Solid Waste Management Practices and Perceived Environmental and Health Effects in Ikwerre Local Government Area, Rivers State, Nigeria: A Cross-Sectional Household Survey

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ABSTRACT

Inadequate solid waste management can contribute to environmental pollution, nuisance conditions and public-health risks. This study assessed household solid waste generation, storage, collection, disposal and recovery practices, as well as residents' perceptions of related environmental and health effects, in Ikwerre Local Government Area (LGA), Rivers State, Nigeria. A household survey was conducted in Ikwerre LGA, with particular attention to Aluu, Igwuruta and Ubima. Of 384 questionnaires administered, 380 were reported as correctly completed and returned (98.96%). A structured questionnaire collected information on respondents' characteristics and household waste practices. Data were analysed in SPSS version 25 using frequencies, percentages, means, standard deviations and Pearson's chi-square tests. Statistical significance was set at $p<0.05$. Household/domestic activities were identified as the main source of waste by 50.0% of respondents, and 75.0% reported generating waste daily. The most commonly reported daily quantity was 1–3 kg (46.6%). In the waste-classification table, biodegradable waste accounted for 57.4% and non-biodegradable waste for 42.6%. Plastic bins (38.2%) and sacks/nylon bags (28.9%) were common storage methods; 34.2% reported uncovered containers and 17.1% damaged or leaking containers. Irregular collection was reported by 31.6%, while 10.6% stated that waste was never collected. Open dumping/burrow-pit disposal was the most frequently reported disposal method (48.7%), followed by municipal collection (36.3%). Only 32.9% reported recycling or reuse, while 67.1% did not. Respondents strongly agreed that poor waste management increases disease occurrence (mean 4.66, SD 0.58) and that open dumping contributes to bad odour (mean 4.64, SD 0.51). The findings indicate important gaps in waste segregation, collection regularity, safe disposal and household recycling in the surveyed communities. Strengthening reliable collection services, providing suitable storage and sorting facilities, improving environmental-health education and integrating community and informal waste actors are priorities. Several internal inconsistencies in the dissertation tables require verification against the original questionnaire dataset before journal submission.

KEYWORDS

solid waste management, household waste, waste disposal, recycling, environmental health, Ikwerre LGA, Nigeria

I. INTRODUCTION

Municipal solid waste management is an important environmental-health function involving the safe handling of waste from generation and temporary storage through collection, transportation, recovery, treatment and final disposal. Rapid population growth, urban expansion, changing consumption patterns and commercial activity increase the volume and diversity of waste generated, while inadequate infrastructure and institutional capacity can encourage open dumping, burning and other unsafe practices. Such practices may contribute to blocked drainage, offensive odours, vector breeding, air pollution and contamination of soil and water.

These challenges are particularly relevant in low- and middle-income settings where collection services, disposal infrastructure, financing and enforcement may not keep pace with the growth of settlements. Nigeria's national policy frameworks on solid waste and plastic waste provide a policy basis for improved management, but implementation depends on local capacity, public participation and accessible services. Research in Nigeria has highlighted the importance of public awareness, household sorting, waste-picker participation and coordinated municipal services (Adekola et al., 2021; Adekunle et al., 2023; Dibia et al., 2022).

Ikwerre LGA in Rivers State contains a mix of rural, semi-urban and expanding residential communities. The dissertation identifies Aluu, Igwuruta and Ubima as focal communities with differing settlement and economic characteristics. Previous work cited in the dissertation has raised concerns about waste disposal and environmental conditions in communities within Ikwerre LGA (Dimkpa et al., 2023; Ugbebor & Ntesat, 2019). However, locally relevant evidence on household generation, storage, collection, disposal and recycling practices remains important for planning interventions suited to the area. This study therefore assessed solid waste management practices in Ikwerre LGA, focusing on household waste generation and storage, collection and disposal arrangements, recycling and resource recovery, and residents' perceptions of environmental and health effects. It also examined selected associations between respondents' sociodemographic characteristics and reported waste practices.

II. MATERIALS AND METHODOLOGY

A. Study design and setting

The study adopted a household survey design in Ikwerre LGA, Rivers State, Nigeria. The methods chapter identifies Aluu, Igwuruta and Ubima as the selected communities. The area is described as comprising rural and semi-urban settlements with residential, commercial and agricultural activities.

B. Study population and sample

The target population was described as adult residents and other stakeholders involved in household and local waste management. The dissertation cites a population of 541,115 for

Ikwerre LGA and reports using Cochran's sample-size formula at a 95% confidence level, 5% margin of error and p=0.5, yielding a target sample of 384. A multistage sampling approach was reported: purposive selection of the LGA, selection of communities/wards, systematic selection of households and selection of one eligible adult per household. A total of 384 questionnaires were administered; 380 were reported as valid and analysed.

C. Data collection instrument and procedure

Data were collected using a structured questionnaire covering sociodemographic characteristics, sources and frequency of waste generation, quantities and composition, storage, collection and disposal, recycling and resource recovery, perceived environmental and health effects, challenges and suggested improvements. The dissertation reports face and content validation by experts in environmental management and public health, and a pilot study in Obio/Akpor LGA. It states that Cronbach's alpha was used to assess reliability and that a coefficient of 0.70 was considered acceptable; however, the actual alpha coefficient is not reported in the available dissertation text.

D. Data analysis

The dissertation reports analysis in SPSS version 25. Frequencies and percentages were used to summarise categorical responses, while means and standard deviations were used for Likert-scale items. Pearson's chi-square tests and Cramer's V were used to examine associations between selected sociodemographic characteristics and waste practices. The stated significance threshold was $p<0.05$. The statistical outputs include several cross-tabulations with small expected cell counts; therefore, those inferential findings should be treated cautiously pending re-analysis of the raw data using appropriate exact or Monte Carlo procedures, or defensible category consolidation.

E. Ethical considerations

The dissertation states that ethical approval was obtained from the relevant institutional authorities, that participation was voluntary, and that confidentiality and anonymity were maintained. The name of the approving committee, approval reference number and approval date are not stated in the text reviewed and should be added before submission.

III. RESULTS

A. Respondent characteristics

The analysis included 380 respondents. Females represented 56.1% and males 43.9%. The largest age group was 26–35 years (41.1%), followed by 18–25 years (36.3%). Most respondents were single (66.1% as reported in the narrative/table), and 95.3% were recorded as having tertiary education. Respondents classified as "others" made up 41.6% of occupational categories, students 24.5% and civil servants 21.1%. A large majority (89.7%) were reported as urban residents.

Table 1: Respondent characteristics

Characteristic	Category	n	%
Gender	Male	167	43.9
	Female	213	56.1
Age	18–25 years	138	36.3
	26–35 years	156	41.1
	36–45 years	81	21.3
	46–55 years	5	1.3
Education	Secondary	18	4.8
	Tertiary	362	95.3
Residence	Urban	341	89.7
	Rural	39	10.3

B. Waste generation and composition

Household/domestic activities were the most frequently identified source of solid waste (50.0%), followed by commercial activities (23.9%) and institutional activities (10.0%). Waste generation was reported as a daily activity by 75.0% of respondents. The most frequently reported daily quantity was 1–3 kg (46.6%), followed by 4–6 kg (26.3%). In the table classifying waste into biodegradable and non-biodegradable categories, biodegradable waste represented 57.4% (218/380) and non-biodegradable waste 42.6% (162/380). Within the non-biodegradable category, plastics accounted for 27.8% and nylon bags/sachet-water wrappers 23.5% of that category.

Table 2: Classifying waste into biodegradable and non-biodegradable categories

Measure	Category	n	%
Main source	Household/domestic activities	190	50.0
	Commercial activities	91	23.9
	Institutional activities	38	10.0
Generation frequency	Daily	285	75.0
Daily quantity	Less than 1 kg	55	14.5
	1–3 kg	177	46.6
	4–6 kg	100	26.3
	Above 6 kg	48	12.6
Waste class	Biodegradable	218	57.4
	Non-biodegradable	162	42.6

C. Storage and handling

Plastic bins were the most commonly reported storage receptacle (38.2%), followed by sacks and nylon bags (28.9%). Only 38.2% reported properly covered containers; 34.2% used uncovered containers, 17.1% reported damaged or leaking containers and 10.5% had

no designated storage container. The reported duration of storage was 1–3 days for 46.1%, 4–7 days for 26.3% and more than seven days for 10.5%. The dissertation also reports that 46.1% never separated waste before disposal, 36.1% sometimes separated it and 17.9% always separated it.

Table 3: Storage and Handling Indicator

Storage/handling indicator	**Category**	**n**	**%**
Storage receptacle	Plastic bins	145	38.2
	Sacks/nylon bags	110	28.9
	Buckets/drums	65	17.1
	Open heaps	38	10.0
Container condition	Properly covered	145	38.2
	Uncovered	130	34.2
	Damaged/leaking	65	17.1
	No designated container	40	10.5
Waste separation	Always	68	17.9
	Sometimes	137	36.1
	Never	175	46.1

D. Collection and disposal

Community/labour groups and scavengers were identified as the main collection actors by 30.3% of respondents, followed by individual households (27.1%), government agencies (24.7%) and private contractors (10.5%). A further 7.4% reported no regular collection. Irregular or occasional collection was reported by 31.6%, while 10.6% said waste was never collected. Open dumping or burrow-pit disposal was the most frequently reported final disposal method (48.7%); 36.3% reported municipal collection, 11.1% burning, 2.6% disposal into drains or water bodies and 1.3% burial. Overall, 57.1% were satisfied or very satisfied with collection services, while 42.9% were dissatisfied or very dissatisfied.

Table 4: Collection and Disposal Indicator and category

Indicator	**Category**	**n**	**%**
Main collection actor	Community/labour/scavengers	115	30.3
	Individual households	103	27.1
	Government agency	94	24.7
	Private contractor	40	10.5
	No regular collection	28	7.4
Collection frequency	Daily	45	11.8
	2–3 times/week	70	18.4
	Weekly	105	27.6
	Occasionally	120	31.6
	Never	40	10.6

Main disposal method	Open dumping/burrow-pit	185	48.7
	Municipal collection	138	36.3
	Burning	42	11.1
	Drainage/water body	10	2.6
	Burial	5	1.3

E. Recycling and resource recovery

Only 125 respondents (32.9%) reported practising some form of recycling or reuse, whereas 255 (67.1%) did not. Just over half (52.9%) reported that waste buyers or recyclers operated in their area; 21.3% said they did not and 25.8% did not know. The questionnaire table's breakdown of materials recycled/reused contains counts and percentages that do not reconcile clearly with the 125 respondents who answered "yes"; this breakdown is therefore not reproduced as a reliable distribution in this manuscript.

F. Perceived environmental and health effects

Respondents expressed strong agreement with statements about the consequences of poor waste management. The highest reported mean was for the statement that poor waste management increases disease occurrence (mean 4.66, SD 0.58), followed by the view that open dumping contributes to bad odour (mean 4.64, SD 0.51). Respondents also endorsed the statements that improper disposal blocks drains and that waste attracts flies, rats and mosquitoes. These are perceptions reported by respondents and should not be interpreted as clinically confirmed disease outcomes or measured environmental contamination.

Table 5: Perceived environmental and health effects

Perceived effect	**Mean**	**SD**	**Decision reported**
Poor waste management increases disease occurrence	4.66	0.58	Accepted
Open dumping contributes to bad odour	4.64	0.51	Accepted
Improper waste disposal blocks drains	4.50	0.63	Accepted
Waste attracts flies, rats and mosquitoes	4.47	0.66	Accepted
Waste burning causes air pollution	4.47	0.66	Accepted

G. Challenges and improvement priorities

Irregular collection was the most frequently reported challenge (26.6%), followed by lack of public awareness (16.8%), inadequate waste bins (14.5%) and weak government

enforcement (11.8%). Respondents rated community sanitation education (mean 3.82), stricter enforcement of sanitation laws (3.80), more frequent collection (3.76), provision of additional waste bins (3.71) and establishment of recycling centres (3.71) as important improvement measures.

H. Associations with sociodemographic characteristics

For the association between sociodemographic characteristics and the reported main collection actor, the SPSS appendix reports statistically significant associations for gender (χ^2=16.526, df=4, p=.002, V=.209), age (χ^2=99.176, df=12, p<.001, V=.295), marital status (χ^2=11.074, df=4, p=.026, V=.171), education (χ^2=46.999, df=12, p<.001, V=.203) and occupation (χ^2=130.291, df=20, p<.001, V=.293). However, expected-count assumptions were not met in several of these tables, particularly for age, education and occupation. These results should not be presented as definitive until reanalysed.

The association analyses for waste composition and storage also contain sparse categories and expected cell counts below five. For example, 78.6% of expected cells were below five in the education-by-waste-type analysis. Consequently, the manuscript does not rely on these tests to make strong inferential claims. The raw respondent-level dataset is required for a defensible reanalysis.

IV. DISCUSSION

The findings portray a household waste system in which waste is generated frequently, but collection and final disposal arrangements are uneven. The prominence of household/domestic sources and daily generation is consistent with the central role of household consumption and routine domestic activity in municipal waste streams. Similar studies cited in the dissertation have described household and commercial activities as important contributors to municipal waste in Nigerian communities (Aderinto et al., 2026; Eyenghe et al., 2022).

The predominance of biodegradable waste in the main waste-classification table suggests an opportunity for organic waste diversion through separation and composting. At the same time, plastics and nylon packaging were prominent within the non-biodegradable fraction. These patterns support the need for differentiated management: organic materials should be kept separate for composting or other appropriate recovery, while plastics, metals, glass and paper should be channelled to material-recovery systems. Household separation was limited, however, with nearly half of respondents reporting that they never separated waste. This is consistent with the wider Nigerian evidence cited in the dissertation on the importance of public awareness, convenient sorting systems and community participation (Adekola et al., 2021; Adekunle et al., 2023; Debrah et al., 2021).

Storage conditions also raise concerns. Although plastic bins were common, more than half of respondents reported uncovered, damaged/leaking containers or no designated container. Prolonged storage may expose waste to animals, insects and rainfall, and can contribute to odour and local nuisance. Promoting durable, covered and cleanable containers should therefore be accompanied by dependable collection schedules; household-level

education alone is unlikely to be sufficient where suitable containers and services are unavailable.

The reported reliance on community groups, scavengers and households, together with the relatively low proportion attributed to private contractors, indicates a mixed service environment. Informal and community-based actors may provide an important collection and recovery function, particularly where formal services are limited. Rather than excluding these actors, local authorities could consider practical arrangements for registration, training, protective equipment, safe handling and links to recycling markets. The dissertation's findings that irregular collection was common and that open dumping was the leading disposal method are consistent with concerns about service capacity and open dumping documented in Nigerian studies (Dibia et al., 2022; Eyenghe et al., 2022; Aluko et al., 2022).

Recycling and reuse were not routine for most respondents, despite more than half reporting that waste buyers or recyclers were present locally. This gap may reflect limited access, low awareness, inconvenient collection arrangements or weak incentives. Establishing accessible drop-off and sorting points, supporting community-based recovery groups and creating reliable links with recycling businesses may help convert the presence of local buyers into greater household participation.

Respondents strongly perceived poor waste management as contributing to disease occurrence, bad odour, blocked drains and vector attraction. These responses demonstrate awareness of environmental-health concerns, but the cross-sectional questionnaire did not establish disease incidence, causal relationships or environmental contamination. Studies around dumpsites in the Niger Delta and elsewhere in Nigeria have reported environmental and health concerns associated with poorly managed waste sites (Abah & Ohimain, 2023; Aluko et al., 2022). Future work in Ikwerre LGA should combine household surveys with environmental sampling and health surveillance to assess these pathways directly.

The study also identifies practical priorities: regular collection, adequate bins, public education, stronger but fair enforcement and recycling facilities. These priorities are mutually reinforcing. Enforcement is more likely to be effective when residents have access to affordable collection services and approved disposal points. Public education should therefore be coupled with infrastructure, clear service schedules and transparent responsibilities among local authorities, environmental agencies, contractors and community organisations.

V. CONCLUSION

This household survey indicates that solid waste is generated frequently in the surveyed communities of Ikwerre LGA, with household activities identified as the leading source. The findings point to shortcomings in waste storage, source separation, collection regularity, recycling participation and final disposal. Open dumping/burrow-pit disposal was the most frequently reported disposal method, while irregular collection was a major challenge. Respondents recognised several environmental and health concerns associated with poor waste management. These results support an integrated local approach combining reliable

collection, safe storage, source separation, organic waste recovery, recycling partnerships, environmental-health education and consistent regulation.

VI. STRENGTHS AND LIMITATIONS

The study provides local household-level evidence on several stages of the waste-management chain and includes respondents from more than one settlement type. However, the results are based primarily on self-reported questionnaire responses and may be affected by recall and social-desirability bias. The sample was heavily urban (89.7%), limiting the extent to which the findings can represent rural households. The study did not report direct weighing or physical characterisation of household waste, environmental laboratory testing or clinically verified health outcomes. In addition, several tables contain inconsistencies in denominators, labels and percentages, and some chi-square analyses violate expected-cell-count assumptions. These issues require correction using the original dataset before the manuscript can be considered submission-ready.

RECOMMENDATIONS

- Ikwerre LGA and relevant state environmental agencies should establish and publish dependable collection schedules, with service coverage prioritised for underserved communities.
- Households and commercial premises should be supported to use durable, covered and easy-to-clean containers. Accessible communal bins and collection points should be provided where household collection is not feasible.
- Community sanitation education should explain waste separation, safe storage, approved disposal routes, composting and the health and environmental risks of open dumping and burning.
- Local authorities should develop partnerships with community groups, waste pickers, private operators and recycling businesses, including appropriate safety and oversight arrangements.
- Organic waste should be diverted, where technically feasible, to composting or other safe recovery options; plastics, paper, metals and glass should be separated for recycling.
- Enforcement of sanitation regulations should be consistent and fair, and should be accompanied by practical access to approved collection and disposal services.
- Future studies should use direct waste characterisation, environmental sampling and health data to validate perceived impacts and quantify waste composition and exposure pathways.

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