

Influence of Public Attitudes, Perceptions and Behaviours to Household Solid Waste Management in Federal Capital Territory, Abuja

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ABSTRACT

Effective household solid waste management remains a critical challenge in rapidly urbanizing Nigerian cities, with inadequate participation, infrastructural constraints, and socio-economic disparities hindering sustainable practices. This study examined perception, attitudes and behaviour towards household waste management in Federal Capital Territory Abuja, with specific objectives to: assess awareness and attitudes toward waste segregation and disposal, evaluate perceptions of household waste management services, explore the influence of socio-demographic factors on waste management behaviours, examine existing community participation initiatives, and identify barriers to effective household participation. A mixed-methods descriptive survey design was employed, collecting data from 400 households through structured questionnaires, supplemented by Focus Group Discussions (FGDs). Quantitative data were analyzed using descriptive statistics, chi-square tests, and regression analysis, while qualitative data underwent thematic analysis. Findings revealed that 72.5% of respondents were aware of segregation practices, and 77.5% recognized the environmental and health risks of improper disposal, with an overall positive attitude (mean = 3.91). However, participation in recycling initiatives was lower at 37.5%, and only 47.5% were willing to join waste management committees. Chi-square analysis showed that education, income, and settlement type significantly influenced behaviours ($p < 0.05$), while age and gender were not significant predictors. Key barriers included high service costs (55%), irregular collection schedules (50%), limited access to bins (45%), and knowledge gaps (40%). The study concluded that while awareness and attitudes are generally positive, structural, financial, and infrastructural constraints limit effective household participation. It recommends that household authorities improve service regularity, expand waste infrastructure, and implement targeted awareness and incentive programs to enhance community engagement and compliance.

Keywords: Household waste management, waste segregation, environmental awareness, municipal waste management, and Federal Capital Territory, Abuja.

INTRODUCTION

Household solid waste management has become one of the most pressing environmental challenges globally due to rapid urbanization, population growth, and increasing consumption. The world currently generates approximately 2.3 billion tonnes of municipal solid waste (MSW) annually, and this is projected to increase to 3.8 billion tonnes by 2050. About 38% of this waste is improperly managed through open dumping or burning, a figure expected to rise significantly by 2050 (United Nations Environment Programme (UNEP), 2024; World Bank, 2023). Consequently, household solid waste management has become one of the most difficult responsibilities of urban administrators worldwide (Sankoh, 2020). Across Africa, countries such as Ghana, Ethiopia, and South Africa continue to experience increasing waste generation, inadequate infrastructure, weak institutional capacity, poor public participation, irregular waste

collection, illegal dumping, and open burning, despite ongoing efforts to improve municipal waste management systems (PubMed, 2023; BMC Public Health, 2024; PubMed, 2024; Palgrave Communications, 2023; International Journal of Environmental Research and Public Health, 2023; Sustainability Science, 2023).

Nigeria reflects a similar pattern. Rapid urbanization, population growth, inadequate waste management infrastructure, and weak enforcement of environmental regulations have resulted in indiscriminate dumping, irregular waste collection, and open burning across many cities, including Lagos, Enugu, Port Harcourt, Sokoto, and the Federal Capital Territory (FCT), Abuja (Journal of Geography, Environment and Earth Science International, 2023; Journal of Basic and Environmental Sciences, 2023; Earth.Org, 2023). Although Abuja was developed as a planned city with relatively better waste management facilities than many Nigerian cities, rapid urban expansion, increasing population, and the growth of informal settlements have placed enormous pressure on existing waste management systems. Consequently, despite the availability of formal waste collection services, indiscriminate dumping and open burning remain common practices, contributing to environmental pollution and public health risks (Nwankwoala & Udofia, 2021).

Evidence suggests that these challenges are not solely the result of inadequate infrastructure but are also influenced by residents' perceptions, attitudes, and behaviours toward household waste management. Socio-economic inequalities, low environmental awareness, poor public participation, and the belief that waste management is solely the responsibility of government agencies continue to discourage proper waste disposal practices and compliance with waste regulations (Ichipi & Senekane, 2023; Fayemi & Oyesomi, 2021; Etim, 2024). Similar behavioural challenges have been reported in Gwagwalada and Kwali Area Councils, where improper waste disposal persists despite the existence of formal waste management services (Abubakar et al., 2018; Akinola & Agbaje, 2019). Although many households have expressed willingness to support improved waste management initiatives, poor environmental education and limited community engagement continue to hinder effective implementation (Afropolitan Journal of Environmental Sustainability Research, 2023).

Existing studies on municipal solid waste management in Nigeria have largely focused on technical, infrastructural, financial, and institutional constraints, emphasizing inadequate facilities, weak enforcement, and poor funding as major obstacles to effective waste management (Olawande & Adedayo, 2018; Umeh, 2020; Journal of Geography, Environment and Earth Science International, 2023; Journal of Basic and Environmental Sciences, 2023). However, comparatively little attention has been given to the behavioural dimensions of household waste management, particularly how residents' perceptions, attitudes, knowledge, and socio-cultural factors influence waste management practices within the Federal Capital Territory, Abuja. This represents an important gap because sustainable waste management cannot be achieved through infrastructural improvements alone; it also requires an informed and actively participating citizenry.

Against this background, this study examines public perception, attitudes, and behaviours toward household waste management in the Federal Capital Territory, Abuja. Specifically, it seeks to provide empirical evidence on how residents' perceptions and attitudes influence their waste management behaviours and participation in formal waste management systems. The findings will contribute to the development of context-specific, community-driven, and behaviourally informed waste management policies capable of improving environmental sustainability, strengthening public participation, supporting the implementation of Nigeria's

National Policy on Solid Waste Management, and advancing the achievement of Sustainable Development Goals 11 and 12.

STUDY AREA

The study was conducted in the Federal Capital Territory (FCT), Nigeria, which comprises six Area Councils: Abuja Municipal Area Council (AMAC), Abaji, Bwari, Gwagwalada, Kuje, and Kwali. The FCT lies between latitudes 8°25'N and 9°20'N and longitudes 6°45'E and 7°39'E, occupying a central position within Nigeria. It covers a land area of approximately 7,315 km² and is bounded by Kaduna State to the north, Niger State to the west, and Nasarawa State to the east and south (ACReSAL, 2023; Britannica, 2023). The central location of the FCT has contributed to its rapid population growth, urban expansion, and increasing pressure on environmental resources, including household solid waste management

The FCT experiences a Tropical Continental climate characterized by distinct rainy and dry seasons, according to Trewartha's modification of Köppen's climatic classification (Money, 2016). The rainy season extends from March to October, while the dry season lasts from November to April, including a brief harmattan period marked by dry, dusty northeast trade winds. Annual temperatures generally range between 12°C and 40°C, with moderate climatic conditions resulting from the Territory's location within the Niger-Benue Trough, proximity to the Jos Plateau, and undulating terrain. These climatic conditions support agricultural activities across the six Area Councils while also influencing waste decomposition, waste generation patterns, and environmental sanitation.

The soils of the FCT are predominantly sandy, gravelly, and shallow, making many areas susceptible to erosion, although relatively deep and fertile clay-rich soils occur within the Gwagwa Plains, particularly around AMAC (Ojigi, 2015). Vegetation falls mainly within the Guinea Savannah ecological zone, consisting of tall grasses interspersed with scattered trees and patches of woodland, shrubland, and rainforest depending on relief, soil conditions, and human activities (Abubakar et al., 2000). Geologically, the Territory is underlain by Precambrian Basement Complex rocks and sedimentary formations. The Basement Complex occupies about 48% of the land area and is associated with rugged terrain, while sedimentary formations account for approximately 52%, particularly in the southern parts, providing relatively productive aquifers and favourable conditions for agriculture and urban development (Etuk et al., 2023; Hydrogeology of Federal Capital Territory, Abuja, 2022; Nigerian Geological Survey Agency [NGSA], 2022).

Household solid waste management in the FCT is coordinated primarily by the Abuja Environmental Protection Board (AEPB) and licensed private contractors. However, the quality of waste collection services varies considerably across the Area Councils. While AMAC generally enjoys relatively regular waste collection, satellite towns and peri-urban communities in Abaji, Bwari, Gwagwalada, Kuje, and Kwali often experience irregular collection services, resulting in indiscriminate dumping and open burning of household waste (Buwah et al., 2024). Waste segregation, recycling, and composting remain poorly developed, with informal waste pickers playing a significant role in material recovery under largely unregulated conditions. Consequently, poor waste disposal practices continue to contribute to blocked drainage channels, flooding, environmental pollution, and public health risks (Yalma & Hyelni, 2024; Buwah et al., 2024). These characteristics make the Federal Capital Territory an appropriate setting for examining public perception, attitudes, and behaviours toward household solid waste management.

METHODOLOGY

This study adopted a mixed-methods descriptive survey design to examine public perceptions, attitudes, and behaviours toward household solid waste management in the Federal Capital Territory (FCT), Abuja. The design combined quantitative and qualitative approaches to provide a comprehensive understanding of the subject. Structured questionnaires were used to collect quantitative data from households, while Focus Group Discussions (FGDs) generated qualitative information on residents' experiences and perceptions. The mixed-methods approach enhanced the validity of the findings through triangulation (Imam et al., 2008; Nzeadibe & Ajaero, 2010; Afon, 2012; Adeyemi & Okunmadewa, 2021).

A reconnaissance survey was conducted before the main fieldwork to familiarize the researcher with the study area and refine the sampling procedure. Both primary and secondary data were collected. Primary data included information on respondents' socio-demographic characteristics, awareness, attitudes, perceptions, waste management practices, and challenges, while secondary data comprised relevant maps and published literature.

The study population consisted of approximately 85,000 households in the Federal Capital Territory, Abuja. A stratified random sampling technique was adopted to ensure adequate representation of urban, peri-urban, and rural communities. A total of 400 households participated in the survey. Data were collected using structured questionnaires and four Focus Group Discussions (FGDs) involving 8–10 participants each.

Quantitative data were analyzed using descriptive statistics (frequencies, percentages, and mean scores) and inferential statistics (Chi-square and regression analysis). Descriptive statistics were used to summarize respondents' characteristics, awareness, attitudes, perceptions, and waste management practices, while Chi-square and regression analyses examined relationships between socio-demographic characteristics and waste management behaviours. Qualitative data from the FGDs were transcribed and analyzed using thematic analysis, which provided deeper insights into residents' perceptions, motivations, barriers, and suggestions regarding household solid waste management. The combination of these analytical techniques ensured comprehensive achievement of the study objectives.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

Table 4.1: Socio-Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage
Age (years)	18–25	60	15.0
	26–35	130	32.5
	36–45	110	27.5
	46–55	60	15.0
	56 and above	40	10.0
	Total	400	100.0
Gender	Male	220	55.0
	Female	180	45.0
	Total	400	100.0
Educational Attainment	No formal education	20	5.0
	Primary	30	7.5
	Secondary	130	32.5
	Tertiary	220	55.0
	Total	400	100.0

Occupation	Civil servant	150	37.5
	Private sector	90	22.5
	Self-employed	100	25.0
	Unemployed/Student	60	15.0
	Total	400	100.0
Income Level (₦)	Low (<100,000/month)	80	20.0
	Medium (100,000–200,000)	200	50.0
	High (>200,000)	120	30.0
	Total	400	100.0
Household Size	1–3 members	90	22.5
	4–6 members	220	55.0
	7 and above	90	22.5
	Total	400	100.0

Source: Field Work, 2025

The majority of respondents were within the economically active age groups (26–35 years, 32.5%; 36–45 years, 27.5%), while younger respondents (18–25 years, 15%) demonstrated greater willingness to adopt waste segregation practices. Older respondents were less consistent in proper waste disposal, suggesting the need for targeted awareness campaigns and community-based education for this group (Akinwale & Olorunfemi, 2024).

Although males constituted 55% of the respondents, women were more actively involved in household waste management activities such as segregation, recycling, and composting. This highlights the importance of gender-sensitive interventions that empower women while encouraging greater male participation (Ibrahim et al., 2024).

Educational attainment influenced waste management behaviour, with over 55% of respondents possessing tertiary education and exhibiting better knowledge of waste segregation and environmental risks. This suggests that practical environmental education should be intensified among less educated residents to improve compliance (Okorie & Nwankwo, 2025).

Occupation and income also shaped waste management practices. Civil servants and self-employed respondents showed greater participation in formal waste management than students and unemployed residents, while higher-income households were more willing to pay for waste services than lower-income households, where cost remained a major barrier. This underscores the need for affordable waste management services and targeted awareness programmes for low-income groups (Adebola et al., 2024).

Most households (55%) consisted of 4–6 members, resulting in greater dependence on municipal waste collection services. Overall, the findings indicate that effective household solid waste management requires interventions that address demographic and socio-economic differences while strengthening environmental awareness and access to affordable waste management services.

Table 2: Cross-Tabulation of Household Size and Occupation

Household Size	Civil Servant	Private Sector	Self-Employed	Unemployed/Student	Total
1–3 members	30	20	25	15	90
4–6 members	90	50	60	20	220
7+ members	30	20	15	25	90
Total	150	90	100	60	400

Source: Author's Analysis, 2025

The cross-tabulation of household size and occupation (Table 2) shows that family composition and employment status influence household waste management behaviours in the Federal Capital Territory, Abuja. Small households (1–3 members) were fairly distributed across occupational groups and generally generated lower volumes of waste, reducing their reliance on formal waste collection services. In contrast, medium-sized households (4–6 members), which formed the majority of respondents, were mainly civil servants and self-employed residents. These households generated more waste and were more likely to utilize municipal collection services, participate in waste segregation, and support formal waste management initiatives when adequate services were available. This finding is consistent with Okorie and Nwankwo (2025), who reported that economically active households are more responsive to formal waste management programmes.

Large households (7 or more members) were more common among civil servants and unemployed respondents. Their higher waste generation, coupled with infrastructural limitations, often reduced effective participation in sustainable waste management practices, supporting the findings of Ibrahim and Yusuf (2024).

Overall, the results indicate that household size and occupation significantly shape waste management attitudes and behaviours. Medium- and large-sized households should therefore receive greater attention in waste management interventions through improved service delivery, adequate infrastructure, and targeted awareness programmes to enhance sustainable household waste management (Adebola et al., 2024; Okorie & Nwankwo, 2025; Ibrahim & Yusuf, 2024).

Level of Awareness and Attitudes of Residents toward Waste Segregation and Disposal Practices in Federal Capital Territory, Abuja

Table 3: Awareness of Waste Segregation and Proper Disposal Practices

Awareness Indicator	Response	Frequency	Percentage
Awareness of waste segregation	Aware	290	72.5
	Not aware	110	27.5
	Total	400	100.0
Knowledge of different waste categories (organic, recyclable, hazardous)	Yes	260	65.0
	No	140	35.0
	Total	400	100.0
Awareness of health/environmental impacts of improper solid waste disposal	Yes	310	77.5
	No	90	22.5
	Total	400	100.0

Source: Field Work, 2025

The findings in Table 3 indicate that 72.5% (n = 290) of respondents were aware of waste segregation practices, while 27.5% (n = 110) were not. This suggests a relatively high level of awareness among residents, which is reflected in the overall positive attitude toward waste segregation and proper disposal (grand mean = 3.91). However, awareness has not fully translated into practice, as only 37.5% of respondents actively participated in recycling initiatives. This implies that although many residents recognize the importance of waste segregation, practical adoption remains limited due to knowledge and infrastructural constraints. These findings agree with Adebayo and Mohammed (2024), who reported that awareness of waste segregation has improved in Nigerian cities but remains uneven across population groups.

Similarly, 65.0% (n = 260) of respondents reported knowledge of different waste categories, while 35.0% (n = 140) lacked such knowledge. This indicates that although most residents possess basic knowledge of waste classification, a substantial proportion may still be unable to segregate waste correctly at source. According to Okafor, Eze, and Umeh (2024), inadequate knowledge of waste categories remains a major obstacle to effective household waste segregation.

The study further revealed that 77.5% (n = 310) of respondents were aware of the health and environmental consequences of improper waste disposal, compared with 22.5% (n = 90) who lacked such awareness. This high level of awareness contributed to the positive attitude toward proper waste management, particularly regarding its role in reducing health and environmental risks (mean = 4.30). Nevertheless, the disparity between awareness, knowledge, and actual waste management practices suggests that many residents still face challenges in translating awareness into consistent behaviour due to limited practical skills and inadequate waste management facilities. Similar observations were made by Lawal and Adekunle (2025)

Attitudes toward Waste Segregation and Disposal Practices

Table 4: Mean Attitude Scores toward Waste Segregation and Disposal

Attitudinal Statement	Mean Score	Interpretation
Waste segregation is important for environmental protection	4.21	Positive
Segregating waste at home is convenient	3.42	Moderately Positive
Waste segregation should be compulsory	4.05	Positive
Proper waste disposal reduces health risks	4.30	Strongly Positive
Willingness to practice waste segregation regularly	3.58	Moderately Positive
Grand Mean	3.91	Overall Positive Attitude

Source: Field Work, 2025

Note: Respondents' attitudes on Table 4.3 were measured using a 5-point Likert scale ranging from **1 = Strongly Disagree** to **5 = Strongly Agree**. Mean scores were used to determine overall attitude levels.

The results in Table 4 indicate that respondents generally held positive attitudes toward waste segregation and disposal practices, with a grand mean of 3.91. The statement "*Proper waste disposal reduces health risks*" recorded the highest mean score (4.30), followed by "*Waste segregation is important for environmental protection*" (4.21) and "*Waste segregation should*

be compulsory" (4.05). These findings suggest that residents recognize the environmental and public health benefits of proper waste management and are supportive of policies promoting waste segregation. Similar findings were reported by Adebayo and Mohammed (2024), Lawal and Adekunle (2025), and Okorie and Nwankwo (2025).

However, respondents expressed only moderately positive attitudes regarding the convenience of segregating waste at home (mean = 3.42) and their willingness to practice waste segregation regularly (mean = 3.58). This indicates that although residents value waste segregation, practical constraints such as inadequate waste bins, irregular collection services, and limited municipal support reduce consistent behavioural adoption. Comparable observations were made by Okafor et al. (2024).

Overall, the findings show that residents of the Federal Capital Territory, Abuja possess favourable attitudes toward household waste management, but these attitudes are not always translated into regular practice. The results imply that improving waste collection services, providing adequate segregation facilities, and strengthening community support will enhance residents' perceptions of convenience and encourage greater participation in sustainable household waste management.

Relationship between Awareness and Attitude toward Waste Segregation

There is no statistically significant association between residents' awareness of waste segregation and their attitudes toward waste segregation and disposal practices.

Table 5: Chi-Square Test of Association between Awareness and Attitude

Variables	χ^2 (Chi-Square)	df	p-value	Decision
Awareness of waste segregation vs. Overall attitude (Positive vs. Neutral/Negative)	18.56	2	0.000	Significant
Total respondents	400	—	—	—

Source: field work, 2025

The Chi-square analysis revealed a statistically significant relationship between residents' awareness of waste segregation and their attitudes toward waste segregation and proper disposal ($\chi^2 = 18.56$, $p < 0.001$). This indicates that respondents who were aware of waste segregation were significantly more likely to exhibit positive attitudes toward proper waste management than those who lacked such awareness.

The finding supports previous studies which show that environmental awareness is a major determinant of positive waste management attitudes. Increased knowledge of waste-related environmental and health issues encourages residents to support waste segregation and responsible disposal practices (Adebayo & Mohammed, 2024). Likewise, studies have shown that environmental awareness strengthens positive attitudes, which can subsequently promote sustainable waste management behaviours when supported by appropriate infrastructure and services. This suggests that continuous public sensitization and environmental education remain essential for improving waste management outcomes in the Federal Capital Territory, Abuja.

Overall, the findings indicate that the relatively high levels of awareness among respondents are reflected in their generally positive attitudes toward waste segregation (grand mean = 3.91). However, despite this positive disposition, moderate knowledge of waste categories and lower ratings for the convenience and regular practice of segregation suggest that awareness alone is insufficient to guarantee consistent behavioural adoption. Similar observations were reported by Adebayo and Mohammed (2024), Lawal and Adekunle (2025), and Ibrahim and Yusuf (2024), who emphasized that positive attitudes are strengthened when supported by adequate waste management infrastructure, practical education, and reliable municipal services. Therefore, improving access to waste segregation facilities, enhancing environmental education, and ensuring efficient waste collection services will help translate residents' positive attitudes into sustained household waste management practices

Table 6: Integrated Awareness and Attitude of Residents toward Waste Segregation and Disposal Practices

Variable	Indicator / Statement	Frequency / Mean	Percentage / Interpretation
Awareness	Awareness of waste segregation	290	72.5% Aware
	Not aware	110	27.5% Not Aware
	Knowledge of waste categories (organic, recyclable, hazardous)	260	65.0% Yes
	No knowledge	140	35.0% No
	Awareness of health/environmental impacts of improper disposal	310	77.5% Yes
	Not aware	90	22.5% No
Attitude	Waste segregation is important for environmental protection	4.21	Positive
	Segregating waste at home is convenient	3.42	Moderately Positive
	Waste segregation should be compulsory	4.05	Positive
	Proper waste disposal reduces health risks	4.30	Strongly Positive
	Willingness to practice waste segregation regularly	3.58	Moderately Positive
Grand Mean (Attitude)	—	3.91	Overall Positive Attitude

Source: Field Work, 2025

The combined analysis of awareness and attitudes toward waste segregation and disposal practices (Table 6) shows a strong relationship between residents' knowledge and their perceptions of household waste management. A majority of respondents were aware of waste segregation (72.5%), waste categories (65.0%), and the health and environmental impacts of improper waste disposal (77.5%). These high awareness levels are reflected in the overall positive attitude toward waste segregation and disposal, with a grand mean score of 3.91.

Respondents strongly agreed that waste segregation is important for environmental protection (mean = 4.21), proper waste disposal reduces health risks (mean = 4.30), and waste segregation should be compulsory (mean = 4.05). This suggests that increased awareness contributes to favourable attitudes toward sustainable waste management, supporting the findings of Adebayo and Mohammed (2024) and Okorie and Nwankwo (2025).

However, lower mean scores for the convenience of waste segregation (mean = 3.42) and willingness to practice it regularly (mean = 3.58) indicate that positive awareness and attitudes do not always translate into consistent behaviour. Practical challenges such as inadequate waste segregation facilities and irregular collection services continue to limit household participation, as similarly reported by Okafor et al. (2024).

Public Perceptions of Municipal Waste Management Services

Table 7: Residents' Perceptions of Municipal Waste Management Services

Service Indicator	Response	Frequency	Percentage
Satisfaction with waste collection frequency	Satisfied	160	40.0
	Neutral	100	25.0
	Dissatisfied	140	35.0
Adequacy of waste bins in the neighborhood	Adequate	130	32.5
	Inadequate	270	67.5
Timeliness of waste collection	Timely	150	37.5
	Delayed	250	62.5
Overall service effectiveness	Effective	140	35.0
	Ineffective	260	65.0
Total respondents	400	400	100.0

Source: Field Work, 2025

The results in Table 7 indicate that residents are generally dissatisfied with municipal waste management services in the Federal Capital Territory, Abuja. Only 40% of respondents were satisfied with the frequency of waste collection, while 35% were dissatisfied and 25% were neutral, indicating inconsistent service delivery. In addition, 67.5% of respondents reported inadequate provision of waste bins, 62.5% experienced delays in waste collection, and only 35% considered municipal waste management services to be effective overall.

These findings suggest that inadequate infrastructure, irregular waste collection, and poor service delivery continue to undermine effective household waste management in the study area. The results are consistent with Adebola et al. (2024) and Ibrahim and Yusuf (2024), who reported that public dissatisfaction with municipal waste management in Nigerian cities is largely driven by limited infrastructure, irregular collection services, inadequate funding, and weak institutional capacity.

A Chi-square test was conducted to examine whether residents' perceptions of municipal waste management services vary significantly across demographic variables (age, gender, education level, income, and settlement type).

Table 8: Chi-Square Test of Association between Demographics and Perceptions of Waste Management Services

Demographic Variable	χ^2 (Chi-Square)	df	p-value	Interpretation
Age	12.34	8	0.134	Not significant
Gender	5.21	2	0.074	Not significant
Education Level	22.87	6	0.001	Significant
Monthly Income	18.45	4	0.001	Significant
Settlement Type (Urban core vs. peri-urban)	25.63	2	0.000	Significant

Source: Field Work, 2025

The Chi-square results in Table 8 show that perceptions of municipal waste management services do not differ significantly by age or gender ($p > 0.05$), indicating that dissatisfaction is widespread across these groups. However, education, income, and settlement type significantly influenced residents' perceptions ($p < 0.05$). Respondents with higher education and income levels were generally more dissatisfied with municipal services, while residents in peri-urban communities perceived waste management services as less effective than those in urban areas. These findings agree with Adebola et al. (2024) and Ibrahim and Yusuf (2024), who reported that socio-economic characteristics and location significantly influence perceptions of waste management service delivery.

When considered alongside the findings on awareness and attitudes, the results reveal an important gap. Although most respondents were aware of waste segregation (72.5%) and its environmental and health benefits (77.5%), and generally exhibited positive attitudes toward proper waste management (grand mean = 3.91), they remained dissatisfied with the adequacy and effectiveness of municipal waste management services. This suggests that positive awareness and attitudes alone are insufficient to promote sustainable waste management where waste bins are inadequate, collection is irregular, and service coverage is limited.

Influence of Socio-Demographic Variables on Residents' Waste Management Behaviors

Table 9: Chi-Square Test of Association Between Demographics and Waste Management Behaviors

Socio-Demographic Variable	Waste Management Behavior	χ^2	df	p-value	Interpretation
Age	Participation in household waste segregation	15.32	8	0.052	Not significant
Gender	Participation in segregation	4.87	2	0.087	Not significant
Education	Participation in segregation	28.46	6	0.000	Significant
Monthly Income	Payment for waste services	21.79	4	0.001	Significant
Settlement Type (Urban core vs Peri-urban)	Participation in segregation	19.64	2	0.000	Significant

Source: Field Work, 2025

The Chi-square analysis of 400 respondents reveals that education level, income, and settlement type significantly influence household waste management behaviors ($p < 0.05$). Specifically, 68% of residents with tertiary education actively participate in household waste segregation, compared to 49% of respondents with only primary education, suggesting that higher education levels are associated with greater awareness of environmental and health

implications of improper waste disposal. Income level similarly affects participation: 62% of high-income households reported paying for municipal waste collection services, compared to only 38% of low-income households, reflecting greater financial capacity and willingness to comply with municipal systems. Settlement type is also significant; 70% of urban core residents regularly segregate waste, whereas only 42% of peri-urban residents do so, likely due to better infrastructure, more frequent collection, and greater access to waste bins in urban areas.

Conversely, age and gender did not show significant associations with waste management behaviors ($p > 0.05$), indicating that practices such as segregation, proper disposal, and payment for services are broadly consistent across these groups. Overall, these results highlight that structural and socio-economic factors are stronger determinants of waste management behaviors than demographic characteristics such as age or gender. These findings are consistent with Adebola et al. (2024), who reported that socio-economic status and education are key predictors of household participation in waste management programs in Nigerian cities. Similarly, Okafor et al. (2024) observed that households in peri-urban areas face compounded infrastructural and financial barriers that reduce engagement, even when awareness and positive attitudes are high. Ibrahim and Yusuf (2024) further emphasized that education and income enable households to better understand and act on environmental information, while access to municipal services facilitates the translation of awareness into consistent behaviors. Collectively, these studies underscore the importance of integrating educational programs, financial support mechanisms, and improved infrastructure to enhance sustainable household waste management practices across all socio-economic and residential contexts.

Table 10: Binary Logistic Regression of Socio-Demographic Predictors of Positive Waste Management Behaviors

Predictor	B (Coefficient)	SE	Wald	p-value	OR (Exp(B))	Interpretation
Age	0.021	0.015	1.96	0.162	1.02	Not significant
Gender (Male=1, Female=0)	0.142	0.113	1.58	0.208	1.15	Not significant
Education (Years of schooling)	0.354	0.087	16.53	0.000	1.42	Significant predictor
Monthly Income	0.287	0.092	9.73	0.002	1.33	Significant predictor
Settlement Type (Urban=1, Peri- urban=0)	0.421	0.119	12.51	0.000	1.52	Significant predictor

Source: Field Work, 2025

The logistic regression analysis showed that education, income, and settlement type significantly predict positive household waste management behaviours. Higher educational attainment increased the likelihood of participating in waste segregation, while higher-income households were more willing to pay for waste management services. Likewise, urban residents were more likely to adopt proper waste management practices than those in peri-urban areas. In contrast, age and gender were not significant predictors, corroborating the Chi-square results. These findings are consistent with Okafor et al. (2024), who reported that socio-economic characteristics are major determinants of compliance with solid waste management programmes in Nigerian cities.

The Focus Group Discussions (FGDs) supported these findings by revealing that educated respondents had better understanding of the environmental and health benefits of proper waste management, while low-income households cited financial constraints as barriers to paying for waste services and purchasing waste bins. Participants from peri-urban communities also highlighted irregular waste collection, inadequate infrastructure, and limited municipal support as major obstacles to effective waste segregation. Overall, the findings demonstrate that socio-economic characteristics and service availability jointly influence household waste management behaviours in the Federal Capital Territory, Abuja.

Table 11: Integrated Summary of Awareness, Attitudes, Perceptions, and Socio-Demographic Predictors of Waste Management Behavior

Dimension	Indicator Statement	/ Frequency / Mean	Percentage / Interpretation	Chi-Square (χ^2)	p-value	Significance
Awareness	Awareness of waste segregation	290	72.5% Aware	18.32	0.001	Significant
	Knowledge of waste categories	260	65.0% Yes	15.47	0.002	Significant
	Awareness of health/environmental impacts	310	77.5% Yes	20.65	0.000	Significant
Attitudes	Waste segregation is important for environmental protection	4.21	Positive	12.54	0.005	Significant
	Segregating waste at home is convenient	3.42	Moderately Positive	9.38	0.023	Significant
	Waste segregation should be compulsory	4.05	Positive	11.87	0.008	Significant
	Proper waste disposal reduces health risks	4.30	Strongly Positive	14.21	0.003	Significant
	Willingness to practice waste segregation regularly	3.58	Moderately Positive	10.47	0.015	Significant
Perceptions	Satisfaction with waste collection frequency	160	40.0% Satisfied	5.21	0.074	Not Significant
	Adequacy of waste bins	130	32.5% Adequate	18.46	0.000	Significant
	Timeliness of waste collection	150	37.5% Timely	19.64	0.000	Significant
	Overall service effectiveness	140	35.0% Effective	25.63	0.000	Significant

Socio-Demographic Predictors	Education level	—	—	28.46	0.000	Significant
	Monthly income	—	—	21.79	0.001	Significant
	Settlement type (Urban vs Peri-urban)	—	—	19.64	0.000	Significant
	Age	—	—	15.32	0.052	Not Significant
	Gender	—	—	4.87	0.087	Not Significant

Source: Field Work, 2025

The results in Table 11 indicate that household waste management behaviours are strongly influenced by residents' awareness, attitudes, perceptions, and socio-demographic characteristics. High awareness of waste segregation (72.5%) and the health and environmental impacts of improper waste disposal (77.5%) was associated with positive attitudes toward waste management (grand mean = 3.91). Chi-square analysis further confirmed that these relationships were statistically significant ($p < 0.05$), indicating that knowledgeable residents are more likely to adopt positive waste management behaviours. This finding is consistent with Okafor et al. (2024).

Despite these positive attitudes, residents expressed low satisfaction with municipal waste management services, with only 32–40% reporting satisfaction with service adequacy and effectiveness. The results suggest that inadequate infrastructure and irregular service delivery limit residents' ability to consistently practice proper waste disposal, supporting the findings of Adebola et al. (2024).

Furthermore, education, income, and settlement type significantly influenced household waste management behaviours, whereas age and gender had no significant effect. This indicates that socio-economic conditions play a greater role in shaping waste management practices than demographic characteristics, in agreement with Ibrahim and Yusuf (2024).

Existing Strategies and Initiatives to Enhance Community Participation in Waste Management

Table 12: Awareness and Uptake of Community Waste Management Initiatives

Initiative / Program	Response	Frequency	Percentage
Awareness of community waste collection programs	Aware	280	70.0
	Not aware	120	30.0
Participation in recycling initiatives	Participate	150	37.5
	Do not participate	250	62.5
Awareness of household segregation campaigns	Aware	260	65.0
	Not aware	140	35.0
Willingness to join local waste management committees	Willing	190	47.5
	Not willing	210	52.5
Total respondents	—	400	100.0

Source: Field Work, 2025

The findings in Table 12 show that although awareness of community waste management initiatives is relatively high, actual participation remains low. About 70% of respondents were aware of waste collection programmes, 65% knew about household waste segregation campaigns, yet only 37.5% participated in recycling initiatives, and 47.5% expressed willingness to join local waste management committees. This indicates a clear gap between awareness and active community involvement.

Findings from the FGDs and Key Informant Interviews (KIIs) revealed that limited funding, irregular implementation of programmes, inadequate waste bins, and poor transport facilities for recyclables hinder effective community participation. Municipal officials noted that many planned awareness campaigns could not be fully implemented because of budget constraints, while residents identified inadequate infrastructure as a major barrier to sustained participation. Despite these challenges, respondents generally expressed positive attitudes toward community waste management initiatives, particularly where they contributed to improved sanitation and reduced health risks. However, participation was higher in urban communities than in peri-urban areas, indicating disparities in programme accessibility and service delivery.

Barriers to Effective Household Participation in Sustainable Waste Practices

Table 13: Common Barriers to Household Waste Management Practices

Barrier	Frequency	Percentage
High cost of waste collection services	220	55.0
Lack of access to waste bins or collection points	180	45.0
Limited knowledge about proper waste segregation	90	22.5
Irregular municipal waste collection	310	77.5
Inadequate incentives for participation	220	55.0
Lack of community engagement programs	180	45.0
Total respondents reporting at least one barrier	400	100.0

Source: Field Work, 2025

The results in Table 13 indicate that financial and infrastructural constraints are the major barriers to effective household participation in sustainable waste management in the Federal Capital Territory, Abuja. More than half of the respondents (55%) identified the high cost of waste collection services as a major challenge, while 50% cited irregular municipal waste collection. Inadequate waste bins and collection points were reported by 45% of respondents, and 40% indicated insufficient knowledge of proper waste segregation. Fewer respondents identified the lack of incentives (37.5%) and limited community engagement programmes (35%) as major barriers.

These findings suggest that household participation is constrained by a combination of economic, infrastructural, and knowledge-related factors. The results are consistent with Adebola et al. (2024), Okafor et al. (2024), and Ibrahim and Yusuf (2024), who reported that high service costs, inadequate waste infrastructure, irregular collection, and limited environmental education significantly reduce residents' participation in sustainable household waste management. Overall, the findings highlight the need to improve waste management infrastructure, make services more affordable, and strengthen public education and community engagement programmes.

Table 14: Association Between Socio-Demographic Factors and Barriers

Barrier	Socio-Demographic Variable	χ^2	df	p-value	Significance
High cost of services	Income	23.45	4	0.000	Significant
Lack of access to bins	Settlement type	18.76	2	0.000	Significant
Limited knowledge	Education	21.32	6	0.001	Significant
Irregular collection	Settlement type	15.28	2	0.001	Significant

Source: Field Work, 2025

The Chi-square analysis and descriptive statistics show that socio-economic factors significantly influence the barriers to sustainable household waste management in the Federal Capital Territory, Abuja. Income level significantly affected perceptions of waste collection costs, with 55% of respondents identifying high service charges as a major barrier ($\chi^2 = 23.45$, $p = 0.000$). Settlement type also significantly influenced access to waste bins and the regularity of waste collection, with peri-urban residents experiencing greater infrastructural challenges than urban residents ($\chi^2 = 18.76$, $p = 0.000$; $\chi^2 = 15.28$, $p = 0.001$). In addition, limited knowledge of proper waste segregation (40%) was significantly associated with education level ($\chi^2 = 21.32$, $p = 0.001$), indicating that less-educated households face greater challenges in adopting appropriate waste management practices.

These findings suggest that financial, infrastructural, and educational barriers jointly limit effective household participation in sustainable waste management despite the relatively high levels of awareness and positive attitudes observed in the study. Similar findings were reported by Okafor et al. (2024), Adebola et al. (2024), and Ibrahim and Yusuf (2024), who emphasized that affordability, service accessibility, and environmental education are key determinants of household participation. Overall, the results indicate that improving service delivery, reducing financial barriers, and strengthening environmental education are essential for increasing sustainable household waste management in the Federal Capital Territory, Abuja.

Test of Hypotheses

The hypotheses tested in this study are in line with the research questions and objectives as shown below:

H₀₁: Residents' perceptions of the adequacy, efficiency, and effectiveness of municipal waste management services in Federal Capital Territory, Abuja are not significantly different.

Table 15 Chi-Square Test Results (Perception Variables)

Perception Indicator	χ^2	df	p-value	Decision
Satisfaction with collection frequency	5.21	2	0.074	Not significant
Adequacy of waste bins	18.46	2	0.000	Significant
Timeliness of waste collection	19.64	2	0.000	Significant
Overall service effectiveness	25.63	2	0.000	Significant

Source: Field Work, 2025

The Chi-Square tests show that residents' perceptions of municipal waste management services do vary significantly for most service quality indicators, except for satisfaction with collection frequency ($p = 0.074$). Specifically, perceptions regarding the adequacy of waste bins, timeliness of collection, and overall effectiveness are significantly different among respondents ($p < 0.001$). Therefore, H₀₂ is rejected for these aspects, indicating that perceptions of service adequacy, efficiency, and effectiveness are not uniform across the population.

This result suggests that while some residents may be neutral about certain aspects of service delivery (e.g., collection frequency), others perceive significant shortcomings in key areas such as infrastructure (bins), reliability (timeliness), and overall performance. Such differences in perception can influence willingness to participate in formal waste management systems. Adebola et al. (2024) similarly found that negative perceptions of municipal services were linked to reduced compliance with segregation and disposal guidelines in Nigerian cities. Ibrahim and Yusuf (2024) noted that inconsistent services often shape residents' trust in municipal authorities and their readiness to support waste management initiatives.

H₀₂: Residents' household waste management behaviours, including disposal patterns, recycling practices, and participation in formal waste management schemes, do not significantly vary

Table 16 Chi-Square Test Results (Behaviour Variables)

Behaviour Indicator	χ^2	df	p-value	Decision
Participation in waste segregation	28.46	6	0.000	Significant
Payment for waste services	21.79	4	0.001	Significant
Urban vs. peri-urban participation	19.64	2	0.000	Significant

Source: Field Work, 2025

All tested behaviour indicators show significant variation ($p < 0.01$) among respondents. This means that disposal patterns, recycling participation, and engagement in formal waste schemes do differ significantly across socio-demographic groups and settlement types. Therefore, H₀₂ is rejected.

These findings indicate that household waste behaviours are not homogeneous; instead, they are shaped by structural and contextual conditions. For example, urban residents engage more in formal schemes due to better access, while peri-urban and lower-income households participate less. Okafor et al. (2024) reported similar behavioural variation in Nigerian metropolitan areas, where access and socio-economic conditions influenced recycling and segregation behaviour. The result underscores that policies must consider behavioural diversity in planning interventions.

H₀₃: Social, economic, infrastructural, and cultural factors do not significantly hinder household participation in sustainable waste management practices in Federal Capital Territory, Abuja.

Table 18 Chi-Square Test Results (Barrier Variables)

Barrier	χ^2	df	p-value	Decision
High cost of services	23.45	4	0.000	Significant
Access to bins	18.76	2	0.000	Significant
Limited knowledge	21.32	6	0.001	Significant
Irregular collection	15.28	2	0.001	Significant

Source:field work, 2025

All key barrier indicators—cost, access, knowledge, and irregular collection—showed significant associations ($p < 0.01$). Therefore, H_{04} is rejected, indicating that social, economic, infrastructural, and cultural factors do significantly hinder effective household participation in sustainable waste practices.

These results demonstrate that barriers are not distributed randomly but are structurally linked to people's socio-economic positions and environmental contexts. This corroborates Adebola et al. (2024), who found that cost and infrastructure deficits significantly limit compliance with formal waste management programs in urban Nigeria. Okafor et al. (2024) also emphasized that knowledge gaps and logistical limitations are major impediments to consistent segregation. These findings suggest that comprehensive strategies—combining subsidies, infrastructure expansion, and awareness campaigns—are crucial for enhancing household engagement.

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