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# Burden and Determinants of Open Defecation: The Reality across the Rural and Urban Areas of Osun State, Southwest Nigeria

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***Abstract***

*The burden of open defecation remains a challenge in Nigeria despite various interventions targeted at ensuring uptake of sanitary means of sewage disposal. This study aimed at determining the factors that influence the practice of open defecation in the rural and urban communities of Osun State. A comparative cross-sectional study design was employed. Two hundred and ninety-nine households were enrolled in the rural and 299 households from urban local government, using multistage sampling technique. Data were collected using an interviewer-administered questionnaire and a checklist was used to assess the sanitation of the house. Determinants of open defecation were assessed using binary logistic regression. The burden of open defecation is more in rural areas both at home and when away from home 31.1% and 37.8% respectively; compared with urban areas, indoor, 8.4%, and away from home, 11.7%. Households in rural areas are four times more likely to practice open defecation than those in the urban area (Odds ratio = 3.9, p <0.001). Likelihood of practice of open defecation declined with level of education of male head and increase in wealth index of households. House ownership reduced the likelihood of practicing open defecation by 2.5 (odds ratio = 0.4, p = 0.015). There is a need for more efforts focused especially on the rural areas to achieve the eradication of open defecation in Nigeria. There is a need to promote having toilets in the house especially in rural areas where a significant proportion still lacks access to toilets.*

***Keywords****: Open defecation, Osun State, rural-urban, sewage disposal.*

## Introduction

Proper sewage disposal is cardinal in the fight against many communicable diseases, especially those transmitted through the faeco-oral route. The means of sewage disposal has been a challenge of public health importance from time immemorial. Improper handling and disposal of sewage have been attributed as the cause of numerous communicable diseases, especially infectious diseases with faeco-oral routes of transmission [1, 2]. Based on the degree of risk of various methods sewage disposal, measured by the rate of undue contact and handling of fresh fecal matters, the means of sewage disposal have been classified into sanitary and unsanitary means of sewage disposal.

At the base of the sanitation, ladder is open defecation [3]. Open defecation carries more health risks relative to other means of sewage disposal as it is characterised by the highest dose of exposure to faecal pathogens. The burden of open defecation has been partly attributed to the

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persistence of and recurrent outbreak of diseases of public health importance like poliomyelitis, diarrheal disease, and cholera, especially in the developing world where the practice of open defecation remains high despite various interventions. There has been a global reduction in the burden of open defecation, and this reduction, however, varies among nations. Findings from JMP Survey showed that about one-out-of-twenty people still practice open defecation in the selected countries studied; while about nine out of ten people who still practice open defecation lived in sub-Sahara Africa, central and south Asia [4]. Nigeria by virtue of its population in sub-Saharan Africa, is one of the major contributors to the burden. Findings from a national survey, national demographic health survey conducted in 2018 showed that one-quarter of households (25%) in Nigeria still practice open defecation. The burden, however varies from one region of the country to another.

The burden and effects of open defecation have gained global attention with numerous global and local efforts aimed at curbing the menace of open defecation. These efforts have been adjudged as having a significant impact, evidenced by the increase in the proportion of the world population using safely managed services between 2000 and 2017, including its expansion of coverage in rural areas; the improved proportion of the population with access to at least a basic sanitation service; and ability of the interventions to halve the proportion of the world population practicing open defecation [4]. Notable among the global efforts include declaration of the World Toilet Day, 'No poop challenge' by UNICEF, and inclusion of effort to eradicate open defecation in both Millennium Development Goals and Sustainable Development Goals. A notable local effort was the adoption of an action plan by Nigerian government to eradicate open defecation by 2025 [5]. Although the efforts improved the adoption of more sanitary means of sewage disposal in the country, the decline in the practice of open defecation is low and insignificant in some parts of the country [5].

Previous studies have adduced the high burden of open defecation to barriers that vary with socio-cultural environments, most of which are usually not factored into the planning of most interventions that have been implemented [6-9]. The significant-high burden of open defecation in Nigeria despite the local and global intervention indicates the likelihood of subtle barriers yet to be captured in the existing interventions, which include the provision of public toilets and regular sensitization [5, 10]. This calls for a more comprehensive review of determinants of open defecation in Nigeria. This study aimed to assess the burden of open defecation and factors that may be aiding its persistence in the study area.

The findings from this study could provide an insight into the effectiveness of several past interventions in the selected communities and, by proxy, communities that share similar socio-cultural environments. This study also assessed the determinants across the rural and urban settings based on the findings from previous studies that revealed subtle variations in the socio-cultural factors across rural and urban settings in relation to the public health systems. Findings from this study will therefore encompass the determinants of open defecation across the rural and urban areas, and it will be important in developing a more holistic public health intervention programme.

## Materials and Methods

### Study Area

The study was conducted in Osun State in southwest Nigeria. The state lies in the tropical rainforest covering an area of approximately 14,875 square kilometers, 7°30′N 4°30′E. According to the national population census, it has a total population of 3,423,535 as of 2006, with a 2020 population projection figure of 5,320,967 based on an annual growth rate of 3.2%. The state comprises 30 local government areas (LGA) classified into an equal proportion

of rural and urban local government areas. Both the rural and urban local communities in Osun State have good access to communication infrastructure that are being used for the dissemination of health information. The common means of mass communication include radio, television, posters, and health education or sensitization conducted by healthcare workers in the communities.

The population relies mainly on private drinking water systems due to the moribund public water supply system in the state [11]. Also, the means of sewage disposal is mainly private because there is no sewerage system in any part of the state or sewage treatment plant. Each local government area has environmental health unit saddled with the responsibility of enforcing existing laws that make it mandatory that all private houses and public buildings should have facilities for sanitary means of sewage and refuse disposals.

## Study Design and Population

This study was conducted using a comparative cross-sectional study design. Participants in the study comprised female heads of households in the rural and urban local government areas selected for this study. Households that were visitors in the study area were excluded from the study. The data were collected between August and September 2021.

## Sample Size and Sampling Technique

The sample size (N) was calculated to get an absolute precision of ± 5% using the sample size formula for comparison between two proportions. After correcting for an anticipated non-response rate of 10%, the sample size was 79. The sample size was calculated based on the proportion of households in the rural and urban areas of Nigeria that used improved toilet facilities, 39%, and 74%, respectively [12]. However, to ensure the robustness of the study, a total of 598 households completed the study: 299 households in the rural local government area (Atakumosa West LGA) and 299 from the urban LGA (Ife East LGA). The participants were selected via a multistage sampling method. The list of local government areas in Osun State was stratified into two groups- rural and urban. One local government area each was randomly selected from each group using a simple random sampling method by balloting. Each selected LGA has eleven wards, out of which three wards were selected per LGA by a simple random sampling method. Alternate households were selected, and a willing eligible adult per household was enrolled in the study. The sample size was proportionally allocated to the LGAs based on the projected population of the selected local government areas.

## Data Collection

Data were collected using an electronic interviewer-administered questionnaire, Kobo Collect. The questionnaire was structured mainly as close-ended, while room was given for other responses not captured in the close-ended response to each question in the form of an open-ended response. The questionnaire comprises three sections: Section A contained questions on the socio-demographic variables, while section B assessed the household assets used for determining the socio-economic status of the households. This section also included questions on sources of water and means of sewage disposal. Section C contained questions on means of sewage disposal, their accessibility, and functionality. The level of satisfaction with means of sewage disposal that were accessible to the households was also assessed.

## Data Analysis

Data were analysed using IBM SPSS version 26 for windows. Categorical variables like level of education of male and female level of education, ethnicity, and means of sewage disposal were summarized using frequencies and percentages. Numerical data like age, and number of people per household were subjected to a test of normality using the Shapiro Wilk test and summarized using the median and

interquartile range. The wealth index of households was calculated based on the assets of the households, means of sewage disposal, and refuse disposal (both classified into sanitary and unsanitary means of disposal), and sources of drinking water supply. The wealth index was calculated using the principal component analysis.

Categorical variables like the prevalence of open defecation, wealth index, and level of education were compared across rural and urban study areas using Pearson Chi-Square. Numerical variables like age were compared across the rural and urban study area using the Mann-Whitney U test. Determinants of the practice of open defecation were assessed using binary logistic regression. A p-value of $< 0.05$ was considered statistically significant.

## Ethical Consideration

Ethical approvals were obtained from the Research and Ethics Units of Ife East Local Government Area and Atakumosa West Local Government Area. Verbal informed consent was sought from each respondent after an adequate explanation of the objectives of the study. Confidentiality and data security were assured. Participation was made voluntary as each participant was at liberty to opt out at any point in the study.

## Results

The overall prevalence of open defecation among the households was 115 (19.2%). The burden of open defecation was higher among households in the rural area, 91 (30.4%), compared with the burden among households in the urban areas, 24 (8.0%). The difference in the prevalence of open defecation across the rural and urban areas was statistically significant, $p < 0.001$. Figure 1 shows that the burden of open defecation was more when respondents were outdoor in the rural area, 113 (37.8%) compared with when they were at home, 93 (31.1%). More respondents in the urban areas, 35 (11.7%), were also observed to practice open defecation when they were away from home compared with the proportion that practice open defecation at home, 25 (8.4%). Details are shown in Figure 1.

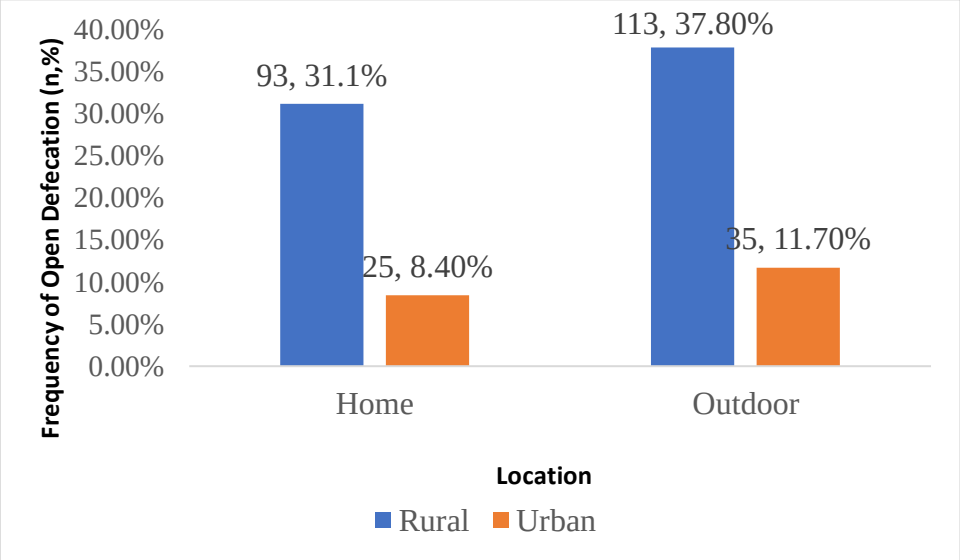


**Figure 1.** Burden of Open Defecation across the Rural and Urban Communities

The most common means of sewage disposal readily accessible to respondents at home in the rural area was pour-flush to the septic tank, 102 (34.1%). This was followed by open defecation, 93 (31.3%), and pit latrine with slab, 57 (19.1%). The least observed means of sewage disposal in the rural area was an open pit (pit latrine without a slab, 3 (1.0%). The most commonly accessible means of sewage disposal in the urban area was pour-flush to the septic tank, 141 (47.2%). This

was followed by the proportion of households that reported pit latrines with slabs as the most accessible, 59 (19.7%). Less than one-tenth, 25 (8.4%) of the households reported open defecation as the most accessible. Details are shown in Table 1.

**Table 1.** The Pattern of Sewage Disposal Across the Rural and Urban Areas

| **Variables** | **Place of Residence** | | **Statistics** |
|---|---|---|---|
| | **Rural** | **Urban** | |
| | **N (%)** | **N (%)** | |
| | **n = 299** | **n = 299** | |
| **Access to toilet facilities** | | | |
| No | 91 (30.4) | 25 (8.4) | $X^2 = 46.589$ |
| Yes | 208 (69.6) | 274 (91.6) | $p < 0.001$ |
| **Types of accessible toilets at home** | | | |
| Flush/pour-flush to septic tank/sewer system | 102 (34.1) | 141 (47.2) | $X^2 = 72.038$ |
| Open defecation | 93 (31.1) | 25 (8.4) | $p < 0.001$ |
| Pit latrine with slab | 57 (19.1) | 59 (19.7) | |
| Pit latrine without slab/ open pit | 3 (1.0) | 24 (8.0) | |
| Pour-flush to pit latrine | 29 (9.7) | 46 (15.4) | |
| Pour-flush with open-drain | 11 (3.7) | 3 (1.0) | |
| Ventilated improved pit (VIP) latrine | 4 (1.3) | 1 (0.3) | |
| **Types of accessible toilets outside home** | | | |
| Flush/pour-flush to septic tank/sewer system | 79 (26.4) | 77 (25.8) | $X^2 = 92.502$ |
| Not Applicable** | 42 (14.0) | 100 (33.4) | $p < 0.001$ |
| Open defecation | 113 (37.8) | 35 (11.7) | |
| Pit latrine with slab | 45 (15.1) | 33 (11.0) | |
| Pit latrine without slab/ open pit | 1 (0.3) | 11 (3.7) | |
| Pour-flush to pit latrine | 11 (3.7) | 39 (13.0) | |
| Pour-flush with open-drain | 7 (2.3) | 4 (1.3) | |
| Ventilated improved pit (VIP) latrine | 1 (0.3) | 0 (0.0) | |

The level of education of male and female heads of the households had a significant association with the pattern of sewage disposal, $p < 0.001$. Open defecation was significantly higher among households that belong to lower wealth index relative to households in a high wealth index, $p < 0.001$. Adoption of sanitary means of sewage disposal was observed to increase across the socio-economic status (wealth index). The households that belong to the lowest wealth index accounted for the highest proportion of households practicing open defecation, 37 (32.2%) while households that practice open defecation were the least among those that belong to the 5$^{th}$ quintile, 7 (6.1%). Being an owner of the house where the household dwell was significantly associated with the use of sanitary means of sewage disposal, 111 (23.0%), while only 11 (9.6%) of household owners practice open defecation, $p < 0.001$. The ages of male and female heads of households were significantly associated with the practice of open defecation, $p = 0.003$ and $p = 0.011$ respectively. Details are shown in Table 2.

**Table 2.** Socio-demographic Variables (rural/urban)

| **Variables** | **Means of Sewage Disposal** | | **Statistics** |
|---|---|---|---|
| | **Open Defecation** | **Open Defecation not practiced** | |
| | **n = 115** | **n = 483** | |
| | **n (%)** | **n (%)** | |
| **Place of residence** | | | |
| Rural | 91 (30.4) | 208 (69.6) | $X^2 = 48.329$ |
| Urban | 24 (8.0) | 275 (92.0) | $p < 0.001$ |
| **Level of education of the male head of households** | | | |
| No formal education | 6 (31.6) | 13 (68.4) | $X^2 = 85.708$ |
| Primary | 59 (45.4) | 71 (54.6) | $p < 0.001$ |
| Secondary | 46 (14.4) | 273 (85.6) | |
| Tertiary | 4 (3.1) | 126 (96.9) | |
| **Level of education of the female head of households** | | | |
| No formal education | 3 (15.0) | 17 (85.0) | $X^2 = 38.866$ |
| Primary | 22 (31.9) | 47 (68.1) | $p < 0.001$ |
| Secondary | 81 (25.0) | 243 (75.0) | |
| Tertiary | 9 (4.9) | 176 (95.1) | |
| **Religion** | | | |
| Christianity | 106 (22.1) | 373 (77.9) | $X^2 = 13.021$ |
| Islam | 9 (7.6) | 110 (92.4) | $p < 0.001$ |
| **Marital status** | | | |
| Married | 112 (19.2) | 472 (80.8) | LR = 0.053 |
| Separated/Divorced | 2 (22.2) | 7 (77.8) | p = 0.974 |
| Widowed | 1 (20.0) | 4 (80.0) | |
| **Ethnicity** | | | |
| Hausa | 1 (14.3) | 6 (85.7) | LR = 1.082 |
| Igbo | 6 (25.0) | 18 (75.0) | p = 0.781 |
| Yoruba | 105 (19.3) | 440 (80.7) | |
| Others | 3 (13.6) | 19 (86.4) | |
| **Wealth Index** | | | |
| First | 37 (32.2) | 81 (16.8) | $X^2 = 32.879$ |
| Second | 26 (22.6) | 94 (19.5) | $p < 0.001$ |
| Third | 31 (27.0) | 90 (18.6) | |
| Fourth | 14 (12.2) | 106 (21.9) | |
| Fifth | 7 (6.1) | 112 (23.2) | |
| **Household ownership** | | | |
| No | 104 (90.4) | 372 (77.0) | $X^2 = 10.295$ |
| Yes | 11 (9.6) | 111 (23.0) | $p < 0.001$ |
| **Age of female head of households** | 29.0 (24.0 – 34.8) | 30.0 (26.0 – 35.0) | U = 22878.5 |
| | | | p = 0.003 |
| **Age of male head of households** | 35.0 (30.0 – 40.0) | 37.0 (30.0 – 41.0) | U = 22736.5 |
| | | | p = 0.011 |
| **Number of females per household** | 2.0 (1.0 – 2.0) | 2.0 (1.0 – 3.0) | U = 22271.5 |
| | | | p = 0.001 |

The geographical location of residents was observed to be a significant factor in the practice of open defecation. Rural dwellers were about four times more likely to practice open defecation than urban dwellers, [Odds ratio = 3.9, (95% CI = 2.242-6.655), p < 0.001]. The level of education of male heads of households was also a significant factor in the practice of open defecation. Households with male heads that have a secondary level of education were 3.3 times less likely to practice open defecation compared with households where the male heads have no formal education [Odds Ratio = 0.3, (95% CI = 0.641- 15.171), p = 0.048). Also, households that had male heads with a tertiary level of education were 10 times less like to practice open defecation relative to those with no formal education [Odds ratio = 0.1, (95% CI = 0.022 – 0.820), p = 0.030]. Households living in their own house were more than two times less likely to practice open defecation compared to households living in rented apartments [Odds ratio= 2.5, (95% CI = 0.189 – 0.838), p = 0.015]. There was a negative relationship between the number of females per household and the practice of open defecation. Details are shown in Table 3.

**Table 3.** Determinants of Open Defecation (Binary Logistic Regression)

| **Variables** | **Odds Ratio** | **p-value** | **95% CI** |
|---|---|---|---|
| **Place of Residence** | | | |
| Urban | Ref | < 0.001 | 2.242 – 6.655 |
| Rural | 3.9 | | |
| **Level of education of the male heads of households** | | | |
| No formal education | Ref | - | - |
| Primary | 1.1 | 0.924 | 0.275 – 4.152 |
| Secondary | 0.3 | 0.048 | 0.065 – 0.986 |
| Tertiary | 0.1 | 0.030 | 0.022 – 0.820 |
| **Level of education of the female heads of households** | | | |
| No formal education | Ref | - | - |
| Primary | 1.8 | 0.496 | 0.341 – 9.224 |
| Secondary | 3.1 | 0.159 | 0.641 – 15.171 |
| Tertiary | 1.4 | 0.720 | 0.227 – 8.555 |
| **Wealth index** | | | |
| 1st quintile | Ref | - | - |
| 2nd quintile | 0.7 | 0.368 | 0.358 – 1.464 |
| 3rd quintile | 0.8 | 0.496 | 0.395 – 1.568 |
| 4th quintile | 0.3 | 0.010 | 0.151 – 0.779 |
| 5th quintile | 0.3 | 0.006 | 0.103 – 0.687 |
| **House ownership** | | | |
| No | Ref | | |
| Yes | 0.4 | 0.015 | 0.189 – 0.838 |
| **Number of females per household** | -0.400 | 0.003 | 0.515 – 0.873 |
| **Age of female head of households** | -0.006 | 0.816 | 0.941 – 1.049 |
| **Age of male head of households** | -0.002 | 0.916 | 0.956 – 1.041 |

## Discussion

The practice of open defecation was observed to be more prevalent in rural areas compared to urban areas. The practice of open defecation was consistently higher in rural areas both when the respondents were in their house and much higher when away from home. This higher burden of open defecation in the rural area could be due to an array of unutilized plots of land available and accessible in the rural area. This could be coupled with poor enforcement in the rural areas compared with the urban areas of the building codes that make construction of toilet facilities mandatory in residential houses. Also, previous governmental and non-governmental interventions to improve water, sanitation and hygiene have been shown to concentrate more on the urban areas compared to the rural areas [13]. This agrees with the findings from a national survey that equally observed a higher prevalence of open defecation in rural areas [10].

The level of education of male and female heads of households had a significant association with means of sewage disposal. Most households that have male and or female head of households with either secondary or tertiary education practice a more sanitary means of sewage disposal while a significant handful of households with lower levels of education practice open defecation. This could be because those with higher levels of education are more likely to be more knowledgeable about the harmful effect of open defecation. This finding was like the observation from a similar study conducted in Ghana and Indonesia [14, 15].

The proportion of households that practice open defecation significantly declines with an increase in the wealth index, while the proportion of households that adopt sanitary means of sewage disposal increase with an increase in the wealth index. This may be due to the affordability of sanitary means of sewage disposal by households that belong to higher socio-economic status.

This is similar to findings from a study conducted in a rural community of India where people that belong to higher socio-economic practice more sanitary means of sewage disposals [16]. A positive association was also observed between socio-economic status and the practice of open defecation in various studies conducted in different socio-cultural environments [17-19].

House ownership was also observed as a significant determinant of the practice of open defecation. Those living in their own house tend to practice less open defecation relative to those living in rented apartments. This could be due to a more deliberate effort to construct toilets to ensure the comfort of the households since living in such houses will not be temporal relative to houses built for renting. The lower prevalence of open defecation among people that own houses could also have a link with the socio-economic status of the households since it has been shown that there is a lower prevalence of open defecation among people of high socio-economic status relative to people with low socio-economic status.

A negative relationship was observed between the number of females in a household and the practice of open defecation. The odds of practicing open defecation were observed to be lower in households with more female members. The higher desire for privacy among women and cultural practices that preclude women from undue exposure of their body parts in the open space may be partly responsible for the negative relationship between the practice of open defecation and the numbers of females in the household. This could also be due to the vulnerability of female gender to various forms of harassment, especially physical and sexual harassment while practicing open defecation in the open space. This was like findings from various studies where it was observed that most females were not favourably disposed to the practice of open defecation [19-21]. Common factors that have been identified to affect the practice of open defecation among females are lack of privacy and dignity, fear, and harassment [22, 23].

## Conclusion

The practice of open defecation is still a challenge of public health importance despite various interventions in the past. There remains a wide gap in the rural-urban uptake of sanitary means of sewage disposal as the prevalence of open defecation is still very high in rural areas compared with urban areas. There is a need for more public health interventions that focus more on the rural areas to address their peculiar needs towards the discontinuation of the practice of open defecation. In the long term, there is a need for social interventions to improve the socio-economic status and school enrolment to improve the level of education of citizens, both of which are important determinants of the practice of open defecation.


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## Declaration of Competing Interest

The authors declare that there is no conflicting interest that could have appeared to influence this study.

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