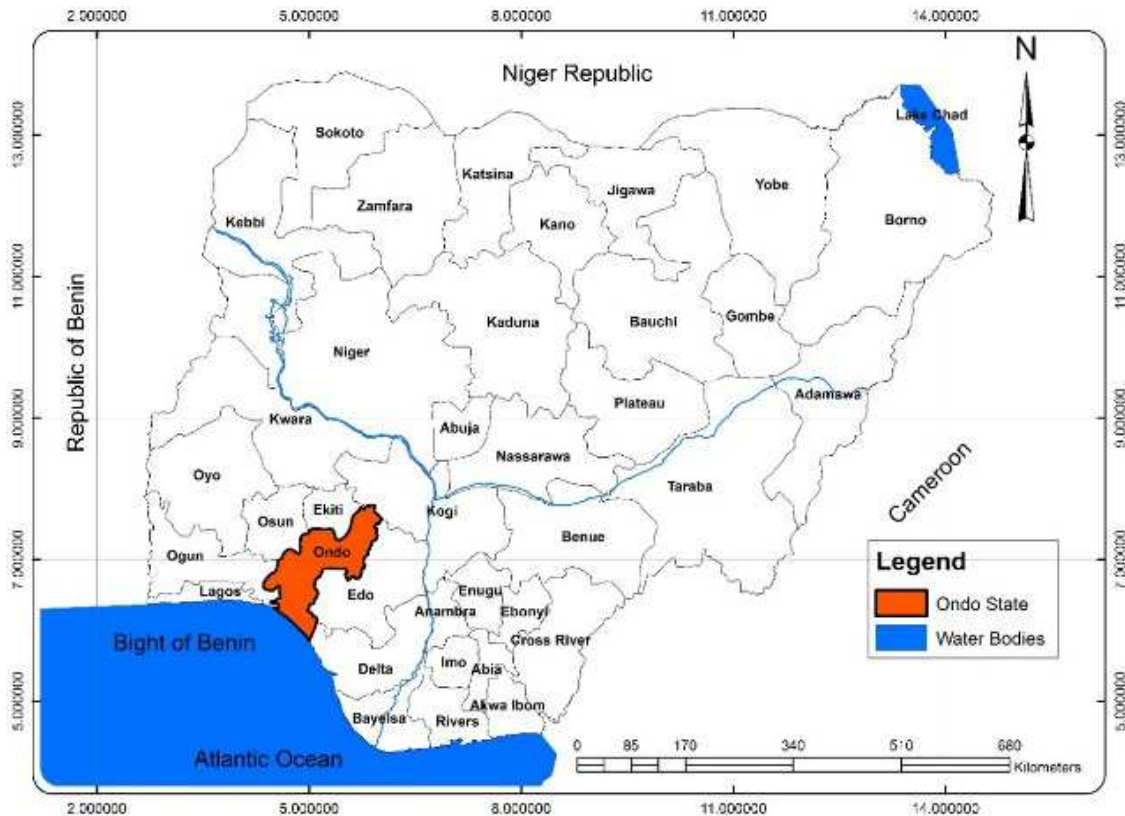


Figure 1. Ondo State in the National setting.

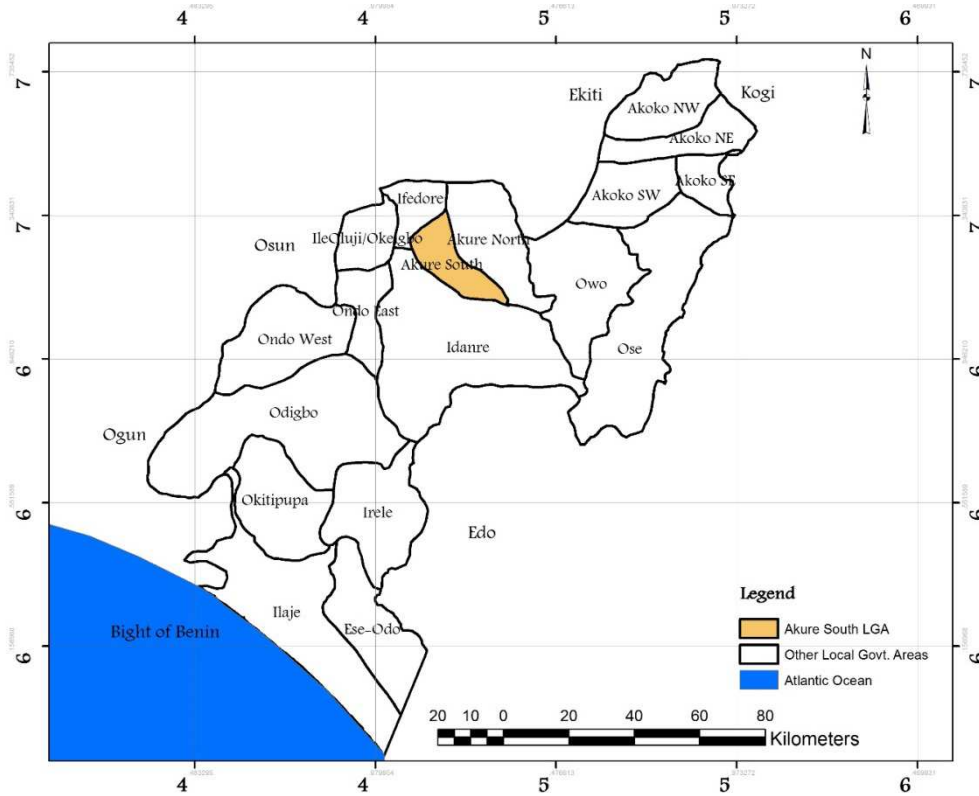


Figure 2. Akure South Local Government Area.

Source: Ministry of Physical Planning and Urban Development, 2019

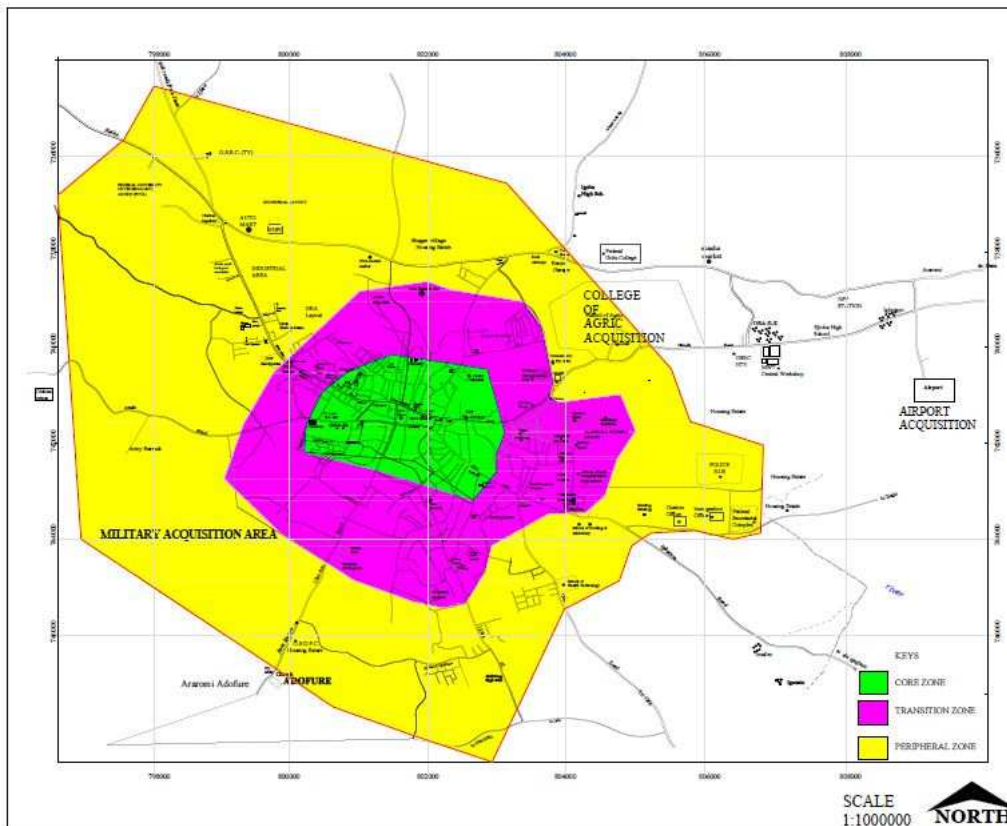


Figure 3. The residential zones.

Source: Amodu, 2020

3.2. Research Methodology

Survey research method was employed in this study. The 2006 base population of Akure is 360,268, which was used to determine the research population as 673,808 in 2020 through population projection using a growth rate of 3.18% as supported by [32, 31]. Data analysed were collected from primary source (household). The city was classified into urban core, transition and periphery residential zones (see Figure 3). The 2006 Enumeration Areas (EAs) of National Population Census for Akure were used as the sampling frame. Out of these, 24 EAs were randomly selected for this study (Table 1). The simple random sampling technique was adopted to select 15 households per EA, which amounted to 360 households across the EAs for questionnaire administration. This sample size was considered plausible because previous studies such as latest WASHNORM survey

in Nigeria in 2018 used 15 households per EA. The demographic, health survey (DHS) (2013) used 10 households per EAs, which was a national survey that cut across all the EAs in Nigeria. Structured questionnaire and observation technique were the research instruments used in this study. Research assistants under strict supervision of the researcher administered questionnaires at evenings and weekends. Data codification and analysis were done with IBM statistical packages for social scientists (SPSS) version 26 and Microsoft Excel 2019. Data were analysed at both univariate and bivariate levels. The univariate analysis of the data is expressed in frequencies and percentages, while the bivariate analysis involved the use of Kruskal Wallis test to show variations in the practice of open defecation across the residential zones. Research findings are presented in Tables.

Table 1. Enumeration Areas.

Core Residential Zone			
	Enumeration Area	No of Household	No of Questionnaire
1	Mr Omoniyi	15	15
2	Adetuyi Bension	15	15
3	Ogungbemi	15	15
4	Alhaji Mohammed Sanni	15	15
5	Ojomu's Palace	15	15
6	Gospel Faith Mission	15	15
7	Ibukun Adesola	15	15
8	Aregbesola's House	15	15
9	Power Bible Assembly	15	15
10	Jimoh Apata's House	15	15
11	Primate Elijah's House	15	15
12	Greater Works Ministry	15	15
	Subtotal	180	180
Transition Residential Zone			
1	Albert House	15	15
2	CAC Oke Itura	15	15
3	Thomas Surgical Scientist	15	15
4	Adelewe Okunriola	15	15
5	CAC Oke Lisa HQ	15	15
6	Ijatoye Emmanuel	15	15
7	Prof. Segun Ojo	15	15
8	Allen Akomolafe's House	15	15
	Sub total	120	120
Peripheral Zone			
1	Alagbaka Primary School	15	15
2	Zion-Wesco	15	15
3	Palmrock Vintage Estate	15	15
4	Adebowale House	15	15
	Subtotal	60	60
	Total	360	360

Source: Adapted from Rotowa, 2014

4. Results and Discussion of Findings

4.1. Socio Economic Background of Households

Modi declared that the best gift to give women of this generation is to end open defecation [37]. The practice of open defecation grossly affects the women folk. Allowing women to drop their skirt in the public to defecate erode their dignity. They are at the risk of physical violence such as rape, murder. They are likely to be exposed to scorpion sting and snake bite when they wait until night to practice open defecation. In this study, 60% of respondents were male because in this part of the world, men dominate the household head structure. The responsibility of household head enthrones men to provide basic facilities to their households, which include sanitation facilities such as toilets. The dominance of men as household head has considerable potential in ameliorating the practice of OD among inhabitants of the city since men are expected to provide financial and physical supports, among other things to their households. Spatially, the male respondents were dominant across the three residential zones.

The age range of 33 years – 48 years was the dominant age group across the residential zones. This study revealed that 70.3% of the total responses fall within active and productive age group in Nigeria. This implies that ample of respondents are financially worthy to own a latrine. Paradoxically, the dominance of the economically productive age group did not translate to overwhelming latrine coverage. However, age has not been a deciding factor in the choice of sanitation facility [33]. People across all age groups tend to defecate openly depending on other externalities.

Level of education could influence the practise of open defecation. Consequently, the respondents were asked about their level of education, and about 26.9% of respondents had no formal education. Out of this 26.9%, 77.3% of respondents reside in the core. This could partly explain the high occurrence of open defecation in the core, since education is indispensable in climbing the sanitation ladder. The significant proportion of the respondents with tertiary education in both transition and the periphery may likely be the determining factor in the low level of open defecation practices in these two zones compared to the core.

The result of the marital structure of the survey participants showed that 47.8% of respondents were married. Across the

EAs, the highest proportion of respondents who lived in the core (48.3%), transition (43.3%) and periphery (55%) were married. Marriage increases the tendency of a household to own a toilet facility to meet the sanitation needs of the family. It could be argued that when a married household fails to provide toilet facilities, the family members resort to alternative ways to defecate, which include open defecation and sharing of toilet with other households. Married households prioritise the provision of basic facilities, which in most cases sanitation facility assumed a low priority as amplified by [6]. Judging from this study, married households engaged more in open defecation than other marital classes. Marriage has direct links to household size, which affects the rate of open defecation. Married households with large households tend to increase the propensity of at least a household member to defecate openly. This could partly explain the high incidence of open defecation in the core.

Trading and civil service dominated the occupational structure in the study area. On spatial variation, majority of respondents (57.8%) who reside in the core were traders, while civil service was the prevalent occupation among the residents in both the transition and periphery. Traders are often compelled to defecate openly when accessible, safe and hygienic toilet is not available. This was the reality in the core of Akure, where trading was the prevalent occupation. The poor maintenance culture of Nigerians ensured that few provided toilets in our offices and public institutions are deficient for use, thereby, promoting the use of open spaces for defecation across the various occupational characteristics.

The respondents in the core were urban poor as exemplified by 69.8% of respondents in the core who earned a maximum of ₦18000 (\$47) monthly (Table 2). This encouraged the use of open spaces for defecation since an overwhelming proportion of respondents in the core was characteristically typified by income poverty. Respondents lamented that they could not own toilet because of the cost of construction. This is supported by the findings of Augsburg and Rodriguez-Lesmes which revealed cost as a key factor hindering the use of latrine in Nigeria [38]. Overall, the highest proportion (28.3%) of respondents earned between ₦18001 - ₦36000. Together with the proportion of respondents that earned maximum of ₦18000, it implies that 45.8% of respondents earned not more than ₦36000. A figure that is slightly above the new minimum wage (₦30000) in Nigeria. As detailed in Table 2, there were spatial variations in the income distribution of the survey participants across the EAs.

Table 2. Socioeconomic attributes of respondents.

Variable	Residential Zone										
	Core (N = 180)			Transition (N = 120)			Periphery (N = 60)			Total (N = 360)	
Gender	Fr.	%*	%**	Fr.	%*	%**	Fr.	%*	%**	Fr.	%**
Female	59	46.1	38.2	49	38.3	40.8	20	15.6	33.3	128	35.6
Male	121	52.2	67.2	71	30.6	59.2	40	17.2	66.7	232	64.4
Age											
≤15 years	36	50.7	20.0	23	32.4	19.2	12	16.9	20.0	71	19.7
16 years – 32 years	19	48.7	10.6	13	33.3	10.8	7	17.9	11.7	39	10.8
33 years – 48 years	70	50.4	38.9	46	33.1	38.3	23	16.5	38.3	139	38.6
49 years – 64 years	36	48.0	20.0	27	36.0	22.5	12	16.0	20.0	75	20.8
65 years and Above	19	52.8	10.6	11	30.6	9.2	6	16.7	10.0	36	10
Education											
No Education	75	77.3	41.7	12	12.4	10	10	10.3	16.7	97	26.9
Primary	43	55.1	23.9	24	30.8	20	11	14.1	18.3	78	21.7
Secondary	41	46.6	22.8	36	40.9	30	11	12.5	18.3	88	24.4
Tertiary	21	21.6	11.7	48	49.5	40	28	28.9	46.7	97	26.9
Marital Status											
Single	52	67.5	28.9	17	22.1	14.2	8	10.4	13.3	77	21.4
Widowed	24	44.4	13.3	19	35.2	15.8	11	20.4	18.3	54	15
Divorced	8	38.1	4.4	8	38.1	6.7	5	23.8	5.3	21	5.8
Separated	9	25.0	5.0	24	66.7	20.0	3	8.3	5.0	36	10
Married	87	50.6	48.3	52	30.2	43.3	33	19.2	55.0	172	47.8
Occupation											
Retired	4	44.4	2.2	2	22.2	1.7	3	33.3	5.0	9	2.5
Trading	104	74.8	57.8	23	16.5	19.2	12	8.6	20.0	139	38.6
Artisan	18	30.0	10.0	30	50.0	25.0	12	20.0	20.0	60	16.7
Farming	20	60.6	11.1	12	36.4	10.0	1	3.0	1.7	33	9.2
Civil Service	34	28.6	18.9	53	44.5	44.2	32	26.9	53.3	119	33.0
Monthly Income											
N 0 – N18, 000	44	69.8	24.4	14	22.2	11.7	5	7.9	8.3	63	17.5
N18,001 – N36, 000	61	59.8	33.9	35	34.3	29.2	6	5.9	10	102	28.3
N36,001 – N54, 000	30	42.9	16.7	27	38.6	22.5	13	18.6	21.7	70	19.4
N54,001 – N72, 000	30	40.0	16.7	27	36.0	22.5	18	24.0	30.0	75	20.8
N72, 000 and Above	15	30.0	8.3	17	34.0	14.2	18	36.0	30.0	50	13.9

*Row percentage **Column percentage

a. Socioeconomic data were gotten during field survey from household heads (primary source of data)

Source: Field survey, 2019

4.2. Open Defecation Practices Across Residential Zones

Judging from this study, the practice of open defecation has spatial inequalities. As depicted in Table 3, 48.3% of respondents did not have toilet facilities in their homes in the core; pit latrine was prominent in the transition, and water closet was the prevalent toilet facility in the peripheral zone. The focus here is to estimate the proportion of open defecators at the household domain. Overall, 34.2% of respondents did not have toilet facilities at their house, and defecate elsewhere aside the designated toilet facility. They defecated in bushes, streams, and open fields, in polythene bags and buckets, and dumped in open fields. Put simply, over 30% of respondents were open defecators in Akure, Nigeria. This finding is greater than the percentage of open defecators in the result of the study conducted by [39]. This implies that, there is an increment in the number of open defecators in the study area. This could partly be associated with an increase in population and losses of income due to significant reduction in oil prices in 2014, which plunge the

country into recession in 2016.

The practice of open defecation across the residential zones varied significantly. The proportion of respondents that defecate openly in the core (48.3%) was significantly more than the proportion of respondents that defecate openly in the transition (13.3%). Similarly, the proportion of respondents that defecate openly in the transition significantly varied from the proportion of respondents that defecate openly in the periphery (33.3%). The high percentage recorded in the periphery could be attributed to many vacant plots in the peri urban areas, which were used for all sorts of open defecation, which include free range, cat method and the flying method. This assertion was validated by a participant in the study that was using an abandoned residential estate in palm rock area along Oda road for defecation. He said, (*I love to defecate in a free range like this where the cool breeze would touch me*). Further, empirical analysis shows that the majority (55.3%) of respondents who use a pit latrine reside in the core, an overwhelming percentage (81.8%) of respondents that use ventilated improved pit latrine dwells in the transition, and a sizeable percentage of respondents that made use of water

closet were inhabitant of the periphery. The foregoing indicates that as people reside away from the city core, they opt for better and improved toilet facility.

In this connection, the majority (70.7%) of respondents that defecate openly in Akure reside in the core of the city. The city core is where compliance with planning standards on toilet construction was remarkably low. Largely, households in this part of the city had no toilet facility installed in their houses. This compels them to practise open defecation. In most cases, residents defecate in polythene bags and throw it to any undeveloped bushy vacant plots around them. These practices have negative effects on the health configuration of the city core residents, which predispose residents to ill health and faecal related diseases. The sighting of human faeces scattered in an unorganised way reflects the extent of

open defecation in the core of Akure. The uncontrolled practice of open defecation in the core of Akure is a principal indicator of the unhealthy and filthy scenes conspicuous in the city core. Consequently, the policy makers require more robust and potent initiatives targeted at reducing open defecation to a barest minimum.

It is momentous to note that open defecation is less frequent in the transition. This could be attributed to several reasons. Residential buildings characteristically typify the transition, which accommodates mostly middle and few low-income earners. These people prioritise environmental cleanliness, were more educated and enlightened, have better income to provide toilet facilities at their homes. Rotowa *et al* added that houses in the transition have a pit latrine, a pour flush toilet or a water closet emptied to septic tank [33].

Table 3. Type of toilet facility in Akure.

Dev. Zone Toilet facility	Core			Transition			Periphery			Total	
	Fr.	%*	%**	Fr.	%*	%**	Fr.	%*	%**	Fr.	%
No toilet	87	70.7	48.3	16	13.0	13.3	20	16.3	33.3	123	34.2
Pit latrine	83	55.3	46.1	62	41.3	51.7	5	3.3	8.3	150	41.7
VIP latrine	5	15.2	2.8	27	81.8	22.5	1	3.0	1.7	33	9.2
Water closet	5	9.3	2.8	15	27.8	12.5	34	63.0	56.7	54	15.0
Total										360	100

*Row percentage **Column percentage

Source: Field survey, 2019

4.3. Open Defecation at Full Disaggregation

Determining the proportion of open defecators using latrine coverage at the household domain has its limitations; the prominent one is that open defecation is a sanitation and behavioural problem that transcend beyond the household domain to individuals. Coffey and Spears recommend the full dis-aggregation of the population in designing latrine use survey [40]. WHO and UNICEF method of estimating the proportion of open defecators in countries supported this [1]. This method covers questions from the individual domain to community domain on the type of sanitation facility used. On this note, this study moves a step further by asking questions on open defecation practice at the individual domain. The results in Table 4 indicates that 54.4% of the respondents had a household member that defecate openly or dispose excreta indiscriminately into an open environment. This could be attributed to the variations in human behaviour. It was discovered that despite some households had access to toilet facility, some members of their families still practice open defecation occasionally. This was among the people that migrate from the rural areas in this city. It was gathered that they could not deviate from the habit of defecating openly that inherently typified their style of living in the rural areas. These results validate the findings of Barnard *et al* who noted that a high proportion of individuals defecate in households

with functional toilet facility [4]. On spatial dimension, the highest proportion of respondents whose at least a single member of the household defecates openly despite having or not having a toilet facility installed at home reside in the core. Conversely, a majority of households where no member defecate openly resides in the periphery. Income of households influence their living standard, the kind of basic facility the household adequately access, and other aspects of life. Among these basic life necessities is a toilet facility at home. Therefore, since the majority of households at the periphery were wealthy, it becomes justifiable that only a few individuals would engage in open defecation. In this connection, the reasons attributable to the high incidence of open defecation in the core were: income poverty and in part, occupation.

The core encapsulates the central business district, the commercial hub of Akure. This made the sanitation issue notable as many shops and stalls lack toilet facility. These traders often defecate in potty and polythene bags, then pack them with solid wastes and they were dumped along the major route which transverse the study area. This practice promotes poor sanitation. In this line, a majority of respondents (60.6%) who were farmers were discovered to reside in the core. Sizeable proportions of them did not have toilet facilities at home because they defecate while in their farms. Quite regrettable that when this group of respondents

were not in the farms and needed to answer the natural call of passing out excreta, they resorted to open defecation locally remarked as “shot put” – an act of defecating in a polythene

bag, and throw away unscrupulously to wrong places. Figures 4 and 5 depict the scene of open defecation in the study area

Table 4. Open defecation practice at individual level.

Dev. Zone	Core			Transition			Periphery			Total	
	Fr.	%*	%**	Fr.	%*	%**	Fr.	%*	%**	Fr.	%
Open Defecation	121	61.7	67.2	52	26.5	43.3	23	11.7	38.3	196	54.4
Open Defecation Free	59	36.0	32.8	68	41.5	56.7	37	22.6	61.7	164	45.6
Total										360	100

*Row percentage **Column percentage
Source: Field survey, 2019



Figure 4. Open defecation in the core of Akure.

Source: Field survey, 2019



Figure 5. Dump ground used for "free range" OD.

Source: Field survey, 2019

4.4. Hypothesis Testing

Having established the intensity (percentage) of open defecation practice among the residential zones in Akure, this

study examined whether spatial variations exist in the practice of open defecation along residential zones inferentially. The intensity of open defecation was ranked into categorical order of 0 – 100%, which was the dependent variable, while the residential zones (core, transition, and periphery) was used as the independent variable in this study. Having met its basic assumptions, the Kruskal Wallis Test was employed to establish the variations that exist among the residential zones in terms of open defecation practice. Essentially, this will help to identify residential zones that need urgent interventions. Empirical analysis shows that the practice of open defecation relates to the residential zones. As depicted in Table 5, statistically significant variation was found in the practice of open defecation across the residential zones in Akure, $H(3) = 24.035$, $P < 0.001$. This implies that, the practice of open defecation in study area exhibits some locational characteristics. The factors at play, which were responsible for this spatial variation, might be traceable to the socioeconomic, cultural and psychological inclinations of residents in each spatial entity (across the EAs). This statistical discovery confirmed that the practice of open defecation has spatial differences.

Table 5. Independent – Samples Kruskal-Wallis Test Summary.

Total N	360
Test Statistic	24.035a
Degree Of Freedom	2
Asymptotic Sig.(2-sided test)	.000

a. The test statistic is adjusted for ties.

Given that, there are three residential zones in Akure, this paper moves a step further to detect the residential zones where the variations in open defecation practice occurred through multiple comparison post hoc tests.

Post Hoc Tests

According to the result of the post hoc test, the first row compared the core with the transition zone, and revealed that there was a significant variation in the practice of open defecation between the core and the transition at ($P < .001$, $r = -.23$) with weak effect. The second row compared the core to

the periphery, and it showed that there was a significant variation in the practice of open defecation between the two zones at ($P < .001$, $r = -.25$) with weak effect. The third row compared the transition with the periphery, and it showed no significance in the practice of open defecation between the two zones ($P = 1.000$, $r = -.05$). This confirmed earlier submission that what operates in the transition is expected to be a mixture of what operate in the other two zones.

The implication is that open defecation practice and trend in the core differ from the periphery and the transition, which shows the residential zones that need the most urgent interventions. This reflects the spatial variations that exist between distinct spatial urban spaces. The differences in the socioeconomic attributes of the residents as well as the locational attributes of these residential zones partly explained the variations experienced between the zones. Past studies show that open defecation is high in urban core due to

lack of space to construct toilets, as well as poor financial strength to construct toilet.

The majority of the people in the peripheral zone were wealthier citizens, which enhanced their capability to own a toilet. Nevertheless, the existing trend of open defecation needs attention, especially, to curb the continuous open defecation by households who reside in incremental housing. It was observed that a significant number of incremental houses on the periphery did not have toilet facilities, which was enhanced by financial constraint to construct a toilet. Given that open defecation is the lowest rung in sanitation ladder, this study submits that the core and the periphery of Akure need urgent attention to ameliorate the practice of open defecation to less than 1% of her population. Viewing from this perspective, such intervention will guarantee the local attainment of sanitation target 2 in 2030 global agenda.

Table 6. Pairwise comparisons of residential zones.

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.a	R
Core-Transition	-43.000	10.579	-4.065	.000	.000	-.23
Core-Periphery	-52.000	13.382	-3.886	.000	.000	-.25
Transition-Periphery	-9.000	14.194	-.634	.526	1.000	-.05

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions were the same.

Asymptotic significances (2-sided tests) were displayed. The significance level is .05.

a. Significant values have been adjusted by the Bonferroni correction for multiple tests

5. Conclusion and Recommendations

This paper revealed that social spatial segregation of the city residents influences the trend of open defecation. For instance, income poverty is one of the primary drivers of open defecation in the core. Thus, open defecation was high in the core. Despite that majority of the wealthy residents live on the periphery, open defecation was still relatively high due to the presence of low-income earners that reside in incremental houses on the periphery. Overall, there was spatial variation in the practice of open defecation along residential zones of Akure, Nigeria. On this note, this paper recommends the acceleration of Community Led Total Sanitation (CLTS) in the city. In Nigeria, CLTS was adopted as far back as 2005 (FMWR, 2017). In this context, Ondo state government should continue to create the institutional and regulatory support in term of policies and programmes that would assist in the germination of CLTS in the city. Akure South Local Government Council should be empowered with adequate resources to ensure the appropriate implementation of CLTS in the city. The CBOs and local NGOs should mobilise communities within the city to take own actions toward eradicating OD.

Subsidizing OD interventions had failed in the past, but it is appropriate to subsidise toilet construction for the urban poor who constitute the major open defecators in Akure. Faith based organisations should be used as a venue to canvass for community participation in evoking pragmatic solutions to sanitation problems in their communities. Equally, this paper recommends the introduction of sanitation marketing and the continuation of the behaviour Change Communication campaign in the city. Finally, socioeconomic inequality produce spatial differentiation in open defecation practice in Akure city. Thus, the core and periphery (low income earners in incremental houses) beg for attention and intervention through aggressive construction and use of toilets.

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Authors Contributions

This study was designed by the authors, written by Ayadi and edited by Rotowa. Both authors reviewed the manuscript, read and approved the final manuscript.

Declaration of Conflicting Interests

The authors have declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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