

INFLUENCE OF SETTLEMENT PATTERN ON SOLID WASTE MANAGEMENT PRACTICES IN OVIA NORTH EAST LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA

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Abstract

Settlement patterns play an important role in shaping municipal solid waste management practices, particularly in developing countries where waste management infrastructure is often inadequate. This study assessed the influence of settlement pattern on solid waste generation, storage, collection, transportation, disposal, waste separation, and recycling practices in selected urban (Okada), semi-urban (Usen), and rural (Iguomon) communities in Ovia North East Local Government Area of Edo State, Nigeria. Primary data were collected from 80 respondents using structured questionnaires administered via simple random sampling. Data were analysed using descriptive statistics and the Chi-square test at a 5% level of significance. The findings revealed that organic waste and plastics constituted the dominant waste streams across the study area. Open burning and open dumping were the predominant waste disposal methods. At the same time, self-disposal, wheelbarrows, and self-transport were commonly employed for waste collection and transportation due to inadequate waste management infrastructure. Chi-square analysis showed that the settlement pattern did not significantly influence the waste generation, storage, collection, transportation, or disposal practices ($p > 0.05$). However, the settlement pattern significantly influenced waste separation ($p = 0.007$) and recycling/reuse practices ($p < 0.001$), with urban residents exhibiting higher levels of waste separation and rural households demonstrating greater recycling and reuse of organic waste for agricultural purposes. The study concludes that settlement patterns primarily influence behavioural aspects of solid waste management, whereas infrastructural deficiencies affecting waste collection, transportation, storage, and disposal remain common across all settlement categories. The study recommends strengthening waste management infrastructure, expanding waste collection services, promoting waste separation at source, supporting community-based recycling programmes, and implementing settlement-specific waste management strategies to improve environmental sustainability.

Keywords: *Settlement pattern, Solid waste management, Recycling, Environmental sustainability*

Introduction

Solid waste management has become one of the major environmental challenges confronting both developed and developing countries due to rapid urbanisation, industrialisation, population growth, and changing consumption patterns (Hoorweg and Bhada-Tata, 2012; UNEP, 2015; World Bank, 2018). In many developing nations, including Nigeria, ineffective waste management practices have contributed significantly to environmental degradation, public health problems, flooding, soil contamination, and air pollution (Nwanta *et al.*, 2010; Ferronato and Torretta, 2019; Srivastava *et al.*, 2015; Medina, 2010). Recent studies have shown that poor waste collection systems, inadequate storage facilities, open dumping, and uncontrolled burning remain common waste disposal methods in many Nigerian communities (Abd'Razack *et al.*, 2017; Adebola, 2006; Muhammad and Marzuki, 2024). Municipal solid waste comprises refuse generated from households, markets, schools, institutions, religious centres, commercial establishments, and industrial activities.

According to NESREA (2005), improper handling and disposal of waste continue to pose serious environmental and public health risks in Nigeria. Open dumping and burning of waste release toxic substances into the environment, contaminate water bodies, degrade air quality, and encourage the proliferation of disease vectors such as flies, mosquitoes, and rodents. Waste generation rates have increased considerably in Nigerian cities and rural settlements due to population growth, urban expansion, and changing lifestyles. Owhe *et al.* (2025) observed that Nigeria generates millions of tonnes of solid waste annually, much of which is

poorly managed or indiscriminately disposed of in drainage channels, roadsides, and open spaces. Similarly, Omokaro (2025) noted that weak institutional frameworks, inadequate infrastructure, and poor public attitudes contribute significantly to ineffective waste management practices across the country. Despite increasing environmental awareness, waste management practices in many communities within Edo State remain inadequate. Waste storage is often carried out using open bins, sacks, or open dumping sites, while disposal methods largely involve open burning and indiscriminate dumping. These practices negatively affect environmental quality, public health, and the aesthetic condition of communities. David *et al.*, (2023) further explained that rapid urbanisation and population growth have placed considerable pressure on municipal waste management systems in Nigerian communities, resulting in poor collection coverage and inefficient disposal practices.

Settlement patterns have increasingly been recognised as an important factor influencing municipal solid waste management practices. Variations in population density, land-use characteristics, socio-economic activities, infrastructure availability, and access to municipal services often result in differences in waste generation, storage, collection, transportation, recycling, and disposal practices among communities. Urban settlements typically generate larger quantities of waste due to higher population concentration and commercial activities, whereas rural settlements often depend on informal waste handling and disposal practices because of limited waste management infrastructure. Semi-urban settlements generally exhibit

characteristics that fall between urban and rural environments. Consequently, understanding the influence of settlement patterns on waste management behaviour is essential for developing sustainable and location-specific waste management strategies.

Mainasara and Dodo (2024) established that ineffective solid waste management significantly affects the quality of life and health conditions of residents in Nigerian communities, thereby underscoring the need for improved waste management systems. Several studies have examined solid waste management practices in Nigerian cities and towns (Ogbonna *et al.*, 2007; Imam *et al.*, 2008; Afon, 2012; Ogwueleka, 2009). However, most previous studies have focused primarily on individual urban centres without explicitly investigating how settlement patterns influence waste management behaviour across urban, semi-urban, and rural communities within the same geographical setting. Consequently, there is limited empirical evidence on the extent to which settlement characteristics affect waste generation, storage, collection, transportation, recycling, and disposal practices in Edo State. As a result, policymakers have limited evidence to develop context-specific waste management interventions that address the distinct environmental and operational challenges of diverse settlement categories.

The environmental consequences of poor waste management have also been widely documented. Studies have shown that inadequate waste management contributes to flooding, water contamination, air pollution, soil degradation, and the spread of sanitation-related diseases (Adekunle *et al.*, 2011; Ukpong and Udofia, 2011). These

environmental impacts are often exacerbated by inadequate waste storage facilities, irregular collection services, indiscriminate dumping, and open burning, which remain prevalent in many Nigerian communities.

Therefore, this study seeks to evaluate the influence of settlement patterns on solid waste management practices in selected urban, semi-urban, and rural communities within Ovia North East Local Government Area of Edo State, Nigeria. Specifically, the study examines the pattern and composition of waste generated in the selected communities; assesses the influence of settlement pattern on waste storage practices; evaluates its effect on waste collection and transportation systems; determines its influence on waste disposal and recycling practices; and compares waste management performance among urban, semi-urban, and rural settlements. The findings are expected to provide valuable information for environmental agencies, policymakers, researchers, and community leaders in developing effective and sustainable waste management strategies tailored to the unique characteristics of different settlement patterns.

Study Area

The study was conducted in Okada, Usen, and Iguomon communities located within Ovia North East Local Government Area (LGA) of Edo State, Southern Nigeria. The LGA covers approximately 2,301 km² and had a population of about 153849 according to the 2006 National Population Census (NPC, 2006). Ovia North East LGA is situated approximately between latitudes 5°40'N - 7°40'N and longitudes 5°00'E - 6°30'E. The area experiences a humid tropical climate characterised by distinct wet and dry

seasons. The rainy season generally extends from March/April to October, while the dry season occurs between November and February. Mean annual rainfall ranges from about 1,500 mm to 2,500 mm, while average temperatures range between 25°C and 28°C. Three communities representing different settlement patterns were purposively selected for the study. Okada represents the urban settlement category due to its relatively high population density and concentration of educational, commercial, transportation, and administrative functions. The presence of Igbinedion University, markets, hotels, restaurants, and numerous business establishments has contributed to rapid urban growth and increased socio-economic activities within the community. Usen was selected to represent the semi-urban settlement category. The community exhibits

moderate population density and a mixture of agricultural, commercial, educational, and artisan activities. The presence of Edo State Polytechnic further contributes to its socio-economic importance within Ovia North East LGA. Iguomon represents the rural settlement category and is characterised by dispersed residential development, relatively low population density, and predominantly agrarian livelihoods. Farming and small-scale trading constitute the major economic activities of residents.

Figure 1 shows the location of the communities selected. The selection of Okada, Usen, and Iguomon was informed by their distinct settlement characteristics, which provide an appropriate framework for assessing the influence of settlement patterns on solid waste management practices.

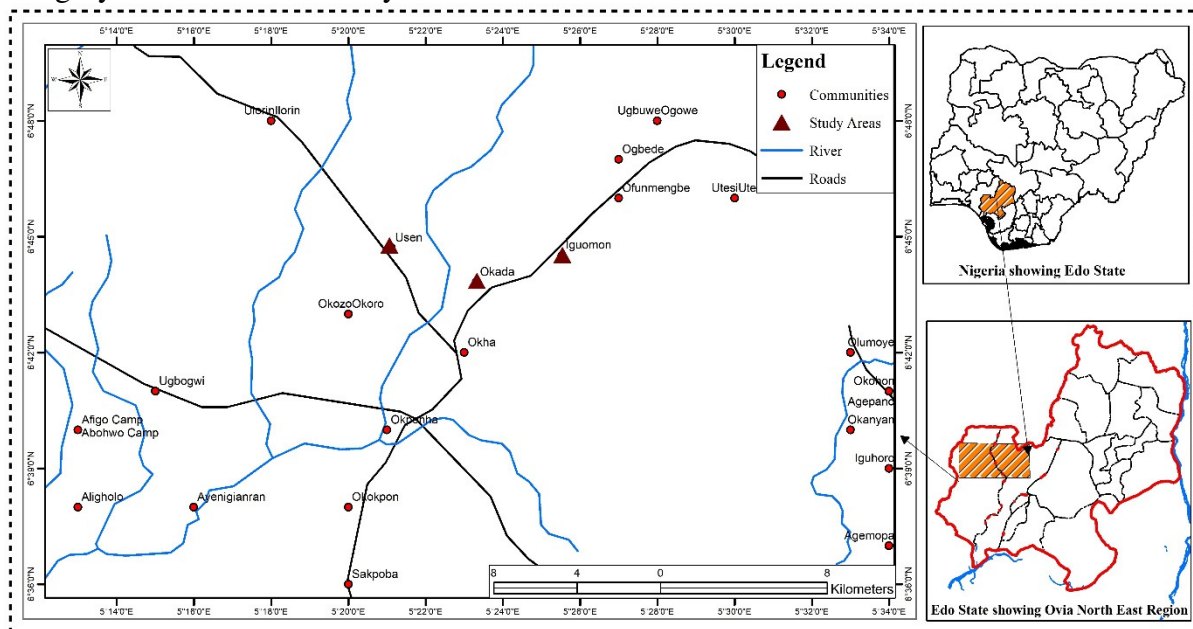


Fig. 1: Map of Ovia North East Region showing Okada, Usen and Iguomon locations

Methodology

This study adopted a descriptive survey research design to investigate the influence of settlement pattern on solid

waste management practices in selected communities within Ovia North East Local Government Area of Edo State, Nigeria. The descriptive survey design

was considered appropriate because it enabled the collection of primary data directly from residents regarding waste generation, storage, collection, transportation, and disposal practices within the study area. The design also facilitated comparison of waste management practices among urban, semi-urban, and rural settlements.

The study focused on residents, households, commercial establishments, educational institutions, religious centres, markets, and other waste-generating units within the selected communities of Okada, Usen, and Iguomon. A simple random sampling technique was employed in selecting respondents within each community to ensure that all eligible respondents had an equal chance of participation. The distribution of questionnaires was based on the relative size, accessibility and population characteristics of the selected settlements. A total of eighty (80) structured questionnaires were administered across the study area, comprising thirty-nine (39) questionnaires in Okada, twenty-four (24) in Usen and seventeen (17) in Iguomon. The study relied primarily on primary data obtained through the administration of structured questionnaires. The questionnaire was designed to obtain information on respondents' socio-economic characteristics, waste generation patterns, storage practices, collection systems, transportation methods, recycling behaviour, and disposal practices within the selected communities. The questionnaire consisted of different sections; however, this study utilised the section relating to waste generation, storage, collection, transportation, and disposal practices. Direct field observations were also conducted to complement information

obtained through the questionnaires and to provide additional insight into prevailing waste management practices within the study area.

Data obtained from the questionnaires were coded, organised, and analysed using descriptive and inferential statistical techniques. Descriptive statistics, including frequencies, percentages, tables, and charts, were used to summarise respondents' responses regarding waste generation, storage, collection, transportation, and disposal practices.

Comparative analysis was conducted to identify variations in waste management practices among the urban (Okada), semi-urban (Usen), and rural (Iguomon) communities. To determine the influence of settlement pattern on selected waste management practices, Chi-square (χ^2) analysis was employed at a 95% confidence level ($p < 0.05$). The results were presented using tables and figures and discussed in relation to the objectives of the study and relevant literature.

To determine whether settlement pattern significantly influences solid waste management practices in the study area, the following hypothesis was tested: Null Hypothesis (H_0): The settlement pattern has no significant influence on solid waste management practices in Ovia North East Local Government Area, Edo State. Alternative Hypothesis (H_1): The settlement pattern has a significant influence on solid waste management practices in Ovia North East Local Government Area, Edo State. The hypothesis was tested using Chi-square (χ^2) statistical analysis at a 95% confidence level ($p < 0.05$). The test was employed to determine whether significant differences existed among the urban (Okada), semi-urban (Usen), and rural (Iguomon) communities with respect

to waste generation, storage, collection, transportation, and disposal practices.

Results and Discussion

Socio-Demographic Characteristics of Respondents

The socio-demographic characteristics of respondents in Okada, Usen, and Iguomon are presented in Table 1. The respondents comprised both males and females across different age groups, indicating that information was obtained from a diverse segment of the population involved in waste generation and management activities. The predominance of respondents within the economically active age bracket suggests that the study captured views from individuals who are directly involved in household, commercial, and institutional waste

generation. The educational profile of respondents revealed varying levels of educational attainment across the three communities. Generally, respondents in urban and semi-urban settlements had higher levels of formal education than those in rural settlements. Educational attainment is an important factor in environmental management because it influences awareness of proper waste handling, environmental sanitation, recycling, and sustainable waste management practices. Educational institutions were more prominent in Okada and Usen, consistent with the presence of major educational facilities within these settlements. Furthermore, the distribution of waste-generating sources reflected the settlement characteristics of the study communities.

Table 1: Socio-Demographic Characteristics of Respondents by Settlement Category

Variable	Category	Okada n (%) N = 39	Usen n (%) N = 24	Iguomon n (%) N = 17
Gender	Male	19	12	4
	Female	20	12	13
	25 – 35	12	11	8
	35 – 44	15	3	5
	45 – 54	17	6	2
	> 55	3	2	2
Educational Level	No Formal Education	0	3	2
	Primary	4	2	0
	Secondary	10	10	11
	Tertiary	21	9	4
Length of Residence	< 1 year	2	3	2
	1 – 5 years	12	7	8
	6 – 10 years	8	4	1
	> 10years	17	12	6
Type of Respondent	School	6	4	1
	House	14	9	9
	Bank	3	0	0
	Stores	10	7	6
	Hospitals	2	1	0
	Institution	1	1	0
	Church	3	2	1

Influence of Settlement Pattern on Waste Generation Pattern

Table 2 presents the major waste types generated in the selected urban, semi-urban and rural communities. Organic waste dominated across settlements (38.1% in Okada, 39.5% in Usen, 61.1% in Iguomon), followed by plastics and paper, which were more prominent in urban and semi-urban areas. No glass waste was reported, and metal waste was minimal.

This pattern aligns with findings from Nigerian studies, where organic waste constitutes the bulk of municipal solid waste (MSW) due to food preparation and agricultural activities, while urbanisation drives higher generation of plastics and paper through packaged goods and commercial activities (e.g. studies in Lagos and other urban centres). Rural areas show stronger dominance of biodegradable waste (Agwu, 2012; Eze *et al.*, 2022).

Table 2: Distribution of Major Waste Types generated in the Selected Communities.

Waste Type	Okada n (%)	Usen n (%)	Iguomon n (%)
Organic Waste	16 (38.1)	15 (39.5)	11 (61.1)
Plastic	15 (35.7)	12 (31.6)	3 (16.7)
Paper	11 (26.2)	10 (26.3)	2 (11.1)
Metal	0 (0.0)	1 (2.6)	2 (11.1)
Glass	0 (0.0)	0 (0.0)	0 (0.0)
Total	42 (100)	38 (100)	18 (100)

Note: Multiple responses were recorded; therefore, frequencies exceeded the number of respondents

Influence of Settlement Pattern on Waste Storage Practices

Table 3 presents the waste storage methods and facilities used by respondents in the selected communities. Open dumping was the dominant storage method (31.7% in Okada, 33.3% in Usen, 68.7% in Iguomon), with limited use of covered bins, especially in rural Iguomon. Open bins and sacks were

common alternatives. Urban settlements showed slightly better access to improved facilities, consistent with regional patterns where rural and semi-urban areas rely heavily on rudimentary storage due to inadequate infrastructure. This highlights systemic gaps in household waste storage across Nigeria (Odoemenam and Ofodu, 2016; Ukpong *et al.*, 2015).

Table 3: Waste Storage methods/Facilities used in the selected Communities

Storage Method/Facility	Okada n (%)	Usen n (%)	Iguomon n (%)
Covered Bin	8 (19.5)	2 (39.5)	0 (0.0)
Open Bin	11 (26.8)	11 (31.6)	3 (18.8)
Sack	9 (22.0)	5 (26.3)	2 (12.5)
Open Dumping	13 (31.7)	9 (2.6)	2 (68.7)
Total	41 (100)	27 (100)	16 (100)

Note: Multiple responses were recorded; therefore, frequencies exceeded the number of respondents

Influence of Settlement Pattern on Waste Collection Service Providers

Table 4 shows the waste collection service providers in the Okada, Usen and Iguomon communities. Self-disposal dominated (66.7% in Okada, 87.5% in Usen, 94.1% in Iguomon), with minimal

local government or private sector involvement, particularly in rural areas. This reflects broader Nigerian trends, where limited formal services force reliance on self-disposal, exacerbating indiscriminate practices, especially outside major cities (Agwu, 2012).

Table 4: Waste Collection Service Providers in the Selected Communities

Waste Collection Service Provider	Okada n (%)	Usen n (%)	Iguomon n (%)
Local Government	5 (12.8)	1 (4.2)	0 (0.0)
Private Waste Collectors	6 (15.4)	0 (0.0)	0 (0.0)
Informal Waste Collectors	2 (5.1)	2 (8.3)	1 (5.9)
Self-disposal	26 (66.7)	21 (87.5)	16 (94.1)
Total	39 (100)	24 (100)	17 (100)

Influence of Settlement Pattern on the Adequacy of Waste Collection Services

Table 5 presents the adequacy of waste collection services in the Selected Communities. Most respondents rated services as inadequate (82.1 - 100%). This

systemic shortfall aligns with studies across Nigeria showing poor coverage of municipal collection, particularly in semi-urban and rural settlements (Ramadan, 2022).

Table 5: Adequacy of Waste Collection Services in the Selected Communities

Adequacy of Waste Collection Services	Okada n (%)	Usen n (%)	Iguomon n (%)
Yes	7 (17.9)	2 (8.3)	0 (0.0)
No	32 (82.1)	22 (91.7)	17 (100.0)
Total	39 (100)	24 (100)	17 (100)

Influence of Settlement Pattern on Waste Transportation Methods

Table 6 shows the waste transportation methods used in the Selected Communities. Wheelbarrows predominated (51.3 – 54.2 %), supplemented by self-transport.

Mechanised options (open trucks, tricycles) were largely confined to Okada. This reliance on manual methods mirrors findings in Edo State and other Nigerian regions, where inadequate vehicles and logistics limit efficiency (Ukpong *et al.*, 2015).

Table 6: Waste Transportation Methods Used in the Selected Communities

Transportation Method	Okada n (%)	Usen n (%)	Iguomon n (%)
Open Truck	6 (15.4)	1 (4.2)	0 (0.0)
Wheelbarrow	20 (51.3)	13 (54.2)	9 (52.9)
Tricycle	2 (5.1)	0 (0.0)	0 (0.0)
Self-transport	11 (28.2)	10 (41.6)	8 (47.1)
Total	39 (100)	24 (100)	17 (100)

Influence of Settlement Pattern on Adequacy of Waste Transportation Methods

Table 7 presents respondents' perceptions of the adequacy of waste

transportation methods in the selected communities. Over 89% of respondents viewed methods as inadequate, consistent with national challenges in waste transport infrastructure (Agwu, 2012).

Table 7: Adequacy of Waste Transportation Methods in the Selected Communities

Adequacy of Transportation Methods	Okada n (%)	Usen n (%)	Iguomon n (%)
Yes	4 (10.3)	1 (4.2)	0 (0.0)
No	35 (89.7)	23 (95.8)	17 (100.0)
Total	39 (100)	24 (100)	17 (100)

Influence of Settlement Pattern on Waste Disposal Practices

Table 8 shows waste disposal practices in the selected communities. Open burning was the primary disposal method (53.5% in Okada, 79.3% in Usen, 84.2% in Iguomon), followed by open dumping. Formal options were rare. These practices

are widespread in Nigeria, where a significant portion of MSW undergoes open burning, contributing to air pollution and health risks, especially in areas with poor service coverage. Rural dependence is often higher due to limited alternatives (Elehinafe *et al.*, 2022; Ramadan, 2022).

Table 8: Waste Disposal Practices in the Selected Communities

Waste Disposal Practice	Okada n (%)	Usen n (%)	Iguomon n (%)
Government Collection	3 (7.0)	1 (3.4)	0 (0.0)
Private Waste Collectors	3 (7.0)	0 (0.0)	0 (0.0)
Open Dumping	14 (32.6)	5 (17.2)	3 (15.8)
Open Burning	23 (53.5)	23 (79.3)	16 (84.2)
Burying	0 (0.0)	0 (0.0)	0 (0.0)
Landfilling	0 (0.0)	0 (0.0)	0 (0.0)
Total	43 (100)	29 (100)	19 (100)

Note: Multiple responses were recorded; therefore, the total frequencies exceed the number of respondents

Influence of Settlement Pattern on Waste Separation Practices before Disposal

Table 9 presents the waste separation practices before disposal in the selected communities. Waste separation was low

overall but higher in Okada (48.7%) than Usen (29.2%) or Iguomon (5.9%). Urban awareness and education likely contribute to this gradient, a pattern observed in other Nigerian studies (Ukpong *et al.*, 2015).

Table 9: Waste Separation Practices before disposal in the selected Communities

Waste Separation Practice	Okada n (%)	Usen n (%)	Iguomon n (%)
Yes	19(48.7)	7(29.2)	1(5.9)
No	20(51.3)	17 (70.8)	16(94.1)
Total	39(100)	24 (100)	17 (100)

Influence of Settlement Pattern on Recycling and Reuse Practices

Table 10 presents the recycling and reuse practices of respondents in the selected communities. Recycling/reuse was highest in Iguomon (88.2%), driven by agricultural reuse of organics, compared to lower rates in urban/semi-

urban areas. This highlights context-specific opportunities: traditional rural practices versus urban awareness gaps. Similar variations appear in Nigerian agrarian communities, where organic recycling supports farming (Odoemenam and Ofodu, 2016).

Table 10: Waste Separation Practices before disposal in the selected Communities

Waste Separation Practice	Okada n (%)	Usen n (%)	Iguomon n (%)
Yes	8(20.5)	6(25)	15(88.2)
No	31(79.5)	18 (75)	2(11.8)
Total	39(100)	24 (100)	17 (100)

Findings underscore how urbanisation influences waste streams and practices, yet systemic deficiencies in infrastructure, services, and enforcement persist across settlements. Targeted interventions such as improved collection, education, and location-specific recycling are needed, consistent with recommendations from Nigerian waste management literature (Agwu, 2012; Ramadan, 2022).

Chi-Square Analysis of the Influence of Settlement Pattern on Solid Waste Management Practices

To determine whether settlement pattern significantly influenced selected solid waste management practices in the study area, Chi-square (χ^2) analysis was conducted using waste generation, waste storage, waste collection, transportation, waste disposal, waste separation, and recycling/reuse practices as presented in Table 11.

Table 11: Chi-Square Analysis of the Influence of Settlement Pattern on Selected Solid Waste Management Practices

Variable	χ^2	df	p-value
Waste Generation Pattern	10.640	6	0.100
Waste Storage Method	11.145	6	0.084
Waste Collection Service Provider	9.436	6	0.151
Adequacy of Waste Collection Services	2.750	2	0.253
Waste Transportation Method	5.512	6	0.480
Adequacy of Transportation Methods	2.090	2	0.352
Waste Disposal Practice	12.180	10	0.273
Waste Separation Practice	10.038	2	0.007
Recycling/Reuse Practice	24.280	2	<0.001

The analysis showed that the waste generation pattern was not significantly associated with the settlement pattern ($\chi^2 = 10.640$, $df = 6$, $p = 0.100$). Similarly, no

statistically significant relationship was observed between settlement pattern and waste storage methods ($\chi^2 = 11.145$, $df = 6$, $p = 0.084$), waste collection service

providers ($\chi^2 = 9.436$, $df = 6$, $p = 0.151$), adequacy of waste collection services ($\chi^2 = 2.750$, $df = 2$, $p = 0.253$), waste transportation methods ($\chi^2 = 5.512$, $df = 6$, $p = 0.480$), adequacy of transportation methods ($\chi^2 = 2.090$, $df = 2$, $p = 0.352$), and waste disposal practices ($\chi^2 = 12.180$, $df = 10$, $p = 0.273$). These findings suggest that deficiencies in waste collection, transportation, storage, and disposal are common across the three settlement categories and are more likely attributable to inadequate institutional support and waste management infrastructure than to settlement pattern alone. Similar observations have been reported by Nnaji, (2015) and Kaza *et al.*, (2018), who noted that ineffective waste management systems in many developing countries are primarily constrained by limited government investment, inadequate infrastructure, and weak institutional capacity rather than differences in settlement type. Conversely, settlement pattern significantly influenced waste separation practices ($\chi^2 = 10.038$, $df = 2$, $p = 0.007$). Respondents in Okada exhibited a higher tendency to separate waste before disposal than those in Usen and Iguomon. This finding is consistent with studies by Guerrero (2013), who reported that urban residents generally demonstrate better waste segregation practices due to higher environmental awareness, better access to information, and greater availability of waste management services. Similarly, Wilson *et al.* (2015) emphasised that public education and awareness are important determinants of household participation in waste segregation. A highly significant relationship was also observed between settlement pattern and recycling/reuse practices ($\chi^2 = 24.280$, $df = 2$, $p < 0.001$). The rural community (Iguomon) recorded the highest recycling

and reuse rate, largely because organic waste is commonly reused for farming through composting and soil improvement. This finding agrees with Hoornweg and Bhada-Tata, (2015) who observed that rural communities in developing countries often recycle or reuse biodegradable waste through agricultural activities, thereby reducing the amount of waste requiring final disposal. Overall, the results indicate that settlement patterns have a greater influence on household behavioural practices, particularly waste separation and recycling, than on infrastructure-dependent components such as waste collection, transportation, storage, and disposal. This suggests that while behavioural interventions should be tailored to settlement characteristics, improvements in infrastructure and institutional support are required across all communities to achieve sustainable solid waste management.

Conclusion

The study revealed variations in waste generation and management across the three settlement categories. Organic waste and plastics were the predominant wastes types while open dumping, open burning, self-disposal, and manual transportation remained the common disposal practices. Formal waste collection, transportation, storage, and disposal services were generally inadequate indicating widespread infrastructural and institutional deficiencies. Chi-square analysis showed that the settlement pattern had no significant influence on waste generation, storage, collection, transportation or disposal practices suggesting that these challenges are systemic across the study area. However, the settlement pattern significantly

influenced waste separation and recycling practices. Urban households were more likely to separate waste before disposal, due to greater environmental awareness, whereas rural household practice more recycling and reuse, particularly through agricultural utilization of organic waste. The study, concludes that sustainable solid waste management in Ovia North East requires improved infrastructure, stronger institutional capacity and community-specific behavioural interventions that promote waste separation, recycling, and resource recovery.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- i. Government should strengthen waste management agencies through increased funding, provision of equipment and recruitment of skilled personnel to enhance efficient waste, collection, transportation and disposal, establish and support recycling programmes that encourage the recovery and reuse of recyclable materials
- ii. Regular and efficient waste collection services should be extended to the semi-urban and rural communities.
- iii. Adequate waste storage containers, covered bins, collection vehicles, and transfer facilities should be provided to improve waste handling and reduce environmental pollution.
- iv. Environmental education campaigns should be intensified to encourage households, institutions, and commercial establishments to separate waste before disposal.

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